Supporting Document 1-1

Air Quality Existing Conditions Report

Twin Creeks Environmental Centre Landfill Optimization Project Environmental Assessment

WM Canada

Watford, Ontario

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Revision History

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Executive Summary

This report presents existing Air Quality conditions associated with the WM Canada Twin Creeks Environmental Centre (TCEC). This work is in support of the environmental assessment (EA) for the TCEC Landfill Optimization Project (the Project) under the Terms of Reference (ToR) approved December 13, 2022.

The TCEC is located at 5768 Nauvoo Rd. approximately 1 km north of the Village of Watford in the Township of Warwick, Ontario. The TCEC is bounded by agricultural area on all sides, with the closest residential area being in Watford in the south.

WM Canada Corporation (WM), the owner and operator of the TCEC, has initiated an EA seeking approval to increase the landfill airspace capacity at the TCEC. The TCEC has approximately 8.9M m^3 of remaining approved landfill airspace, depending on the density of waste received this corresponds to about 5 years of operating life. The Project could provide additional airspace capacity of up to approximately 14.3 million m^3, which could extend the site life by 12 years. There would be no change to the current 301 ha site area, the approved service area, or the annual fill rate.

This assessment of the potential effects of the proposed landfill optimization on the environment will be carried out in accordance with the requirements of the *Environmental Assessment Act*. The Existing Conditions Report forms one component of the EA, used to determine the baseline conditions at the facility prior to implementation of the Project. Current potential effects on the surrounding area can then be compared to the potential future effects resulting from the Project, which will be completed in future study. The assessment methodology for the Existing Conditions Report has been carried out in accordance with the approved Terms of Reference (ToR) including the Air Quality work plan dated March 30, 2022 (Air Quality work plan).

Characterization of the existing site conditions assumed that all currently approved landfill activities are in operation with the addition of the Renewable Natural Gas (RNG) Facility, which has been approved by the MECP and is currently under construction. Existing conditions were modelled for the anticipated closure year determined based on the currently approved waste acceptance rate and the remaining available airspace. Modelling of the landfill considers operations in the last year before closure. The last year before closure was selected because it represents the year when the landfill will contain the maximum amount of waste while still being in full operation. During the last year before closure, there will be no more cell construction activities on site and estimated emissions will be representative of landfill activities and final cap construction only. This provides a reasonable estimate of the peak operating conditions at the landfill including all currently approved sources and the proposed RNG Facility, which forms the baseline conditions from which the Project will be assessed. The landfill closure year was determined based on the total waste tonnage capacity predicted in the 2016 Environmental Screening Report. The waste in place was based on historical waste acceptance records up to and including 2022; from

2023 until closure, it was assumed that the maximum permitted waste is deposited each year until the total waste tonnage capacity is met. This results in a predicted closure year of 2033, which was used for the Air Quality Existing Conditions Report.

The Air Quality discipline evaluates the releases to air from the Project and assesses the potential effects on surrounding areas by comparing them to standards and guidelines published by government agencies. The Air Quality discipline assesses releases of air quality compounds of interest, namely particulate matter (dust), odour, blowing litter, volatile organic compounds (VOCs), reduced sulphur compounds, and combustion byproducts. Sources of air emissions at the facility include:

- Onsite equipment and vehicle traffic;
- The landfill mound (interim and final cover areas);
- The active face and associated equipment;
- The final cap construction and associated equipment;
- Material storage piles;
- The RNG Facility;
- The approved future leachate treatment plant and leachate collection system;
- Landfill gas flares (as currently planned for end of current operations); and
- Emergency generators.

Emissions from these sources were quantified using a combination of on-site sampling, published emission factors, and engineering calculations. Note that the original plan for the current operations of the site included waste diversion and composting. These operations do not currently exist and if implemented are planned to be discontinued at the end of phase 7 (2029) as per the 2016 Environmental Screening Report, which is prior to the noted assessment year of 2033. Therefore, they have not been included at this time in the existing conditions report.

Compounds of interest were assessed at a series of discrete receptors that have been identified in the vicinity of the facility and have been considered in the Air Quality assessment as well as at a grid of receptors at and beyond the property boundary.

Potential impacts at all off-site receptors were assessed using the US EPA dispersion model AERMOD, version 22112. Dispersion modelling was completed for dust, odour, VOCs, and combustion byproducts. Potential impacts related to blowing litter were assessed qualitatively.

Predicted impacts for the establishment of existing conditions considered the cumulative impact from existing background concentrations and dispersion modelling results. This approach provides a cumulative impact at the receptors from the facility and surrounding industrial and agricultural activities, traffic, and other sources of like air emissions. Background concentrations for dust, VOCs, and reduced sulphur compounds were determined through ambient monitoring. Background concentrations

for contaminants not included in the ambient monitoring campaign were obtained from representative publicly available data. No background was considered for odour or blowing litter.

This assessment of the potential effects of the proposed landfill optimization on the environment will be carried out in accordance with the requirements of the *Environmental Assessment Act*. The assessment methodology was generally consistent with the Air Quality work plan; however, minor adjustments were made to accommodate project-specific circumstances and ensure a more accurate evaluation.

The potential for blowing litter impacts was assessed through a review of the existing mitigation measures, complaints history, MECP inspection records, internal logs, a literature review, and analysis of local meteorological conditions. During the operating period between 2009 and the end of 2024, a total of 15 litter related complaints were received with the majority occurring between 2019 and 2024. When complaints were received WM took the necessary corrective action in accordance with their existing Best Management Practices Plan (BMPP). MECP inspection records noted that although off-site litter was identified, WM was responsive and organized cleanup of the impacted property promptly. WM litter logs provide evidence that litter inspections are being performed and cleanup and maintenance activities are being completed when required. The meteorological assessment identified the litter zones where impacts are most likely to occur. Based on review of litter windspeed thresholds presented in studies by James. M. Lapp (Lapp, 1983)[1] and RWDI, wind speeds in excess of the established litter thresholds are expected to occur approximately 5% of the time in the predominant wind direction (southwest to northeast). WM has installed permanent litter fences along the northern boundary to control the off-site migration of litter, which decreases the potential impacts. Overall, litter related impacts from landfill operations are expected to be low.

The odour study assessed the potential impacts at discrete receptor locations. Odour was assessed on a 10-minute averaging period. When assessing odour-related impacts, three thresholds were considered:

- 1 OU – associated with detection of odour;
- 3 OU – recognition of the odour; and
- 5 OU – nuisance resulting from the odour.

Dispersion modelling predicts maximum odour concentrations at all sensitive receptors to exceed the MECP odour guideline objective of 1 OU/m³. Frequency of exceedance of the 1 OU/m³ guideline is predicted to be greater than 0.5% at receptors R2 through R7. Exceedances of the 3 OU/m³ guideline were predicted at only two

[1] Lapp, James M., Sanitary Landfill, Controlling Blowing Litter. Alberta Environment, Pollution Control Division, Waste Management Branch, 1983.

receptors, R2 and R4, with a frequency less than 0.5%. No exceedances of the 5 OU/m³ guideline were predicted.

Based on the predicted odour concentrations, there is potential that landfill related odours will be detectable and occasionally recognizable at discrete receptors from time to time which is supported by the historical complaints received.

Landfill areas under interim and final cover and operations at the active face are the greatest contributors of odour under normal operations. WM should continue to manage emissions of landfill gas by routine maintenance of the final cap and interim cover areas and the gas and leachate collection systems. Conditions outside normal operations, such as leaks or fissures through the landfill cap, may result in increased odour impacts. Preventing these types of conditions and mitigating them as quickly as possible when they may occur are key to minimizing potential off-site odour impacts. The proper development and implementation of an odour management plan can help reduce the potential for these conditions.

The landfill gas and combustion byproduct study assessed the potential impacts for a select list of key indicator contaminants, including:

- VOCs such as vinyl chloride, benzene, and 1,2-dichloroethane.
- Combustion by-products such as nitrogen oxides (NO_x), sulphur dioxide (SO_2), and dioxins and furans (D&F).
- Ammonia from the proposed leachate treatment facility.

Indicator contaminants were selected based on the results of previous studies completed at the landfill. In general, the contaminants with predicted concentrations greater than 15% of their current criteria in the previously completed 2016 Environmental Screening Report were determined to be the key indicator contaminants. Emissions of sulphur compounds were also considered. This study focuses on the following sulphur compounds:

- Hydrogen sulphide (H_2S); and
- Total reduced sulphurs (TRS).

TRS represents the cumulative impact from all sulphur compounds including carbonyl sulphide, H_2S, carbon disulfide, methyl mercaptan, ethyl mercaptan, dimethyl sulphide, 1-propyl mercaptan, methyl ethyl sulphide, and dimethyl disulphide. In addition to being assessed as a component of TRS, H_2S was assessed independently as it is the primary contributor to TRS emissions.

Dispersion modelling predicts compliance with all criteria at all discrete receptors as well as the property boundary and beyond for benzene, vinyl chloride, 1,2-dichloroethane, ammonia, SO_2, NO_x, D&F, and 24-hour H_2S. Predicted concentrations of 10-minute H_2S, 10-minute TRS, and 24-hour TRS are predicted to exceed at all discrete receptors and the property boundary. Predicted contributions from landfilling

activities for all H_2S and TRS averaging periods are low, accounting for less than 10% of the cumulative concentration.

Between June 2nd and July 14th, 2023, the laboratory analyzed TRS and H_2S samples using elevated Reportable Detection Limit (RDL). The RDL used for TRS was 11 µg/m³ which exceeded the applicable TRS criteria. The RDL used for H_2S was 5.6 µg/m³. These RDLs were reduced and were used for the July 17th samples onward. Although the Air Quality work plan states that background concentrations are based on the 90th percentile value of upwind data only, the background concentration for H_2S and TRS were based on the 90th percentile value of all wind direction background data. Considering all wind directions rather than upwind only provides a conservative estimate of the background concentration because downwind and crosswind conditions have the potential to capture emissions from landfill sources which when paired with dispersion modelling could double count landfill emissions.

Overall, predicted concentrations of H_2S and TRS are dominated by elevated background values results from elevated laboratory detection limits and the predicted concentrations of H_2S and TRS from landfill operations at all discrete receptors and the property boundary are low. Therefore, impacts associated with landfilling operations are expected to be low.

The dust study assessed the potential impacts for three particulate species:

- Total suspended particulate matter (TSP),
- Inhalable particulate matter (PM_{10}), and
- Respirable particulate matter ($PM_{2.5}$).

Predicted concentrations for annual TSP and annual $PM_{2.5}$ are expected to comply with the relevant criteria at all discrete receptors. Although predicted concentrations of TSP are above the applicable criteria at discrete receptors, the frequency of exceedance remains low, (with exceedances predicted a maximum of 2.88% of the time at the worst-case discrete receptor location). Exceedances of 24-hour PM_{10} and $PM_{2.5}$ were predicted at an even lower frequency of 2.2% and 0.3% respectively, at their worst-case discrete receptor locations.

It is important to note that, for $PM_{2.5}$, exceedances at discrete receptor locations are predicted only when the background contribution is applied; the modelled concentrations from the landfill operations are below the relevant criteria when considered on their own.

Dispersion modelling considered several conservative assumptions including worst-case source locations, maximum site activity, dry conditions with no consideration of precipitation or snow cover, and the use of conservative emission rates. A one year ambient monitoring program for dust from January to December 2023 was completed and the average background values of upwind samples were applied to predicted concentrations.

Overall, because of the conservatisms included in the assessment, the modelling likely over-predicts the impacts from the landfill and impacts from landfill operations are expected to be low. In addition, modelling was completed to assess impacts at the monitoring locations. Predicted concentrations at the monitoring location demonstrated alignment with the monitored data, with the modelled results showing more exceedances compared to the monitored data.

The results of these studies represent the existing conditions on site for the closure year 2033 and form the baseline which will be used for comparison with the preferred alternative in future studies. The existing conditions predict impacts from existing landfill operations are expected to be low and emissions from the site are being managed effectively.

Acronyms, Units and Glossary

Acronyms

Acronym	Definition
AAQC	Ambient Air Quality Criteria
AERMAP	U.S. EPA AERMOD Terrain Preprocessor
AMoN	Ammonia Monitoring Network
AQS	Air Quality Standards
BMPP	Best Management Practices Plan
BPIP	U.S. EPA Building Profile Input Program
CAAQS	Canadian Ambient Air Quality Standards
CCME	Canadian Council of Ministers of Environment
CDEM	Canadian Digital Elevation Model
CO_2^e	Carbon Dioxide Equivalent
EA	Environmental Assessment
EAA	*Environmental Assessment Act*
ECA	Environmental Compliance Approval
ECCC	Environment and Climate Change Canada
EMRB	MECP Environmental Monitoring and Reporting Branch
ESDM	Emission Summary and Dispersion Modelling
EST	Eastern Standard Time
GHG	Greenhouse Gas
H_2S	Hydrogen Sulphide
IWA	Interim Waste Authority
LandGEM	Landfill Gas Emission Model
MECP	Ministry of Environment, Conservation and Parks
MOVES	Motor Vehicle Emission Simulator
NAPS	National Air Pollution Surveillance
NO_x	Nitrogen Oxides
NO_2	Nitrogen Dioxide
OLM	Ozone Limiting Method
O.Reg	Ontario Regulation
OU	Odour Unit
PAH	Polycyclic Aromatic Hydrocarbon
PM_{10}	Particulate Matter less than 10 micron in Diameter
$PM_{2.5}$	Particulate Matter less than 2.5 micron in Diameter
RDL	Reportable Detection Limit
SO_2	Sulphur Dioxide

Acronym	Definition
SOP	Standard Operating Procedure
TCEC	Twin Creeks Environmental Centre
THC	Total Hydrocarbons
ToR	Terms of Reference
TRS	Total Reduced Sulphur
TSP	Total Suspended Particulate
U.S. EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compound
WM	WM Canada

Units

Unit	Definition
Km	Kilometre
M	Metre
µg/m³	Microgram per cubic metre
g/s	Grams per second
OU	Odour Units
$g/m^2 – s$	Grams per metre squared per second
OU/m^2-s	Odour units per metre squared per second
CFM	Cubic feet per minute

Glossary

Term	Definition
Active cell	A landfill cell is a waste-holding unit within the landfill area. The “active cell” is the waste-holding unit where waste is currently being deposited.
Active face	The working surface of a landfill within the active cell upon which waste is deposited each day before placement of daily cover. Often referred to as “working face” or “active working face”.
Approval	Permission granted by an authorized individual or organization for a project to proceed. This may be in the form of program approval, certificate of approval or provisional certificate of approval.
Capacity (Disposal Volume)	The total volume of air space available for disposal of waste at a landfill site for a particular design (typically in m³); includes both waste and daily cover materials but excludes the final cover.

Term	Definition
Environment	As defined by the *Environmental Assessment Act*, environment means: • Air, land or water; • Plant and animal life, including human life; • The social, economic and cultural conditions that influence the life of humans or a community; • Any building, structure, machine or other device or thing made by humans; • Any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirectly from human activities; or, • Any part or combination of the foregoing and the interrelationships between any two or more of them (ecosystem approach).
Environmental Assessment (EA)	A systematic planning process that is conducted in accordance with applicable laws or regulations aimed at assessing the effects of a proposed project on the environment.
Evaluation criteria	Evaluation criteria are considerations or factors taken into account in assessing the advantages and disadvantages of various alternatives being considered.
Flux Chamber	Is a stainless-steel vessel of volume 0.5 m². It is used to measure minute emissions from near passive sources that do not have any mechanical fans to discharge the contaminants of interest.
Indicators	Indicators are specific characteristics of the evaluation criteria that can be measured or determined in some way, as opposed to the actual criteria, which are fairly general.
Landfill gas (LFG)	The gases produced from the wastes disposed in a landfill; the main constituents are typically carbon dioxide and methane, with small amounts of other organic and odour-causing compounds.
Landfill site	An approved engineered site/facility used for the final disposal of waste. Landfills are waste disposal sites where waste is spread in layers, compacted to the smallest practical volume, and typically covered by soil.
Mitigation	Measures taken to reduce adverse impacts on the environment.
Odour Unit	The quantity of odourous substance that, when dispersed in 1 m^3 of odour free air, becomes just detectable by a human observer whose sensitivity to the odorant represents the mean of the population.
Project	Is defined in the *Environmental Assessment Act* as: one or more enterprises or activities or a proposal, plan or program in respect of an enterprise or activity.
Proponent	A person who: • Carries out or proposes to carry out a project; or, • Is the owner or person having charge, management or control of a project.
Renewable Natural Gas (RNG)	Product of the decomposition of organic matter that is collected from the landfill site, as opposed to traditional natural gas, which is collected from deep wells.
Terms of Reference (ToR)	A terms of reference is a document that sets out detailed requirements for the preparation of an Environmental Assessment.
Waste	Refuse from places of human or animal habitation; unwanted materials left over from a manufacturing process.

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1 Introduction

This report presents a description of the existing conditions for Air Quality for the WM Canada (WM) Twin Creeks Environmental Center (TCEC) Landfill Optimization Project in support of the EA. The purpose of the EA is to assess the potential effects of the proposed landfill optimization on the environment. The EA is being carried out in accordance with the requirements of the *Environmental Assessment Act* (*EAA*) and Terms of Reference (ToR), which was approved by the Ministry of Environment, Conservation and Parks (MECP) on December 13, 2022.

WM, the owner and operator of the TCEC in Watford, Ontario, has initiated the EA seeking approval to optimize the landfill design and operation, maximizing the use of the constructed infrastructure and the significant investment made at the TCEC. There are approximately 5 years of approved landfill airspace capacity remaining at the TCEC. The proposed optimization would provide additional airspace of approximately 14.3 million cubic metres (m^3), which could extend the site life by approximately 12 years and may be achieved through alternative landfill configurations or alternative methods within the existing 301 hectare (ha) TCEC site area. No changes are proposed to the size of the TCEC site area, approved service area, or annual fill rate.

There is a need for the continued development of the TCEC as it is a significant component of the provincial waste management network and infrastructure, which is lacking in sufficient and secure long-term disposal capacity. Optimizing the future development of the TCEC allows for on-going sustainable business operations and continued provision of essential financial support for community services and programs.

The approved ToR included a preliminary description of the existing conditions within the area surrounding the TCEC, with the commitment that a more detailed description of existing environmental conditions would be prepared as part of the EA. In accordance with the approved ToR, additional investigative studies were carried out as necessary to generate a more detailed description of the existing natural, cultural, socio-economic, and built environments for use in the assessment of the effects of the alternative methods for the TCEC Optimization Project during the EA.

This Air Quality Existing Conditions Report is one component of the EA. The EA Study Report will incorporate the information presented herein as appropriate, and this report will be included with the EA Study Report as a supporting document. The Air Quality section of the EA assesses the release of air quality related compounds of interest including particulate matter (dust), odour, landfill gas, blowing litter, VOCs, and combustion byproducts.

The area surrounding the TCEC comprises mostly agricultural lands as well as portions of Hwy 402, Nauvoo Road, and Confederation Line, and the village of Watford including a number of small businesses. Sources of air emissions include on-site operations and activities from the surrounding agricultural operations, as well as traffic on local roads.

Characterization of the existing site conditions assumed that all currently approved landfill activities were in operation with the addition of the Renewable Natural Gas (RNG) Facility which has been approved by the MECP and is currently under construction. Existing conditions were modelled for the anticipated closure year determined based on the currently approved waste acceptance rate and the remaining available airspace. Modelling of the landfill active face considers operations in the last year before closure. Based on historical waste acceptance up to 2022 and assuming the maximum permitted waste is deposited each year, the predicted closure year is 2033.

The existing conditions at residential receptors and the property line were assessed using a combination of dispersion modelling and ambient monitoring.

2 TCEC and Study Areas

The TCEC is located at 5768 Nauvoo Road in the Township of Warwick, within the County of Lambton. The TCEC lies to the north of the Village of Watford and is generally bounded by Confederation Line to the south, Nauvoo Road to the west, Zion Line to the north, and agricultural lands to the east. The TCEC is a regional facility that provides safe and convenient disposal services for communities, businesses and industries serving the Province of Ontario. The landfill is approved to receive municipal, industrial, commercial, and institutional solid non-hazardous wastes generated, including non-hazardous contaminated soil.

The TCEC is engineered with environmental protection systems that meet or exceed regulatory requirements and are subject to highly regulated monitoring and reporting requirements. Systems include engineered liners and covers, leachate collection and removal, landfill gas collection and control, and on-site leachate disposal through phytoremediation.

Leachate that is generated in the waste is conveyed toward a perimeter leachate collection system. WM received approval to treat leachate through a phytoremediation system consisting of a 9.3 ha Poplar System planted on the existing landfill cap in 2003. Surplus leachate is trucked off-site to approved wastewater treatment plants.

During the EA, existing conditions and potential effects with respect to air quality will be considered in the context of the following study areas:

- On-site study area: the existing TCEC.

- Off-site study area: the lands within the vicinity of the TCEC extending approximately 5 km out from the on-site Study Area.

Although most disciplines under this EA consider an off-site study area extending approximately 1 km from the on-site study area, for the purposes of the air quality assessment, this has been extended to include lands within approximately 5 km from the TCEC. This 5 km study area is consistent with MECP modelling guidelines for air quality. The extended 5 km study area will be used to establish predicted concentration isopleths for each contaminant within the wider area and ascertain there are no elevated concentration anomalies beyond the immediate vicinity represented by the 1 km study area. The general study areas assessed for the Existing Conditions Report are provided in **Figure 2-1**.

2.1 Air Quality Receptors

The focus of the modelling was on identified discrete receptors in the immediate vicinity (within ~1 kilometre) of the active landfill area. These discrete receptors are closest to the landfill area in each compass direction and are expected to provide the worst-case estimate for predicted contaminant concentrations in all directions from the landfill. Impacts beyond these receptors will be visible in the concentration isopleths. A total of 25 discrete receptors were identified consisting of 24 residential receptors and the cemetery. All receptors were identified in the Air Quality work plan. Receptors for the air quality assessment are based on previous studies conducted at TCEC. Receptors were confirmed through review of updated aerial imagery as well as a site visit. Their locations are presented in **Figure 2-2**. The receptor located at the cemetery to the southwest of the landfill has been included in the air quality assessment as a short-term receptor, denoted as STR1, as people are expected to use this location for short periods during daytime only. Therefore, only odour and contaminants with 10-minute or 1-hour averaging period criteria were assessed at this receptor. All other receptor locations represent residences with potential 24-hour occupancy and were assessed for all averaging periods, denoted as R1 – R24. All discrete receptors are modelled using a flagpole height of 1.5m.

In addition, the modelling was performed using a receptor grid covering the off-site study area to produce predicted concentration isopleths. Concentrations for areas not specifically represented by discrete receptors can be extrapolated from these isopleths. The receptor grid extends a minimum of 5 kilometers from the existing landfill site and utilizes the receptor spacing outlined in the MECP guideline A-11, “Air Dispersion Modelling Guideline for Ontario”, version 3.0, dated February 2017. The receptor grid used for generating the isopleths is presented in **Figure 2-3**.

3 Methods

This Air Quality Existing Conditions Report was developed based on the evaluation criteria, indicators, and data sources included in the approved ToR, which were

developed in consultation with government agencies and other stakeholders. The evaluation criteria, rationale, indicators and data sources used for Air Quality as per the approved ToR are provided in **Table 3-1**.

Table 3-1. Evaluation Criteria, Indicators and Data Sources for Air Quality

Evaluation Criteria	Rationale	Indicators	Data Sources
Natural Environment			
Atmospheric Environment			
Air Quality - Blowing Litter	Waste disposal site and associated operations can release litter, which may be blown to the surrounding areas.	• Extent of zones potentially impacted by blowing litter. • Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms odour sensitive area(s), institutions).	• On-site meteorological data. • MECP-provided meteorological data. • MECP inspection records, WM inspection records, and complaint history. • Published literature related to the factors affecting the generation and mitigation of blowing litter. • Landfill design and operation data.
Air Quality - Odour	Waste disposal site and associated operations can emit contaminants that generate odorous emissions.	• Off-site odour concentrations (odour units) at identified odour sensitive receptors in the immediate vicinity of the site. • Frequency of any odour levels above defined odour benchmarks. • Number of off-site receptors potentially affected (e.g., residential properties, public facilities, businesses/farms odour sensitive area(s), institutions).	• MECP-provided meteorological data. • Applicable MECP guidelines, technical standards, and accepted models. • Aerial photographic mapping and field reconnaissance. • Previously completed reports for the TCEC facility, including the 2016 Environmental Screening Report, the 2005 EA, various ECA/ESDM reports, ambient monitoring reports, etc. • Off-site odour-sensitive receptors defined as per the MECP Odour Technical Bulletin1, identified in coordination with other disciplines. • Proposed facility characteristics. • Landfill design and operation data. • Published terrain data. • Published air emission factors. • Emission measurements from comparable landfills and/or on-site sampling. • Applicable air quality standards, guidelines, and criteria from the MECP and the CCME.
Air Quality – Landfill Gas and Combustion By-Products	Waste disposal site and associated operations can emit gaseous contaminants that can degrade air quality.	• Off-site point of impingement air concentrations of indicator compounds at identified receptors in the immediate vicinity of the site, and community (within 5 km). • Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors. • Number of off-site receptors potentially affected (e.g., residential	• MECP-provided meteorological data. • Applicable MECP guidelines, technical standards and accepted models. • Aerial photographic mapping and field reconnaissance. • Previously completed reports for the TCEC facility, including the 2016 Environmental Screening Report, the 2005 EA, various ECA/ESDM reports, ambient monitoring reports, etc. • Off-site receptors identified in coordination with other disciplines. • Available background ambient air data. • Site specific ambient monitoring data. • Proposed facility characteristics.

Evaluation Criteria	Rationale	Indicators	Data Sources
		properties, public facilities, businesses/farms, institutions).	• Landfill design and operation data. • Published terrain data. • Published air emission factors and predictive models. • Established gas characteristics from the existing operation. • Applicable air quality standards, guidelines, and criteria from the MECP and the CCME.
Air Quality - Dust	Construction and operation activities at a waste disposal site can lead to increased levels of particulates (dust) in the air.	• Off-site point of impingement air concentrations of particulate matter (dust) compounds at identified receptors in the immediate vicinity of the site, and community. • Frequency of any exceedance of applicable standards, limits, or guidelines at identified receptors. • Number of off-site identified receptors potentially affected (e.g., residential properties, public facilities, businesses/farms, institutions). • Both operational and construction activities occurring in each of the future operational stages of the landfill considered in the assessment will be independently identified, described, and assessed.	• MECP-provided meteorological data. • Applicable MECP guidelines, technical standards and accepted models. • Aerial photographic mapping and field reconnaissance. • Previously completed reports for the TCEC facility, including the 2016 Environmental Screening Report, the 2005 EA, various ECA/ESDM reports, ambient monitoring reports, etc. • Off-site receptors identified in coordination with other disciplines. • Available background ambient air data. • Site specific ambient particulate monitoring data. • Proposed facility characteristics. • Landfill design and operation data. • Published terrain data. • Published air emission factors and predictive models. • Published particle size fractionation data. • Traffic data. • Applicable air quality standards, guidelines, and criteria from the MECP and the CCME.

Note:
[1] MECP, 2016: Technical Bulletin – Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines under O. Reg. 419/05, September 2016.

4 Data Collection and Review

See **Table 4-1** for a description of the data collection and review methodology for the sources of data noted in **Table 3-1**.

Table 4-1. Collection and Review of Data Sources

Data Source	Collection	Review
Site visits on October 05, 2022	Haul route road dust and daily cover stockpile sampling.	Collected samples for laboratory analysis in order to characterize site paved haul routes, unpaved haul routes, and the daily cover stockpile.

Data Source	Collection	Review
MECP Guideline A-11 “Air Dispersion Modelling Guideline for Ontario”, version 3, dated February 2017	Ontario dispersion modelling requirements for comparison to MECP criteria.	Reviewed document to align dispersion modelling with MECP requirements for comparison to MECP criteria.
US Environmental Protection Agency (EPA) Landfill gas generation model LandGEM	Predicted landfill gas generation from waste.	Updated to model input site-specific landfill gas composition data and Ontario recommended first-rate constants.
MECP Interim Guide to Estimate and Assess Landfill Air Impacts, October 1992	Obtain MECP recommended LandGEM K, L_o, and C_{NMOC} constants.	Review of the MECP recommended LandGEM factors.
Landfill Gas Sampling Report (Laboratory 2023)	Concentrations of select compounds in the landfill gas.	Collected raw landfill gas samples for analysis to determine composition.
Landfill Odour Sampling Report (x2) (Laboratory 2023)	Odour flux rates from various landfill locations.	Flux chamber analysis for odour emissions from key areas of the landfill.
Landfill Gas Odour Sampling Report (St. Croix, 2025)	Odour concentrations in the landfill gas.	Collected raw landfill gas samples from individual wells for analysis to determine odour levels.
Aerial mapping and field reconnaissance to confirm off-site points of reception	Lambton County GIS online website and google earth imagery. Site visit by field team.	Reviewed to confirm off-site receptor locations. Receptors were confirmed by field team onsite.
Air Quality Assessment Environmental Centre Renewable Natural Gas Facility (RWDI, 2023)	RNG Facility sources.	Review of Air Quality related sources from the proposed RNG Facility for consideration of like emissions.
2016 TCEC Increase Tonnage Environmental Screening Report	Traffic values from interior haul route, tonnage fill rate, estimated landfill capacity, equipment fleet specifications, active face and waste soil pile sizes, dispersion modelling source parameters, and daily cover and active face moisture contents.	Review of previous modelling methodology, source parameters, equipment specifications, and interior haul route traffic distribution. Obtained the active face and daily cover stockpile moisture contents. Modelling parameters were used as the basis for the dispersion modelling of the existing conditions assessment.
Traffic Study (HDR, 2026)	Hourly traffic volumes with a detailed breakdown of vehicle types.	Reviewed to determine worst-case on-site traffic hour/day.
Air Contaminants Benchmark List (ACB List).	Ontario modelling criteria.	Review of the criteria set by the MECP for assessment of contaminants of interest.
Ambient Air Quality Criteria Human Toxicology and Air Standards Section – Technical Assessment and Standards development Branch MECP, dated May 1, 2020.	Ambient Air Quality criteria.	Review of the ambient air quality criteria for comparison with monitored and modelled concentrations.
Canadian Ambient Air Quality Standards (CAAQs)	Canadian ambient air quality objectives.	Review of CAAQs criteria for contaminants without Ontario modelling or ambient monitoring criteria.

Data Source	Collection	Review
Methodology for Modelling Assessments of Contaminants with 10-minute average standards and guidelines for odour under O.Reg. 419/05	Methodology for assessing odour-based standards.	Methodology for assessing contaminants with 10-minute averaging periods.
Air Quality Work Plan dated March 30, 2022	Assessment Methodology.	Review of the assessment methodology approved in the ToR.
O.Reg. 419/05	Ontario Air Quality Assessment Requirements.	Review of the regulatory requirements for air dispersion modelling in Ontario.

5 Indicator Contaminants

The TCEC has been well characterized through studies such as the 2005 EA, the 2016 Environmental Screening Report, and various ECA applications. Based on the conclusions of these studies as well as an understanding of the contaminants typically emitted by landfill operations, a set of key indicator contaminants were selected for use in the EA. In general, the contaminants with predicted concentrations greater than 15% of their current criteria in the previously completed 2016 Environmental Screening Report were determined to be the key indicator contaminants.

The key indicator contaminants were divided into four studies:

1. Blowing Litter
    a. Assessed qualitatively as there are no applicable criteria.
2. Odour
3. Landfill Gas and Combustion Byproducts:
    a. Vinyl Chloride (CAS# 75-01-4);
    b. Benzene (CAS# 71-43-2);
    c. 1,2-Dichloroethane (CAS# 107-06-2);
    d. Total Reduced Sulphurs (TRS);
    e. Hydrogen Sulphide (H_2S) (CAS# 7783-06-4);
    f. Ammonia; (CAS# 7664-41-7)
    g. Nitrogen Oxides (NO_x) / Nitrogen Dioxide (NO_2) (CAS# 10102-44-0);
    h. Dioxins and Furans (D&F as TEQ); and,
    i. Sulphur Dioxide (SO_2) (CAS# 7446-09-5).
4. Dust:
    a. Total Suspended Particulate (TSP);
    b. Particulate Matter less than 10 µm in diameter (PM_{10}); and,
    c. Particulate Matter less than 2.5 µm in diameter ($PM_{2.5}$).

Assessment criteria for these contaminants were obtained from:

- MECP Regulation 419/05 – ACB List;
- MECP Ambient Air Quality Criteria (AAQC); and,
- Canadian Council of Ministers of Environment (CCME), Canadian Ambient Air Quality Standards (CAAQS).

Contaminants were compared against criteria from O.Reg. 419/05 and AAQC where available. In the absence of any MECP criteria, contaminants were compared to the CAAQS criteria.

The CAAQS outline regional objectives for ambient concentrations of select air pollutants. These values are intended for use in a regional context and were not developed as facility level regulatory standards. NO_x and SO_2 have applicable O.Reg. 419/05 and AAQC criteria from the MECP, which are the most appropriate criteria for this facility-level assessment. Therefore, the CAAQS were not considered for these contaminants.

Conversely, the CAAQS have been considered for $PM_{2.5}$, due to a lack of a criterion set by the MECP for this specific contaminant. The Air Quality existing conditions considered the 2020 CAAQS as a benchmark for $PM_{2.5}$; the 2030 CAAQs became available in July 2025, after the completion of the characterization of existing conditions and would not materially impact the conclusions of the Air Quality Existing Conditions Report.

A summary of the contaminants and their applicable criteria are provided in **Table 5-1**.

Table 5-1. Assessment Criteria for Key Indicator Compounds

Contaminant	Applicable Sub-Assessment	Averaging Period	Air Quality Criteria (µg/m^3)	Source
Total Suspended Particulate (TSP)	Dust	24-hour	120	AAQC & O.Reg 419/05
		Annual	60	AAQC
Particulate Matter less than 10 µm in diameter (PM_{10})	Dust	24-Hour	50	AAQC
Particulate Matter less than 2.5 µm in diameter ($PM_{2.5}$)	Dust	24-Hour	27[1]	CAAQS (2020)
		Annual	8.8[2]	CAAQS (2020)
Vinyl Chloride	Landfill Gas	24-hour	1.0	AAQC & O.Reg 419/05
		Annual	0.2	AAQC
Benzene	Landfill Gas	24-hour	2.3	AAQC
		Annual	0.45	AAQC & O.Reg 419/05
1,2-Dichloroethane	Landfill Gas	24-hour	2	AAQC & O.Reg 419/05
		Annual	0.4	AAQC

Contaminant	Applicable Sub-Assessment	Averaging Period	Air Quality Criteria (µg/m³)	Source
Ammonia	Landfill Gas	24-hour	100	AAQC
Hydrogen Sulphide (H_2S)	Landfill Gas	10-minute	13	AAQC & O.Reg 419/05
		24-hour	7	AAQC & O.Reg 419/05
Total Reduced Sulphurs (TRS)	Landfill Gas	10-minute	13	AAQC & O.Reg 419/05
		24-hour	7	AAQC & O.Reg 419/05
Odour	Odour	10-minute	1 OU/m³	MECP Guidance
Dioxins and Furans (D&F)	Combustion	24-hour	0.1 pg TEQ/m³	AAQC
Nitrogen Oxides/Nitrogen Dioxides (NO_X/NO_2)	Combustion	1-hour	400	AAQC & O.Reg 419/05
		24-hour	200	AAQC & O.Reg 419/05
Sulphur Dioxide (SO_2)	Combustion	1-hour	100	AAQC & O.Reg 419/05
		Annual	10	AAQC & O.Reg 419/05

Notes:

[1] The 24-hour $PM_{2.5}$ CAAQs criteria is based on the 3-year average of the annual 98th percentile of the daily 24-hour average concentration.

[2] The annual $PM_{2.5}$ CAAQs criteria is based on the 3-year average of the annual average of the daily 24-hour average concentration.

6 Ambient Dust and VOC Monitoring

In order to better characterize the existing conditions at TCEC, two types of field studies were completed:

- Ambient dust and VOC monitoring; and,
- Emission source sampling.

These studies provide site-specific data that are used to characterize and refine the potential impacts from landfill operations on the surrounding area. This section discusses the ambient monitoring program, and details regarding the emission source sampling are provided in **Section 7**.

RWDI was retained by WM to complete the ambient monitoring campaign. Ambient monitoring is the collection and analysis of ambient air samples in order to determine the concentration of contaminants of interest in the air. The resulting concentrations can then be compared against applicable AAQC. Ambient monitoring data is used to

determine the background concentrations of the contaminants of interest in the vicinity of the landfill. These background concentrations are then included with the predicted concentrations from the landfill operations in order to assess the potential cumulative effect. This chapter outlines the results from the existing conditions ambient air quality sampling campaign.

TCEC has maintained a robust monitoring program throughout the life of the landfill. The site maintains three (3) permanent monitoring stations for TSP, located on the landfill property. In support of the EA, the ambient monitoring program was expanded to include PM_{10}, $PM_{2.5}$, VOC, and TRS sampling at the same locations as TSP, consistent with the Air Quality work plan, dated March 30th, 2022. The sampler locations are shown in Figure 6-1. These locations remained fixed for the duration of the sampling program. Measurement of ambient particulate (TSP, PM_{10}, and $PM_{2.5}$) began on January 6, 2023 and concluded on December 26, 2023. VOC and TRS sampling began on June 2, 2023 and concluded at the end of September 2023. This Existing Conditions Report considers all background data collected during the 2023 sampling campaign.

6.1 Sampling Methodology

6.1.1 High Volume Air Samplers (Hi-Vols)

The TSP, PM_{10}, and $PM_{2.5}$ samples were collected using standard high-volumetric (Hi-Vol) air samplers outfitted with size-selective inlet heads capable of collecting PM_{10} and $PM_{2.5}$ particulate size fractions. Each Hi-Vol is equipped with a mass flow controller, which ensures a flow rate of 40 cubic feet per minute (CFM) and a timer for starting and stopping each sample. Consistent with the Ambient Monitoring Program outlined in the Air Quality work plan, the samplers run on a 6-day schedule from January 1st to May 31st and October 1st to December 31st of each year and run on a 3-day cycle from June 1st to September 30th of each year. All stations operate over a 24-hour sampling time (midnight to midnight), concurrent with the National Air Pollution Surveillance Program (NAPS) schedule. Each Hi-Vol was calibrated once per quarter to ensure accuracy and validity of the data. Pre-tared glass fibre filters were used, which were pre and post weighed by the Bureau Veritas Laboratory (BV) located in Mississauga, ON.

6.1.2 Evacuated Canisters (VOCs and TRS)

The ambient VOC and TRS samples were collected in the same pre-conditioned silica-lined evacuated canisters, as specified in EPA Compendium Method TO-14/15. The evacuated canisters were supplied, proofed, and analyzed by ALS Environmental Laboratory (ALS) in Waterloo, ON.

Critical orifice flow controllers approved for use by the MECP were used to maintain a constant flow rate of approximately 3.5 milliliters per minute over a sampling period of 24 hours. The controllers were supplied and conditioned by ALS and were used once

and returned to the ALS for cleaning/reconditioning. The controllers were constructed of inert materials including stainless steel, charcoal ferrules and Teflon coating, and were equipped with pressure gauges. Each controller was fitted with an RWDI supplied Nutech 2701 programmable automated sampling timer, which both opens and closes the canister over a programmed time period. During the sampling campaign, a few Nutech 2703 controllers were used, which have an integrated sample controller and timer all in one. All three (3) stations ran on a three-day schedule from June 1st to September 30th, 2023, each consisting of a 24-hour (midnight to midnight) sample, concurrent with the NAPS schedule.

6.1.3 Air Quality Criteria and Standards

The monitored contaminant concentrations were compared to the AAQC criteria outlined in **Section 5**. The AAQC are the maximum desirable concentrations in the outdoor air, based on effects to the environment and health (MECP, 2020). When MECP criteria was not available ECCC objectives were used. ECCC has established a CAAQS for $PM_{2.5}$ (CCME, 2012). CAAQS are health-based air quality objectives for the outdoor air.

It should be noted that the AAQC for PM_{10} is an interim value of 50 µg/m^3 for an averaging period of 24 hours, and the current CAAQS' for $PM_{2.5}$ is 27 µg/m^3 for the 3-year average of annual 98th percentile 24-hour concentration, and 8.8 µg/m^3 for the 3-year average of annual concentrations (in effect as of 2020). Since this program has been in place for less than the prescribed 3-year duration required for application of the CAAQS values, they are not applicable to the sampling results at this time. The criteria used for comparison of ambient monitoring results is summarized in **Table 5-1**.

6.2 Summary of Ambient Monitoring Data

6.2.1 Wind Data: Upwind/Downwind/Crosswind Interpretation

To assess whether the samplers were considered upwind, downwind or crosswind during each individual sampling period, a wind direction range was associated with each sampling location. The wind direction ranges are shown in **Table 6-1**. The 'downwind' designation indicates that the sampler was located downwind of the active landfill cell for >50% of the sampling period. Under these conditions the landfilling operations are likely to contribute to the measured concentrations. The 'upwind' designation indicates that the sampler was located upwind from the active cell for >50% of the sampling period. The 'crosswind' designation indicates that the sampler was neither upwind or downwind for >50% of the sampling period with respect to the active cell. Under the 'upwind' and 'crosswind' conditions, the landfilling operations are unlikely to make a significant contribution to the measured concentrations. **Appendix 6A** includes wind data interpretation for all sample locations during sample dates in 2023 from January to December.

Table 6-1. Upwind and Downwind Wind Direction Range Based on Sampler Location

	Northeast	West	Southeast
	Degrees (°)		
Upwind	40-110	214-292	120-158
Downwind	220-290	34-112	300-338

6.2.2 TSP

From January to December of 2023, there were a total of eighty-one (81) sample dates based on 6-day sampling from October through May and 3-day sampling from June through September. A total of two hundred and forty-three (243) samples were initiated across all three sample locations, of which two hundred twenty-six (226) samples were valid. This indicates that 93% of the total samples were successful. Total sample validity at the Northeast, Southeast and Western Stations were 90%, 93% and 96% respectively, indicating that all sampling stations had a valid sampling period (≥75% validity).

A summary of the calculated statistics for measured TSP concentrations at the Twin Creeks Environmental Centre sampling locations is presented in **Table 6-2**.

Table 6-2. Calculated Statistics for Measured 24-Hour Averaged TSP Concentrations for Samples from January to December of 2023

Sample Locations	Total No. of Samples	No. of Valid Samples	Percentage of Valid Samples	Percentiles (%)			Maximum (µg/m³)	Arithmetic Mean (µg/m³)	No. of Measurements Above the AAQC (120 µg/m³)
				50	70	90			
Northeast	81	73	90%	22	39	112	236	43	6
Southeast	81	75	93%	20	29	58	145	30	3
Western	81	78	96%	33	47	92	211	44	4

Background concentrations of TSP used in the existing conditions assessment are discussed in **Section 8**.

The MECP 24-hour AAQC for TSP (120 µg/m^3) was exceeded thirteen (13) times out of the two hundred twenty-six (226) valid samples taken during the sampling period. Therefore, 94% of valid TSP samples were below the applicable criteria. Exceedance events are summarized in **Table 6-3**.

Table 6-3. Summary of TSP Exceedances

Date	Station	Measured Concentration (µg/m³)
12-Apr-23	Northeast station	201
12-May-23	Northeast station	200
12-May-23	Southeast station	145
12-May-23	Western station	128

Date	Station	Measured Concentration (µg/m³)
18-May-23	Western station	148
24-May-23	Northeast station	170
24-May-23	Southeast station	122
2-Jun-23	Southeast station	136
2-Jun-23	Western station	130
8-Jun-23	Northeast station	158
20-Jun-23	Western station	211
11-Jul-23	Northeast station	130
3-Oct-23	Northeast station	236

6.2.2.1 Historic Particulate Monitoring Data

As discussed in **Section 6**, WM has maintained a robust monitoring program for particulate matter throughout the life of the landfill. Historic particulate matter monitoring has been completed at the same monitoring stations considered in the 2023 campaign. However, prior to 2023 only total particulate matter was considered and the smaller size fractions for PM_{10} and $PM_{2.5}$ were not collected.

Overall, in the time since the fill rate increase in 2017, exceedances at the onsite monitoring stations have been recorded from time to time. A summary of the ambient monitoring data collected since 2017 is provided in **Table 6-4**.

Table 6-4. Calculated Statistics for Measured 24-Hour Averaged TSP Concentrations for Samples from 2017 through 2022

Sample Location	No. of Measurements Above the AAQC (120 µg/m³)					
	2017	2018	2019	2020	2021	2022
Northeast	5	6	3	4	1	6
Southeast	1	7	2	3	3	7
Western	0	4	3	6	0	2
Total	6	17	8	13	4	15

As shown in **Table 6-3** the total number of exceedances of the 120 µg/m³ AAQC recorded at all monitoring station in 2023 was 13. Between 2017 and 2022 the number of exceedances ranged from 4 to 17, with the highest number of exceedances occurring in 2018. Over the past 7 years some exceedances have been recorded every year with slight variations year to year. The exceedances observed in 2023 fall withing the range typically seen since 2017.

6.2.3 PM_{10}

From January to December of 2023, there were a total of eighty-one (81) sample dates based on 6-day sampling from October through May and 3-day sampling from June through September. A total of two hundred and forty-three (243) samples were initiated

across all three sample locations, of which two-hundred and twenty-five (225) samples were valid. This indicates that 93% of the total samples were successful. Total sample validity at the Northeast, Southeast and Western Stations were 96%, 86% and 95% respectively, indicating that all sampling stations had a valid sampling period (≥75% validity).

A summary of the calculated statistics for measured PM_{10} concentrations at the Twin Creeks Environmental Centre sampling locations is presented in **Table 6-5**.

Table 6-5. Calculated Statistics for Measured 24-Hour Averaged PM_{10} Concentrations for Samples from January to December 2023

Sample Locations	Total No. of Samples	No. of Valid Samples	Percentage of Valid Samples	Percentiles (%)			Maximum (µg/m³)	Arithmetic Mean (µg/m³)	No. of Measurements Above the AAQC (50 µg/m³)
				50	70	90			
Northeast	81	78	96%	11	19	51	106	20	8
Southeast	81	70	86%	11	17	28	74	15	2
Western	81	77	95%	14	20	44	106	20	7

Background concentrations of PM_{10} used in the existing conditions assessment are discussed in **Section 8**.

The MECP 24-hour AAQC for PM_{10} (50 µg/m³) was exceeded seventeen (17) times out of the two hundred twenty-five (225) valid samples taken during the sampling period. Therefore, 92% of valid PM_{10} samples were below the applicable criteria. Exceedance events are summarized in **Table 6-6**.

Table 6-6. Summary of PM_{10} Exceedances

Date	Station	Measured Concentration (µg/m³)
12-Apr-23	Northeast station	95
12-May-23	Northeast station	106
12-May-23	Southeast station	74
12-May-23	Western station	60
18-May-23	Western station	52
24-May-23	Northeast station	66
24-May-23	Southeast station	52
2-Jun-23	Northeast station	55
2-Jun-23	Western station	69
5-Jun-23	Northeast station	70
5-Jun-23	Western station	55
8-Jun-23	Northeast station	77
20-Jun-23	Western station	106
29-Jun-23	Western station	73
11-Jul-23	Northeast station	58

Table 6-6. Summary of PM_{10} Exceedances

Date	Station	Measured Concentration (µg/m³)
3-Oct-23	Northeast station	89
3-Oct-23	Western station	52

6.2.4 $PM_{2.5}$

From January to December of 2023, there were a total of eighty-one (81) sample dates based on 6-day sampling from October through May and 3-day sampling from June through September. A total of two hundred and forty-three (243) samples were initiated across all three sample locations, of which two-hundred and twenty-six (226) samples were valid. This indicates that 93% of the total samples were successful. Total sample validity at the Northeast, Southeast and Western Stations were 93%, 89% and 98% respectively, which means that every sampling station had a valid sampling period ($\geq$75% validity).

A summary of the calculated statistics for measured $PM_{2.5}$ concentrations at the TCEC sampling locations is presented in **Table 6-7**.

Table 6-7. Calculated Statistics for Measured 24-Hour Averaged $PM_{2.5}$ Concentrations for Samples from January to December of 2023

Sample Locations	Total No. of Samples	No. of Valid Samples	Percentage of Valid Samples	Percentiles (%)			Maximum (µg/m³)	Arithmetic Mean (µg/m³)	No. of Measurements Above the CAAQS[1] (27 µg/m³)
				50	70	90			
Northeast	81	75	93%	8	12	22	38	10	5
Southeast	81	72	89%	7	10	17	40	10	3
Western	81	79	98%	10	14	24	54	12	2

Notes:
[1] CAAQS (2020)

Background concentrations of $PM_{2.5}$ used in the existing conditions assessment are discussed in **Section 8**.

The $PM_{2.5}$ CAAQS is only being applied as a comparison and not an exceedance threshold, as the program has been in place for less than the prescribed 3-year duration required based on the CAAQS statistical form for $PM_{2.5}$.

6.2.5 Particulate Fraction Proportions

The TSP, PM_{10} and $PM_{2.5}$ samples are collocated at each of the 3 sampling locations. From January to December 2023, there were 17 occurrences where the measured concentration of a smaller fraction was greater than the corresponding concentration of a larger fraction (i.e., PM_{10} was greater than TSP or $PM_{2.5}$ greater than PM_{10}). This

generally occurred when particulate concentrations were low (i.e., <20 µg/m^3). There were 5 occurrences at the Southeast sampler, 5 occurrences at the Northeast sampler, and 8 occurrences at the Western sampler. These results are considered valid with the exception of 1 occurrence, as the equipment was calibrated on a quarterly basis verifying that the samplers were operating correctly and the difference between the fractions was typically very minor (1-5 µg/m^3), which is within the margin of error for this type of sampling. The 1 occurrence was on August 25, 2023, and the Southeast PM_{10} sample was invalidated based on disagreement between fraction proportion, being an outlier value relative to the other stations and other size fraction samplers.

6.2.6 VOCs and TRS

From June to September 2023, there were a total of forty-one (41) sample dates based on a 3-day sampling schedule. A total of one hundred and twenty-three (123) samples were initiated across all three sample locations, of which one hundred and nine (109) samples were valid. This indicates that 89% of the total samples were successful. Sample validity at the Northeast, Southeast and Western Stations were 90%, 83% and 93% respectively, indicating that the Northeast, Southeast, and Western samplers had a valid sampling period (>75% validity).

A summary of the calculated statistics for measured VOC, H_2S and TRS concentrations at the Twin Creeks Environmental Centre sampling locations is presented in **Table 6-8**.

Table 6-8. Calculated Statistics for Evacuated Canister Samples from June to September of 2023

Sample Locations	Total No. of Samples	No. of Valid Samples	Percentage of Valid Samples	No. of Measurements Above the Applicable Criteria				
				VOCs			H_2S	TRS
				Benzene	1,2-Dichloroethane	Vinyl Chloride		
Northeast	41	37	90%	0	0	0	1	14[1]
Southeast	41	34	83%	0	0	0	0	11[1]
Western	41	38	93%	0	0	0	2	13[1]

Notes:
[1] TRS sampling RDL's were greater than the criteria for 15 sample dates during the campaign. This contributed to the 34 occurrences of non-detect results that are above the criteria, therefore not truly measured exceedances.

At the onset of the sampling program RWDI understood that ALS would be using a lower RDL for TRS than they were subsequently able to achieve. As a result, the samples from June 2nd through to July 14th, which reported a non-detect result for TRS, exceeded the applicable criteria. This led to a total of thirty-four (34) non-detect results that were greater than the applicable criteria for TRS. Upon discovering this RDL issue, discussion occurred between ALS and RWDI, who then worked together to determine a resolution to reduce the TRS RDL. On July 21st, ALS confirmed that they were able to lower the RDL from the July 17th samples onward. Since July 17th, with the exception

of samples collected on August 22nd, all samples were below the updated detection limit and thus below the TRS criteria.

The H_2S criteria was exceeded three (3) times and the TRS criteria was exceeded four (4) times during the sampling period. There were thirty-four (34) TRS non-detect results that were above the criteria. The H_2S and TRS exceedances are summarized in **Table 6-9**.

Table 6-9. Summary of H_2S and TRS Exceedances

Date	Station	H_2S and TRS Criteria (24-hour) (µg/m³)	Predicted H_2S Concentration (µg/m³)	Predicted TRS Concentration (µg/m³)
23-Jun-23	Northeast station	7	27.0	27.0
26-Jun-23	Western station	7	9.2	<11.0[1]
2-Jul-23	Western station	7	8.2	<11.0[1]
22-Aug-23	Northeast station	7	3.8[2]	8.2
22-Aug-23	Southeast station	7	3.9[2]	8.4
22-Aug-23	Western station	7	3.8[2]	11.4

Notes:
[1] Detection limit above criteria.
[2] H_2S concentration not above criteria but has been included as a component of TRS.

Although the detection limit for TRS was above the criteria for the June 26th and July 2nd samples TRS is primarily influenced by the concentration of H2S and therefore the concentration of TRS was between 9.2 µg/m³ and 11 µg/m³ on June 26th, and between 8.2 µg/m³ and 11 µg/m³ on July 2nd. A summary of all ambient monitoring data is provided in **Appendix 6B.**

6.2.6.1 Historic VOC Sampling Data

Prior to 2023 no stationary long-term ambient monitoring program for VOCs had been maintained at TCEC. Instead, 30-minute short-term, upwind/downwind sampling was completed through the summer months from June 21st to September 21st. From 2017 to 2021, 30-minute compliance sampling was completed and compared to O.Reg.419 Schedule 2 criteria which are no longer the regulatory criteria used in Ontario. In 2022 compliance monitoring was updated to 24-hour compliance monitoring and compared to O.Reg. 419 Schedule 3 criteria which are the current applicable criteria used in Ontario. These samples were collected from two locations on property surrounding the working face at TCEC. These two sampling locations varied based on the wind direction on the day of sampling in order to capture upwind and downwind contribution. Five sample sets were collected per year. A summary of the monitoring data from 2017 through 2022 is provided in **Table 6-10**.

Table 6-10. Maximum Measured 30-Minute VOC Concentrations for Samples from 2017 through 2022

Contaminant	CAS	Schedule 2 30-minute AAQC (µg/m³)	Schedule 3 24-hour AAQC (µg/m³)	Maximum Downwind Concentration (µg/m³)					
				2017[2]	2018[2]	2019	2020	2021	2022[3]
1,2-Dichloroethane	107-06-2	6	2	ND	0.4	ND	ND	ND	ND
Benzene	71-43-2	7	2.3	0.8	0.9	0.8	0.7	1.1	0.4
Vinyl Chloride	75-01-4	3	1	ND	0.2	0.4	ND	ND	0.1

Notes:
[1] Field denoted with "ND" indicate samples below the detection threshold.
[2] 2017 -2022 monitoring was completed for the 30-minute averaging period for comparison to Schedule 2 criteria.
[3] 2022 monitoring was completed for the 24-hour averaging period for comparison to Schedule 3 criteria.

The 2017 – 2022 monitoring programs differed from the 2023 monitoring that was implemented in support of the EA. The 2023 monitoring was a specialized one-time monitoring program from June 2nd to September 30th, 2023. This monitoring program was completed using fixed location 24-hour monitoring stations co-located with the existing particulate matter monitoring stations. These stations were located within the property boundary and collected on a 3-day sampling schedule.

As shown in **Table 6-10**, the majority of samples collected in the years following the 2017 fill rate expansion for 1,2-dichloroethane and vinyl chloride have been below the detection threshold. The samples that are above the detection threshold remain consistently low compared to their respective criteria. Concentrations of benzene are consistently above the detection threshold but have been measured in low concentrations relative to the criteria. Measured concentrations of all three compounds have remained consistent over the last 6 years with minor variations year over year.

7 Emission Source Sampling

In addition to the ambient monitoring program, on-site source sampling was completed to aid in the development of the emission inventory for the TCEC facility. Details of the source sampling are provided in the following sections.

7.1 Odour Sampling

7.1.1 Flux Chamber Sampling

In order to better characterize fugitive odour emissions from the existing TCEC landfill and leachate collection system, RWDI collected flux chamber samples from landfill

areas under final cover, landfill areas under interim cover, the active face with new waste deposited, the freshly exposed waste at the active face following stripping of the daily cover, leachate maintenance holes, and the contaminated soil pile. Sampling was completed on June 19th, 2023 for the final cover and interim cover, on June 29th, 2023 for the leachate maintenance holes as well as new waste and freshly exposed waste at the active face, and on October 2nd, 2023 for additional samples from final cover and interim cover. Sampling locations are shown in **Figure 7-1**.

Odour emissions from the areas listed above were measured using three identical flux chambers. The flux chambers used are 40.6 cm in diameter and approximately 35 cm in height, and constructed of 14-gauge stainless steel, as per the designer's specifications outlined in Ontario Stack Testing Code Method ON-6. All interior and exterior fittings are constructed from inert stainless-steel material and all lines were made from Teflon tubing. The flux chambers are equipped with four quick connect ports: one for the sweep gas line, one for the sample line, one for the temperature instrument and one for the pressure instrument.

Before taking measurements, each flux chamber was placed on the surface of the landfill and the inlet of the chamber was embedded slightly into the area to create a seal. Sand was used to surround the chamber and the surface in areas where the chambers could not be inserted.

Ultra-high purity nitrogen gas was used as the sweep gas, which was metered into the chamber at a constant rate of 5 liters per minute. The sweep gas was allowed to run through the chambers for 30 minutes prior to sample collection.

Odour samples were collected through a sample port on the flux chamber into a Tedlar bag. The Tedlar bag was filled and purged three times before sampling over a 10-minute time frame for each of the forty-eight (48) samples.

During the odour flux chamber sampling, unexpected conditions were encountered during the final cover samples collected in June 2023, which are discussed in **Section 11.4**. For all other samples the landfill was operating under normal conditions and the landfill gas utilization system was operating under normal conditions.

All samples were sent to St. Croix Sensory, Inc., for odour panel analysis to determine the concentration in odour unit (OU) per cubic metre. Concentrations for both odour detection and odour recognition were provided by the laboratory.

As a conservative approach, the detection values were used. Flux chamber measurements were used to determine odour emission rates, further details regarding the emission rate calculations are provided in **Section 11**.

Odour flux chamber sampling locations, the field notes, and the laboratory analysis are provided in **Appendix 7A**.

7.1.2 Landfill Gas Sampling

In order to better characterize odour emissions associated with landfill gas, samples of raw landfill gas were collected from fifteen (15) on-site gas wells. All samples were sent to St. Croix Sensory, Inc., for odour panel analysis to determine the concentration in odour unit (OU) per cubic metre. Concentrations for both odour detection and odour recognition were provided by the laboratory.

As a conservative approach, the detection values were used. Raw landfill gas measurements were used to determine odour emission rates, further details regarding the emission rate calculations are provided in **Section 11**.

Raw landfill gas odour sampling laboratory analysis are provided in **Appendix 7E**.

7.2 H_2S and TRS Flux Chamber Sampling

In order to better characterize H_2S and TRS emissions from the TCEC landfill, RWDI collected flux chamber samples from landfill areas under final cover and landfill areas under interim cover. Sampling was completed on September 21st and September 22nd, 2023, for the final cover and interim cover areas. A total of 18 samples were collected, 9 from the final cover areas and 9 from the interim cover areas.

H_2S and TRS emissions from the final cover and interim cover areas were measured using the same sampling methodology described for odour in **Section 7.1**, with the exception that H_2S and TRS samples were collected in evacuated canisters rather than Tedlar bags.

During the H_2S and TRS flux chamber sampling, the landfill was operating under normal conditions and the landfill gas utilization system was operating under normal conditions.

All samples were sent to ALS Limited, for analysis to determine the concentration in micrograms per cubic metre (µg/m³). Flux chamber measurements were used to determine emission rates of sulphur compounds, further details are provided in **Section 12**.

H_2S and TRS flux chamber sampling locations, the field notes, and the laboratory analysis are provided in **Appendix 7B**.

7.3 Landfill Gas Source Sampling

In order to better characterize fugitive emissions of sulphur and VOCs compounds from the existing TCEC landfill, RWDI collected samples of landfill gas from the landfill gas flare header. The main landfill gas header is the outlet from the landfill gas collection system where all collected gas is passed to the flares. Sampling was completed on June 29th, 2023.

Samples were sent to Bureau Veritas for analysis of sulphur compounds and VOCs. Gas composition determined through laboratory analysis was used to calculate

emissions of VOCs from fugitive releases through the final cap and interim cap areas, and the landfill gas flares. Composition of sulphur compounds in the gas were used to estimate emissions from the landfill gas flares only. Fugitive emissions of sulphur compounds from the final cap and interim cover areas were based on flux chamber analysis as outlined in **Section 7.2**. Further details on VOC and sulphur compound emissions rate development are provided in **Section 12**.

During collection of landfill gas, the landfill was operating under normal conditions. A copy of the field notes and the laboratory analysis are provided in **Appendix 7C**.

7.4 Roadway and Material Stockpile Sampling

In order to better characterize fugitive dust emissions from the existing TCEC roadways and material storage piles, RWDI collected paved and unpaved roadway samples as well as a sample of daily cover material. Sampling was completed on October 5th, 2022. At the time of sampling, weather conditions were dry and there had been no reported rain for the previous two days. Samples were collected in accordance with US EPA AP-42 Appendix C.1 Procedures for Sampling Surface/Bulk Dust Loading. Multiple samples were taken at various locations at the facility. This was done in order to better characterize the landfill roadways. In total four samples were taken from paved roads, six samples were taken from unpaved roads, and one sample was taken from the daily cover storage pile.

Samples were sent for laboratory analysis to determine silt content, moisture content, and grain size analysis. Unfortunately, the laboratory was unable to provide the moisture content for the daily cover sample. Details on dust emissions rate calculations are provided in **Section 13**.

The grain size analysis for paved roads, unpaved roads, and the daily cover storage pile were used to determine the deposition parameters applied to dust sources. Dust particulates are dense, and deposition allows for the model to account for the settling out of particles as they migrate away from the emissions source. More details on how deposition parameters were determined and applied is provided in **Section 13.5.1**.

A copy of the sampling methodology, field notes, and the laboratory analysis are provided in **Appendix 7D**.

8 Background Data

Background data refers to concentrations of the contaminants of interest in the environment resulting from sources other than the Project. When available, background concentrations were obtained from the site-specific ambient monitoring data, outlined in **Section 6**. Background data is used in conjunction with dispersion modelling in order to assess the potential for cumulative impacts on the surrounding areas from the Project and surrounding industrial and agricultural activities, traffic, and other sources of like air emissions. When calculating background concentrations, only

upwind sample data was considered so as not to double count emissions associated with landfill operations, with the exception of H_2S and TRS values. The upwind analysis was completed in accordance with the methodology outlined in **Section 6.2.1**.

Background concentrations were taken as the 90th percentile value when comparing to 10-minute, 1-hour, and 24-hour averaging period criteria, while the average concentration was considered when assessing annual criteria as stated in the Air Quality work plan. Twenty four-hour 90th percentile concentrations were converted to 10-minute and 1-hour averaging periods using the methodology found in Section 4.4 of MECP's Guideline A-11 published in February 2017.

VOC and TRS sampling started at the beginning of June. Background concentrations consider the full monitoring program data from June - September. During June and July, the campaign experienced several samples that did not meet MECP criteria and were therefore voided from the dataset. Corrections were made to the sampling program and the successful sample collection was significantly improved. Of the valid data recorded, background concentrations of vinyl chloride, benzene, and 1,2-dichloroethane have remained consistent throughout the program, with the majority of vinyl chloride and benzene samples being non-detect. Concentrations of 1,2-dichloroethane were above the detection limit but remained low relative to the criteria for this contaminant.

H_2S and TRS compounds laboratory results from June up until July 17th, 2023 applied elevated detection limits, with the detection limit for TRS exceeding the applicable criteria. Starting on July 17th, 2023, the H_2S detection limits were decreased from 5.6 µg/m³ to 2.79 µg/m³, and the TRS detection limits decreased from 11 µg/m³ to 5.6 µg/m³. Even prior to the reduction in detection limit, H_2S has recorded concentrations above the detection limit in 9 of the 35 valid samples. Similarly, only 1 of the 35 valid TRS samples exceeded the detection limit prior to the reduction in detection limit. After the decrease in detection limit 29 of the 74 valid samples were recorded above the detection limit for H_2S and 3 of the 74 valid samples were above the new TRS detection limit. This suggests that for H_2S the background concentration is at or below the detection limit more than half the time and, for TRS the background concentration is at or below the detection limit the majority of the time.

Although the Air Quality work plan states that background concentrations are based on the 90th percentile value of upwind data only, the background concentration for H_2S and TRS were based on the 90th percentile value of all wind direction background data. This was completed after the reduction in detection limits on July 17th, 2023, there were only 3 upwind samples across all monitoring stations were recorded prior to the change in detection limit and only 6 upwind measurements over the entire H_2S and TRS monitoring period. Considering all wind directions rather than upwind only provides a conservative estimate of the background concentration because downwind and crosswind conditions have the potential to capture emissions from landfill sources which when paired with dispersion modelling could double count landfill emissions. A summary of the results from the ambient monitoring program are provided in **Appendix 6B**.

For contaminants that were not included in the ambient monitoring program, background concentrations were obtained from publicly available sources.

Background concentrations for ammonia were based on data provided by the Ammonia Monitoring Network (AMoN). AMoN is an American based monitoring network with a few stations in Ontario. The most recent data from the Longwoods, Ontario AMoN station (Site ID ON26) was used for the years 2014 – 2016. The Longwoods station was selected as it represents similar land use as the TCEC site and is located approximately 32 kilometers southeast of the site.

Background concentrations of D&F, NO_2, and SO_2 were obtained from the National Air Pollution Surveillance program (NAPS).

Background concentrations of NO_X were based on data from the London station (NAPS ID 60904). This station is located in a residential neighborhood surrounded by low-density housing and two parks. The station is located in a more urban setting opposed to TCEC which is located in rural Ontario. In urban settings, background concentrations of NO_X are typically higher due to the increase in vehicle traffic and proximity to industrial sources. The NO_X concentrations from the London station may be higher than what would be expected in a rural area, therefore, they provide a conservative estimate of background concentration. Concentrations were based on the 90th percentile NO_X values from the most recent 5 years of 1-hour and 24-hour data from 2017 – 2021. This station is approximately 54 km from the TCEC facility and was selected for its relative proximity and data availability.

Concentrations of D&F and SO_2 were based on data from the Simcoe Experimental Farms station (NAPS ID 62601), as data for these contaminants was not available from the London monitoring station. Simcoe Experimental Farms is located in a rural area with similar land use to the TCEC facility. D&F were based on the 90th percentile value for the most recent available 5 years of 24-hour data for the years 2007 to 2011. Concentrations of SO_2 were based on the 90th percentile value for the most recent 5 years of 1-hour data from 2017 – 2021 and annual concentrations were based on 5 years of the annual mean from 2017 – 2021.

Table 8-1 summarizes the background concentration and data source for each contaminant.

Table 8-1. Background Concentrations and Data Sources

Pollutant	Air Quality Criteria µg/m³	Averaging Period	Background Level µg/m³	Source of Background Level
TSP	120	24-Hour	46	[1]
	60	Annual	24	[2]
PM_{10}	50	24-Hour	19	[1]
$PM_{2.5}$	27	24-Hour	12	[1]
	8.8	Annual	7	[2]
Vinyl Chloride (75-01-4)	1	24-Hour	0.05	[1]
	0.2	Annual	0.05	[2]
Benzene (71-43-2)	2.3	24-Hour	0.6	[1]

Pollutant	Air Quality Criteria µg/m³	Averaging Period	Background Level µg/m³	Source of Background Level
	0.45	Annual	0.4	[2]
1,2-Dichloroethane (107-06-2)	2	24-Hour	0.1	[1]
	0.4	Annual	0.06	[2]
Ammonia (7664-41-7)	100	24-Hour	3.1	[4]
H_2S (7783-06-4)	13	10-Minute	22.4	[1] [3]
	7	24-Hour	5.6	[10]
TRS	13	10-Minute	44	[1] [3]
	7	24-Hour	11	[10]
Odour	1 OU/m³	10-Minute	--	--
D&F	0.1 pg TEQ/m³	24-Hour	0.02	[5]
NO_x (10102-44-0)	400	1-Hour	21	[6]
	200	24-Hour	19	[7]
SO_2 (7446-09-5)	100	1-Hour	2.4	[8]
	10	Annual	1.4	[9]

Notes:

[1] Represents the 90th percentile concentration of the upwind 24-hour monitoring data.

[2] Represents the average concentration of the upwind 24-hour monitoring data.

[3] 24-Hour 90th percentile concentrations were converted to 10-Minute averaging periods using the methodology found in section 4.4 Guideline A-11 published in February 2017.

[4] Ambient data for ammonia, 2014 to 2016, from the Ammonia Monitoring Network (AMoN), Longwoods, Ontario, AMoN Site ID ON26.

[5] Background data for dioxins and furans from National Air Pollutants Surveillance Program (NAPS) from Simcoe Experimental Farm, NAPS ID 62601 for 2007 to 2011.

[6] Five-year average of the 90th percentile of the 1hr average, based on NAPS data for London, Ontario, NAPS ID 60904, from 2017 to 2021.

[7] Five-year average of the 90th percentile of the 24hr average, based on NAPS data for London, Ontario, NAPS ID 60904, from 2017 to 2021.

[8] Five-year average of the 90th percentile of the 1hr average, based on NAPS data for Simcoe Experimental Farm, Ontario, NAPS ID 62601, from 2017 to 2021.

[9] Five-year average of the annual mean, based on NAPS data for Simcoe Experimental Farm, Ontario, NAPS ID 62601, from 2017 to 2021.

[10] Represents the 90th percentile concentration of all wind direction 24-hour monitoring data.

9 Dispersion Modelling

The potential impact from the proposed landfill operations were determined using a dispersion model and reasonable worst-case emission rates for the odour, landfill gas and combustion byproducts, and dust studies. Dispersion modelling was performed using the U.S. EPA's AERMOD dispersion model (AERMOD), version 22112, to predict concentrations of contaminants of interest emitted from the landfill operations at various receptors in the vicinity. The AERMOD model is an advanced dispersion model that has been approved for use in Ontario by the MECP. AERMOD is a steady-state Gaussian model that is capable of handling multiple emission sources. Within

the model, receptor grids as well as discrete receptor locations of interest can be considered. The modelling assessment was conducted in accordance with MECP Guideline A11: “Air Dispersion Modelling Guideline for Ontario”, February 2017.

The individual contaminant emission rates were applied to various sources in the dispersion model to predict the off-site concentrations.

Additional elements of the dispersion modelling assessment are discussed in the following sections.

9.1 Sources Modelled

The sources included in the dispersion model were:

- Final cap areas;
- Interim cover areas;
- Active face area;
- Active face equipment;
- LFG flares;
- Proposed RNG Facility;
- Waste soil storage pile;
- Future approved leachate treatment plant;
- Material handling;
- Vehicle traffic on internal haul routes;
- Idling vehicles at the active face and weigh scale; and
- Generators.

The landfill final cap areas, interim cover areas, active face area, leachate maintenance holes, and daily cover storage pile were modelled as area sources. The LFG flares, proposed RNG Facility, future approved raw leachate treatment plant, and generators were modelled as point sources. Material handling and idling vehicles were modelled as volume sources, while the internal haul routes were modelled as line volume sources. The landfill active face, which moves throughout the landfill over the course of its life, was modelled in a single worst-case location within the final cell in 2033. All modelled sources were assumed to emit reasonable worst-case emissions concurrently throughout the modelled period. A summary of all sources considered in the dispersion model and their emission rates are provided in **Appendix 9A.** Emission rate calculations for odour, LFG and combustion byproducts, and dust are discussed in **Sections 11** to **13**.

During portions of the landfill life, landfilling operations occurred below grade although the final landfill mound will extend up to 35 m above grade. Sensitivity testing was

conducted with landfill sources at grade, as well as at elevated heights of 35 m (top of landfill mound above grade) and 17.5 m (mid-height of landfill mound). The worst-case results occurred with the landfill at grade, so all landfill area sources were modelled using a grade-level base height. This is a conservative approach.

The locations of all modelled sources are shown in **Figures 9-1a** and **9-1b**.

9.2 Meteorological Data

To ensure that a broad range of dispersion conditions are addressed, five years of local meteorological data (2011-2015) were used in the AERMOD model. The meteorological data set was developed by the MECP's Environmental Monitoring and Reporting Branch (EMRB) specifically for the study site and provided on April 25, 2023. The data set was based on wind-sector dependent land use specific to the landfill site, surface meteorological data collected from Environment and Climate Change Canada's London Airport station, and upper air meteorological data from the U.S. National Weather Service's Detroit station. The data set provided by the EMRB was used directly in the model, with no changes or alterations conducted by RWDI.

9.3 Area of Modelling

All discrete receptor points identified for the work plan were included in this study. For all cases, humans were assumed to be present at these receptors for 24 hours per day, with the exception of STR1, which was only assessed for criteria with short-term, 10-minute and 1-hour averaging periods. STR1 represents the cemetery located southwest of the site, where human activity is expected to be infrequent and short-term and therefore longer averaging periods do not apply. Discrete receptors were modelled at flagpole heights of 1.5 m above grade. The locations of these discrete receptors are shown on **Figure 2-2**.

In addition, the modelling was performed using a receptor grid covering the Site-Vicinity and Regional study areas to produce isopleths of predicted concentrations. The receptor grid covers the lands within approximately 5 kilometers from the existing landfill site. The grid receptors are shown on **Figure 2-3**.

9.4 Terrain Data

Terrain information for the area surrounding the facility was obtained from the MECP Regional Meteorological and Terrain Data for Air Dispersion Modelling website. The terrain data is based on the Canadian Digital Elevation Model (CDEM) horizontal reference datum. These data were run through the AERMAP terrain pre-processor to estimate base elevations for sources and receptors to help the model account for changes in elevation.

9.5 Building Information

The Building Profile Input Program (BPIP) is used to calculate the effects of building downwash on point sources, such as stacks. The leachate building and RNG Facility were included in the modelling, as these structures have the potential to affect emissions from the leachate plant exhausts and the landfill gas flares.

The BPIP model was run prior to running the AERMOD model in order to incorporate the potential building downwash effects.

The potential building downwash effects were evaluated for all point sources within the dispersion model. Building downwash effects are not applicable to volume, line volume, or area sources. Although the landfill mound may be considered as a "structure", dispersion modelling tests completed by RWDI for a different landfill facility found that the effects of mound downwash have insignificant impacts on the maximum off-site concentrations. The effects of the mound downwash are insignificant as the sloping features of the mound do not act as a solid block building. Therefore, the landfill mound was not considered in the assessment of potential building downwash effects.

9.6 Averaging Periods Used

Emissions were modelled for 1-hour, 24-hour, and annual averaging times, to correspond with the criteria for the various compounds, as listed in **Table 5-1**. A conversion factor of 1.65 was used to convert 1-hour results to 10-minute averages, based on guidance provided in the MECP's "Procedure for Preparing an Emission Summary and Dispersion Modelling Report", March 2018.

9.7 Sensitivity Analysis

To address some uncertainties in the model, a sensitivity analysis was completed in order to assess the potential impacts of two variables:

1. Estimation of the closure year; and
2. Waste tonnage distribution in the landfill.

The lifespan of the existing landfill is assessed annually based on an aerial survey which is used to estimate the volume of the waste already in place and the remaining airspace available. The maximum fill rate and the most recent waste density measurement is then applied to predict the closure year. Using this method, the projected closure year is currently 2031, which suggests there is approximately 8 years of landfill capacity remaining. For the air quality assessment, the landfill closure year was determined based on the total waste tonnage capacity predicted in the 2016 Environmental Screening Report. The waste in place was based on historical waste acceptance records up to and including 2022; from 2023 until closure, it was assumed that the maximum permitted waste is deposited each year until the total waste tonnage capacity is met. This results in a predicted closure year of 2033, which was used for the Air Quality existing conditions report. In order to ensure the Air Quality assessment

was conservative a sensitivity analysis was completed based on both a 2031 closure year and a 2033 closure year.

Changing the closure year impacts two variables:

1. Tailpipe emissions – The U.S EPA Traffic Model MOVES3 used to estimate tailpipe emissions produces lower emission factors with further modelling years. Therefore, a closure year of 2031 versus 2033 would result in an increase in tailpipe emissions.
2. Landfill Gas Generation – Since both methods of calculating the closure year apply the maximum fill rate, having an earlier closure year (2031 versus 2033) assumes less waste is in place at the time of closure and therefore the quantity of gas generated from the landfill mound decreases.

In addition, the change in waste distribution was considered in the 2031 scenario. The AREA5 landfill represents the Existing Landfill which was filled from 1972 – 2004, upon review there is potential that waste was deposited up to 2009. This does not change the total waste deposited in the landfill but slightly changes the distribution of the waste in the landfill. The 2031 scenario considers waste deposited from 2005 - 2009 being placed in AREA5 opposed to AREA1.

In order to assess the potential influence of the 2031 and 2033 scenarios, three compounds were assessed. Benzene, which was affected by both the change in landfill gas generation and MOVES emission factors, $PM_{2.5}$, which was affected by the MOVES emission factors only, and vinyl chloride, which was affected by the landfill gas generation only.

With both changes incorporated into the 2031 scenario, benzene modelling resulted in a decrease in predicted concentrations for the 2031 scenario relative to the 2033 scenario at all but one discrete receptor. However, the receptor's predicted concentration increased by <2% and the concentration at this receptor remained lower than the concentration at the worst-case receptor. The reduction in landfill gas generation in the 2031 scenario has a stronger influence on benzene concentrations relative to the increase in tailpipe emissions.

$PM_{2.5}$ tailpipe emissions from idling vehicles increased approximately 30% in 2031 compared to 2033. Modelling showed <1% increase at the worst-case discrete receptor. Site wide emissions of $PM_{2.5}$ are dominated by fugitive emission sources such as unpaved haul routes and material handling, which are not impacted by the change in closure year, resulting in no significant change to predicted concentrations.

Vinyl chloride was modelled in order to assess the impacts of the decreased gas generated in 2031 versus 2033 and the change in waste distribution in the landfill. Predicted concentrations at discrete receptors increase a maximum of 1.3% because of the change in waste distribution but decreased at some receptors due to the decrease in gas generated. The overall worst-case receptor concentration decreased by 0.6% from the original 2033 scenario.

Overall, the sensitivity analysis shows that considering a closure year of 2033 versus 2031 has no significant impact on predicted concentrations and in most cases the use of the year 2033 provides a conservative approach. Therefore, the assessment was completed considering the closure year of 2033.

10 Blowing Litter

A potential nuisance created by the landfill is wind-blown litter. Litter typically consists of loose, lightweight materials that can be picked up by the wind such as paper products, empty plastic bags, and cardboard. These materials are commonly found at the active face where freshly deposited waste is exposed to the wind. Litter may be transported off-site during events with above average wind speeds. Non-active waste filling areas are covered by daily, interim, or final cover to minimize the potential for windblown litter. Blowing litter was assessed by means of the following tasks:

- Review of existing mitigation measures;
- Review of litter related complaints;
- Review of the MECP inspection logs and WM litter logs;
- Evaluation of landfill characteristics and assumptions against literature and wind climate information; and,
- Analysis of local meteorological conditions and their influence on litter events.

10.1 Existing Mitigation Measures

Although it is not feasible to completely eliminate blowing litter, litter can be reduced significantly with proper control practices. In an effort to minimize the potential for litter events for the operations of TCEC, WM has developed and implemented a Blowing Litter Best Management Practice Plan (BMPP), dated December 11, 2007. This BMPP (Litter) is used to manage the migration of litter off-property. The BMPP was previously provided to the MECP for review and comment. The plan implements mitigation controls such as:

- Inspection of incoming trucks to ensure that loads are secure prior to arriving at the site;
- Inspection of outbound trucks to ensure that the loads have been completely cleared of the material to avoid litter escaping from the vehicles when leaving;
- Application of soil cover to the active tipping area at the end of each working day;
- Continuous movement of the compactor over the new waste throughout the day;
- Identification of loads of waste received at the active face with material noted as being a potential for litter, which are to be covered as soon as possible to reduce the potential for litter events;

- Use of portable litter fences that are moved around the active face area to capture blowing litter on a day-to-day basis based on forecasted meteorological conditions;
- Installation of permanent litter fences, downwind of the current phases to capture the blowing litter for the predominant wind directions;
- Use of inclement weather fill areas, which are utilized during weather events consisting of sustained high winds speeds; and,
- Training of relevant staff on these policies.

Even with litter controls in place, litter events do occur from time to time. In order to ensure a thorough and rapid response, the BMPP includes a protocol to dispatch a site crew to the impacted zone for cleanup. This protocol extends to adjacent properties as well as main roadways.

Further details regarding the complete set of litter controls and protocols are provided in the copy of the blowing litter BMPP in **Appendix 10A**.

10.2 Complaints History

A review of the TCEC complaints log was conducted in order to determine the current level of blowing litter impacts in the vicinity of the landfill. From 2009 to the end of 2024 a total of 15 litter related complaints were received. A summary of these complaints is shown in **Appendix 10B**.

Of the 15 litter-related complaints that have been received by TCEC, only one occurred between the years of 2009 and 2018. The remaining 14 instances occurred over the period from 2019 to the end of 2024, with generally a few instances occurring each year. In accordance with TCEC's wind-blown litter BMPP, the facility responded immediately to each complaint and applied the necessary corrective action, which generally involved sending staff to remove the litter from off-site locations. No complaints occurred consecutively which suggests that once corrective action was taken, the issue did not persist. In general, these litter events were isolated incidents, and the majority of potential litter events are effectively being controlled. Therefore, the BMPP is effective in controlling off-site migration of litter.

10.3 Review of MECP Inspection Logs and WM Litter Logs

Historical MECP and WM inspection records were reviewed from 2019 - 2022 in order to assess the current level of litter related impacts. Over the 4-year period during MECP inspections litter was observed both on and off-site. A summary of the MECP inspection reports related to windblown litter is provided in **Appendix 10C**.

The MECP logs indicate off-property migration of litter does occur, but WM is effective at addressing litter events in a timely manner. Many of the observed events are related to high wind conditions. In some instances, it was noted that litter cleanup was delayed, however these were commonly associated with extreme weather such as cold and snowy/icy conditions which delayed litter pickup due to safety concerns.

The majority of litter events were limited to on-site areas which suggest that WM's BMPP is successfully mitigating offsite migration of litter. The MECP noted on several occasions that when off-site litter was identified, WM prioritized the cleanup of off-site litter by contacting and working with affected community members to establish a cleanup plan in a timely manner. Overall, when litter events occur WM responded in accordance with their BMPP and resolved incidents in a timely manner.

A review of WM's litter logs shows that between 2019 – 2022, weekly inspection of the litter zones are being completed. WM inspection logs indicate that regular inspection of litter zones is being completed and identified litter is being cleaned up.

10.4 Wind Speed and Blowing Litter Literature

Waste is exposed to wind during unloading and landfilling operations, and lighter components of the waste can be blown off-site. **Table 10-1** and **Table 10-2** show the approximate relationship between wind speed and type of refuse that is carried away from the working area of a landfill, based on two different studies.

Table 10-1. Wind Speed and Wastes Blown (based on calculations presented by Lapp, 1983)

Wind Speed Range (km/h)	Type of Waste
16 - 24	Envelope, dry slightly crumpled paper
24 – 32	Empty plastic bag
32 – 48	Corrugated cardboard, crumpled paper towel
48 - 62	Plastic strips, tissue box, tightly crumpled paper
62 - 88	Milk carton, corrugated box
> 88	170cc metal can

Table 10-2. Threshold Speeds for Blowing Litter (based on a previous RWDI wind tunnel study)

Wind Speed Range (km/h)	Type of Waste	Impact Category
0 - 22	None	None
22 – 33	Newsprint, tissue, paper towel, light bond paper	Light
33 – 47	All of the above plus plastic bags, small boxes, small cardboard tubes, paper bags, small plastic sheets	Moderate
> 47	All of the above plus heavy bond paper	Heavy

10.5 Zones of Impact

During the 1990's, Ontario's Interim Waste Authority Limited (IWA) conducted a literature review and interviewed landfill operators to get an indication of the potential

for blowing litter impacts during high wind speed events as noted in **Table 10-1** and **Table 10-2**. Their findings are summarized in **Table 10-3**.

Table 10-3. Blowing Litter Potential Zones of Impact for Above-Grade Landfills (IWA, 1994)

Distance from Landfill Perimeter	Finding	Impact Category
0 to 500 m	50% of escaping litter retained in this area	Medium
500 to 1,000 m	Remaining 50% of escaping litter retained in this area	Low
Beyond 1,000 m	Very little litter escapes beyond this distance	None

The background data presented previously in **Table 10-3** indicates that potential blowing litter impacts are expected to occur within 500 m of the landfill and to a lesser degree limited to within 1 km of the proposed landfill. A figure showing these litter zones and discrete receptors is provided in **Figure 10-1**.

10.6 Meteorological Analysis

Litter events are highly dependent on meteorological conditions, primarily wind speed and wind direction, as shown in **Table 10-1** and **Table 10-2** above. The Lapp study suggests minimum wind speeds for litter events of 16 - 24 km/h, whereas RWDI concluded that 22 - 33 km/h were the minimum wind speeds for litter events. As a conservative approach the conclusions of the Lapp study, wind speeds ranging from 16 – 24 km/h, were considered the minimum wind speeds required for potential litter events. As wind speed increases, more material has the potential to be lifted by the wind which then increases the potential for litter. The predominant wind direction can be used to determine where the litter from these events are most likely to impact. Understanding the zones for litter allows for effective implementation of mitigation measures.

An examination of site-specific meteorological data provided by the MECP was used in order to determine the zones for litter. **Figure 10-2** provides the wind rose for 5-years of site-specific meteorological data prepared by the MECP for the years 2011 to 2015. A wind rose shows the joint distribution of wind speed and wind direction. A lobe indicates the direction that the wind originated from and the percentage of time. A longer lobe means that that wind direction occurred more frequently.

Wind speeds above 16 km/h are relevant to blowing litter, as demonstrated by the data presented previously in **Table 10-1** and **Table 10-2**. Wind speeds above 16 km/h are shown in the wind rose. Wind speeds below 16 km/h are considered calm for the purpose of this assessment. **Figure 10-2** shows that winds speeds greater than 16 km/h can be associated with any wind direction but are most often associated with winds blowing from westerly directions (SSW through NW). The frequency of winds greater than 16 km/h vary between <1% to 5% depending on wind direction. Winds are less than 16 km/h 58% of the time.

Five rural residences and the cemetery are located within 500 m of the landfill. Based on the wind rose presented in **Figure 10-2** and the wind speed thresholds presented in **Table 10-1** and **Table 10-2**, high winds that could potentially cause litter to blow toward these residences are expected to occur infrequently, less than 2% of the time. R2 and R4 are located to the northeast of the landfill in the predominant wind direction.

Despite being in the predominant wind direction, **Figure 10-2** indicates the probability for winds greater than the thresholds for litter are 5% of the time. WM has installed permanent litter fences along the northern property boundary which provide additional control, further reducing the potential impact. Portable wind fences are also utilized at the active face to assist in reducing the potential for wind-blown litter. R7, R9, and STR1 are located to the west/southwest of the landfill site. These receptors are not located in the predominant wind direction, the frequency of winds exceeding the litter thresholds are predicted to range from <1% - 3%. Therefore, the potential for litter impacts at the receptors within 500 m of the landfill is low.

Between a distance of 500 m and 1,000 m there are 12 discrete receptors, however only R3, R5 and R6 are located in the predominant wind direction. As mentioned in **Table 10-3**, the impact in the area is expected to be low. Thus, the potential for litter impacts at these receptors is expected to be low.

Other residences in the area are farther than 1 km from the proposed landfill and have little or no potential for blowing litter impacts.

10.7 Elevated Mound

In 2033, the landfill mound height will have increased to approximately 35m above grade. As elevation increases, waste materials will be exposed to higher windspeeds which has the potential to increase the frequency of litter events. However, the procedures outlined in the landfill's BMPP are expected to be effective in controlling litter for the active face.

10.8 Blowing Litter Conclusion

Between 2009 and the end of 2024,15 litter related complaints were received, with the majority of complaints occurring between 2019 and 2024. In all instances, litter-related complaints were addressed in accordance with the TCEC Blowing Litter BMPP. Review of the MECP inspection records indicate that off-site litter was observed; however, WM has prioritized litter cleanup and working with community members to quickly and effectively clean up impacted areas. WM litter logs provide evidence that litter inspections are being performed and cleanup and maintenance activities are being completed when required. The meteorological analysis combined with the location of nearby residences allows for the identification of litter zones which allows WM to focus their mitigation and inspections in these areas. Overall, with the blowing litter BMPP in place WM is able to minimize off-site impacts such that existing impacts to residences are low.

11 Odour

As part of the characterization of the landfill, the potential for odour related impacts were considered. This study assesses potential for nuisance effects at sensitive off-site receptors from odour associated with landfill operations. Receptors considered in the assessment are outlined in **Section 2.1**. Potential odour impacts were assessed by means of the following tasks:

- Review of existing mitigation measures;
- Review of odour related complaints;
- Review of potential odour sources;
- Quantification of odour emissions through field measurements and engineering calculations; and,
- Prediction of potential impacts using dispersion modelling.

Exposure to odours does not necessarily pose a health risk to individuals residing adjacent to a landfill, but the odours can potentially become a nuisance. Site-wide odours from the landfill operation, including sources such as landfill gas, fresh waste, leachate, and waste soil odours, have been evaluated due to their potential for nuisance impacts on the environment surrounding the landfill. Although these odours are distinct from one another, as a conservative approach they have been treated as cumulative odours for the purpose of this odour study.

Typically, Ontario Regulation 419/05 provides air quality standards used in Ontario. However, Reg. 419 does not include a standard for “odour” as a mixture of compounds. According to section 14 of the *Ontario Environmental Protection Act*, an odour is deemed to be a nuisance if it is detected and considered to be unpleasant. The MECP does provide some guidance regarding the assessment of odour impacts in their document, “Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines under O.Reg, 419/05”, dated September 2016. This guidance document indicates that odour concentrations need only be assessed at odour-sensitive receptor locations, such as residences, commercial buildings, and outdoor parks and recreation areas. Odour impacts that are greater than 1 odour unit (OU) per cubic metre (m^3) are considered acceptable at sensitive receptor locations, as long as the frequency of exceedance is less than 0.5% of the time.

An odour unit is defined as the quantity of odourous substance 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. The average odour detection threshold is 1 OU/m^3, although odours at this level are not necessarily a nuisance. Odour concentrations that may cause a complaint due to their ability to annoy typically range from 3 to 5 OU/m^3. Through RWDI’s experience with other landfills in Southern Ontario, the objectionable level for odour was generally in the range of 3 to 5 OU/m^3. These levels are more closely related to public complaints. For

the purposes of this assessment, the predicted site-wide odours from the TCEC operations were compared to both the 1 OU/m³ detection threshold and the 3 OU/m³ and 5 OU/m³ annoyance thresholds.

Although certain contaminants known to be present in landfill gas (LFG), such as H_2S, have odour-based standards under O. Reg. 419, these contaminant-specific standards are not applicable to the overall mixture of compounds that form the LFG odours. Comparisons of the impacts from individual contaminants to their odour-based O. Reg. 419 Standards are discussed in **Section 12**. Odours are generally best evaluated by the human response to smell (olfactory response).

The odours from the landfill itself are based on a mixture of compounds contained within the landfill gas and surface emissions (e.g., active face odour). The odours from other landfill-related sources are based on a mixture of compounds contained in the leachate area sources and in the waste soil piles.

Potential odour sources were identified based on previous assessments of odour from the TCEC site, as well as consultation with local and regulatory stakeholders as outlined in the ToR. Existing conditions were characterized using a combination of emission factors and site-specific odour sampling. The resulting odour emissions were then incorporated into a dispersion model to assess potential impacts at residential receptors.

Odour from landfill traffic represents a small proportion of the traffic along the external haul route. Although waste haul trucks can be a source of odour, any potential impacts from travel along haul routes would be short-term and transient in nature and thus were not considered.

Characterization of the existing site conditions assumed that all currently approved landfill activities were in operation including the approved leachate treatment plant. Although the leachate facility is not currently operational, the potential for odour from the facility has been included in previous site wide assessments such as the 2016 Environmental Screening Report.

11.1 Best Management Practices Plan

Solid waste landfills have the potential to produce odour at several locations including the active face and adjacent working areas, within the leachate collection system, and leachate treatment system. Landfill gas escaping through the daily and interim covers and final cap are also potential odour sources. The active face and adjacent working area are expected to be the dominant odour source. In an effort to minimize odour emissions from the site, WM has previously prepared and implemented an odour BMPP, dated April 3, 2017, to minimize the off-site impacts associated with odour. This BMPP (Odour) outlines details on standard operating procedures, mitigation measures, and training to control key operations typically associated with odour emissions. The BMPP was provided to the MECP for review and comment. Key control measures outlined in the plan include:

- Screening of incoming loads to identify highly odourous loads and applying cover material immediately once placed in the active face;
- Applying a minimum of 0.15 metres of daily cover or an alternative cover system to the active face on a daily basis;
- When required, applying tear resistant tarping capable of odour and vapour suppression to the active face (when daily cover is unavailable);
- Providing interim cover areas with 0.3 to 0.45 metres of cover, graded to promote precipitation run-off;
- Including 2.0 metres of material in the final cap;
- Installing and maintaining a landfill gas collection system;
- Destruction of landfill gas through landfill gas flares;
- Completion of “walkabouts” using total hydrocarbon (THC) analyzers by trained employees to identify odourous areas;
- Routine inspection of interim and final cap areas to ensure damage or erosion areas can be remediated as soon as possible; and
- Training of relevant staff.

The BMPP includes robust record keeping programs including the results of walkabouts (locations of sampling, field measurements, and remedial actions), employee training, vacuum testing of the collection system, composition of gas, and temperature of combustion.

Although it is impossible to eliminate odour from landfills, these mitigative measures and operating procedures help to minimize odours associated with landfill activities. A copy of the BMPP (Odour) is provided in **Appendix 11A**.

11.2 Complaints History

A review of the TCEC complaints log was conducted in order to determine the level of odour impacts in the vicinity of the landfill. From 2009 to the end of 2024 a total of 233 odour-related complaints were received. The majority (213) of these odour-related complaints have been logged since 2019. A review of odour complaints received (as documented in the Annual Monitoring Reports) shows a decrease in odour complaints over time with the exception of those received in 2022, when the Township provided information on the formal public complaints process via a notice on their website. The summary of odour complaints from 2019 onwards is as follows:

- 2019: 51 odour complaints
- 2020: 30 odour complaints
- 2021: 26 odour complaints
- 2022: 68 odour complaints

- 2023: 23 odour complaints
- 2024: 15 odour complaints

Where complaints were received, WM completed the required steps as outlined in the BMPP in response. This included logging the complaint, completing the appropriate investigations into the potential source of the complaint, implementing required corrective action or mitigation, following up with the complainant, and filing a formal complaint log.

The 233 odour complaints received between 2009 and the end of 2024 represent 201 discrete odour events, with 133 events documented from separate physical locations such as a residence or commercial building, with the other 68 events representing transient (drive-by) occurrences during which odour was observed while in transit near the site.

However, upon investigation, it was determined that some of the complaints were a result of upset conditions (power outages, upgrades to the gas collection system), some were determined to not be landfill-related (wind direction not consistent with complaint location, observations of manure odours), and some were determined to be related to landfill operations, sometimes occurring with weather conditions associated with poor odour dispersion. The upset conditions are not covered in the modelling assessment and are best managed through the implementation of the BMPP for odour.

Based on a review of the 2024 complaints, approximately 33% of the odour complaints were related to abnormal conditions (e.g., power interruptions causing shutdown of landfill gas collection system).

A summary of these complaints, details of investigative steps taken, and any applicable corrective measures implemented is provided in **Appendix 11B**.

11.3 Odour Emission Sources

Under normal operating conditions, solid waste landfills have the potential to produce odours from several areas, including:

- Landfill gas (LFG) and waste odours from the landfill and waste acceptance activities: active face, interim cover areas, final cap areas, waste transport, and excavation of exposed waste;
- Leachate odours from the leachate collection, storage, and treatment system; and
- Hydrocarbon odours from contaminated soils.

Each of these odour emission sources is discussed in the following sections.

11.3.1 Landfill Mound under Final Cap

The landfill mound under final cap is the portion of the landfill where waste is no longer being deposited. This area is characterized by the presence of a landfill cap and LFG collection system.

Odour from the landfill mound under final cap results from the fugitive emissions of LFG released through the surface of the landfill. The LFG collection system in the final cap area of the landfill serves to apply a vacuum and extract the LFG from the mound, thus reducing the amount of LFG available to escape through the surface of the mound. In addition, the cap material filters and limits the ability of the LFG to be released through the surface of the landfill. However, even with the LFG collection system and landfill cap in place, some LFG can be released to the atmosphere from seepage through the landfill cap soils. The final cap area was included in the quantitative assessment.

11.3.2 Active Stage (Interim Cover Area)

The active stage of the landfill is the area where waste has been deposited more recently. The active stage is characterized by the presence of an interim cover. The active stage does not have a completely installed LFG collection system, therefore has greater potential for landfill gas related odours. The interim cover area was included in the quantitative assessment.

11.3.3 Active Face

The active face is the area where landfilling is actively occurring, and fresh waste is deposited during normal operations. Starting at 6:00 a.m. the daily cover from the previous day is stripped from the active face before new waste is added between 7:00 a.m. to 5:00 p.m. This freshly uncovered waste tends to be more odourous than the regular daily waste fill; this diurnal variation in active face odours was considered in the quantitative assessment. The active face size is limited based on the odour control measures outlined in the facility odour BMPP. Odours from the active face include contributions from the waste itself, as well as LFG seepage from underlying waste.

11.3.4 Waste Transport

Waste hauling trucks arriving or leaving the site have the potential to be odourous. The odour levels from individual vehicles vary and are dependent on the operator and type of waste being received. When travelling along the off-site haul routes any potential odours from these vehicles will be transitory and are not expected to be significant at any single receptor location. In accordance with the odour BMPP, all trucks are inspected upon entry and unacceptable waste loads are either refused or transferred to the landfill operations on-site for disposal. Received waste that is overly odorous is immediately covered upon disposal at the active face. When on-site, emissions from the waste vehicles are typically small relative to the overall landfill operation and, as such, were not considered in the dispersion modelling assessment.

11.3.5 Cracks/Fissures in Landfill Cap

The final cap of the landfill limits the migration of LFG through the surface of the landfill. However, cracks and fissures can form in this layer, allowing LFG to pass through. These cracks and fissures can form for a variety of reasons, including the effect of

freeze/thaw cycles, erosion due to surface water runoff, and heavy equipment operating on the capped area. These cracks and fissures in the landfill cap represent conditions not indicative of normal landfill operation. This activity is addressed through the existing BMPP. The final cap is routinely inspected in order to minimize the potential for odours. The entire landfill mound is inspected semi-annually through a "walkabout" which assesses the integrity of the landfill mound using a THC analyzer to identify LFG hotspots or breakout points. When required, repairs to the mound are completed in order to manage the potential for odour emissions.

11.3.6 Excavation of Exposed Waste

It may become necessary to excavate exposed waste at the landfill for purposes such as installation of a landfill gas well or gas collection system piping.

Excavating through the landfill final clay cap opens a conduit for LFG to escape directly into the atmosphere which may contribute to off-site impacts of odour. This type of excavation represents upset conditions and, as such, was not considered in the quantitative assessment; instead, this activity is best addressed through the implementation of Best Management Practices to minimize potential impacts if/when required.

11.3.7 Leachate Collection System

Leachate produces a strong, unpleasant odour that is distinct from the LFG odours. The leachate collection mains are placed under negative pressure to minimize the potential for odours to escape from the maintenance holes or other open points in the leachate management system. However, even with control measures in place it is possible for leachate maintenance holes to be a source of odour emissions. Individual leachate maintenance holes are not expected to be major sources of odours but have the potential to contribute to cumulative effects from other odour sources. As such, odours from leachate maintenance holes were considered in the quantitative assessment.

11.3.8 Leachate Treatment System

Currently, leachate generated at TCEC is treated through the poplar irrigation system or is shipped off-site for treatment. However, the construction of a leachate treatment plant has been approved by the MECP and is included in the facility's current Environmental Compliance Approval (ECA). Odour emissions from this proposed facility were considered in the quantitative assessment.

11.3.9 Contaminated Soil Stockpiles

The landfill receives contaminated soil from off-site locations for use as daily cover. A portion of this soil contains VOCs, which can be odourous. Contaminated soil odours are distinct from landfill odours. However, to provide a conservative estimate of facility-

wide odours, odour from contaminated soil was considered due to potential cumulative impacts with odour from other landfill operations.

11.4 Emission Calculations

11.4.1 Fugitive Odour Sources

Odour emissions from fugitive sources were determined through engineering calculations and site-specific measurements. Two separate approaches were utilized. Odour emissions from the active face, including freshly uncovered waste, the contaminated soil pile, and the leachate maintenance holes were developed based on odour flux measurements. Odour emissions from the interim and final cover areas were based on measurements of raw landfill gas coupled with calculated landfill gas generation rates.

In accordance with the Air Quality work plan sampling was completed on June 19th and June 29th, 2023, for the following sources. Note that for each source triplicate samples were collected as noted below:

- 1 area from the active face;
- 1 area from freshly uncovered waste;
- 1 area from leachate maintenance holes;
- 1 area from the contaminated soil pile;
- 3 areas from final cover; and
- 3 areas from interim cover.

Further odour flux sampling of the final cover and interim cover areas was completed on October 2nd, 2023. To assess a larger representation of these source areas, additional singular samples were collected from the following sources:

- 9 areas from the final cover; and,
- 9 areas from the interim cover.

Sampling of the raw landfill gas was completed on October 30th, 2025. Samples were collected from a total of 15 active landfill gas wells.

11.4.1.1 Active Face and Freshly Uncovered Waste

Odour emissions for the active face, including freshly uncovered waste, were determined based on odour flux sampling, as discussed in **Section 7.1.1**. Overall, the results from the active face and freshly uncovered waste, were found to be valid and were reflective of expected findings based RWDI's experience from other similar studies. Sampling was completed under normal conditions and the landfill gas utilization system was operating under normal conditions.

Odour from the active face varies by time of day. Starting at 6:00 a.m., daily cover from the previous day is stripped from the active face to improve the hydraulic connectivity of the waste mound. The stripping process takes approximately one hour to complete and during this time freshly uncovered waste is exposed. Freshly uncovered waste is more odourous than the typical daily waste fill. By 7:00 a.m. deposition of new waste begins at the active face and the freshly exposed waste is gradually covered. Complete coverage of the active face with new waste typically takes 1 - 1 ½ hours.

As the active face is covered with new waste odour emissions will be reduced, but as a conservative estimate of odour the entire active face was assumed to be freshly uncovered waste from 6:00 a.m. to 9:00 a.m., and all other periods were modelled using the odour flux rate for the active face with new daily waste in place.

Details on odour emission rate calculations and laboratory analysis data are provided in **Appendix 11D**.

11.4.1.2 Leachate Maintenance Holes

Odour emissions for the leachate maintenance holes were determined based on odour flux sampling, as discussed in **Section 7.1.1**. Overall, the results from the leachate maintenance holes were found to be valid and were reflective of expected findings based RWDI's experience from other similar studies. Sampling was completed under normal conditions and the landfill gas utilization system was operating under normal conditions.

All existing leachate maintenance holes were identified and considered in the dispersion modelling. Each maintenance hole was assumed to have an area of 0.5 m², and emissions were based on the average odour flux rate determined through source testing.

11.4.1.3 Contaminated Soil Pile

Odour emissions for the contaminated soil pile were determined based on odour flux sampling, as discussed in **Section 7.1.1**. Overall, the results from the contaminated soil pile were found to be valid and were reflective of expected findings based RWDI's experience from other similar studies. Sampling was completed under normal conditions and the landfill gas utilization system was operating under normal conditions.

Odour from the contaminated soil pile was considered based on flux chamber analysis. The average odour flux rate determined from source testing was applied to the storage pile located near the active face.

11.4.1.4 Final and Interim Cover

Odour emissions for the final and interim cover areas were calculated based on measurements of the odour concentration in raw landfill gas and estimated landfill gas generation rates. Final cover and interim cover flux chamber sampling were completed in accordance with the Air Quality workplan. However, upon review the

odour flux sampling, were determined to be unrepresentative of odours associated with landfill gas emissions and flux measurements were inconsistent with other landfills in southwestern Ontario.

This is a result of the limitations of odour analysis where any detectable odour can influence the odour concentration. This means that odour emission rates can be easily influenced by other odour sources, such as soil or vegetation, and does not guarantee that landfill odours are reflected in the sampling. The peer review team noted in their comments that the report should provide an assessment and discussion of the potential odour sources, specifically for covered areas, to differentiate potential natural odours from landfill odours and the significance of odour impacts from each odour source. In order to better understand the source contribution, additional source testing was completed to further evaluate the odours emanating from the landfill gas itself. Therefore, odour emissions from final and interim cover were determined using the methodology described below.

The odour emission calculations for the final and interim cover areas used a combination of site-specific gas landfill gas odour measurements and landfill gas generation quantities from the U.S. EPA's LANDGEM landfill gas generation model. LANDGEM is a first-order emission rate model and was used to estimate quantity of landfill gas generated for the closure year 2033. Details on the LANDGEM inputs are provided in **Section 12**.

There are approximately 194 landfill gas wells currently installed at the site. Of these 194 wells, fifteen were sampled to obtain odour concentrations from the raw landfill gas. The wells selected for sampling were based on a combination of measured landfill gas flow rates and spatial distribution across the entire landfill area. All landfill gas odour samples were provided to St. Croix Sensory, Inc., for odour panel analysis to determine the concentration in odour unit (OU) per cubic metre. Concentrations for both odour detection and odour recognition were provided by the laboratory. As a conservative approach, the detection values were used.

In addition to odour, other sampling parameters were recorded including gas flow rate, oxygen, and hydrogen sulphide concentrations. Sampling data was used to establish a correlation between landfill gas odour concentrations and the gas quality parameters.

The correlation between gas quality and odour concentration was applied to a full year of gas well quality sampling data from 2024, which better characterizes the entire landfill mound. Odour emissions were derived for the landfill mound based on the gas well quality sampling data from 2024 and the odour concentrations determined using the 2025 raw gas data. Detailed emission calculations are provided in **Appendix 7E**.

Odour concentrations from the raw landfill gas (OU/m^3) were multiplied by the quantity of landfill gas released through the landfill cap in order to obtain odour emission rates. In 2033, all landfill areas are assumed to be under final cover, with the exception of the final phase of the Expansion landfill (represented by AREA4). For the active phase (AREA4), 75% of the generated LFG is assumed to be collected with the remaining

25% emitted through the final cover area. For the remainder of the Expansion landfill area (AREA1, 2, and 3), 90% of the LFG was assumed to be collected with the remaining 10% emitted.

The Existing Landfill refers to the area represented by AREA5 in the model and is located on the eastern boundary of the landfill. The existing landfill is currently under final cover. Due to difference in final cover thickness of the Expansion Landfill (2.00 m thick) and the Existing Landfill (1.25 m thick) AREA5 was assumed to have a collection efficiency of 75% of the LFG, with the remaining 25% emitted.

11.4.2 Leachate Treatment Plant

Since the proposed leachate treatment process has not yet been installed, source testing for odours could not be conducted. Instead, odour emissions from the proposed leachate treatment process were developed and approved by the MECP under ECA #4365-7VXJ5G using published odour threshold values for individual contaminants emitted by the leachate plant. The same odour emission rates were used in subsequent assessments including the 2016 Environmental Screening Report and have also been used in this assessment. This method holds some uncertainty; however, there is not currently a more accurate way of accounting for odour from the leachate treatment plant as it has not yet been constructed.

Once the leachate treatment plant is built, MECP-approved odour testing will be done to ensure compliance.

Odour emissions from the proposed leachate plant were developed based on individual contaminant emission rates released by the leachate treatment process. The U.S. EPA wastewater treatment model WATER9 was used to estimate potential air emissions from the leachate treatment system. WATER9 outputs gram per second emission rates to air by contaminant for each source. WATER9 allows the user to select component equipment configurations within the plant and arrange the flows and process inputs to approximate the facility configuration, allowing the user to simulate the plant virtually within the modelling program. Certain parameters were inputted to the program (i.e., temperatures, flows, influent concentrations), based on the Technical Design Brief - On-Site Leachate Treatment Facility document, dated August 2007, prepared by CRA, as well as information provided by WM.

Where required information was not available from either of these sources, parameters were based on the WATER9 defaults. In cases where a specific equipment configuration did not exist within the program, the most reasonably representative equipment type or configuration was chosen.

For the TCEC facility, the sequencing batch reactor was represented by the “diffused air biotreatment” equipment type in the WATER9 model. This equipment type considers biological degradation of the compounds in the leachate and aeration/agitation of the leachate in the containment tank. The other three sources at the facility – sludge aeration tanks, reverse osmosis system, and slurry dryer, were represented by the “open mix tank” equipment type in the WATER9 model. Since the

specific equipment configurations for sludge aeration tanks, reverse osmosis system, and slurry dryer were not contained in the WATER9 model, the open mix tank source was used as a conservative approach. The open mix tank source considers agitation of the liquid; however, no additional degradation of the leachate compounds was considered with this source type.

For ammonia emissions from the sequencing batch reactor, WATER9 predicted emissions result in an overestimate of ammonia releases. This is due to the fact that WATER9 does not take into account the full capabilities of the biological activity occurring in the sequencing batch reactor. As per CRA, “the biological system of the leachate treatment was designed to oxidize 99% of ammonia biologically. This process occurs at a pH of approximately 6.8 and volatilization of ammonia is minimal.” It was assumed that 99% of the ammonia in the leachate was removed biologically, and the remaining 1% was emitted to the environment.

For clarity, each of the four leachate treatment facility source types were modelled in a separate WATER9 file. A summary of the WATER9 emission rates is provided in **Appendix 11D**.

11.5 Dispersion Modelling

The potential odour impacts from landfill operations were determined using dispersion modelling and reasonable worst-case emission rates. Dispersion modelling for odour was completed in accordance with the methodology outlined in **Section 9**. Modifications to the methodology specific to odour modelling are provided in the following sections.

11.5.1 Sources Modelled

The sources included in the dispersion model for odour were the final cap areas, the interim cover areas, the active face, leachate collection maintenance holes, the contaminated soil storage pile, and the leachate treatment plant.

The locations of all modelled sources are shown in **Figures 9-1a** and **9-1b**.

11.5.2 Area of Modelling

The potential for odour impacts is assessed using a 10-minute averaging period at discrete receptors only. All discrete receptor points identified for the work plan were included in the odour modelling. Since odour is assessed on a short-term period impact at STR1 were considered for daytime hours between 6:00 a.m. and 6:00 p.m. Discrete receptor STR1 represents the cemetery located southeast of the site where human activity is expected to be limited to daytime hours; therefore, overnight hours do not apply. Discrete receptors were modelled at flagpole heights of 1.5 m above grade. The locations of these discrete receptors are shown on **Figure 2-2**.

In addition, modelling was performed using a receptor grid covering the site-vicinity and regional study areas to produce isopleths of predicted concentrations. The

receptor grid covers the lands within approximately 5 kilometers from the existing landfill site.

11.6 Baseline Condition Results

Exposure to odours does not necessarily pose a health risk, however, odour can cause nuisance impacts at sensitive receptors in the immediate vicinity of the landfill. Odour impacts were assessed at 24 residences and the cemetery as identified in the Air Quality work plan. When assessing odour-related impacts, three thresholds were considered:

- 1 OU – associated with detection of odour;
- 3 OU – recognition of the odour; and
- 5 OU – nuisance resulting from the odour.

A summary of the maximum predicted concentrations and frequency of exceedance for 1 OU, 3 OU, and 5 OU is provided in **Table 11-1**. Frequency analysis for the cemetery (STR1) considers events between 6:00 a.m. and 6:00 p.m. only.

The overall highest maximum predicted concentration was 3.5 OU/m³ which is predicted at R4.

Maximum predicted concentrations at all receptors exceed the MECP odour guideline objective of 1 OU/m³. A frequency analysis was performed on the predicted concentrations. The 1 OU/m³ guideline shows exceedances at a frequency greater than 0.5% of the time at receptors R2 through R7. The highest overall frequency of exceedance of 1 OU/m³ is 1.0% which is predicted at R4 and R7.

Table 11-1. Odour Concentrations and Frequency Analysis

Receptor ID	Maximum Concentration (OU/m^3)	Events > 1 OU		Events > 3 OU		Events > 5 OU	
		Count (over 5 years)	Frequency of Exceedance	Count (over 5 years)	Frequency of Exceedance	Count (over 5 years)	Frequency of Exceedance
R1	2.0	154	0.4%	0	0.0%	0	0.0%
R2	3.4	312	0.7%	1	0.002%	0	0.0%
R3	2.5	294	0.7%	0	0.0%	0	0.0%
R4	3.5	421	1.0%	3	0.007%	0	0.0%
R5	3.0	243	0.6%	0	0.0%	0	0.0%
R6	2.5	239	0.6%	0	0.0%	0	0.0%
R7	2.4	420	1.0%	0	0.0%	0	0.0%
R8	2.1	165	0.4%	0	0.0%	0	0.0%
R9	2.7	188	0.4%	0	0.0%	0	0.0%
R10	1.8	63	0.1%	0	0.0%	0	0.0%
R11	1.8	33	0.1%	0	0.0%	0	0.0%
R12	1.6	47	0.1%	0	0.0%	0	0.0%
R13	1.3	23	0.1%	0	0.0%	0	0.0%
R14	1.3	13	0.0%	0	0.0%	0	0.0%
R15	2.0	68	0.2%	0	0.0%	0	0.0%
R16	1.9	158	0.4%	0	0.0%	0	0.0%
R17	2.0	177	0.4%	0	0.0%	0	0.0%
R18	2.0	134	0.3%	0	0.0%	0	0.0%
R19	1.9	133	0.3%	0	0.0%	0	0.0%
R20	1.9	125	0.3%	0	0.0%	0	0.0%
R21	1.8	118	0.3%	0	0.0%	0	0.0%
R22	1.8	96	0.2%	0	0.0%	0	0.0%
R23	1.7	91	0.2%	0	0.0%	0	0.0%
R24	1.6	70	0.2%	0	0.0%	0	0.0%
STR1 - Daytime Only	2.5	20	0.05%	0	0.0%	0	0.0%

Exceedances of 3 OU/m³ were predicted at two receptors, R2 and R4; the frequency analysis suggests that exceedance of 3 OU/m³ is less than 0.5% at these receptors. The highest overall frequency of exceedance of 3 OU/m³ is 0.007% which is predicted at R4.

No exceedances of 5 OU/m³ were predicted at any of the receptors.

A contour of maximum predicted odour concentrations extending 5km around the site is provided in **Appendix 11E**.

These maximum predicted odour results and frequencies of exceedance of the 1 OU/m³ detection threshold are based on normal maximum operations with the active face of the landfill in a worst-case position relative to the nearest residential receptor locations.

However, the modelling cannot consider upset conditions within the landfill operations such as flare shutdowns, repairs and maintenance of gas collection infrastructure, unusually odourous waste, and maintenance and repair of waste cover and filling areas. These upset conditions are unpredictable and represent irregular operations onsite which have the potential to cause additional adverse odour impacts. In the past, increases in odour complaints have been found to coincide with these upset conditions. Given the unpredictable nature and unique characteristics of upset conditions, defining the emissions from such events would be extremely difficult. Therefore, it is not feasible to assess all potential upset conditions at the site when assessing the potential for odour impacts and the odour results presented represent the worst-case scenario under normal operating conditions.

The modelling considers a five-year set of hourly meteorological data for the period, 2011 to 2015. Maximum predicted concentrations are based on the worst-case conditions within this data set. Frequencies are calculated based on the use of the entire dataset. Therefore, odour related impacts are likely overpredicted.

Based on the predicted odour concentrations there is potential that landfill related odours will be detectable at discrete receptors from time to time. At some discrete receptors, the odours will be strong enough to be recognizable on occasion.

11.7 Odour Conclusions and Recommendation

Dispersion modelling predicts maximum odour concentrations at all sensitive receptors to exceed the MECP odour guideline objective of 1 OU/m³. Frequency of exceedance of the 1 OU/m³ guideline is predicted to be greater than 0.5% at receptors R2 through R7. Exceedance of the 3 OU/m³ guideline were predicted at only two receptors, R2 and R4, with a frequency less than 0.5%. No exceedances of the 5 OU/m³ guideline were predicted.

Based on the predicted odour concentrations there is potential that landfill-related odours will be detectable and occasionally recognizable at discrete receptors from time to time.

Landfill areas under interim and final cover and operations at the active face are the greatest contributors of odour under normal operations. WM should continue to manage emissions of landfill gas by routine maintenance of the final cap and interim cover areas and the gas and leachate collection systems. Conditions outside normal operations, such as leaks or fissures through the landfill cap, may result in increased odour impacts. Preventing these types of conditions and mitigating them as quickly as possible when they may occur are key to minimizing potential off-site odour impacts. In an effort to address the potential for odour related impacts from both normal operation and potential upset conditions a review of the existing odour best management practices plan will be completed as part of the preferred alternative assessment. The proper development and implementation of the BMPP (Odour) can help reduce the potential for these conditions.

12 Landfill Gas and Combustion Byproducts

Landfill gas (LFG) is created through decomposition of the biodegradable waste within the landfill. LFG consists mainly of methane and carbon dioxide; however, it also contains trace amounts of VOCs and reduced sulphur compounds. VOCs include a broad spectrum of contaminants however, as discussed in **Section 5**, this study focuses on a select list of key indicator contaminants, including the VOCs vinyl chloride, benzene, and 1,2-dichloroethane. Previous studies at the TCEC and similar facilities in Ontario indicate that compliance with these contaminants typically results in compliance for all other VOC compounds. For this assessment the indicator contaminants for reduced sulphur compounds were H_2S and TRS. TRS represents the combination of carbonyl sulphide, H_2S, carbon disulfide, methyl mercaptan, ethyl mercaptan, dimethyl sulphide, 1-propyl mercaptan, methyl ethyl sulphide, and dimethyl disulphide. Potential impacts from H_2S emissions were assessed both individually as well as a part of TRS.

Potential LFG and combustion byproduct impacts were assessed by means of the following tasks:

- Review of existing mitigation measures;
- Review of LFG related complaints;
- Review of potential LFG and combustion byproduct sources;
- Quantification of LFG and combustion byproduct emissions through field measurements and engineering calculations; and
- Prediction of potential impacts using dispersion modelling.

As described in **Section 6**, the existing ambient monitoring program was expanded in June 2023 to include VOC sampling through the summer months (June, July, August, and September). In general, the VOC concentrations measured since the onset of the monitoring program have been below detection limits. However, there have been 3 exceedances of the applicable criteria for H_2S and 38 exceedances of the TRS criteria.

TRS exceedances were the result of the detection limit being above the criteria. The majority of samples were below detection and remained below detection once the detection threshold was lowered. Not including detection level exceedances, there were 3 exceedances of the TRS criteria.

The majority of the landfill gas generated at TCEC is collected by the landfill gas collection system and sent for destruction or for utilization; however, a portion of the landfill gas is released through the landfill surface as fugitive emissions.

Landfill gas that is collected but not utilized is destroyed by combustion through the landfill gas flares. Combustion of landfill gas produces combustion byproducts, including NO_x, SO_2, dioxins and furans (D&F) and particulate matter. This section considers the potential impacts from the combustion byproducts NO_2, SO_2, and D&F. Potential impacts of particulate matter are discussed in **Section 13**.

Emissions of NO_x, and SO_2 are commonly associated with other fuel-burning combustion equipment used during landfill activities, such as the landfill gas flares, on-site vehicles and heavy equipment, and diesel generators. Dioxins and furans are generated at extremely high temperatures and therefore are only considered as combustion byproducts from flaring and the thermal oxidizers.

Although it is neither a VOC or a combustion by-product, ammonia may be released from the proposed leachate treatment facility and is also addressed in this section of the report.

12.1 Complaint History

A review of the TCEC complaints log was conducted in order to determine the current level of VOC and combustion byproduct impacts in the vicinity of the landfill. From 2009 to the end of 2024 no VOC or combustion byproduct related complaints were received. However, as discussed in **Section 11** there were odour related complaints. Reduced sulphur compounds such as H_2S and TRS are known to be odourous and can therefore contribute to odour impacts. Although, no specific VOC or combustion byproduct complaints were received, it is reasonable to assume that some of the odour related complaints are influenced by emissions of reduced sulphur species.

12.2 Landfill Gas and Combustion Byproduct Emission Sources

Gas generated by decomposing waste in a landfill can migrate though the soil cover to the surface of the landfill, mix into the atmosphere, and disperse downwind and off-site. The landfill gas consists primarily of methane, carbon dioxide and trace amounts of VOCs and TRS compounds. Although the levels of VOC and TRS account for less than one percent by volume of the gas escaping from a landfill, the concentrations of these gases must be considered because of the potential for health or odour impacts at receptors in proximity to the landfill.

Under normal operating conditions, TCEC has the potential to emit LFG contaminants, including VOCs and TRS compounds, from several areas:

- Fugitive emissions of LFG through the surface of the landfill, through both final cap and interim cover areas, excavation of exposed waste, and cracks/fissures in the landfill covers;
- VOCs and ammonia from the leachate collection and treatment system;
- VOCs from contaminated soils;
- Uncombusted LFG compounds emitted from the flares;
- Uncombusted LFG compounds from the RNG Facility thermal oxidizers and flares; and
- Tailpipe emissions from mobile equipment.

Combustion byproducts are generated by the combustion of fuels. Under normal operating conditions, TCEC has the potential to emit combustion byproducts from the following sources:

- Landfill gas flares;
- RNG Facility thermal oxidizers and bypass flares;
- Emergency generators; and
- Tailpipe emissions from mobile equipment.

Each of these sources is discussed in the following sections.

12.2.1 Landfill Mound under Final Cover

The landfill mound under final cover is the portion of the landfill where waste is no longer being deposited. This area is characterized by the presence of a landfill cap and final LFG collection systems have been put in place.

Fugitive emissions of LFG are released through the surface of the landfill mound under final cover. The LFG collection systems in the final capped areas of the landfill serve to help maximize extraction of LFG from the mound, thus reducing the amount of LFG available to escape through the surface. In addition, the capping materials filter and limit the ability of the LFG to be released through the surface of the landfill. However, even with the LFG collection system and cap in place, some LFG is released to the atmosphere through the final cover. The overall LFG collection efficiency from areas under final cap is conservatively assumed to be 70%, with the remaining 30% of the gas released through the surface of the landfill. This is consistent with the assumptions from the 2016 Environmental Screening Report. The final capped area was included in the quantitative assessment.

12.2.2 Active Stage (Interim Cover Area)

The active stage of the landfill is the area where waste has been deposited more recently. The active stage is characterized by the presence of an interim cover. The active stage does not have a completely installed LFG collection system, therefore collection of LFG occurs with a lower overall collection efficiency, conservatively assumed to be 50%. Although some cells within a given stage of the landfill may be under final cap, for the purposes of the assessment the entire stage was assumed to be under interim cover as a conservative approach. The interim cover area was included in the quantitative assessment.

The active face, where incoming waste is deposited each day, is located within the active stage. However, the fresh waste does not contribute to the LFG emissions (which are a result of the decomposition of waste), so the active face is not included as a source for the LFG and combustion byproducts assessment.

12.2.3 Landfill Gas Flare

Collected landfill gas is combusted in fully enclosed flares. The collected gas is currently sent to the two existing flares on-site or is sent off-site for utilization in a local greenhouse operation. There are two additional flares that have been approved for the facility but have not yet been constructed, to which landfill gas can be sent in the future. The RNG Facility will add two additional flares, for a total of six landfill gas flares on-site. As the landfill expands, blowers and flares will be added to the system to draw the increasing amount of gas generated. At completion the system will have six flares in total, with four dedicated landfill flares and two flares associated with RNG bypass. For the purposes of this study, all existing and proposed flares were assumed to be in operation concurrently which is highly conservative.

Flaring of the landfill gas typically converts about 99.9% of the methane to carbon dioxide and destroys 98% of the trace organic compounds. For this assessment, the overall destruction efficiency was capped at 98% for all contaminants as a conservative approach. Emissions of LFG constituents and combustion byproducts from the LFG flares were included in the quantitative assessment.

12.2.4 RNG Thermal Oxidizers

The RNG Facility will add one pre-treatment thermal oxidizer and one main thermal oxidizer. During RNG Facility operation, the thermal oxidizers will combust waste gas streams from the RNG Facility. The combustion of the landfill gas results in the emission of uncombusted VOCs and combustion byproducts. Emissions of these contaminants from the thermal oxidizers were included in this quantitative assessment.

12.2.5 Emergency Generators

Four emergency generators will be used to provide back-up power for TCEC operations. Three generators are currently in place to provide back-up power for the landfill gas plant, the leachate pumps, and the maintenance office. A fourth is planned to provide back-up power for the RNG Facility. These emergency generators use diesel fuel, and diesel combustion results in combustion by-products. Emissions of combustion byproducts from the diesel generators were included in this quantitative assessment.

12.2.6 Cracks/Fissures in Landfill Cap

The final cap of the landfill limits the migration of LFG through the surface of the landfill. However, cracks and fissures can form in the cap, allowing LFG to pass through unchecked. These cracks and fissures can form for a variety of reasons, including the effect of freeze/thaw cycles, erosion due to surface water runoff, and heavy equipment operating on the capped area. Cracks and fissures in the landfill cap represent conditions out normal operations and, as such, were not considered in the quantitative assessment; instead, this is best assessed through the development of Best Management Practices to minimize potential impacts to the integrity of the landfill cap.

12.2.7 Excavation of Exposed Waste

It may become necessary to excavate exposed waste at the landfill for purposes such as installation of a landfill gas well or gas collection system piping.

Excavating through the landfill final clay cap opens a conduit for LFG to escape directly into the atmosphere. This type of excavation represents upset conditions and, as such, was not considered in the quantitative assessment; instead, this activity is best addressed through the development of Best Management Practices to minimize potential impacts if/when required.

12.2.8 Leachate Collection System

Leachate contains many of the same contaminants that are contained in LFG. The leachate collection mains are placed under negative pressure so that no gases escape from maintenance holes or other open points in the leachate management system. Although these systems are designed to be under negative pressure and effectively sealed, gases may occasionally be emitted through maintenance holes. However, compared to emissions from the landfill mound and active stage, these intermittent sources represent an insignificant portion of total emissions and therefore the leachate collection system was excluded from the quantitative assessment.

12.2.9 Leachate Treatment System

Currently TCEC does not have a leachate treatment plant, but one has been considered in past assessments and approved under the Facility's existing ECA. For the purposes of this assessment, it was assumed that the treatment plant was operational. The TCEC leachate treatment facility can be operating at a maximum

capacity of 300 m^3/day of raw leachate. The overall process will consist of primary treatment (equalization), secondary treatment (biological), tertiary treatment consisting of softening and ultrafiltration (UF), and post-tertiary treatment consisting of a two-stage reverse osmosis (RO) membrane. Waste stream management will consist of evaporator and dryer technologies, together with a sludge management system to serve the biological system. Emissions from leachate treatment were considered in the quantitative assessment.

12.2.10 Leachate Seepage

Leachate seepage can occur if leachate "breaks through" the cap of the landfill and pools on the surface. Leachate seepage can occur due to poor drainage, or cracks and fissures in the landfill cap. Leachate seepage represents an upset condition and as such was not considered in the quantitative assessment; instead, this is best assessed through the development of Best Management Practices to minimize occurrence of leachate seepage and its potential impacts.

12.2.11 Waste Soil Stockpiles

The landfill receives waste soil from off-site locations. The majority of this soil is petroleum fuel-contaminated and contains fuel-related VOCs such as benzene and other light aromatics. VOC emissions from the waste soil stockpiles were included in the quantitative assessment. Site specific VOC emissions were not available, and emissions were based on sampling from similar facilities in Ontario.

12.2.12 Tailpipe Emissions

Vehicles associated with landfill operations emit VOCs and combustion byproducts from their tailpipes. The contribution from vehicle tailpipe emissions were considered in the quantitative assessment.

12.3 Emission Calculations

12.3.1 Final Cap and Interim Cover Areas

The emission rates for VOCs, H_2S, and TRS from the final cap and interim cover areas were determined through a combination of landfill gas sampling and field flux measurements. Gas composition determined through laboratory analysis was used to calculate emissions of VOCs from fugitive releases through the final cap and interim cap areas. Composition of sulphur compounds in the gas were used to estimate emissions from the landfill gas flares. Details on flare emissions are provided in **Section 12.3.2**. Fugitive emissions of H_2S and TRS from the final cap and interim cover areas were based on flux chamber analysis as outlined in **Section 7.2**.

U.S. EPA's LandGEM landfill gas emission estimation model is the most direct method to determine first-order emission rates of VOCs from the proposed landfill. It is also recommended by the MECP; however, it can generate overly conservative estimates

of VOC and sulphur compound emissions. LandGEM was used to calculate landfill gas generation for the calculated closure year of the landfill, 2033.

Inputs to LandGEM include the methane generation rate (k), the methane generation potential of the waste (Lo), the concentration of methane in the LFG, and the waste deposition history of the landfill. The k and Lo values were obtained from the MECP's "Interim Guide to Estimate and Assess Landfill Air Impacts". The methane concentration was based on the maximum methane concentration from samples of raw landfill gas completed at Twin Creeks on June 29th, 2023; results of this sampling are provided in **Appendix 12A**.

Annual landfill waste acceptance history available up to the end of 2022 was entered into the LandGEM model; future years were based on the maximum approved filling rate of 1,400,000 tonnes of waste per year from 2023 – 2032. In 2033 the landfill capacity is reached with a maximum waste acceptance of 1,007,000 tonnes. A summary of the waste volume acceptance is provided in **Appendix 12B**. This waste acceptance data was used to calculate emissions from LandGEM. The landfill area is divided into 5 main areas.

These areas represent the landfill stages outlined in the original EA. Areas 1-4 represent the current operating areas and Area 5 represents the closed landfill which is under final cover. Emissions from each landfill stage were estimated based on the following time periods:

- Area 5 receiving waste from 1972 – 2004;
- Area 1 receiving waste from 2005 – 2019;
- Area 2 receiving waste from 2020 – 2024;
- Area 3 receiving waste from 2025 – 2029; and
- Area 4 receiving waste from 2030 – 2033.

LandGEM workbooks for each stage are provided in **Appendix 12C**.

For the areas under final cover, 70% of the generated LFG is collected with the remaining 30% emitted through the final cover area. For the interim cover areas, 50% of the LFG was assumed to be collected with the remaining 50% emitted. As a conservative approach, the entire active stage of the landfill was assumed to be under interim cover for the purposes of this assessment. For the existing conditions it was assumed Areas 1-3 and 5 were under final cover, with Area 4 representing the active cell.

The concentration of individual VOC compounds within the landfill gas were based on the average concentration from the landfill gas samples taken at Twin Creeks on June 29th, 2023. Landfill gas source testing results are provided in **Appendix 12A**.

LandGEM was used to predict the total annual vinyl chloride emissions from TCEC for the year 2033. Emissions of the remaining two VOC compounds, benzene and 1,2-dichloroethane, were scaled from the vinyl chloride emissions based on their

concentration in the landfill gas, relative to vinyl chloride. These emission rates were converted to flux rates (in g/m²/s) by dividing the total emission rate by the footprint area for each stage of the landfill.

The emission calculations based on LandGEM and the maximum concentration of each individual contaminant in the LFG resulted in conservative emission rates. For H_2S and TRS, the hydrogen sulphide concentrations in the raw landfill gas resulted in elevated emission estimates when following the LandGEM approach. However, the LandGEM Model has been developed as an LFG generation model and is not an LFG emission model. The approaches taken in this assessment also produce an estimate of LFG generation rather than LFG emission. This is a very critical distinction when assessing air quality. The effect of LFG passing through several feet of moistened soil, full of microbes and reactive minerals, greatly reduces the amount of many LFG compounds. This is particularly true for reduced Sulphur compounds such as hydrogen sulphide.

Therefore, for H_2S and TRS compounds, emission rates from the landfill mound were developed based on source testing conducted at the TCEC in September 2023. This source testing used a flux chamber to collect samples of sulphur species from the final cover and interim cover areas of the landfill, in accordance with the methodology outlined in **Section 7.3**. A total of 9 samples were taken for each source type and the average flux rate was applied in the dispersion modelling.

Please refer to **Appendix 12D** for full details on the LFG emission calculations for the final and interim cover areas.

12.3.2 Landfill Gas Flares

VOC, H_2S, and TRS emissions from all six LFG flares were calculated based on their individual maximum landfill gas flow rates and the average concentration of each contaminant in the landfill gas from the samples taken at Twin Creeks on June 29th, 2023. Landfill gas source testing results are provided in **Appendix 12A**.

The emissions of each individual contaminant were determined by applying the contaminant concentration to the total volume of LFG flared and reducing the predicted emissions by the 98% destruction efficiency.

Please refer to **Appendix 12E** for full details on the landfill gas emission calculations for the flares.

Emissions of the combustion byproducts NO_X, SO_2, and TSP, were based on emission factors provided in US EPA AP-42 Chapter 2.4 Municipal Solid Waste Landfills. Emissions of D&F were estimated based on the measured D&F emissions for a landfill gas flare at another Waste Management owned landfill site in Ontario. Emissions were calculated based on the individual maximum capacity of each landfill gas flare and a methane gas content of 50%.

Please refer to **Appendix 12F** for full details on the combustion byproduct emission calculations for the flares.

12.3.3 RNG Thermal Oxidizers

There are two thermal oxidizers associated with the RNG Facility, a pre-treatment thermal oxidizer (RNG_TO1), and the main thermal oxidizer (RNG_TO2).

Thermal oxidizer parameters and emissions were based on the Emission Summary and Dispersion Modelling, (ESDM) report submitted to the MECP in support of the RNG Facility application dated May 8, 2023.

Emissions from the thermal oxidizer were based on inlet contaminant concentrations provided by MRW Technologies Inc. (MRW), with gas flow scenarios for each thermal oxidizer chosen to provide the most conservative estimate of emissions. For RNG_TO1 the high carbon scenario with a flow rate of 690 scfm at 6% methane was selected. For RNG_TO2 the mid methane scenario with a flow rate of 4,900 scfm at 14% methane was used. Details on the emission calculations are provided in **Appendix 12G.**

12.3.4 Waste Soil Piles

There was no site-specific waste storage pile source testing available for the Twin Creeks facility. Emissions from the waste storage piles were based on flux chamber VOC sampling conducted at similar facilities in Ontario. Sampling from two facilities were considered, and the maximum recorded flux rate was used for the emissions estimate. Please refer to **Appendix 12H** for full details on the waste soil piles emission rates.

12.3.5 On-Site Vehicle Emissions

VOC and combustion by-product emissions from on-road vehicles were obtained using the US EPA's Motor Vehicle Emission Simulator (MOVES), version MOVES3. MOVES is a model that has been developed for the purpose of estimating vehicular emissions using computer simulation techniques based on extensive previous testing of a wide range of vehicles. MOVES provides an aggerate emission factor that includes emissions associated with fuel combustion in the engine, as well as brake and tire wear. MOVES3 was used to generate vehicle emission factors for the baseline year 2033.

Tailpipe emissions for landfill equipment, such as loaders and bulldozers, were also developed using MOVES3. These emissions were generated using the MOVES nonroad option. This option is designed specifically for calculating emissions of non-road sources and produces emission rates in gram per hour based on the type of equipment and its rated horsepower. The horsepower of all off-road equipment was based on equipment specified in the 2016 Environmental Screening Report.

12.3.5.1 Vehicle Traffic

Traffic volumes for landfill operations were obtained from HDR. Northbound and southbound traffic along Nauvoo Road was used to determine the number of vehicles

entering and leaving the landfill. Hourly traffic was provided for small, medium, and large vehicles from 6:00 a.m. to 5:00 p.m. which aligned with landfill operations. This hourly data was used to select the AM, MD, and PM peak hour traffic volumes:

- AM hours were considered to be between 7:00 a.m. and 10:00 a.m.;
- MD hours were considered to be between 10:00 a.m. and 2:00 p.m.; and
- PM hours were considered to be between 2:00 p.m. and 5:00 p.m.

The distribution and volume of small, medium, and large vehicles for each AM, MD, and PM peak hour were assumed to apply for each hour in that time period.

This peak hourly traffic was based on observations made by HDR on October 30, 2019 and was not representative of the worst-case peak hours. In order to capture the worst-case peak hourly traffic, the waste tonnage received on October 30, 2019 of 4,487 tonnes was compared with the maximum daily tonnage of 8,974 based on daily waste receipts from 2018 – 2022.

The average metric tonnes per load for each vehicle type, based on TCEC Ticket Reports, was applied to the hourly traffic volume to determine a traffic scaling factor that would result in the maximum daily tonnage received in 2019 – 2022. Based on this analysis peak hourly traffic for the AM, MD, and PM time periods were linearly scaled by a factor of 1.6.

There has been no change in the distribution of onsite traffic since the 2016 Environmental Screening Report as the landfill footprint has not changed. Therefore, maximum peak hourly traffic values were used to scale onsite haul route traffic to account for the new peak hourly traffic value.

The total traffic volume was applied to the site entrance route, and then the traffic was divided across the on-site roads based on vehicle type and route information from the 2016 Environmental Screening Report. The route alignments are unchanged from the 2016 Environmental Screening Report except for the final approach to the active face. This has been modified to accommodate relocation of the active face to the anticipated final cell location in 2033.

A summary of the vehicle types, average vehicle weight, maximum vehicle count, and the hourly vehicle passes for the ante-meridiem (AM), mid-day (MD), and post meridiem (PM) time periods for each roadway segment are presented in **Appendix 13E.**

12.3.5.2 Tailpipe Emission Rates

The MOVES3 model allows the user to generate emission factors by time of day and day of year, which accounts for diurnal and seasonal fluctuations in temperature and relative humidity. The average vehicle speed on TCEC roadways was assumed to be 10km/h, or 50% of the posted speed limit, as was used in the 2016 Environmental Screening Report. Three sets of daily emission factors were generated for both January and July – morning (AM, 8:00 a.m.), mid-day (MD, 12:00 p.m.), and evening

(PM, 6:00 p.m.) and vehicle speeds 0 and 10km/h. For each vehicle type and speed the maximum emission factor of the AM, MD, and PM time periods was applied for all time periods.

Since the traffic data was provided in terms of vehicle size (“small”, “medium”, “large”) MOVES3 emission rates were grouped according to size and vehicle speed then averaged. For example, an average emission factor for “small” vehicles consisting of MOVES3 Vehicle Types “PassengerCar”, “PassengerTruck”, and “LightCommercialTruck” was calculated for each contaminant and speed. These average emission factors for “small”, “medium”, and “large” vehicles were used to calculate a weighted average emission factor for each time of day, (AM, MD, PM) based on the composition of traffic volume during that period.

MOVES3 emission factors for 0km/h are provided in g/s, these emission rates were applied to idling vehicles. For the 10km/h speed emissions are provided in grams per vehicle mile traveled (g/VMT). These emission factors were converted to grams per kilometer traveled (g/VKT) by multiplying the g/VMT factors by 0.621.

For landfill equipment and construction equipment such as bulldozers and loaders, the nonroad emission factors from MOVES3 in g/s were scaled according to the number of vehicles operating concurrently during each hour.

A gram per second (g/s) emission rate was calculated for each hour of the day for each roadway segment. This emission rate is based on the tailpipe emission factor developed using MOVES as well as the number of vehicles travelling upon it.

Roadways were modelled as line volume sources, meaning that the roadway segments were broken up into a number of volume sources. The emission rate calculations consider a single vehicle travelling across the entire length of the roadway segment. The single-vehicle emission rate is then multiplied by the number of vehicles travelling along the roadway over each hour of the day to develop hourly emission rates based on all traffic.

Please refer to **Appendix 13D** for full details on the roadway emissions calculations for on-site haul routes.

12.3.6 Idling Vehicles

Idling emissions were calculated based on MOVES, as outlined in **Section 12.3.5.2**. Idling was simulated by entering a vehicle speed of 0 km/hr into the MOVES run. MOVES provides a gram/hour emission factor during idling. For the purposes of the assessment of benzene, ammonia and combustion byproduct emissions, two waste trucks were assumed to be idling at the weigh scale and two waste trucks were assumed to be idling at the active face constantly during the operating hours for the landfill. Further details are provided in **Appendix 13D**.

12.3.7 Leachate Treatment Plant

The United States Environmental Protection Agency's (U.S. EPA) wastewater treatment model WATER9 was used to estimate potential air emissions from the leachate treatment system as described in **Section 11.4.2**. Gram per second emission rates for the relevant indicator contaminants were used in the modelling.

For clarity, each of the four leachate treatment facility source types were modelled in a separate WATER9 file. The WATER9 files are presented in **Appendix 11D**.

12.3.8 Emergency Generators

Emissions of combustion byproducts from the emergency generator associated with the landfill gas plant (GEN1) were estimated based on Cummins Power Generator Specifications provided by Comcor Environmental.

Emissions of combustion byproducts from the emergency generator associated with the leachate pumps (GEN2) and the emergency generator associated with the maintenance offices (GEN3) were estimated based on emission factors from U.S. EPA's AP-42 Document, Chapter 3.3 Gasoline and Diesel Industrial Engines.

Emissions of combustion byproducts from the emergency generator associated with the proposed RNG Facility (GEN4) were estimated based on emission factors from U.S. EPA's AP-42 Document, Chapter 3.3 Gasoline and Diesel Industrial Engines, and from U.S. EPA's Tier 2 Non-Road Diesel Emission Standards.

Please refer to **Appendix 12I** for details on emergency generator emission calculations.

12.4 Dispersion Modelling

Dispersion modelling was completed in accordance with the methodology outlined in **Section 9**. Modifications to the methodology specific to landfill gas and combustion byproducts modelling are provided in the following sections.

12.4.1 Sources Modelled

The sources included in the dispersion model for landfill gas and combustion byproducts were the final cap areas, the interim cover areas, the LFG flares, the RNG Facility, the waste soil storage pile, the raw leachate treatment plant, equipment tailpipe emissions, and generators.

The locations of all modelled sources are shown in **Figures 9-1a** and **9-1b**.

12.5 Baseline Condition Results

Results for benzene, vinyl chloride, 1,2-dichloroethane, ammonia, H_2S, TRS, SO_2, D&F, and NO_x were compared against their applicable criteria as outlined in **Table 5-1**. Modelling was competed for the 1-hour, 24-hour and annual averaging periods. One-

hour concentrations were converted to 10-minute averaging periods following the methodology outlined in MECP Guideline A-11. Predicted concentrations were assessed at both grid and discrete receptor locations. Background concentrations were added to the predicted concentrations in order to assess cumulative effects. The 90th percentile background value was used for the 10-minute, 1-hour and 24-hour averaging periods, and the average background concentration was used for annual averaging periods. The receptor located at the cemetery to the southwest of the landfill has been included in the air quality assessment as a short-term receptor, denoted as STR1, as people are expected to use this location for short periods during daytime only. Therefore, only odour and contaminants with 10-minute or 1-hour averaging period criteria were assessed at this receptor.

Benzene, vinyl chloride, 1,2-dichloroethane, ammonia, SO_2, NO_x, and D&F are predicted to be below their applicable criteria at all off-site locations with background included. **Table 12-1** provides a summary of the maximum predicted concentration of each contaminant and averaging period. All maximums occur at or near the property boundary, and concentrations at discrete receptors are predicted to be lower than the values presented here. Maximum predicted concentrations at all discrete receptors are provided in **Appendix 12J** and contour plots are provided in **Appendix 12K**.

Predicted concentrations of 24-hour H_2S are expected to comply at all discrete receptors and at the property boundary and beyond. 10-minute H_2S, 10-minute TRS, and 24-hour TRS are predicted to exceed applicable criteria with background included. However, these elevated concentrations are the result of high background concentrations with very little contribution coming from landfill activities. **Table 12-2** through **Table 12-5** provide a summary of the dispersion modelling results. For contaminants with 10-minute averaging periods predicted concentrations were assessed at discrete receptors only in accordance with MECP assessment guidelines for contaminants with 10-minute standards.

Predicted concentrations of H_2S for the 24-hour averaging period are below the applicable criteria with background. The maximum predicted concentration occurs at the property boundary with a predicted concentration of 6.5 µg/m³ or 92% of the criteria.

Table 12-1. Summary of VOCs and Combustion Byproduct Dispersion Modelling Results

Contaminant	CAS #	Averaging Period	Background Concentration (µg/m³)	Existing Conditions				
				Maximum Modelled Concentration Without Background(µg/m³)	Percentage of Criteria Without Background (%)	Maximum Modelled Concentration with Background (µg/m³)	Percentage of Criteria with Background (%)	POI Location
Benzene	71-43-2	24-Hour	0.56	0.3	14%	0.9	38%	Max GLC
		Annual	0.4	0.05	10%	0.4	99%	Max GLC
Vinyl Chloride	75-01-4	24-Hour	0.05	0.4	41%	0.5	46%	Max GLC
		Annual	0.1	0.05	24%	0.1	49%	Max GLC
1,2-Dichloroethane	107-06-2	24-Hour	0.10	0.3	15%	0.4	20%	Max GLC
		Annual		0.03	9%	0.1	24%	Max GLC
Ammonia	7664-41-7	24-Hour	3.1	8.5	9%	12	12%	Max GLC
Sulphur Dioxide	7446-09-5	1-Hour	2.4	75	75%	77	77%	Max GLC
		Annual	1.4	2.0	20%	3.4	34%	Max GLC
Nitrogen Oxides	10102-44-0	1-Hour	21.0	278.2	70%	299	75%	Max GLC
		24-Hour	19.1	37.5	19%	57	28%	Max GLC
Dioxins and Furans	DF	24-Hour	0.02	0.001	0.0005%	0.02	21%	Max GLC

Table 12-2. 24-Hour H_2S Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%)[1]	Maximum Modelled Concentration with Background (µg/m³)[2]	Percentage of Criteria with Background (%)[1]
Max GLC	0.85	12.2%	6.5	92%
R1	0.04	0.6%	5.6	81%
R2	0.07	1.0%	5.7	81%
R3	0.07	1.0%	5.7	81%
R4	0.07	1.0%	5.7	81%
R5	0.06	0.9%	5.7	81%
R6	0.07	1.0%	5.7	81%
R7	0.07	0.9%	5.7	81%
R8	0.04	0.6%	5.6	81%
R9	0.10	1.5%	5.7	81%
R10	0.04	0.5%	5.6	81%
R11	0.06	0.9%	5.7	81%
R12	0.10	1.4%	5.7	81%
R13	0.08	1.1%	5.7	81%
R14	0.07	1.0%	5.7	81%
R15	0.08	1.1%	5.7	81%
R16	0.04	0.6%	5.6	81%
R17	0.04	0.6%	5.6	81%
R18	0.04	0.6%	5.6	81%
R19	0.04	0.6%	5.6	81%
R20	0.04	0.5%	5.6	81%
R21	0.04	0.5%	5.6	81%
R22	0.03	0.5%	5.6	80%
R23	0.03	0.5%	5.6	80%
R24	0.03	0.4%	5.6	80%
STR1	N/A	N/A	N/A	N/A

Notes:
[1] Criteria = 7 µg/m³
[2] 90th Percentile Background Concentration based on all wind directions = 5.6 µg/m³

Table 12-3. 10-Minute H_2S Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%) [1]	Maximum Modelled Concentration with Background (µg/m³) [2]	Percentage of Criteria with Background (%)[1]
R1	0.4	3.3%	22.9	177%
R2	0.3	2.6%	22.9	176%
R3	0.4	2.8%	22.9	176%
R4	0.4	3.1%	22.9	176%
R5	0.3	2.3%	22.8	176%
R6	0.3	2.6%	22.8	176%
R7	0.4	3.2%	22.9	176%
R8	0.4	2.7%	22.9	176%
R9	0.6	4.6%	23.1	178%
R10	0.3	2.2%	22.8	175%
R11	0.3	2.5%	22.8	176%
R12	0.4	3.0%	22.9	176%
R13	0.4	2.9%	22.9	176%
R14	0.4	2.8%	22.9	176%
R15	0.4	3.3%	22.9	177%
R16	0.3	2.6%	22.9	176%
R17	0.4	3.1%	22.9	176%
R18	0.4	2.8%	22.9	176%
R19	0.4	3.3%	22.9	177%
R20	0.4	3.4%	23.0	177%
R21	0.4	3.4%	23.0	177%
R22	0.4	3.3%	22.9	177%
R23	0.4	3.2%	22.9	176%
R24	0.4	3.0%	22.9	176%
STR1	0.8	5.9%	23.3	179%

Notes:

[1] Criteria = 13 µg/m³

[2] 90th Percentile Background Concentration based on all wind directions = 22.5 µg/m³

Predicted concentrations of H_2S for the 10-minute averaging period exceed the applicable criteria. However, cumulative concentrations are dominated by elevated background concentrations. The maximum contribution to the predicted POI occurs at receptor STR1 with a predicted concentration of 0.8 µg/m³ or 5.9% of the criteria. This accounts for approximately 3.4% of the predicted cumulative concentration.

Table 12-4. 10-Minute TRS Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%)[1]	Maximum Modelled Concentration with Background (µg/m³)[2]	Percentage of Criteria with Background (%)[1]
R1	0.7	5.7%	45.0	346%
R2	1.0	7.6%	45.2	348%
R3	0.8	5.8%	45.0	346%
R4	1.2	9.0%	45.4	349%
R5	0.8	6.0%	45.0	346%
R6	0.7	5.5%	45.0	346%
R7	0.6	4.7%	44.8	345%
R8	0.6	4.3%	44.8	345%
R9	0.6	4.8%	44.9	345%
R10	0.6	4.4%	44.8	345%
R11	0.6	4.3%	44.8	345%
R12	0.7	5.2%	44.9	345%
R13	0.7	5.5%	44.9	346%
R14	0.7	5.3%	44.9	346%
R15	0.6	4.9%	44.9	345%
R16	0.6	4.3%	44.8	345%
R17	0.7	5.7%	45.0	346%
R18	0.7	5.5%	45.0	346%
R19	0.7	5.5%	45.0	346%
R20	0.7	5.4%	44.9	346%
R21	0.7	5.3%	44.9	346%
R22	0.7	5.3%	44.9	346%
R23	0.7	5.3%	44.9	346%
R24	0.7	5.3%	44.9	346%
STR1	0.8	5.9%	45.0	346%

Notes:
[1] Criteria = 13 µg/m³
[2] 90th Percentile Background Concentration based on all wind directions = 44.2 µg/m³

Predicted concentrations of TRS for the 10-minute averaging period exceed the applicable criteria. However, cumulative concentrations are dominated by elevated background concentrations. The maximum contribution to the predicted POI occurs at receptor R4 with a predicted concentration of 1.2 µg/m³ or 9.2% of the criteria. This accounts for approximately 2.6% of the predicted cumulative concentration.

Table 12-5. 24-Hour TRS Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%)[1]	Maximum Modelled Concentration with Background (µg/m³)[2]	Percentage of Criteria with Background (%)[1]
Max GLC	0.86	12.2%	11.9	169%
R1	0.08	1.2%	11.1	158%
R2	0.12	1.7%	11.1	159%
R3	0.10	1.5%	11.1	159%
R4	0.13	1.9%	11.1	159%
R5	0.10	1.5%	11.1	159%
R6	0.09	1.3%	11.1	158%
R7	0.13	1.9%	11.1	159%
R8	0.10	1.5%	11.1	159%
R9	0.15	2.2%	11.2	159%
R10	0.06	0.8%	11.1	158%
R11	0.07	1.0%	11.1	158%
R12	0.10	1.5%	11.1	159%
R13	0.08	1.2%	11.1	158%
R14	0.08	1.1%	11.1	158%
R15	0.08	1.1%	11.1	158%
R16	0.08	1.1%	11.1	158%
R17	0.10	1.4%	11.1	159%
R18	0.09	1.2%	11.1	158%
R19	0.07	1.1%	11.1	158%
R20	0.07	1.0%	11.1	158%
R21	0.06	0.9%	11.1	158%
R22	0.05	0.8%	11.1	158%
R23	0.05	0.7%	11.0	158%
R24	0.05	0.7%	11.1	158%
STR1	N/A	N/A	N/A	N/A

Notes:

[1] Criteria = 7 µg/m³

[2] 90th Percentile Background Concentration based on all wind directions = 11 µg/m³

Predicted concentrations of TRS for the 24-hour averaging period exceed the applicable criteria. However, cumulative concentrations are dominated by elevated background concentrations. The maximum contribution to the predicted POI occurs at the property boundary with a predicted concentration of 0.86 µg/m³ or 12.2% of the criteria. This accounts for approximately 7.2% of the predicted cumulative concentration.

Background concentrations of H_2S and TRS were obtained as part of the ambient monitoring campaign. Background TRS is primarily driven by hydrogen sulfide as it is the most abundant sulphur species and therefore, the background value of TRS follow the same trends as H_2S which is the focus of this analysis.

Background values were determined from the 90th percentile of all wind direction concentrations based on the discussion in **Section 6.2.1**. The use of all wind direction data is conservative because emissions from the landfill may be double counted when considering the cumulative effects from dispersion modelling and background. However, this provides a better estimate of background concentrations due to the limited upwind data available. Over the sampling period from June 2nd, 2023, through September 30th, 2023 a total of 109 valid samples were collected. Of these 109 H_2S samples 6 were determined to be upwind of which 3 samples were non-detect, and 1 sample was unexpectedly high with a concentration of 27 µg/m³.

Recall, upwind is defined as days where hourly wind directions are upwind of the station >50% of the sample time. This means that up to 50% of the measured concentration could include emissions from the landfill. However, the 27 µg/m³ measurement was recorded at the northeast station on June 23rd, 2023 and hourly wind data for this day has winds downwind of the landfill 0% of the time, with winds being upwind 58.3% of the time. Although some emissions from the landfill could be captured in the crosswind conditions, it is highly likely that this elevated concentration is the result of an off-property, non-landfill-related source and does not represent typical regional background concentrations.

The 90th percentile 10-minute H_2S and 10-minute TRS background concentrations remain above the criteria. This is because from June 2nd, 2023 through July 17th, 2023 the laboratory was only able to provide a detection limit of 5.6 µg/m³ for 24-hour H_2S, which when converted to a 10-minute averaging period results in a concentration of 23 µg/m³ which exceeds the 13 µg/m³ criteria. Similarly, the 24-hour TRS detection limit provided by the laboratory was 11 µg/m³ which when converted to a 10-minute averaging period result in a concentration of 44 µg/m³ which exceeds the 13 µg/m³ criteria.

Starting July 17th, 2023, the laboratory provided a new 24-hour detection limit for H_2S of 2.79 µg/m³ which when converted to a 10-minute averaging period results in a concentration of 11.2 µg/m³ which is below the criteria of 13 µg/m³. Since the new detection limit came into effect 45 of the 74 valid samples have been below detection. This suggests that had the detection limit been lowered earlier the background concentration would have likely been even lower.

Starting July 17th, 2023, the laboratory provided a new 24-hour detection limit for TRS of 5.6 µg/m³ which when converted to a 10-minute averaging period results in a concentration of 23 µg/m³ which is still above the criteria of 13 µg/m³. Since the new detection limit came into effect 71 of the 74 valid samples have been below detection. This suggests that had the TRS background values may be even lower. Considering only the samples taken since the lowered detection limit predicted cumulative

concentrations at the property boundary and all discrete receptors would be below the 24-hour TRS criteria.

Overall, the predicted landfill contribution of H_2S and TRS to the cumulative concentration at all discrete receptors and the property boundary are low. Predicted concentration greater than the applicable criteria are being driven by elevated background concentrations and elevated laboratory detection limits. Despite this, H_2S and TRS compounds can contribute to odour and as described in **Section 11.2** odour complaints do occur from time to time. The ambient monitoring data shows that a majority of the time measured H_2S and TRS concentrations are below detection and elevated concentrations of H_2S and TRS are rare but do occur which may contribute to occurrences of off-site odour. WM should continue to manage emissions of landfill gas by routine maintenance of the final cap and interim cover areas. Conditions outside normal operations, such as leaks or fissures through the landfill cap, may result in increased H_2S and TRS impacts. Preventing these types of conditions and mitigating them as quickly as possible when they may occur are key to minimizing potential off-site odour impacts.

Overall, the predicted concentrations of H_2S and TRS from landfill operations at all discrete receptors and the property boundary are low. Therefore, impacts associated with landfilling operations are expected to be low.

12.6 LFG and Combustion Byproducts Conclusion and Recommendation

Dispersion modelling predicts compliance with all criteria at all discrete receptors as well as the property boundary and beyond for benzene, vinyl chloride, 1,2-dichloroethane, ammonia, SO_2, NO_x, D&F and 24-hour H_2S. Predicted concentrations of 10-minute H_2S, 10-minute TRS, and 24-hour TRS are predicted to exceed at all discrete receptors and the property boundary. Predicted contributions from landfilling activities for all H_2S and TRS averaging periods are low, accounting for less than 10% of the cumulative concentration.

Predicted concentrations are dominated by elevated background values results from elevated laboratory detection limits. H_2S and TRS can contribute to off-site odour impacts and although the ambient data shows that a majority of the time measured H_2S and TRS concentrations are below detection some elevated measurements did occur. WM should continue to manage emissions of landfill gas by routine maintenance of the final cap and interim cover areas. Conditions outside normal operations, such as leaks or fissures through the landfill cap, may result in increased H_2S and TRS impacts. Preventing these types of conditions and mitigating them as quickly as possible when they may occur are key to minimizing potential off-site odour impacts.

13 Dust

Dust or particulate matter emissions can become a nuisance by infiltrating residences through open windows, soiling cars and house siding, affecting visibility, and, in the case of the smaller particulate fractions, can cause health effects. Dust at landfills consists primarily of relatively inert particulate matter from native and impacted soils. The dust is emitted on an intermittent basis, largely during landfill operations and construction activities, with significant emissions occurring during dry weather only. There are typically three contaminants of interest related to the dust emissions from landfills: total suspended particulate matter (TSP), inhalable particulate matter (PM_{10}), and respirable particulate matter ($PM_{2.5}$). The primary concerns associated with TSP are reduced visibility and general nuisance, while inhalable PM_{10} and respirable $PM_{2.5}$ particulate matter fractions may result in health effects.

TSP refers to particles less than 44 μm in aerodynamic diameter (defined as a particle that would have the same aerodynamic behavior in air as a sphere, with a specific gravity of 1.0 and a diameter of 44 μm). These particles are small enough to remain suspended in the atmosphere over long periods of time due to their low settling velocity. When present in large quantities, they can affect visibility and cause soiling effects.

PM_{10} refers to particles that are less than 10 μm in aerodynamic diameter. These particles are referred to as the inhalable portion of particulate matter as they have the ability to enter the lungs. When exposed to elevated levels of PM_{10} over a long period of time, negative health effects can result.

$PM_{2.5}$ refers to solid or liquid particles that are less than 2.5 μm in aerodynamic diameter. These particles are referred to as the respirable portion of particulate matter as these very small particles can be inhaled into the lungs and are small enough to reach the gas transfer sites in the lungs. When exposed to elevated levels of $PM_{2.5}$ over a long period of time, detrimental health effects can result.

13.1 Complaints History

A review of the TCEC complaints log was conducted in order to determine the current level of dust impacts in the vicinity of the landfill. From 2009 to the end of 2024, a total of ten dust related complaints were received. A summary of these complaints is shown in **Appendix 13A**.

On occasion dust related complaints were received, however; none of the complaints were related to fugitive dust or soiling. Complaints associated with fugitive dust or soiling would be the result of airborne particulates migrating off site and depositing on neighbouring properties. No such complaints were received. All dust related complaints were associated with track out, which is the buildup of dirt or other materials commonly in close proximity to the site entrance/roadways.

All ten dust related complaints that have been received by TCEC are related to track out and/or roadway debris in the form of Automobile Shredder Residue (ASR) material and dirt. Six of the ten complaints occurred in 2021 when ASR material was used as a daily cover material. Since then, WM has implemented a new ASR material abatement plan to control ASR material track out. The following year in 2022 there was one dust related complaint regarding track out. This suggests the abatement plan has been successful in decreasing the ASR material track out.

When WM was notified of the complaints, the facility responded and applied the necessary corrective action, which generally involved sending the sweeper to clean the road surface. Complaints were infrequent, with 2021 being the year having the highest number of complaints (6) otherwise no more than one complaint was received per year. In general, these dust events are isolated incidents and overall dust related complaints are low, with no complaints associated with fugitive dust impacts.

13.2 Best Management Practices Plan

Landfill operations can be a significant source of fugitive dust. In an effort to minimize fugitive dust emissions from the site, WM has previously prepared and implemented a dust BMPP, dated April 3, 2017, to minimize the off-site migration of fugitive dust. This BMPP (Dust) outlines details on standard operating procedures, mitigation measures, and training to control key operations typically associated with dust emissions. The BMPP (Dust) was previously provided to the MECP for review and comment. Key control measures outlined in the plan include:

- Watering of frequently disturbed or erodible surfaces;
- Watering of roadway surfaces;
- Sweeping of roadways;
- Posting and enforcing paved and unpaved road speed limits;
- Inspection and maintenance of internal and external roadways;
- Development and use of inclement weather areas;
- Ambient monitoring of TSP; and
- Training of relevant staff.

A copy of the BMPP is provided in **Appendix 13B**.

13.3 Dust Emission Sources

Vehicle traffic on interior haul routes, landfill heavy equipment operation, and wind erosion from exposed areas and material storage piles have the potential to generate fugitive dust, especially during extended periods of dry weather. These sources are managed under the current BMPP and would typically not be included when modelling

to assess compliance with Reg. 419/05 criteria. However, for the purposes of this study all sources of fugitive dust were considered, including these activities.

Under normal operating conditions, TCEC has the potential to emit dust from several sources, including:

- On-site vehicle traffic (on both paved and unpaved roads);
- Idling vehicles;
- Wind erosion of exposed areas;
- Material handling, including waste soils, daily cover material, and final cap construction material;
- Bulldozing;
- Combustion sources;
- Landfill gas flares;
- Proposed RNG Facility flares and thermal oxidizers; and
- Emergency generators.

Each of these sources is discussed in the following sections.

13.3.1 On-Site Vehicle Traffic

A network of paved and unpaved roadways allows trucks to travel from the entrance of the landfill site to the active face, waste soil pile, and other areas on-site. Particulate matter emissions generated by the vehicles traveling along these unpaved and paved surfaces include particulate matter emissions from tailpipes, brake wear, tire wear, and re-entrainment of loose material on the road surfaces. Emissions of particulate matter from these sources were included in this quantitative assessment.

The movement of on-site heavy equipment at the landfill active face was also included in the assessment of on-site roadway sources.

The traffic generated due to ancillary operations and landfill maintenance operations was not considered in the dust assessment because the traffic volumes are relatively small; the generation of particulate matter would therefore be insignificant relative to the generation of particulate matter from the traffic volumes traveling on the on-site main haul routes.

13.3.2 Idling Vehicles

During landfill operation, there are some periods where trucks will be idling at specific locations. During idling, there will be emissions from vehicle tailpipes, but no road dust re-entrainment will occur. For the purposes of the study, it was conservatively assumed that two landfill trucks will be idling at the weigh scale and two landfill trucks

will be idling at the active face at all times during the operating hours of the landfill. The particulate emissions from these idling trucks were considered in the assessment.

13.3.3 Wind Erosion of Exposed Areas

Wind erosion occurs when exposed areas are subjected to high wind speeds, typically greater than 6 m/s. Wind erosion will cause both fine and sand size particles to become airborne, but the fine particles are of greatest importance since they can travel much further.

The wind erosion sources included all exposed areas that were not vegetated, such as soil stockpiles and areas with daily and interim soil cover.

The exposed areas subject to wind erosion were assumed to be recently disturbed areas of the waste soil stockpile, the landfill active face, and the final cap construction face. Other areas, such as the landfill stages under final cover were assumed to be vegetated and/or crusted over and therefore not subject to wind erosion.

13.3.4 Material Handling

Dust producing materials, such as waste soils, are handled during normal landfill operations. Particulate matter emissions are generated during the following material handling activities at the landfill:

- Material loading and unloading at waste soil and grey clay stockpiles; and
- Material unloading at the landfill active face and final cap construction face.

Emissions of particulate matter from these activities have been included in this quantitative assessment.

13.3.5 Bulldozer Activity

As part of landfill operations dust producing materials, such as waste soils, are smoothed and contoured by bulldozers and other heavy equipment. Particulate matter emissions are generated during bulldozer activity at the following locations:

- Soil stockpile;
- Removal and replacement of daily cover at the landfill active face; and
- Construction of the final cap at the construction face.

13.3.6 Landfill Gas Flares

Collected LFG is combusted in fully enclosed flares. The collected gas is currently sent to the two existing flares or is sent off-site for utilization in a local greenhouse operation. There are two additional flares that have been approved for the facility but have not yet been constructed, to which landfill gas can be sent in the future. The proposed RNG Facility will add an additional two flares, for a total of six landfill gas flares on-site. As the landfill expands, blowers and flares will be added to the system

to draw the increasing amount of gas generated. At completion the system will have six flares, four dedicated landfill flares, and two flares associated with RNG bypass.

The combustion of the landfill gas results in the emission of combustion by-products, including particulate matter. Emissions of particulate matter from the LFG flares were included in this quantitative assessment.

13.3.7 Proposed RNG Thermal Oxidizers

The proposed RNG Facility will add one pre-treatment thermal oxidizer and one main thermal oxidizer. During RNG Facility operation the thermal oxidizers will combust waste gas streams from the RNG Facility. The combustion of the landfill gas results in the emission of combustion by-products, including particulate matter. Emissions of particulate matter from the thermal oxidizers were included in this quantitative assessment.

13.3.8 Emergency Generators

Four emergency generators will be used to provide back-up power for TCEC operations. Three generators are currently in place to provide back-up power for the landfill gas plant, the leachate pumps, and the maintenance office. A fourth is planned to provide back-up power for the proposed RNG Facility. These emergency generators use diesel fuel, and diesel combustion results in combustion by-products, including particulate matter. Emissions of particulate matter from the diesel generators were included in this quantitative assessment.

13.4 Emission Calculations

The emission rate development methodology for each source is presented in the following sections. Additional details and sample calculations are provided in the Appendices.

13.4.1 On-Site Vehicle Traffic

Dust emissions from vehicle movements are generated from three mechanisms, re-entrained road particulate from vehicles travelling on the road, vehicle brake and tire wear, and tailpipe particulate emissions as combustion by-products.

Estimates of the re-entrained road particulate matter emission rates from vehicle movements were obtained using the U.S EPA AP-42 documents, Chapters 13.2.1 and 13.2.2. These documents provide a reasonable general estimate of emission rates in dry conditions. Formulas for calculating particulate matter emission rates from traffic on paved and unpaved roads were provided in these documents.

Estimates of tailpipe particulate emissions from on-road vehicles were obtained using the US EPA’s Motor Vehicle Emission Simulator (MOVES), version MOVES3. MOVES is a model that has been developed for the purpose of estimating vehicular emissions using computer simulation techniques based on extensive previous testing of a wide

range of vehicles. MOVES provides an aggregate emission factor that includes emissions associated with vehicle break and tire wear. MOVES3 was used to generate vehicle emission factors for the baseline year 2033.

Tailpipe emissions for landfill equipment were developed using MOVES3. These emissions were generated using the MOVES nonroad option. This option is designed specifically for calculating emissions of non-road sources and produces emission rates in gram per hour based on the type of equipment and its rated horsepower. The horsepower of all off-road equipment was based on equipment specified in the 2016 Environmental Screening Report.

13.4.1.1 Vehicle Traffic

On-site vehicle traffic volumes were calculated based on a traffic volume study by HDR, scaled up to peak waste acceptance rates and distributed across the site based on the 2016 Environmental Screening Report, as described previously in **Section 12.2.5**.

13.4.1.2 Re-entrained Road Dust Emissions

To determine the roadway particulate emissions from re-entrained road particulate matter, the required inputs include number of vehicles, average weight of vehicles, roadway length, surface silt content (for unpaved roads), and road surface silt loading (for paved roads).

The number of vehicles travelling each roadway during each period (AM, MD, PM) was determined through the traffic data analysis as noted in **Section 12.2.5**. The vehicle weight by type was unchanged from the 2016 Environmental Screening Report. The average vehicle weight for each roadway segment during each period was based on a weighted average of the vehicles travelling that roadway during that period. Since the traffic composition in terms of vehicle type and vehicle frequency changed during each period, the average vehicle weight also changed. Emissions were calculated based on variable vehicle weight for each time period and roadway segment. The surface silt content and silt loading were based on source testing as outlined in **Section 7**. Where applicable, road segment specific silt content or silt loadings were applied. In areas where sampling data was not available the average sampled values were used. The values used in the assessment are summarized in **Appendix 13C**.

In addition to these inputs, the AP-42 equations require the use of a “k” factor and other constants, which adjusts the equation to represent the various particle sizes (TSP, PM_{10}, and $PM_{2.5}$). The “k” factors and constants published in AP-42 Chapter 13.2.1 and 13.2.2 are representative of $PM_{2.5}$, PM_{10}, and PM_{30} as TSP. In Ontario, TSP is defined as PM_{44}; therefore, the AP-42 “k” factor for TSP (PM_{44}) was scaled logarithmically from the published PM_{30} “k” factors to PM_{44} values of 4.79 and 7.32 for paved and unpaved roads, respectively.

Control factors were considered for emissions from the roadway sources based on dust control programs in place at TCEC. For the 2016 Environmental Screening Report, these controls were assumed to have a control efficiency of 90%. The same control efficiency was adopted for the current assessment and are assumed to remain constant over future years.

13.4.1.3 Tailpipe Emission Rates

The tailpipe emissions from on-site vehicles and landfill equipment were developed using the US EPA's MOVES3 model, as described previously in **Section 12.2.5**.

13.4.1.4 Composite Emission Rates

A gram per second (g/s) emission rate was calculated for each hour of the day for each roadway segment. This emission rate is based on the re-entrained road particulate matter emission factor calculated using AP-42 combined with the tailpipe emission factor developed using MOVES as well as the length of the roadway segment and the number of vehicles travelling upon it. The emission rate calculations for each roadway segment are presented in **Appendix 13C**. Roadways were modelled as line volume sources, meaning that the roadway segments were broken up into a number of volume sources. The emission rate calculations consider a single vehicle travelling across the entire length of the roadway segment. The single-vehicle emission rate is then multiplied by the number of vehicles travelling along the roadway over each hour of the day to develop hourly emission rates based on all traffic.

Please refer to **Appendix 13D** for full details on the roadway emissions calculations for on-site haul routes.

13.4.2 Idling Vehicles

Idling emissions were calculated based on MOVES, as outlined in **Section 12.2.5**. Idling was simulated by entering a vehicle speed of 0 km/hr into the MOVES run. MOVES provides a gram/hour emission factor during idling. For the purposes of the dust assessment, two waste trucks were assumed to be idling at the weigh scale and two waste trucks were assumed to be idling at the active face constantly during the operating hours for the landfill.

Further details are provided in **Appendix 13D**.

13.4.3 Wind Erosion of Exposed Areas

Wind Erosion sources include the active face and material storage piles. Emission factors from U.S. EPA AP-42, Chapter 13.2.5 Industrial Wind Erosion were used to predict particulate matter emission rates from wind erosion. These emission factors are dependent on wind speed; therefore, to accurately reflect the change in emissions with changes in wind speed, hourly wind speeds from the local meteorological data file (see Section 9.2) were used in combination with the emission factor to develop a file of hourly emission rates for use in the dispersion modelling analysis. Erodible

material was assumed to be overburden, and AP-42 Table 13.2.5-2 parameters for overburden were used in the calculation of emission rates.

As a conservative approach, dry conditions were assumed for the entire modelling period and no control was applied to the calculated wind erosion emissions from the landfill.

Wind erosion emission calculations are provided in **Appendix 13F**.

13.4.4 Material Handling Sources

Estimates of the particulate matter emission rates from material handling during landfilling operations were obtained using the US EPA's AP-42 document, Chapter 13.2.4. This document provides a reasonable general estimate of emission rates in dry conditions. Material handling occurs as part of TCEC landfill operations.

The required inputs into the AP-42 material handling equation are mean wind speed and moisture content of the material handled. An hourly emission rates file was generated using the hourly wind speed recorded in the local meteorological data file, corresponding to the years of meteorological data modelled (see Section 9.2). This hourly emission rate file calculates a separate emission rate for each hour in the meteorological file. For landfill sources, a 12% moisture content was assumed for the material handled, based on the mean moisture content for "cover" from AP-42.

In addition to these inputs, the AP-42 equation requires the use of a "k" factor which adjusts the equation to represent the various particle sizes (TSP, PM_{10}, and $PM_{2.5}$). The maximum "k" factor published in AP-42 Chapter 13.2.4 is 0.74, which is representative of PM_{30}. In Ontario, TSP is defined as PM_{44}; therefore, the AP-42 "k" factor for TSP (PM_{44}) was scaled up logarithmically to 0.8 from the published k-factor of 0.74 which referred to PM_{30}.

Material handling was assumed to occur only during the landfill hours of operation between 6 a.m. and 6 p.m. Handling of grey clay at the clay storage pile and final cap construction face was assumed to operate between 7 a.m. and 5 p.m.

The AP-42 calculations provide an emission factor in terms of kilogram of emissions per tonne of material handled. Hourly material handling rates for the landfill were based on those used in the 2016 Environmental Screening Report. Handling quantities of grey clay were determined based on the estimated daily tonnage over a 10-hour operating period.

As a conservative approach, dry conditions were assumed for the entire modelling period and no control was applied to the calculated material handling emissions from the landfill.

Further details regarding the material handling emission calculations and excerpts of the hourly emission rate files can be found in **Appendix 13G**. Emission calculations for the quantity of handling material associated with final cap construction are provided in **Appendix 13M**.

13.4.5 Bulldozer Activity

Estimates of the particulate matter emission rates from bulldozer and other heavy equipment activity at the active face and soil storage area were obtained using the United States Environmental Protection Agency AP-42 document, Chapter 11.9.

The equation and constants from Table 11.9-2 were used for bulldozing overburden material. The required inputs into the AP-42 equation are material moisture content and material silt content of the material. As described in Section 3.2, material samples were collected on site and sent for laboratory analysis. Silt content for daily cover samples was used to determine silt content. Unfortunately, the laboratory was unable to provide the moisture content for the daily cover sample. The moisture content from the 2016 Environmental Screening Report of 12% for the soil storage area and 24% for the active face were used. Moisture content of the grey clay material used for final cap construction was based on the moisture content provided in the proctor analysis.

Further details can be found in **Appendix 13H**.

13.4.6 Landfill Gas Flares

Collected landfill gas is sent to the flares, where it is combusted. Combustion by-products, including particulate matter, are emitted during flare operation. Emission factors for landfill gas combustion are provided in the US EPA AP-42 guidance document, Chapter 2.4 – Draft 2008. In this chapter, emission factors are presented in kilograms of emission per million dry standard cubic metres of methane gas. The flow rate of landfill gas and the percent composition of methane were based on design capacity of each flare.

The flares are designed to operate at temperatures between 875 °C and 950 °C. Flaring of the landfill gas typically converts about 98% of the methane to carbon dioxide and consumes more than 99.9% of the trace organic compounds. The overall destruction efficiency was capped at 98% for all contaminants as a conservative approach.

Please refer to **Appendix 13I** for details on the emission calculations for the flares.

13.4.7 RNG Thermal Oxidizers

There are two thermal oxidizers associated with the RNG Facility, a pre-treatment thermal oxidizer, (RNG_TO1) and the main thermal oxidizer, (RNG_TO2).

Thermal oxidizer parameters and emissions were based on the Emission Summary and Dispersion Modelling, (ESDM) report submitted to the MECP in support of the RNG Facility application dated May 8, 2023.

Emissions from the thermal oxidizer were based on inlet contaminant concentrations provided by MRW Technologies Inc. (MRW), with gas flow scenarios for each thermal oxidizer chosen to provide the most conservative estimate of emissions. For RNG_TO1 the high carbon scenario with a flow rate of 690 scfm at 6% methane was

selected. For RNG_TO2 the mid methane scenario with a flow rate of 4,900 scfm at 14% methane was used. Emissions of particulate matter from combustion of landfill gas were based on the emission factor for a flares acting as a control device as summarized in US EPA AP-42, Table 2.4-4.

Detailed emission calculations are provided in **Appendix 13I**.

13.4.8 Emergency Generators

Emissions of combustion byproducts from the emergency generator associated with the landfill gas plant (GEN1) were estimated based on Cummins Power Generator Specifications provided by Comcor Environmental.

Emissions of combustion byproducts from the emergency generator associated with the leachate pumps (GEN2) and the emergency generator associated with the maintenance offices (GEN3) were estimated based on emission factors from U.S. EPA's AP-42 Document, Chapter 3.3 Gasoline and Diesel Industrial Engines.

Emissions of combustion byproducts from the emergency generator associated with the proposed RNG Facility (GEN4) were estimated based on emission factors from U.S. EPA's AP-42 Document, Chapter 3.3 Gasoline and Diesel Industrial Engines, and from U.S. EPA's Tier 2 Non-Road Diesel Emission Standards.

Please refer to **Appendix 12I** for details on emergency generator emission calculations.

13.5 Dispersion Modelling

Dispersion modelling was completed in accordance with the methodology outlined in **Section 9**. For predicted concentrations of particulate species receptor STR1 was not considered. STR1 represents the cemetery located southeast of the site, where human activity is expected to be infrequent and short-term and therefore longer averaging periods do not apply. Since criteria for particulate species have only 24-hour and annual averaging periods, STR1 was not considered for the dust assessment.

In addition to the methodology described in **Section 9**, the effects of particle deposition and dry depletion were considered in the dispersion model and are discussed in the following section.

13.5.1 Deposition and Dry Depletion

Particulate matter plumes differ from gaseous plumes in that the particles can settle out due to gravity. Heavier particles will tend to settle out quickly, reducing the particulate concentration in the plume as it moves farther from the source. The AERMOD model allows the user to account for this settling through the use of deposition and plume depletion algorithms. The deposition results that are produced by the model represent the deposition flux rate, in grams per square metre (g/m^2). With the deposition algorithm, the model does not reduce the plume size by the

deposition flux rate; it merely predicts the amount of deposition that could occur from the plume at any receptor point. In order to decrease the plume by the deposited amount, the plume depletion algorithm must also be activated. For the purposes of this assessment, only the effects of dry deposition and dry plume depletion were considered.

In order to apply the deposition and depletion parameters, the modelling requires additional inputs, namely particle size ranges, mass fractions within each particle size category, and the density of the material. Surface samples from paved and unpaved roadways as well as samples of overburden material from the TCEC site were collected and used to determine particle size distributions for use in the modelling. Further details regarding the particle size sampling are described in **Section 7**.

This methodology of using dry deposition and dry plume depletion for ground-based fugitive emissions has been historically accepted by the MECP for the assessment of particulate matter emissions from landfills and quarries as part of the EA processes, including for the 2016 Environmental Screening Report.

Additional details regarding the deposition parameters used in the assessment are provided in **Appendix 13J**.

13.6 Baseline Condition Results

Results for TSP, PM_{10}, and $PM_{2.5}$ were compared against their applicable criteria as outlined in **Table 5-1**. Modelling was competed for the 24-hour and annual averaging periods. Predicted concentrations of TSP were assessed at both grid and discrete receptor locations. Predicted concentrations of PM_{10} and $PM_{2.5}$ were assessed at discrete receptors only. Background concentrations were added to the predicted concentrations in order to assess cumulative effects. The 90^{th} percentile background value was used for the 24-hour averaging periods, and the average background concentration was used for annual averaging periods. Results are not shown for receptor STR1 as all applicable averaging periods are greater than 1-hour.

Table 13-1 provides a summary of the predicted annual TSP concentrations. Predicted concentrations for the annual averaging period are below the 60 µg/m³ criteria at all discrete receptors. The maximum predicted concentration, including background contribution, at a discrete receptor was 39 µg/m³ which occurred at R4. Predicted concentrations are conservative, as they are based on maximum operating activity paired with the worst-case dry meteorological conditions over 5-years. In addition, the dispersion modelling does not account for precipitation, snow cover, or vegetation interception of particulate matter, each of which can decrease the concentration observed at the receptor.

Table 13-1. Annual TSP Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background(µg/m³)	Percentage of Criteria Without Background (%)	Maximum Modelled Concentration with Background (µg/m³)[2]	Percentage of Criteria with Background (%)[1]
R1	2	4%	26	44%
R2	10	17%	34	56%
R3	7	11%	30	51%
R4	15	25%	39	64%
R5	5	9%	29	48%
R6	5	9%	29	49%
R7	4	6%	28	46%
R8	2	4%	26	44%
R9	5	8%	29	48%
R10	2	3%	26	43%
R11	2	3%	26	43%
R12	3	5%	27	45%
R13	4	6%	27	46%
R14	3	5%	27	45%
R15	2	4%	26	44%
R16	2	3%	26	43%
R17	2	4%	26	44%
R18	2	4%	26	43%
R19	2	4%	26	43%
R20	2	3%	26	43%
R21	2	3%	26	43%
R22	2	3%	26	43%
R23	2	3%	25	42%
R24	1	2%	25	42%
STR1	N/A	N/A	N/A	N/A

Notes:
[1] Criteria = 60 µg/m³
[2] Average Background Concentration = 23.9 µg/m³

Table 13-2 provides a summary of the predicted 24-hour TSP concentrations. Predicted concentrations for the 24-hour averaging period exceeded the 120 µg/m³ criteria at discrete receptors R2, R3, R4, R5, R6, R7, R9, R10, R12, and R13. Since exceedances were predicted at discrete receptors a frequency analysis was conducted to determine the percentage of time that modelled TSP concentrations are predicted to exceed the criteria.

Table 13-2. 24-Hour TSP Predicted Concentration

Receptor ID	Existing Conditions				
	Maximum Modelled Concentration Without Background(µg/m³)	Percentage of Criteria without Background (%)[1]	Maximum Modelled Concentration with Background (µg/m³)[2]	Percentage of Criteria with Background (%)[1]	Frequency of Exceedance (%)
R1	73	61%	119	99%	--
R2	171	143%	217	181%	1.1%
R3	128	107%	174	145%	0.4%
R4	213	177%	259	215%	2.8%
R5	99	83%	145	121%	0.1%
R6	96	80%	142	118%	0.2%
R7	77	64%	123	103%	0.1%
R8	49	41%	95	79%	--
R9	108	90%	154	129%	0.4%
R10	78	65%	124	103%	0.1%
R11	53	44%	99	82%	--
R12	101	84%	147	122%	0.1%
R13	96	80%	142	119%	0.2%
R14	62	52%	108	90%	--
R15	74	61%	120	100%	--
R16	40	33%	86	72%	--
R17	45	38%	91	76%	--
R18	40	33%	86	71%	--
R19	70	59%	116	97%	--
R20	57	47%	103	85%	--
R21	38	32%	84	70%	--
R22	36	30%	82	68%	--
R23	35	29%	81	67%	--
R24	32	27%	78	65%	--
STR1	N/A	N/A	N/A	N/A	N/A

Notes:
[1] Criteria = 120 µg/m³
[2] 90th Percentile Background Concentration = 46 µg/m³

The maximum predicted concentration at a sensitive receptor location with background considered was 259 µg/m³ and occurred at R4. The maximum frequency

of exceedance occurred at R4 with a frequency of 2.8%, or 49 events over the 5-years of modelling. The frequency of exceedance at other discrete receptors were lower than this maximum amount; of the receptors with exceedances, most were on the order of a day or two per year. Although exceedances are predicted, the frequency of exceedance is low. Predicted concentrations are conservative, as they are based on maximum operating activity paired with the worst-case dry meteorological conditions over 5-years. In addition, the dispersion modelling does not account for precipitation or vegetation interception of particulate matter which can decrease the concentration observed at the receptor.

TSP has a standard under Regulation 419/05. Under Reg. 419, facilities are required to comply with MECP Standards and Guidelines at points at and beyond the property line of the facility. The impacts presented in this EA should not be used for direct comparison to the Reg. 419 limits, as there are key differences in the way the EA assessment is conducted versus a Reg. 419 assessment, most notably the inclusion of background concentrations. As shown in **Table 13-2**, concentrations without background are all below the criteria with the exception of receptors R2, R3, and R4.

The EA assessment considers additional differences relating to the sources considered and assumptions made. For instance, Reg. 419 excludes the contribution from motor vehicles when comparing to the standards and does not include consideration of cumulative effects. In addition, sources such as fugitive dust from on-site haul routes and wind erosion are typically excluded from modelling under a Reg. 419 assessment, instead these sources are typically managed through a BMPP for dust. For the landfill, the only identified sources of particulate that would be modelled when assessing compliance with Reg. 419 requirements would be the landfill gas flare, thermal oxidizers, generators and material handling. For the dust assessment, these sources were not significant contributors to off-site concentrations; therefore, the landfill is considered to be capable of achieving Reg. 419 compliance. This is supported by the most recent ESDM report dated May 8th, 2023.

Table 13-3 is a summary of the predicted 24-hour PM_{10} concentrations. Predicted concentrations for the 24-hour averaging period exceeded the 50 µg/m³ criteria at discrete receptors R2, R3, R4, R5, R6, R9, R12 and R13. Since exceedances were predicted at discrete receptors a frequency analysis was conducted to determine the percentage of time that modelled PM_{10} concentrations are expected to exceed the criteria.

Table 13-3. 24-Hour PM_{10} Predicted Concentrations

Receptor ID	Existing Conditions				
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%)[1]	Maximum Modelled Concentration with Background (µg/m³)[2]	Percentage of Criteria with Background (%)[1]	Frequency of Exceedance (%)
R1	29	57%	48	96%	--
R2	66	132%	85	171%	0.8%
R3	47	94%	66	132%	0.3%
R4	83	167%	103	205%	2.2%
R5	35	71%	55	109%	0.1%
R6	35	71%	55	109%	0.1%
R7	30	60%	49	99%	--
R8	21	42%	40	80%	--
R9	40	80%	59	118%	0.3%
R10	29	58%	48	97%	--
R11	20	39%	39	78%	--
R12	38	76%	57	114%	0.1%
R13	36	72%	55	110%	0.1%
R14	23	46%	42	85%	--
R15	26	53%	46	92%	--
R16	17	34%	36	73%	--
R17	19	38%	38	77%	--
R18	16	32%	35	70%	--
R19	27	55%	47	93%	--
R20	22	44%	41	83%	--
R21	15	30%	34	68%	--
R22	14	28%	33	66%	--
R23	13	25%	32	64%	--
R24	11	23%	31	61%	--
STR1	N/A	N/A	N/A	N/A	n/a

Notes:

[1] Criteria = 50 µg/m³

[2] 90th Percentile Background Concentration = 29 µg/m³

The maximum predicted concentration at a sensitive receptor location for the current scenario including background was 103 µg/m³ and occurred at R4. The maximum frequency of exceedance occurred at R4 with a frequency of 2.2%, or 40 events over the 5-years of modelling. Although exceedances are predicted, the frequency of exceedance is low.

Predicted concentrations are conservative, as they are based on maximum operating activity paired with the worst-case dry meteorological conditions over 5-years. In addition, the dispersion modelling does not account for precipitation or vegetation interception of particulate matter which can decrease the concentration observed at the receptor.

Table 13-4 is a summary of the predicted 24-hour $PM_{2.5}$ concentrations. Predicted concentrations of $PM_{2.5}$ for the 24-hour averaging period exceed the 27 µg/m³ CAAQs objective at discrete receptor R4. The CAAQs criteria specifies that the predicted concentration should be based on the 3-year average of the 98th percentile of the daily 24-hour average concentration, this was applied to the dispersion modelling results. Modelling results adjusted for the 3-year average of the 98th percentile of the daily 24-hour average period predicts exceedances at R4 only with a maximum predicted concentration of 29 µg/m³ with a frequency of 0.3%, or 5 events over the 5-years of modelling.

Although exceedances are predicted, the frequency of exceedance is low. Predicted concentrations are conservative, as they are based on maximum operating activity paired with the worst-case dry meteorological conditions over 5-years. In addition, the dispersion modelling does not account for precipitation or vegetation interception of particulate matter which can decrease the concentration observed at the receptor. It should be noted that exceedances are only predicted with background concentrations considered, and predicted concentrations at all receptors are below the criteria without background. Therefore, results shown provide a conservative estimate of potential landfill related impacts.

Table 13-4. 24-Hour $PM_{2.5}$ Predicted Concentrations

Receptor ID	Existing Conditions				
	3-year Average of the 98th Percentile Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%)[1]	3-year Average of the 98th Percentile Modelled Concentration with Background (µg/m³)[2]	Percentage of Criteria with Background (%)[1]	Frequency of Exceedance (%)
R1	3	12%	15	57%	--
R2	13	48%	25	93%	--
R3	9	35%	22	80%	--
R4	17	64%	29	109%	0.5%
R5	7	26%	19	71%	--
R6	8	30%	20	75%	--
R7	7	24%	19	69%	--
R8	4	13%	16	58%	--
R9	5	18%	17	63%	--

Receptor ID	Existing Conditions				
	3-year Average of the 98th Percentile Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%)[1]	3-year Average of the 98th Percentile Modelled Concentration with Background (µg/m³)[2]	Percentage of Criteria with Background (%)[1]	Frequency of Exceedance (%)
R10	3	10%	15	55%	--
R11	3	10%	15	55%	--
R12	5	17%	17	62%	--
R13	4	14%	16	59%	--
R14	3	13%	16	58%	--
R15	4	13%	16	58%	--
R16	3	12%	15	57%	--
R17	4	15%	16	60%	--
R18	4	13%	16	58%	--
R19	3	11%	15	56%	--
R20	3	10%	15	56%	--
R21	3	11%	15	56%	--
R22	3	10%	15	55%	--
R23	3	10%	15	55%	--
R24	2	8%	14	53%	--
STR1	N/A	N/A	N/A	N/A	n/a

Notes:
[1] Criteria = 27 µg/m³
[2] 90th Percentile Background Concentration = 12 µg/m³

Table 13-5 is a summary of the predicted annual $PM_{2.5}$ concentrations. It should be noted that the CAAQs criteria specifies that the predicted concentration should be based on the 3-year average of the annual average of the daily 24-hour average concentration, which was applied to the predicted concentrations. The predicted concentrations for $PM_{2.5}$ are below the 8.8 µg/m³ criteria at all discrete receptors. The maximum predicted concentration occurs at R4 with a predicted concentration of 8.6 µg/m³ or 98% of the criteria.

Table 13-5. Annual $PM_{2.5}$ Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%)[1]	Maximum Modelled Concentration with Background (µg/m³)[2]	Percentage of Criteria with Background (%)[1]
R1	0.3	4%	7.2	82%
R2	1.1	13%	8.0	91%
R3	0.7	8%	7.6	87%
R4	1.7	19%	8.6	98%
R5	0.6	7%	7.5	85%
R6	0.6	7%	7.5	85%
R7	0.5	5%	7.4	84%
R8	0.3	4%	7.2	82%
R9	0.4	5%	7.3	83%
RR10	0.2	2%	7.0	80%
R11	0.2	2%	7.1	80%
R12	0.3	3%	7.2	81%
R13	0.3	3%	7.2	82%
R14	0.3	3%	7.2	81%
R15	0.2	2%	7.1	81%
R16	0.3	3%	7.2	81%
R17	0.4	4%	7.2	82%
R18	0.3	3%	7.2	82%
R19	0.3	3%	7.2	81%
R20	0.3	3%	7.2	81%
R21	0.2	3%	7.1	81%
R22	0.2	3%	7.1	81%
R23	0.2	2%	7.1	81%
R24	0.2	2%	7.1	80%
STR1	N/A	N/A	N/A	N/A

Notes:
[1] Criteria = 8.8 µg/m³
[2] Average Background Concentration = 7 µg/m³

Concentration isopleths for TSP, PM_{10}, and $PM_{2.5}$ are provided in **Appendix 13K** for all applicable averaging periods.

13.6.1 Monitoring and Modelling Comparison

As discussed in **Section 6**, throughout the 2023 ambient monitoring campaign for particulate matter there were occasionally exceedances of the particulate matter

criteria recorded at the three onsite ambient monitoring stations. Given the recorded exceedances, a comparison between the monitored values and predicted concentrations from the dispersion modelling was completed in order to ensure the dispersion modelling provided a reasonable representation of dust emissions from TCEC operations.

For the comparison a separate dispersion model was developed considering only three (3) receptors representing the Northeast, Southeast, and West monitoring stations. Other than the change in receptors, the dispersion model used all the same modelling inputs as the off-property model. For the monitored and modelled analysis, the frequency of exceedances were calculated and compared. For total particulate matter monitoring data from 2017 – 2023 was considered. For PM_{10} and $PM_{2.5}$, data from 2023 was considered in the assessment, as this was the only year of monitoring data available. A summary of the monitored and modelled exceedance analysis is provided in **Appendix 13L**.

As shown in **Tables 13L-1** the maximum monitored TSP exceedance frequency was 15.5% which occurred in 2018. In all other years the frequency of exceedance is significantly lower, with frequencies in more recent years decreasing to 1.8% in 2021, 6.6% in 2022, and most recently 5.8% in 2023. The 7-year average from 2017 – 2023 was 6.9%, excluding 2018 the average drops to 5.5%. As shown in **Table 13L-4**, dispersion modelling predicted a maximum exceedance frequency was 18.9% in a single year with the average over the 5-year modelling period being 16.8%. Comparing these monitored and modelled results, the frequency of exceedance is significantly higher in the modelling data than the monitored data. Therefore, based on this comparison, the dispersion model provides a reasonable and highly conservative estimate of particulate matter impacts.

Recall, no historical monitoring data for PM_{10} or $PM_{2.5}$ was available as the ambient monitoring program was not expanded to include these size fractions until 2023. **Tables 13L-2** and **13L-3** in **Appendix 13L** provide a summary of the 2023 measured exceedances. As shown in Tables **13L-2** the monitored PM_{10} exceedance frequency was 7.6%. As shown in **Table 13L-4,** dispersion modelling predicted a maximum exceedance frequency was 15.6% in a single year with the average over the 5-year modelling period being 13.6%. Comparing the monitored and modelled results the frequency of exceedance predicted using dispersion modelling is significantly higher compared to the monitoring result.

As shown in **Tables 13L-3** the monitored $PM_{2.5}$ exceedance frequency was 4.4%. As shown in **Table 13L-4,** dispersion modelling predicted a maximum exceedance frequency was 6.6% in a single year with the average over the 5-year modelling period being 5.3%.

Comparing these monitored and modelled results the frequency of exceedance is reasonably similar with the modelling results predicting slightly higher frequencies of exceedance. Both PM_{10} and $PM_{2.5}$ modelling results predicted frequencies of exceedance higher than the 2023 monitoring. This suggests that dispersion modelling

is overpredicting PM_{10} and $PM_{2.5}$ impacts. Some of the discrepancies between monitored and modelled results is likely due to the fact that the existing conditions scenario for modelling is not the same as operations currently on site. Recall that the existing conditions modelling scenario was assessed assuming all permitted activities are operation on site in the last year before closure of the currently approved landfill footprint, (2033).

In this scenario the haul routes, working face, and supporting activities take place in different areas of the site compared to 2023 operations. In addition, no precipitation or snow cover was considered in the dispersion modelling. Modelling considered the maximum operating scenario occurring every day for the entire modelling period.

Keeping these differences in mind, the monitored values for TSP, PM_{10}, $PM_{2.5}$ are all lower than the modelled results at the monitoring station. Therefore, based on this comparison, the dispersion model provides a conservative estimate of particulate matter impacts.

13.7 Dust Conclusion and Recommendation

Predicted concentrations for annual TSP and annual $PM_{2.5}$ are expected to comply at all discrete receptors. Although predicted concentrations of TSP are above the applicable criteria at discrete receptors, the frequency of exceedance remains low. The model also considers several sources that are not required to be modelled for facility level compliance studies which add conservatism to the results. Even with these conservatisms, 24-hour TSP was only predicted to exceed at 10 discrete receptors with a maximum frequency of 2.8%. Exceedances of 24-hour PM_{10} and $PM_{2.5}$ were predicted at an even lower frequency of 2.2% and 0.3% respectively.

It is important to note that, for $PM_{2.5}$, exceedances at discrete receptor locations are predicted only when the background contribution is applied; the modelled concentrations from the landfill operations are below the relevant criteria when considered on their own.

In addition, the maximum predicted concentrations and frequencies for all particulate species are based on a conservative model, which assumes reasonable worst-case operations and dry conditions occurring in worst-case locations every day for the 5-year modelled period, which is not possible. These conservatisms include, but are not limited to, the following:

- Sources that move throughout the site have been positioned in a single worst-case location, closest to the property line and the nearest receptor;
- All operations were assumed to occur at their reasonable worst-case levels every day;
- When calculating emissions, conservative assumptions were made; and
- The assessment did not consider the effects of precipitation and snow cover, which would serve to reduce particulate emissions.

Overall, because of the conservatisms included in the assessment, the modelling likely over-predicts the impacts from the landfill and impacts from landfill operations are expected to be low. In an effort to address the potential for dust related impacts a review of the existing dust best management practices plan will be completed as part of the preferred alternative assessment. The proper development and implementation of the BMPP (dust) can help reduce the potential for impacts.

14 Conclusions

The Existing Conditions Report establishes a baseline for four studies areas:

1. Blowing Litter;
2. Odour;
3. Landfill Gas and Combustion Byproducts; and
4. Dust

The Existing Conditions Report shows blowing litter impacts are being effectively managed through the Blowing Litter BMPP. With the blowing litter BMPP in place WM is able to minimize off-site impacts such that existing impacts to residences are low.

Odour concentrations greater than the 1 OU/m³ detection guideline are predicted at frequencies greater than 0.5% at several discrete receptor locations. No discrete receptors are predicted to exceed the 3 OU/m³ recognition guideline more than 0.5% of the time and no exceedances of the 5 OU/m³ nuisance guideline are predicted. Based on the predicted odour concentrations there is potential that landfill-related odours will be detectable and occasionally recognizable at discrete receptors from time to time. WM should continue to manage emissions of landfill gas by routine maintenance of the final cap and interim cover areas and the gas and leachate collection systems in order to minimize odour emissions.

Predicted concentrations of benzene, vinyl chloride, 1,2-dichloroethane, ammonia, SO_2, NO_x, and D&F are below their applicable criteria at all off-site locations with background included. Predicted concentrations of H_2S and TRS exceed their applicable criteria with background included. However, H_2S and TRS concentrations are dominated by elevated background concentrations and contributions from the landfill are low. WM should continue to manage emissions of landfill gas by routine maintenance of the final cap and interim cover areas and the gas and leachate collection systems in order to minimize the potential for off-site impact.

Although the dust study predicted some exceedances of applicable criteria in all instances the frequency is low with a maximum of 2.8% for 24-hour TSP. The dust model considers many conservatisms and the modelling likely over-predicts the impacts from the landfill and impacts from landfill operations are expected to be minimum.

The results of these studies represent the existing conditions on site for the closure year 2033 and form the baseline which will be used for comparison with the preferred alternative in future studies. The existing conditions predict impacts from existing landfill operations are expected to be low and emissions from the site are being managed effectively.

15 References

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2012 Guidance Document on Achievement Determination Canadian Ambient Air Quality Standards for Fine Particulate Matter and Ozone.

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2016 Technical Bulletin – Methodology for Modelling Assessments of Contaminants with 10-Minute Average Standards and Guidelines under O. Reg. 419/05.

2017 Air Dispersion Modelling Guideline for Ontario: Guidance for Demonstrating Compliance with The Air Dispersion Modelling Requirements set out in Ontario Regulation 419/05 – Local Air Quality.

2018 Air Contaminants Benchmarks (ACB) List: Standards, Guidelines and Screening Levels for Assessing Point of Impingement Concentrations of Air Contaminants.

2018 Procedure for Preparing an Emission Summary and Dispersion Modelling Report: Guidance for Demonstrating Compliance with Ontario Regulation 419: Air Pollution – Local Air Quality.

2020 Ambient Air Quality Criteria.

Ontario Interim Waste Authority (IWA)

1994 Literature Review of Blowing Litter Impacts.

RWDI AIR Inc. (RWDI)

2005 Air Quality Impact Assessment. Warwick Landfill Expansion, Environmental Assessment.

2016 Final Report. Twin Creeks Landfill Site, Air Quality, Odour, and Dust Evaluation. Proposed Increase to Waste Tonnage.

U.S. Environmental Protection Agency (USEPA)

2008 AP-42 Chapter 2.4 Municipal Solid Waste Landfills, Environmental Protection Act.

Waste Management (WM)

2022 Terms of Reference. Twin Creeks Environmental Centre Landfill Optimization Project Environmental Assessment.

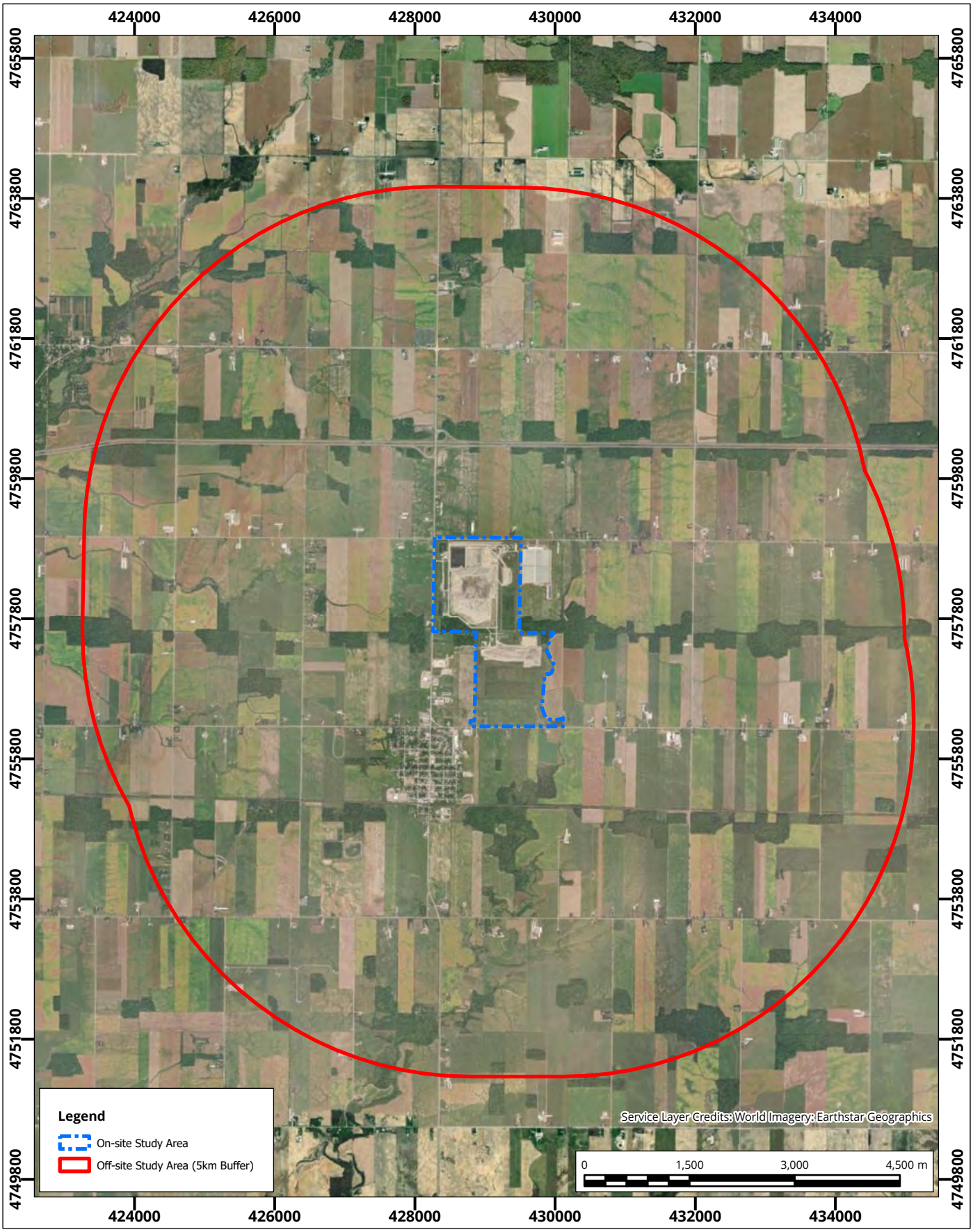
16 Statement of Limitations

This report entitled Air Quality Existing Conditions Report - was prepared by RWDI AIR Inc. (“RWDI”) for WM Canada (“Client”). The findings and conclusions presented in this report have been prepared for the Client and are specific to the Project described herein (“Project”). The conclusions contained in this report are based on the information available to RWDI when this report was prepared. Because the contents of this report may not reflect the final assumptions and information for the Project or subsequent changes made after the date of this report, RWDI recommends that it be retained by Client during the final stages of the Project to verify that the results provided in this report have been correctly interpreted in the final design of the Project.

The conclusions contained in this report have also been made for the specific purpose(s) set out herein. Should the Client or any other third party utilize the report and/or implement the conclusions contained therein for any other purpose or project without the involvement of RWDI, the Client or such third party assumes any and all risk of any and all consequences arising from such use and RWDI accepts no responsibility for any liability, loss, or damage of any kind suffered by Client or any other third party arising therefrom.

Finally, it is imperative that the Client and/or any party relying on the conclusions in this report carefully review the stated assumptions contained herein to understand the different factors which may impact the conclusions provided.

FIGURES



Site Plan Showing Study Area

True North

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre - Watford, Ontario

Project #: 2101750

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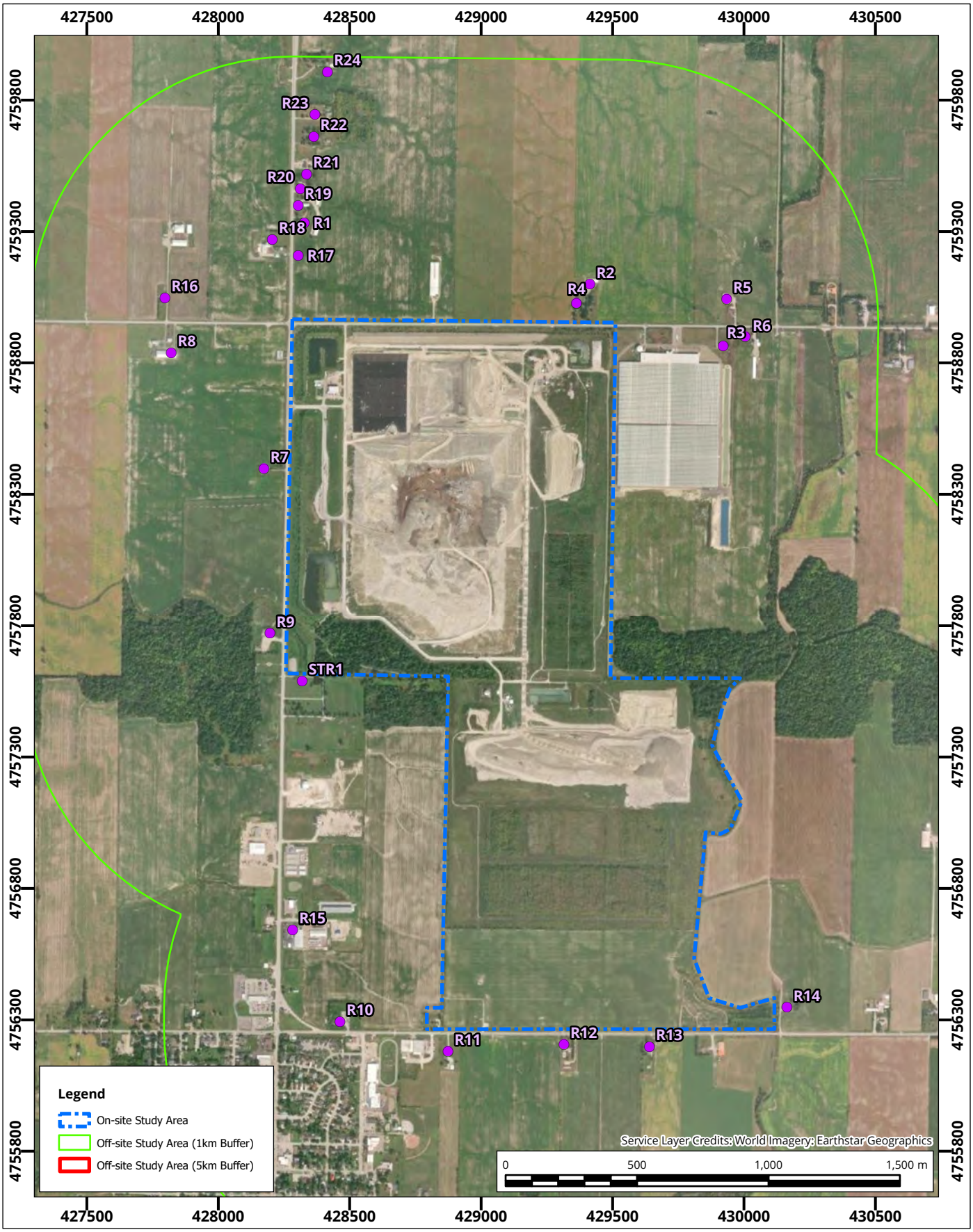

Site Plan Showing Discrete Receptor Locations

True North

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre - Watford, Ontario

Project #: 2101750

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Exact Scale:	1:20,000
Date Revised:	Oct 27, 2023

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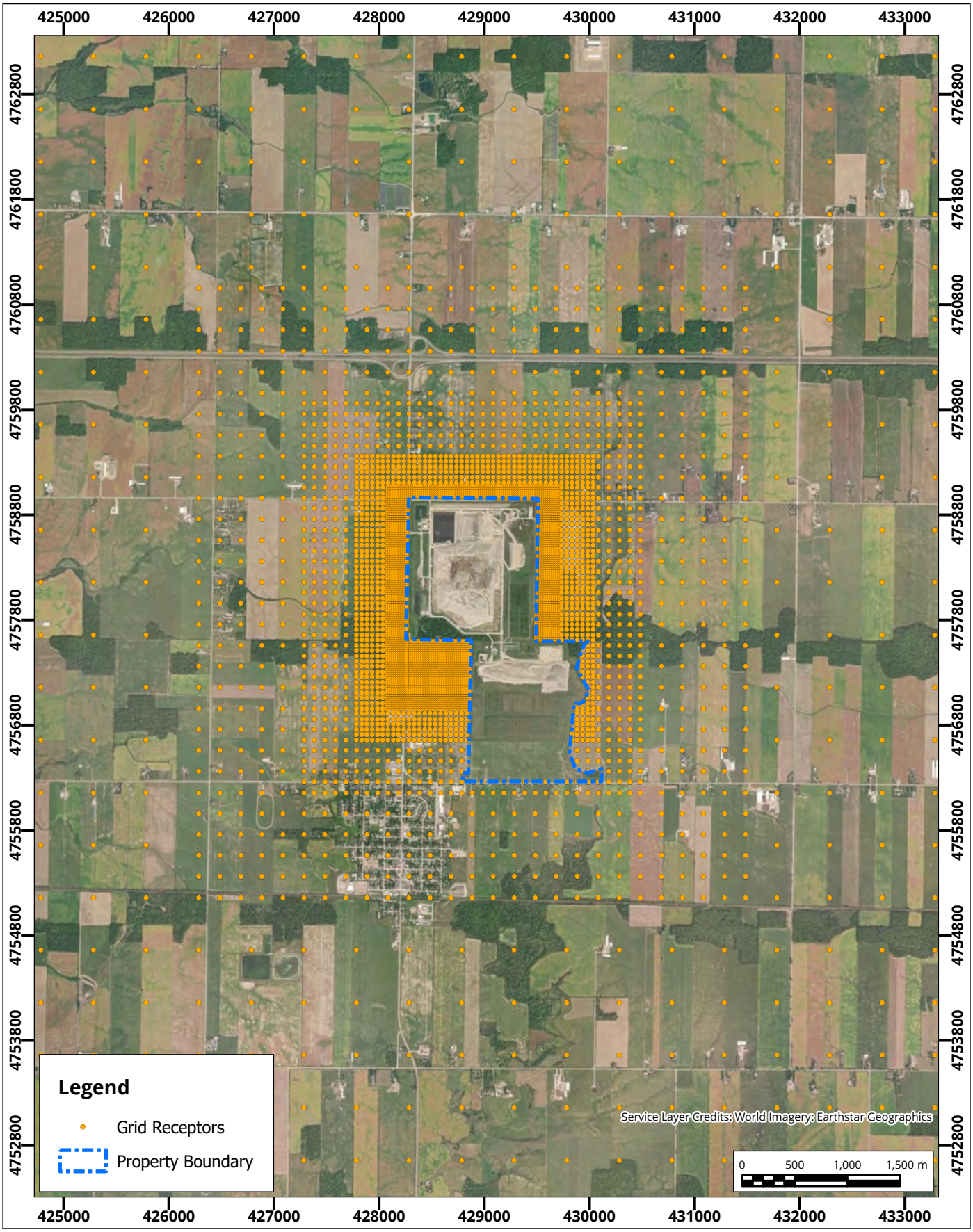

Site Plan Showing Grid Receptor Locations

True North

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre - Watford, Ontario

Project #: 2101750

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Exact Scale:	1:50,000
Date Revised:	Oct 2, 2023

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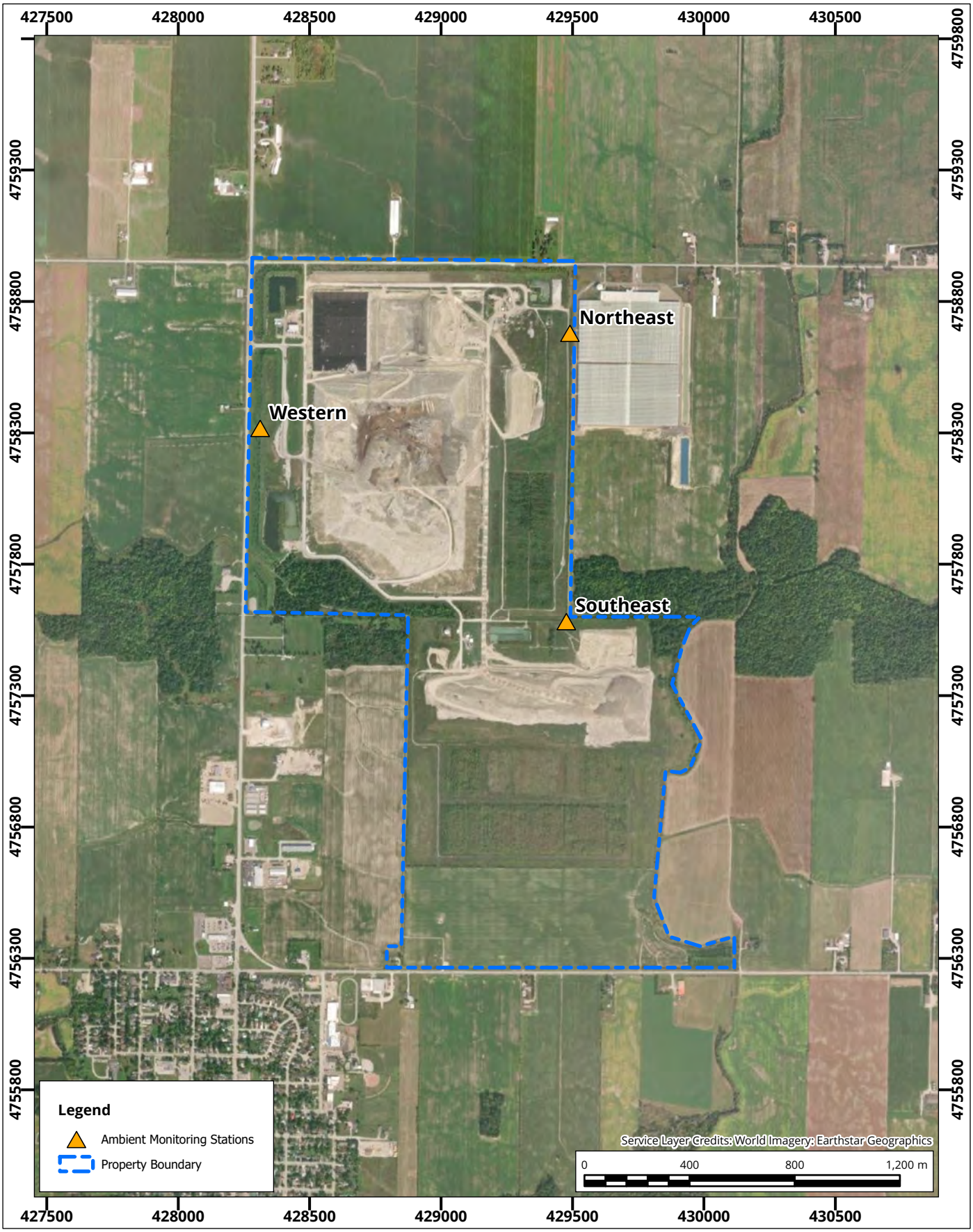

Ambient Monitoring Sampling Locations

True North

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre - Watford, Ontario

Project #: 2101750

Drawn by: MDKB	Figure: 6-1
Exact Scale:	1:20,000
Date Revised:	Jun 14, 2024

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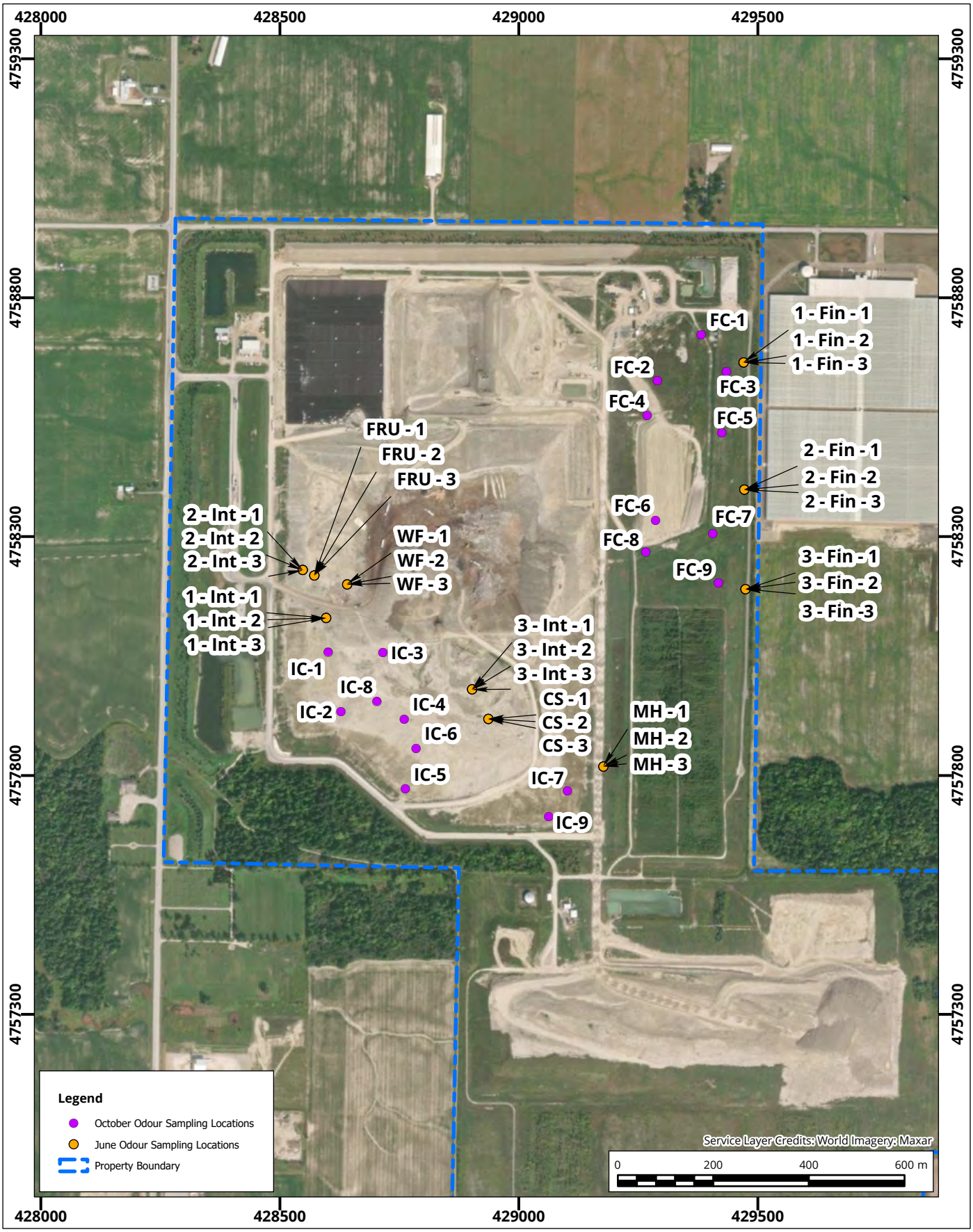

Odour Flux Chamber Sampling Locations

True North

Drawn by: MDKB | Figure: 7-1

Exact Scale: 1:11,000

Date Revised: Oct 27, 2023

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre - Watford, Ontario

Project #: 2101750

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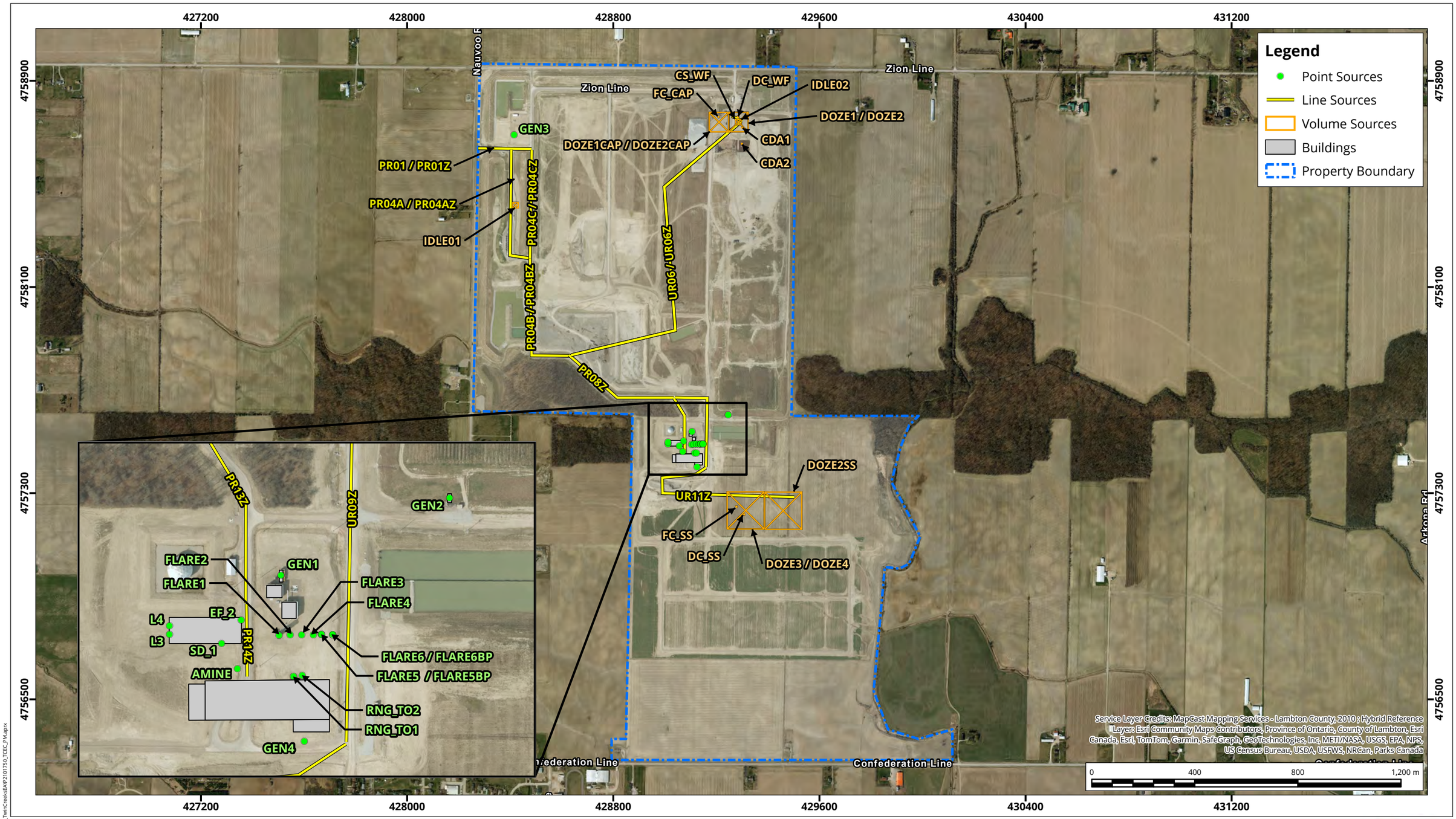

Site Plan Showing Location of Significant Sources, Buildings, and Property Boundary

Map Projection: NAD 1983 UTM Zone 17N

Twin Creek Environmental Centre - Watford, ON

True North

Project #: 2101750

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Approx. Scale:	1:14,000
Date Revised:	Jun 26, 2024

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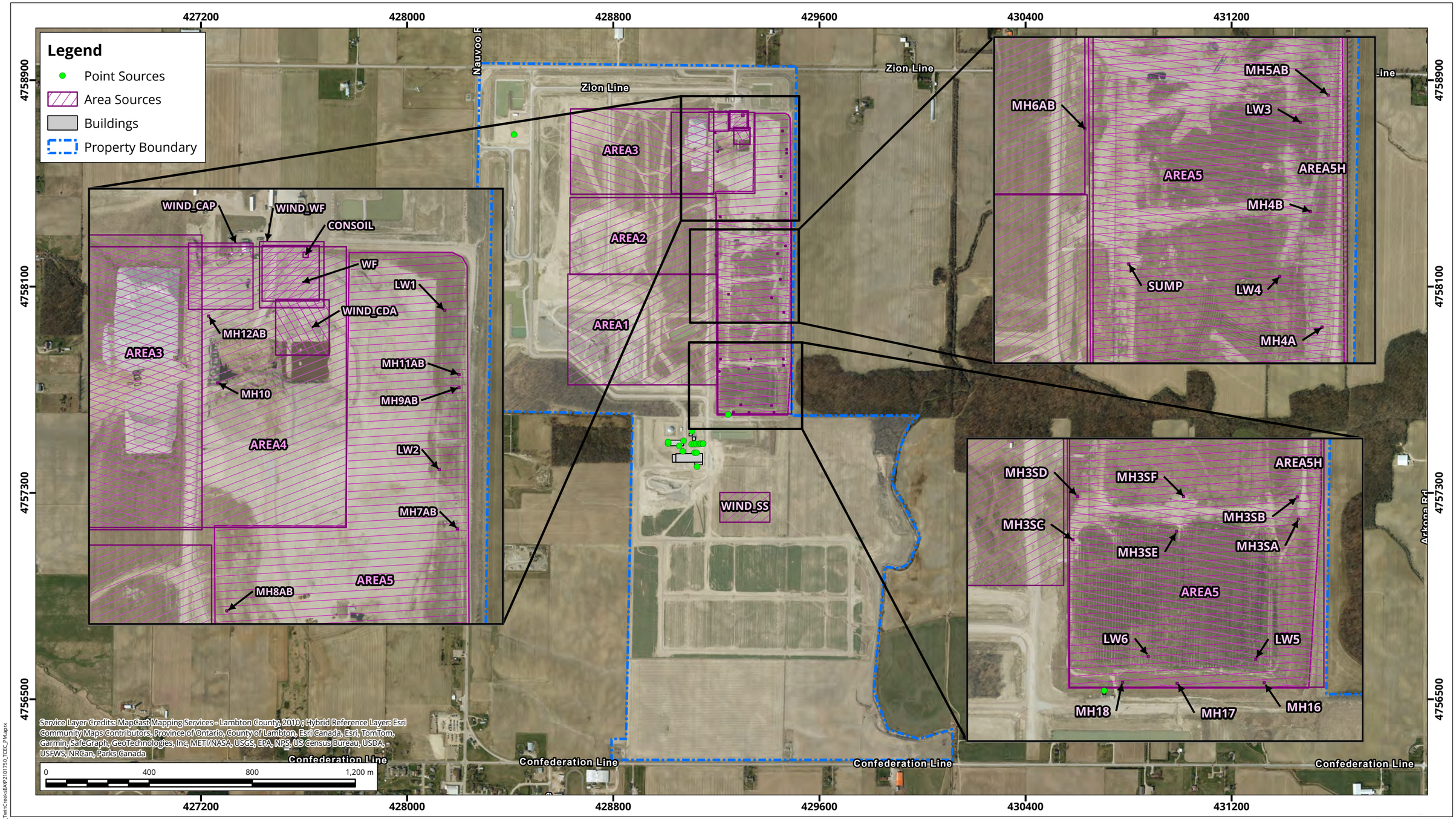

Site Plan Showing Location of Area Sources, Buildings, and Property Boundary

Map Projection: NAD 1983 UTM Zone 17N
Twin Creek Environmental Centre - Watford, ON

True North

Project #: 2101750

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Approx. Scale:	1:14,000
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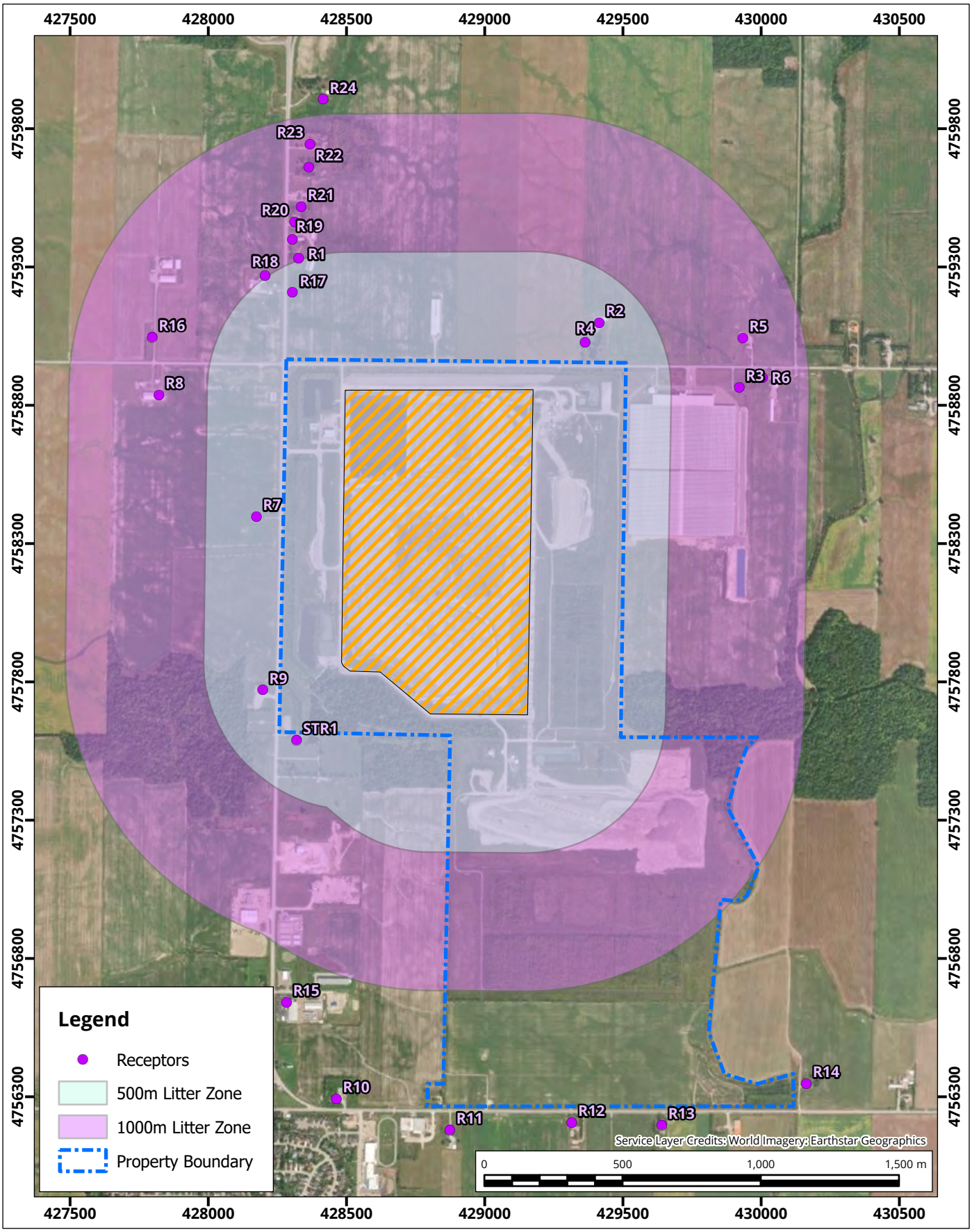

Site Plan Showing Property Boundary, Sensitive Receptors, and Litter Zones

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre - Watford, Ontario

Project #: 2101750

True North

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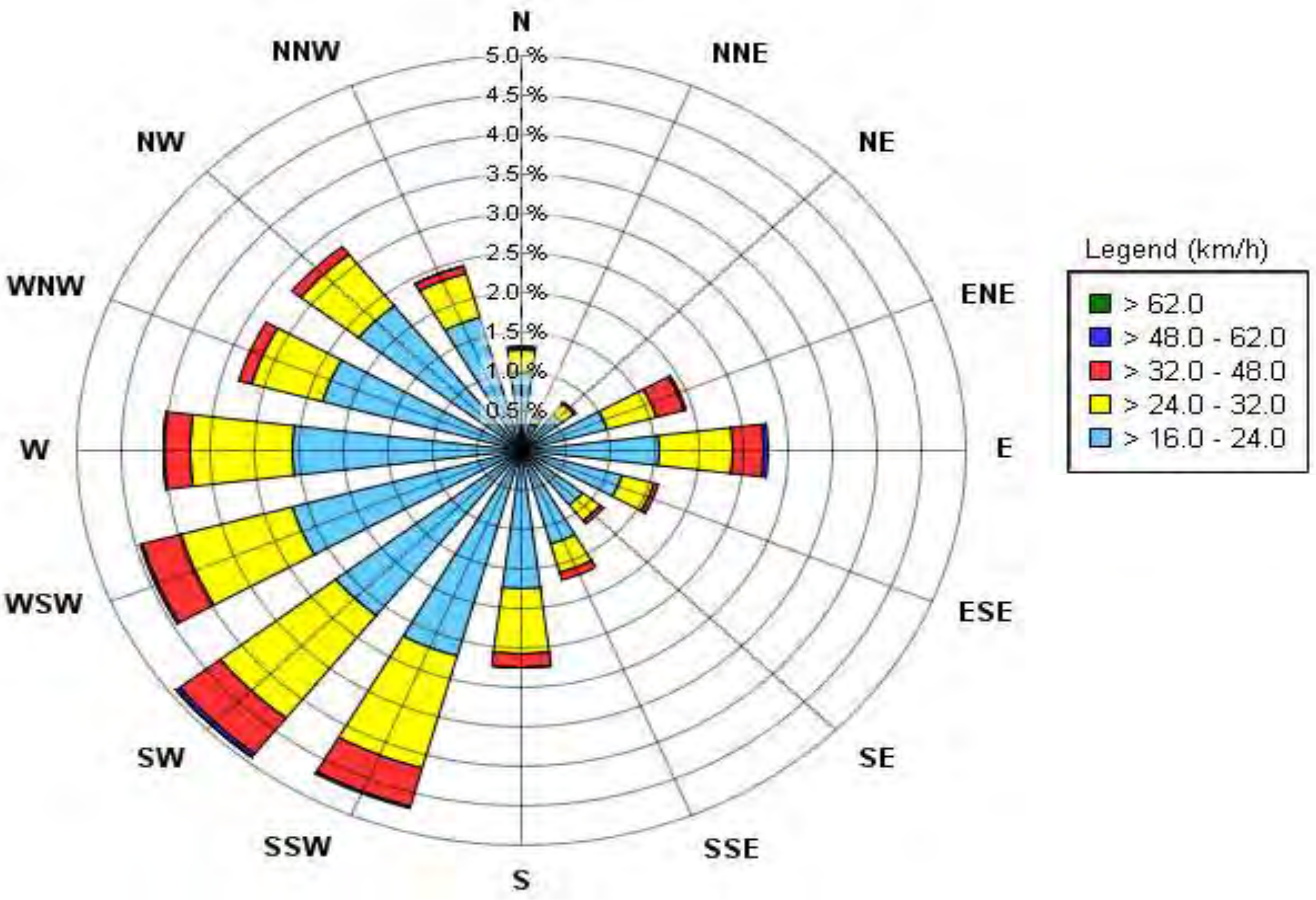


Wind Rose (Blowing From)
Wind Speeds > 16 km/h
Site-Specific Meteorological Data 2011 - 2015

Twin Creeks Environmental Centre Optimization - Watford, ON

RWDI# 2101750

Drawn by: MDKB	Figure: 10-2
Approx. Scale: not to scale	
Date Revised: October 13, 2023	

APPENDIX 6A

Appendix 6A: Summary of Meteorological Conditions for January to August of 2023

Sample Date	Southeast	Northeast	West
6-Jan-23	Crosswind	Downwind	Upwind
12-Jan-23	Crosswind	Crosswind	Crosswind
18-Jan-23	Crosswind	Crosswind	Upwind
24-Jan-23	Crosswind	Downwind	Upwind
30-Jan-23	Crosswind	Crosswind	Crosswind
5-Feb-23	Crosswind	Crosswind	Upwind
11-Feb-23	Crosswind	Crosswind	Crosswind
17-Feb-23	Crosswind	Crosswind	Crosswind
23-Feb-23	Crosswind	Crosswind	Crosswind
1-Mar-23	Crosswind	Upwind	Downwind
7-Mar-23	Crosswind	Crosswind	Crosswind
13-Mar-23	Downwind	Crosswind	Crosswind
19-Mar-23	Crosswind	Downwind	Upwind
25-Mar-23	Crosswind	Crosswind	Crosswind
31-Mar-23	Crosswind	Crosswind	Crosswind
6-Apr-23	Crosswind	Downwind	Upwind
12-Apr-23	Crosswind	Downwind	Upwind
18-Apr-23	Crosswind	Downwind	Upwind
24-Apr-23	Crosswind	Crosswind	Crosswind
30-Apr-23	Crosswind	Crosswind	Crosswind
6-May-23	Crosswind	Crosswind	Crosswind
12-May-23	Crosswind	Crosswind	Crosswind
18-May-23	Crosswind	Crosswind	Crosswind
24-May-23	Crosswind	Crosswind	Crosswind
30-May-23	Crosswind	Crosswind	Crosswind
2-Jun-23	Crosswind	Crosswind	Crosswind
5-Jun-23	Crosswind	Crosswind	Crosswind
8-Jun-23	Downwind	Crosswind	Crosswind
11-Jun-23	Crosswind	Crosswind	Crosswind
14-Jun-23	Crosswind	Crosswind	Crosswind
17-Jun-23	Downwind	Crosswind	Crosswind
20-Jun-23	Crosswind	Upwind	Downwind
23-Jun-23	Crosswind	Upwind	Downwind
26-Jun-23	Crosswind	Crosswind	Crosswind
29-Jun-23	Crosswind	Crosswind	Crosswind
2-Jul-23	Crosswind	Crosswind	Crosswind
5-Jul-23	Crosswind	Crosswind	Crosswind
8-Jul-23	Crosswind	Crosswind	Crosswind
11-Jul-23	Crosswind	Downwind	Upwind
14-Jul-23	Crosswind	Crosswind	Crosswind
17-Jul-23	Crosswind	Crosswind	Crosswind
20-Jul-23	Crosswind	Crosswind	Crosswind
23-Jul-23	Crosswind	Crosswind	Crosswind
26-Jul-23	Crosswind	Crosswind	Crosswind
29-Jul-23	Crosswind	Crosswind	Crosswind
1-Aug-23	Crosswind	Crosswind	Crosswind
4-Aug-23	Crosswind	Crosswind	Crosswind
7-Aug-23	Crosswind	Crosswind	Crosswind
10-Aug-23	Crosswind	Crosswind	Crosswind

Sample Date	Southeast	Northeast	West
13-Aug-23	Crosswind	Crosswind	Crosswind
16-Aug-23	Crosswind	Crosswind	Crosswind
19-Aug-23	Crosswind	Crosswind	Crosswind
22-Aug-23	Crosswind	Crosswind	Crosswind
25-Aug-23	Crosswind	Crosswind	Crosswind
28-Aug-23	Crosswind	Crosswind	Crosswind
31-Aug-23	Crosswind	Upwind	Downwind

APPENDIX 6B

Appendix 6B: Ambient Monitoring Data Summary

Southeast Station Summary

Date	Wind Direction			Contaminants							
	Upwind	Downwind	Crosswind	PM10 (µg/m³)	PM2.5 (µg/m³)	TSP (µg/m³)	Vinyl Chloride (µg/m³)	Benzene (µg/m³)	1,2 - Dichloroethane (µg/m³)	hydrogen sulfide (µg/m³)	TRS (µg/m³)
6-Jan-23			X	5	4	16	--	--	--	--	--
12-Jan-23			X	Invalid	9	invalid	--	--	--	--	--
18-Jan-23			X	3	3	6	--	--	--	--	--
24-Jan-23			X	13	10	20	--	--	--	--	--
30-Jan-23			X	4	3	9	--	--	--	--	--
5-Feb-23			X	8	6	22	--	--	--	--	--
11-Feb-23			X	3	3	13	--	--	--	--	--
17-Feb-23			X	7	7	9	--	--	--	--	--
23-Feb-23			X	5	3	12	--	--	--	--	--
1-Mar-23			X	10	7	21	--	--	--	--	--
7-Mar-23			X	3	3	13	--	--	--	--	--
13-Mar-23		X		7	7	9	--	--	--	--	--
19-Mar-23			X	5	3	5	--	--	--	--	--
25-Mar-23			X	4	3	8	--	--	--	--	--
31-Mar-23			X	11	6	17	--	--	--	--	--
6-Apr-23			X	5	4	16	--	--	--	--	--
12-Apr-23			X	24	16	61	--	--	--	--	--
18-Apr-23			X	7	3	32	--	--	--	--	--
24-Apr-23			X	7	3	27	--	--	--	--	--
30-Apr-23			X	6	6	17	--	--	--	--	--
6-May-23			X	5	5	17	--	--	--	--	--
12-May-23			X	74	Invalid	145	--	--	--	--	--
18-May-23			X	37	10	80	--	--	--	--	--
24-May-23			X	52	23	122	--	--	--	--	--
30-May-23			X	Invalid	16	53	--	--	--	--	--
2-Jun-23			X	Invalid	31	136	0.1	0.3	0.1	5.6	11
5-Jun-23			X	Invalid	29	113	0.1	0.3	0.1	5.6	11
8-Jun-23		X		47	Invalid	74	0.1	0.3	0.1	5.6	11
11-Jun-23			X	24	Invalid	52	0.1	0.3	0.1	5.6	11
14-Jun-23			X	Invalid	12	31	0.1	0.3	0.2	5.6	11
17-Jun-23		X		27	Invalid	41	0.1	0.3	0.1	5.6	11
20-Jun-23			X	21	Invalid	36	invalid	invalid	invalid	invalid	invalid
23-Jun-23			X	14	7	18	invalid	invalid	invalid	invalid	invalid
26-Jun-23			X	11	8	16	invalid	invalid	invalid	invalid	invalid
29-Jun-23			X	48	40	54	0.05	0.6	0.04	5.6	11
2-Jul-23			X	10	7	19	0.05	0.4	0.04	5.7	11
5-Jul-23			X	22	17	29	0.05	0.3	0.05	5.6	11
8-Jul-23			X	Invalid	10	7	0.05	0.3	0.04	5.6	11
11-Jul-23			X	21	12	invalid	invalid	invalid	invalid	invalid	invalid
14-Jul-23			X	13	8	21	invalid	invalid	invalid	invalid	invalid
17-Jul-23			X	25	19	32	invalid	invalid	invalid	invalid	invalid
20-Jul-23			X	17	13	23	0.05	0.3	0.04	2.8	5.6
23-Jul-23			X	16	10	20	0.05	0.3	0.04	2.8	5.6
26-Jul-23			X	28	Invalid	37	0.05	0.4	0.05	2.8	5.6
29-Jul-23			X	11	16	18	0.05	0.3	0.04	5.6	5.6
1-Aug-23			X	7	5	13	0.05	0.3	0.04	3.5	5.6
4-Aug-23			X	22	15	36	0.05	0.6	0.06	2.8	5.6
7-Aug-23			X	10	7	invalid	0.05	0.3	0.05	2.8	5.6
10-Aug-23			X	36	24	73	0.05	0.5	0.05	3.3	5.6
13-Aug-23			X	3	Invalid	10	0.05	0.4	0.05	3.5	5.6
16-Aug-23			X	30	25	41	0.05	0.5	0.07	3.6	5.6
19-Aug-23			X	17	14	27	0.05	0.5	0.04	2.8	5.6
22-Aug-23			X	11	7	5	0.05	0.4	0.04	3.9	8.4
25-Aug-23			X	26	6	13	0.05	0.3	0.04	2.8	5.6
28-Aug-23			X	5	7	7	0.05	0.3	0.04	2.8	5.6
31-Aug-23			X	7	5	9	invalid	invalid	invalid	invalid	invalid

Appendix 6B: Ambient Monitoring Data Summary

Northeast Station Summary

Date	Wind Direction			Contaminants							
	Upwind	Downwind	Crosswind	PM10 (µg/m³)	PM2.5 (µg/m³)	TSP (µg/m³)	Vinyl Chloride (µg/m³)	Benzene (µg/m³)	1,2 - Dichloroethane (µg/m³)	hydrogen sulfide (µg/m³)	TRS (µg/m³)
6-Jan-23		X		9	8	11	--	--	--	--	--
12-Jan-23			X	Invalid	9	19	--	--	--	--	--
18-Jan-23			X	3	3	7	--	--	--	--	--
24-Jan-23		X		14	7	22	--	--	--	--	--
30-Jan-23			X	4	3	11	--	--	--	--	--
5-Feb-23			X	7	7	17	--	--	--	--	--
11-Feb-23			X	4	3	11	--	--	--	--	--
17-Feb-23			X	4	4	8	--	--	--	--	--
23-Feb-23			X	4	3	12	--	--	--	--	--
1-Mar-23	X			11	8	19	--	--	--	--	--
7-Mar-23			X	3	3	17	--	--	--	--	--
13-Mar-23			X	6	3	17	--	--	--	--	--
19-Mar-23		X		3	3	13	--	--	--	--	--
25-Mar-23			X	3	3	13	--	--	--	--	--
31-Mar-23			X	8	8	20	--	--	--	--	--
6-Apr-23		X		9	5	22	--	--	--	--	--
12-Apr-23		X		95	32	201	--	--	--	--	--
18-Apr-23		X		5	6	43	--	--	--	--	--
24-Apr-23			X	3	3	25	--	--	--	--	--
30-Apr-23			X	8	7	16	--	--	--	--	--
6-May-23			X	7	4	23	--	--	--	--	--
12-May-23			X	106	28	200	--	--	--	--	--
18-May-23			X	40	12	117	--	--	--	--	--
24-May-23			X	66	25	170	--	--	--	--	--
30-May-23			X	38	17	invalid	--	--	--	--	--
2-Jun-23			X	55	Invalid	102	0.05	0.3	0.07	5.6	11.0
5-Jun-23			X	70	28	invalid	invalid	invalid	invalid	invalid	invalid
8-Jun-23			X	77	31	158	0.05	0.4	0.06	5.6	11.0
11-Jun-23			X	24	12	80	0.05	0.3	0.06	6.7	11.0
14-Jun-23			X	19	11	49	0.05	0.3	0.09	5.6	11.0
17-Jun-23			X	24	Invalid	invalid	invalid	invalid	invalid	invalid	invalid
20-Jun-23	X			18	Invalid	44	0.05	0.3	0.14	5.6	11.0
23-Jun-23	X			13	8	invalid	0.05	0.3	0.04	27.0	27.0
26-Jun-23			X	11	Invalid	17	0.05	0.3	0.05	5.6	11.0
29-Jun-23			X	48	38	invalid	0.05	0.5	0.04	6.5	11.0
2-Jul-23			X	11	5	invalid	0.05	0.3	0.04	6.3	11.0
5-Jul-23			X	23	14	invalid	0.05	0.3	0.04	6.4	11.0
8-Jul-23			X	10	9	15	0.05	0.3	0.04	5.6	11.0
11-Jul-23		X		58	22	130	0.05	0.3	0.04	5.6	11.0
14-Jul-23			X	15	11	34	0.05	0.3	0.04	5.6	11.0
17-Jul-23			X	28	19	47	0.05	0.6	0.06	2.8	5.6
20-Jul-23			X	23	14	48	0.05	0.3	0.05	2.9	5.6
23-Jul-23			X	10	12	30	invalid	invalid	invalid	invalid	invalid
26-Jul-23			X	28	18	44	0.05	0.4	0.04	4.2	5.6
29-Jul-23			X	9	4	18	0.05	0.3	0.06	3.6	5.6
1-Aug-23			X	9	Invalid	16	0.05	0.3	0.04	3.9	5.6
4-Aug-23			X	30	19	114	0.05	0.6	0.05	3.1	5.6
7-Aug-23			X	10	7	20	0.05	0.3	0.05	2.8	5.6
10-Aug-23			X	27	18	51	0.05	0.6	0.06	3.8	5.6
13-Aug-23			X	6	3	19	0.05	0.3	0.07	3.3	5.6
16-Aug-23			X	29	22	39	0.05	0.4	0.06	4.2	5.6
19-Aug-23			X	17	16	28	0.05	0.6	0.06	2.8	5.6
22-Aug-23			X	11	8	18	0.05	0.4	0.04	3.8	8.2
25-Aug-23			X	7	7	3	0.05	0.3	0.05	2.8	5.6
28-Aug-23			X	8	Invalid	15	0.19	0.3	0.09	2.8	5.6
31-Aug-23	X			8	6	9	0.05	0.3	0.04	3.5	5.6

Appendix 6B: Ambient Monitoring Data Summary

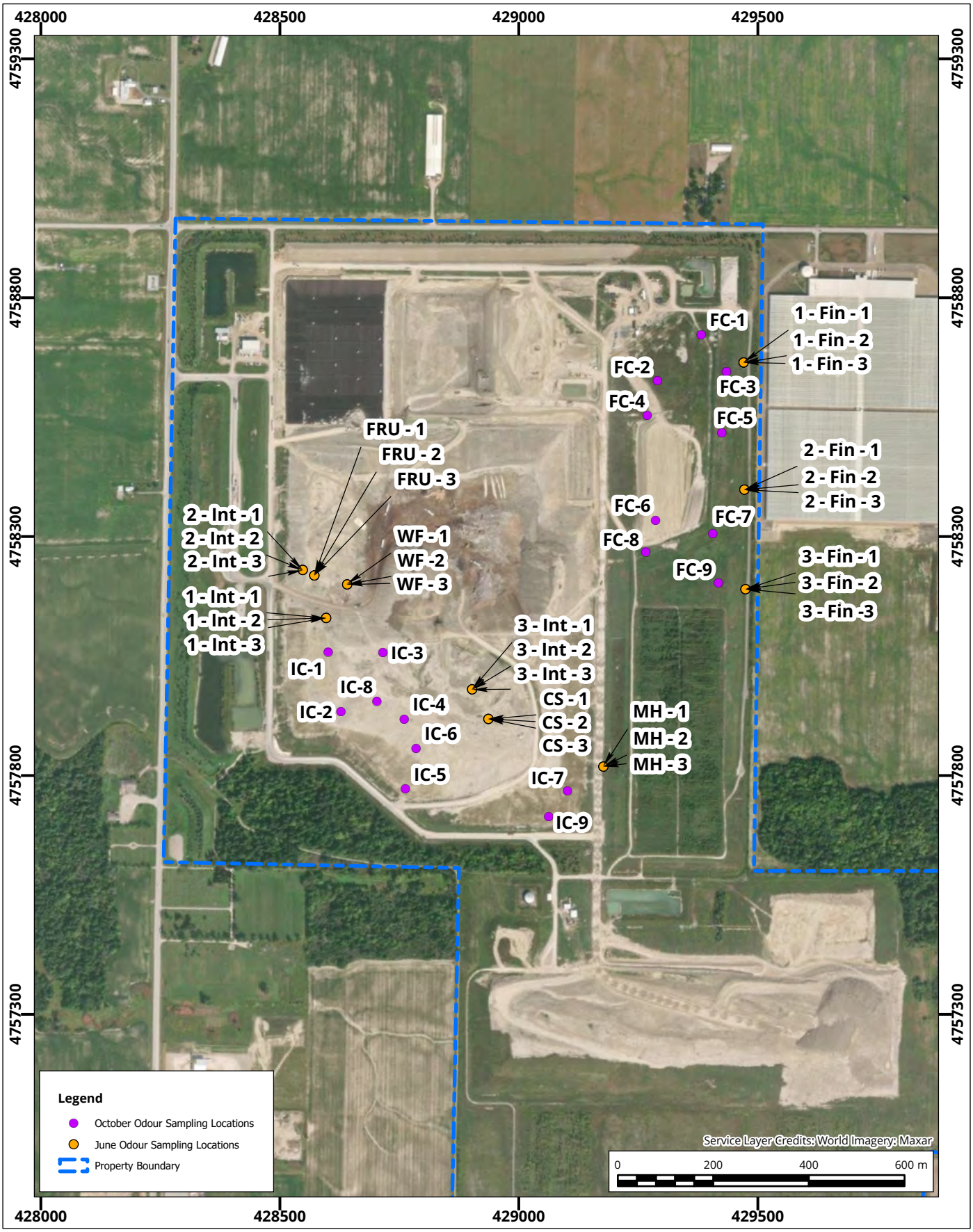
West Station Summary

Date	Wind Direction			Contaminants							
	Upwind	Downwind	Crosswind	PM10 (µg/m³)	PM2.5 (µg/m³)	TSP (µg/m³)	Vinyl Chloride (µg/m³)	Benzene (µg/m³)	1,2 - Dichloroethane (µg/m³)	hydrogen sulfide (µg/m³)	TRS (µg/m³)
6-Jan-23	X			Invalid	8	17	--	--	--	--	--
12-Jan-23			X	21	12	54	--	--	--	--	--
18-Jan-23	X			7	3	73	--	--	--	--	--
24-Jan-23	X			16	11	31	--	--	--	--	--
30-Jan-23			X	9	Invalid	23	--	--	--	--	--
5-Feb-23	X			10	7	17	--	--	--	--	--
11-Feb-23			X	5	3	18	--	--	--	--	--
17-Feb-23			X	3	3	12	--	--	--	--	--
23-Feb-23			X	6	5	24	--	--	--	--	--
1-Mar-23		X		29	15	70	--	--	--	--	--
7-Mar-23			X	Invalid	4	47	--	--	--	--	--
13-Mar-23			X	7	8	34	--	--	--	--	--
19-Mar-23	X			3	3	14	--	--	--	--	--
25-Mar-23			X	4	3	13	--	--	--	--	--
31-Mar-23			X	11	9	23	--	--	--	--	--
6-Apr-23	X			3	3	21	--	--	--	--	--
12-Apr-23	X			25	11	49	--	--	--	--	--
18-Apr-23	X			3	3	15	--	--	--	--	--
24-Apr-23			X	6	7	28	--	--	--	--	--
30-Apr-23			X	10	9	29	--	--	--	--	--
6-May-23			X	13	6	43	--	--	--	--	--
12-May-23			X	60	24	128	--	--	--	--	--
18-May-23			X	52	17	148	--	--	--	--	--
24-May-23			X	29	16	82	--	--	--	--	--
30-May-23			X	48	24	108	--	--	--	--	--
2-Jun-23			X	69	24	130	0.1	0.3	0.11	5.6	11
5-Jun-23			X	55	24	92	0.1	0.3	0.04	5.6	11
8-Jun-23			X	30	22	55	invalid	invalid	invalid	invalid	invalid
11-Jun-23			X	19	14	36	0.1	0.3	0.06	5.6	11
14-Jun-23			X	17	11	43	0.1	0.3	0.08	5.6	11
17-Jun-23			X	25	17	43	0.1	0.3	0.06	5.6	11
20-Jun-23		X		106	54	211	0.1	0.3	0.04	5.6	11
23-Jun-23		X		18	13	82	invalid	invalid	invalid	invalid	invalid
26-Jun-23			X	10	8	41	0.1	0.3	0.06	9.2	11
29-Jun-23			X	73	42	120	0.1	0.6	0.07	5.6	11
2-Jul-23			X	13	9	29	0.1	0.3	0.07	8.2	11
5-Jul-23			X	32	18	51	0.1	0.3	0.04	5.9	11
8-Jul-23			X	Invalid	8	42	invalid	invalid	invalid	invalid	invalid
11-Jul-23	X			19	14	Invalid	0.05	0.3	0.04	5.6	11
14-Jul-23			X	12	10	31	0.05	0.3	0.05	5.6	11
17-Jul-23			X	Invalid	20	43	0.05	0.54	0.06	2.8	5.6
20-Jul-23			X	18	13	42	0.05	0	0.04	2.8	5.6
23-Jul-23			X	16	12	28	0.05	0	0.05	4.7	5.6
26-Jul-23			X	29	24	43	0.05	0.54	0.04	2.8	5.6
29-Jul-23			X	8	6	15	0.05	0	0.06	2.8	5.6
1-Aug-23			X	39	16	95	0.05	0.32	0.07	3.2	5.6
4-Aug-23			X	18	17	34	0.05	0.64	0.05	2.8	5.6
7-Aug-23			X	6	5	15	0.05	0.32	0.04	2.8	5.6
10-Aug-23	X			20	Invalid	29	0.05	0.54	0.05	3.3	5.6
13-Aug-23			X	3	3	13	0.05	0.32	0.04	3.2	5.6
16-Aug-23			X	25	24	35	0.05	0.48	0.04	3.6	5.6
19-Aug-23	X			15	15	24	0.05	0.57	0.04	2.8	5.6
22-Aug-23			X	31	13	82	0.05	0.4	0.06	3.8	11
25-Aug-23			X	8	5	22	0.05	0.3	0.04	2.8	5.6
28-Aug-23			X	24	11	50	0.05	0.3	0.04	2.8	5.6
31-Aug-23		X		26	9	67	0.21	0.3	0.09	3.2	5.6

Ambient Monitoring Data Summary Across All Three Stations

90th Percentile	Upwind	20	13.55	48	0.05	0.56	0.10	TBD	TBD
	Downwind	84	31	180	0.15	0.32	0.09	TBD	TBD
	Crosswind	48	24	109	0.05	0.57	0.07	TBD	TBD
Max Value	Upwind	25	15	73	0.05	0.57	0.14	TBD	TBD
	Downwind	106	54	211	0.21	0.32	0.09	TBD	TBD
	Crosswind	106	42	200	0.19	0.64	0.17	TBD	TBD
Average	Upwind	12	8	28	0.05	0.40	0.06	TBD	TBD
	Downwind	32	15	71	0.08	0.32	0.07	TBD	TBD
	Crosswind	20	12	41	0.05	0.38	0.06	TBD	TBD

APPENDIX 7A



Odour Flux Chamber Sampling Locations

True North

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre - Watford, Ontario

Project #: 2101750

Drawn by: MDKB	Figure: 7A
Exact Scale:	1:11,000
Date Revised:	Oct 12, 2023

Map Document: C:\GIS\2101750 Twin Creeks EA\02 Work\210312 Twin Creeks.aprx

Date	19-Jun-23
Wind Direction	
Cloud Cover	10%

Source ID	Sample ID	Location		Initial					Final				
				Time	Champer P ("H2O)	Chamber Temp °C	Soil Temp °C	Sweep Gas Flow (L/min)	Time	Champer P ("H2O)	Chamber Temp °C	Soil Temp °C	Sweep Gas Flow (L/min)
Final Cover	1 - Fin - 1			9:54	0.4	28.5	27.2	5.0	10:30	0.2	28.5	27.2	5.0
#1	1 - Fin - 2	42.9773765	-81.8649898						10:39	0.3	28.1	25.7	5.0
	1 - Fin - 3								10:51	0.3	28.2	28.0	5.0
Final Cover	2 - Fin - 1			11:14	0.4	31.2	28.9	5.0	11:35	0.3	31.7	29.2	5.0
#2	2 - Fin - 2	42.9749800	-81.8649370						11:44	0.2	31.1	32.4	5.0
	2 - Fin -3								11:56	0.1	31.7	31.7	5.0
Final Cover	3 - Fin - 1			12:21	0.3	32.4	30.1	5.1	12:52	0.2	31.5	30.1	5.0
#3	3 - Fin - 2	42.9731038	-81.8648815						13:00	0.3	31.6	29.2	5.0
	3 - Fin - 3								13:09	0.3	31.5	30.4	5.0
Inter Cover	1 - Int - 1			1:34	0.2	31.0	34.6	5.0	14:03	0.2	32.0	32.4	5.0
#1	1 - Int - 2	42.9724798	-81.8756338						14:21	0.2	32.2	32	5.0
	1 - Int - 3								14:23	0.1	32.3	31.6	5.0
Inter Cover	2 - Int - 1			2:57	0.3	31.1	32.1	5.2	15:07	0.2	32.1	32.7	5.0
#2	2 - Int - 2	42.9733798	-81.8762464						15:16	0.1	32.4	32	5.0
	2 - Int - 3								15:28	0.3	31.9	32.1	5.0
Inter Cover	3 - Int - 1			3:44	0.4	31.9	36.9	4.8	16:14	0.2	31.9	36.9	5.0
#3	3 - Int - 2	42.9711629	-81.871869						16:23	0.2	31.7	35.7	5.0
	3 - Int - 3								16:33	0.3	36.1	36.1	5.0
Blank	Blank			9:30					9:30				

Date	29-Jun-23
Wind Direction	SE
Cloud Cover	40%

Source ID	Sample ID	Location		Initial					Final				
				Time	Champer P ("H2O)	Chamber Temp °C	Soil Temp °C	Sweep Gas Flow (L/min)	Time	Champer P ("H2O)	Chamber Temp °C	Soil Temp °C	Sweep Gas Flow (L/min)
Working Face	WF - 1			10:42	0.3	21.6	23.8	5.0	11:12	0.3	21.6	23.8	5
	WF -2	42.9731166	-81.8751021						11:22	0.2	21.7	23.8	5
	WF - 3								11:31	0.3	21.6	23.7	5
Fresh Uncover	FRU - 1			11:45	0.3	21.4	20.9	5.0	12:15	0.3	21.4	20.9	5
	FRU - 2	42.9732782	-81.8759476						12:24	0.4	21.4	21.1	5
	FRU - 3								12:34	0.3	21.5	21.1	5
Manhole	MH - 1			12:55	0.3	23.3	34.2	5.0	13:25	0.3	23.3	34.2	5
	MH -2	42.9697331	-81.8684807						13:34	0.3	23.5	34.4	5
	MH - 3								13:43	0.4	23.5	34.0	5
Soil Pile	CS - 1			2:05	0.2	27.1	32.2	5.00	14:35	0.3	27.1	32.2	5
	CS - 2	42.9706085	-81.8714435						14:44	0.2	27.7	32.0	5
	CS - 3								14:53	0.2	27.1	32.0	5
Blank	Blank			3:10					15:10				

Date	2-Oct-23
Wind Direction	SW
Cloud Cover	0%

Source ID	Sample ID	Location		Initial					Final				
				Time	Champer P ("H2O)	Chamber Temp °C	Soil Temp °C	Sweep Gas Flow (L/min)	Champer P ("H2O)	Chamber Temp °C	Soil Temp °C	Sweep Gas Flow (L/min)	
Interim Cover	IC-9	42.9687727	-81.8698637	11:18	0.1	41.7	26.0	5.0	0.1	42.4	26.8	5.0	
Interim Cover	IC-4	42.9705758	-81.8735950	11:47	0.1	29.5	28.1	5.0	0.1	29.9	28.5	5.0	
Interim Cover	IC-7	42.9692606	-81.8693890	12:10	0.2	46.1	28.9	5.0	0.1	47.4	29.3	5.0	
Final Cover	FC-1	42.9778809	-81.8660795	12:22	0.1	37.2	28.9	5.0	0.1	38.9	28.9	5.0	
Interim Cover	IC-6	42.9700310	-81.8732835	12:34	0.1	32.2	31.7	5.0	0.1	32.8	32.1	5.0	
Interim Cover	IC-5	42.9692626	-81.8735494	12:50	0.1	47.8	29.4	5.0	0.1	49.3	30.4	5.0	
Final Cover	FC-2	42.9770128	-81.8671932	13:10	0.1	39.4	28.9	5.0	0.1	40.0	29.4	5.0	
Interim Cover	IC-8	42.9709063	-81.8743001	13:20	0.1	36.5	34.0	5.0	0.1	36.8	34.6	5.0	
Final Cover	FC-8	42.9737752	-81.8674430	13:40	0.2	39.4	21.1	5.0	0.1	40.4	21.6	5.0	
Final Cover	FC-4	42.9763470	-81.8674454	13:55	0.1	38.3	28.3	5.0	0.1	39.4	28.9	5.0	
Interim Cover	IC-2	42.9707093	-81.8752201	14:04	0.1	35.9	33.4	5.0	0.1	37.0	34.8	5.0	
Final Cover	FC-6	42.9743710	-81.8671983	14:30	0.1	30.6	26.1	5.0	0.1	31.1	27.2	5.0	
Final Cover	FC-7	42.9741368	-81.8657278	14:31	0.1	33.3	25.0	5.0	0.2	35.6	26.1	5.0	
Interim Cover	IC-1	42.9718277	-81.8755641	14:51	0.1	34.8	32.6	5.0	0.1	36.7	33.4	5.0	
Final Cover	FC-9	42.9732093	-81.8655735	15:25	0.1	26.1	21.7	5.0	0.1	27.8	22.2	5.0	
Final Cover	FC-5	42.9760365	-81.8655229	15:30	0.1	34.4	25.0	5.0	0.1	36.7	25.6	5.0	
Interim Cover	IC-3	42.9718341	-81.8741599	15:37	0.1	34.7	32.3	5.0	0.1	36.7	32.6	5.0	
Final Cover	FC-3	42.9771935	-81.8654200	16:14	0.1	32.8	25.6	5.0	0.1	33.9	25.6	5.0	
Blank	B-1												
Blank	B-2												

St. Croix Sensory, Inc.

Odour Evaluation Report

Report Number: C2317101

Project Name: 2101750.12

Samples Collected: 6/19/23
Samples Received: 6/20/23
Samples Evaluated: 6/20/23

Report Prepared For: **RWDI**
600 Southgate Drive
Guelph, ON N1G 4P6
Canada

Report Prepared By: **St. Croix Sensory Canada, Inc.**
2555 Meadowpine Blvd., Unit 2
Mississauga, ON L5N 6C3 Canada
905-580-3330
tvallarino@fivesenses.com

Data Release Authorization:

Thomas Vallarino, A.Sc.T.
Laboratory Director

Reviewed and Approved:

Michael A. McGinley, P.E.
President

Odour Evaluation Report

St. Croix Sensory, Inc.

Client: **RWDI**
Project Name: **2101750.12**

Report Number: **C2317101**
Samples Evaluated: **6/20/23**

#	Field No.	Sample Description	DT	RT	I	HT	DR	Comments
1	Blank	Blank	24	15	- - -	- - -	- - -	Neat Pre-Dilution
2	1-Fin-1	Final Soil Landfill Cap	44	29	- - -	- - -	- - -	Neat Pre-Dilution
3	1-Fin-2	Final Soil Landfill Cap	81	29	- - -	- - -	- - -	Neat Pre-Dilution
4	1-Fin-3	Final Soil Landfill Cap	126	48	- - -	- - -	- - -	Neat Pre-Dilution
5	2-Fin-1	Final Soil Landfill Cap	81	34	- - -	- - -	- - -	Neat Pre-Dilution
6	2-Fin-2	Final Soil Landfill Cap	81	41	- - -	- - -	- - -	Neat Pre-Dilution
7	2-Fin-3	Final Soil Landfill Cap	89	44	- - -	- - -	- - -	Neat Pre-Dilution
8	3-Fin-1	Final Soil Landfill Cap	150	81	- - -	- - -	- - -	Neat Pre-Dilution
9	3-Fin-2	Final Soil Landfill Cap	252	126	- - -	- - -	- - -	Neat Pre-Dilution
10	3-Fin-3	Final Soil Landfill Cap	252	116	- - -	- - -	- - -	Neat Pre-Dilution
11	1-Int-1	Interim Soil Landfill Cap	97	57	- - -	- - -	- - -	Neat Pre-Dilution
12	1-Int-2	Interim Soil Landfill Cap	106	58	- - -	- - -	- - -	Neat Pre-Dilution

Odour Detection Threshold Testing (Evaluations) conducted in compliance with and under all conditions specified or required by ASTM E679 and EN13725 unless noted in report "Comments" column. The Client Chain of Custody (COC) attached to the Odour Evaluation Report provides information that may include sampling location(s), methods, and/or environmental conditions during sampling. Client, designated agents, and/or reviewers provide interpretation of results based on sampling conditions.

DT - Detection Threshold as determined by ASTM E679 and EN13725. The Practical Detection Limit (PDL) of DT is 12, based on the nominal lowest dilution presentation ratio of 8. Result is dimensionless dilution ratio at which half the assessors detect the diluted air as different from the blank air. Odour Units (OU) or Odour Units per cubic meters (OU/m3) are commonly used as pseudo-units.

RT - Recognition Threshold as determined by ASTM E679 and EN13725. Result is dimensionless dilution ratio at which half the assessors recognize a character in the diluted odourous air. Odour Units (OU) or Odour Units per cubic meter (OU/m3) are commonly used pseudo-units.

I - Perceived odour intensity as determined by ASTM E544. Intensity is expressed as average reported scale value on 10pt n-butanol in water static scale.

HT – Hedonic Tone value. Average rating of assessors' opinion of odour pleasantness on scale of -10 (most unpleasant) to +10 (most pleasant).

DR – the slope of the dose-response relationship of odour intensity with dilution (persistency of odour).

Odour Evaluation Report

St. Croix Sensory, Inc.

Client: **RWDI**
Project Name: **2101750.12**

Report Number: **C2317101**
Samples Evaluated: **6/20/23**

#	Field No.	Sample Description	DT	RT	I	HT	DR	Comments
13	1-Int-3	Interim Soil Landfill Cap	106	53	- - -	- - -	- - -	Neat Pre-Dilution
14	2-Int-1	Interim Soil Landfill Cap	116	58	- - -	- - -	- - -	Neat Pre-Dilution
15	2-Int-2	Interim Soil Landfill Cap	116	53	- - -	- - -	- - -	Neat Pre-Dilution
16	2-Int-3	Interim Soil Landfill Cap	89	53	- - -	- - -	- - -	Neat Pre-Dilution
17	3-Int-1	Interim Soil Landfill Cap	89	48	- - -	- - -	- - -	Neat Pre-Dilution
18	3-Int-2	Interim Soil Landfill Cap	75	34	- - -	- - -	- - -	Neat Pre-Dilution
19	3-Int-3	Interim Soil Landfill Cap	75	34	- - -	- - -	- - -	Neat Pre-Dilution

Comment: Field pre-dilutions have been noted in this report but not applied to calculate the net odour concentration for each odour sample.

Odor Detection Threshold Testing (Evaluations) conducted in compliance with and under all conditions specified or required by ASTM E679 and EN13725 unless noted in report "Comments" column. The Client Chain of Custody (COC) attached to the Odor Evaluation Report provides information that may include sampling location(s), methods, and/or environmental conditions during sampling. Client, designated agents, and/or reviewers provide interpretation of results based on sampling conditions.

DT - Detection Threshold as determined by ASTM E679 and EN13725. The Practical Detection Limit (PDL) of DT is 12, based on the nominal lowest dilution presentation ratio of 8. Result is dimensionless dilution ratio at which half the assessors detect the diluted air as different from the blank air. Odour Units (OU) or Odour Units per cubic meters (OU/m3) are commonly used as pseudo-units.

RT - Recognition Threshold as determined by ASTM E679 and EN13725. Result is dimensionless dilution ratio at which half the assessors recognize a character in the diluted odourous air. Odour Units (OU) or Odour Units per cubic meter (OU/m3) are commonly used pseudo-units.

I - Perceived odour intensity as determined by ASTM E544. Intensity is expressed as average reported scale value on 10pt n-butanol in water static scale.

HT – Hedonic Tone value. Average rating of assessors' opinion of odour pleasantness on scale of -10 (most unpleasant) to +10 (most pleasant).

DR – the slope of the dose-response relationship of odour intensity with dilution (persistency of odour).

Attachments

PINCHIN
2555 Meadowpine Blvd. Unit 2
Mississauga, ON L5N 6C3
tel: 905.363.0678 fax: 905.363.0681
1.855.PINCHIN | pinchin.com

Chain of Custody Record for Odour Samples

Company: RWDI	Project/P.O.#: 2101750	☐ Destroy sample 48 hours after analysis
Contact Name: Dan Harrigan	Sampled By: Dan Harrigan	☐ Hold for pickup within one (1) week of analysis
Address: 600 Southgate Dr., Guelph, ON	Sampling Date: June 19, 2023	
Phone: 905-373-2372	Send Report To: dan.harrigan@RWDI.com	

Are samples safe for human consumption? Yes ☐ No ☐
*Samples not safe for human consumption cannot be accepted

Report Format Paper ☐ PDF ☑

Item No.	Field ID	Process (ex. Compost pile, paint line)	Source (ex. Biofilter inlet, spray booth exhaust)	Field Pre-Dilution Ratio	Sample Time	Evaluation Requested (Check all applicable): Detection (DT)	Recognition (RT)	Hedonic Tone (HT)	Characterization	For Lab Use Only: Odour Evaluation Report No. / Lab Sample No
1	3-Fin-3	Final Soil Landfill Cap	Ground Surface	–	1:09	☑	☑	☐	☐	
2	1-Int-1	Interim Soil Landfill Cap	"	–	2:03	☑	☑	☐	☐	
3	1-Int-2	"	"	–	2:13	☑	☑	☐	☐	
4	1-Int-3	"	"	–	2:23	☑	☑	☐	☐	
5	2-Int-1	"	"	–	3:07	☑	☑	☐	☐	
6	2-Int-2	"	"	–	3:16	☑	☑	☐	☐	
7	2-Int-3	"	"	–	3:28	☑	☑	☐	☐	
8	3-Int-1	"	"	–	4:14	☑	☑	☐	☐	

Notes/Special Instructions:	Comments	
Relinquished By (Name): Dan Harrigan	Accepted By: T. Villarroel	Date: Jun 2023
Date: June 20, 2023	Analyzed By (Initial):	Date:

Authorized by: _____ _____
Signature Date:

Customer Signature MUST Accompany Request. Customer accepts Pinchin Ltd. Standard Terms and Conditions for Odour Laboratory Services (see over)

Distribution: White = Laboratory, Yellow = Customer Copy, Pink= Customer Copy

PINCHIN

2555 Meadowpine Blvd. Unit 2
Mississauga, ON L5N 6C3
tel: 905.363.0678 fax: 905.363.0681
1.855.PINCHIN | pinchin.com

Chain of Custody Record for Odour Samples

Company: RWDI	Project/P.O.#: 2101750	☐ Destroy sample 48 hours after analysis
Contact Name: Dan Harrigan	Sampled By: Dan Harrigan	☐ Hold for pickup within one (1) week of analysis
Address: 600 Southgate Dr., Guelph	Sampling Date: June 19, 2023	
Phone: 905-373-2372	Send Report To: dan.harrigan@RWDI.com	

Are samples safe for human consumption? Yes ☑ No ☐
*Samples not safe for human consumption cannot be accepted

Report Format Paper ☐ PDF ☑

Item No.	Field ID	Process (ex. Compost pile, paint line)	Source (ex. Biofilter inlet, spray booth exhaust)	Field Pre-Dilution Ratio	Sample Time	Evaluation Requested (Check all applicable) Detection (DT)	Recognition (RT)	Hedonic Tone (HT)	Characterization	For Lab Use Only: Odour Evaluation Report No. / Lab Sample No
1	1-Fin-1	Final soil landfill cap	Ground Surface	–	10:30	☑	☑	☐	☐	
2	1-Fin-2	"	"	–	10:39	☑	☑	☐	☐	
3	1-Fin-3	"	"	–	10:51	☑	☑	☐	☐	
4	2-Fin-1	"	"	–	11:35	☑	☑	☐	☐	
5	2-Fin-2	"	"	–	11:44	☑	☑	☐	☐	
6	2-Fin-3	"	"	–	11:56	☑	☑	☐	☐	
7	3-Fin-1	"	"	–	12:52	☑	☑	☐	☐	
8	3-Fin-2	"	"	–	1:00	☑	☑	☐	☐	

Notes/Special Instructions: If too many samples, please skip 2-Fin-1, 2-Fin-2, and 2-Fin-3

Comments

Relinquished By (Name): Dan Harrigan

Date: June 20, 2023

Accepted By: T. Vallerie

Date: Jun 20/23

Analyzed By (Initial):

Date:

Authorized by: _____ _____
Signature Date:

Customer Signature MUST Accompany Request. Customer accepts Pinchin Ltd. Standard Terms and Conditions for Odour Laboratory Services (see over)

Distribution: White = Laboratory, Yellow = Customer Copy, Pink= Customer Copy

PINCHIN
2555 Meadowpine Blvd. Unit 2
Mississauga, ON L5N 6C3
tel: 905.363.0678 fax: 905.363.0681
1.855.PINCHIN | pinchin.com

Chain of Custody Record for Odour Samples

Company: RWDI	Project/P.O.#: 2101750	☐ Destroy sample 48 hours after analysis
Contact Name: Dan Harrigan	Sampled By: Dan Harrigan	☐ Hold for pickup within one (1) week of analysis
Address: 600 Southgate Dr., Guelph, ON	Sampling Date: June 19, 2023	
Phone: 905-373-2372	Send Report To: dan.harrigan@RWDI.com	
Are samples safe for human consumption? Yes ☐ No ☐ *Samples not safe for human consumption cannot be accepted	Report Format Paper ☐ PDF ☐	

Item No.	Field ID	Process (ex. Compost pile, paint line)	Source (ex. Biofilter inlet, spray booth exhaust)	Field Pre-Dilution Ratio	Sample Time	Evaluation Requested (Check all applicable) Detection (DT)	Recognition (RT)	Hedonic Tone (HT)	Characterization	For Lab Use Only: Odour Evaluation Report No. / Lab Sample No
1	3-Int-2	Interim Soil Landfill Cap		–		☑	☑	☐	☐	
2	3-Int-3	"		–		☑	☑	☐	☐	
3	Blank	Blank		–	9:36	☑	☑	☐	☐	
4						☐	☐	☐	☐	
5						☐	☐	☐	☐	
6						☐	☐	☐	☐	
7						☐	☐	☐	☐	
8						☐	☐	☐	☐	

Notes/Special Instructions:	Comments	
Relinquished By (Name): Dan Harrigan	Accepted By: T. Vallarino	Date: Jun 20/23
Date: June 20, 2023	Analyzed By (Initial):	Date:

Authorized by: _____ _____
Signature Date:

Customer Signature MUST Accompany Request. Customer accepts Pinchin Ltd. Standard Terms and Conditions for Odour Laboratory Services (see over)

Distribution: White = Laboratory, Yellow = Customer Copy, Pink= Customer Copy

St. Croix Sensory, Inc.

Odour Evaluation Report

Report Number: C2318101

Project Name: 2101750.12

Samples Collected: 6/29/23
Samples Received: 6/30/23
Samples Evaluated: 6/30/23

Report Prepared For: **RWDI**
600 Southgate Drive
Guelph, ON N1G 4P6
Canada

Report Prepared By: **St. Croix Sensory Canada, Inc.**
2555 Meadowpine Blvd., Unit 2
Mississauga, ON L5N 6C3 Canada
905-580-3330
tvallarino@fivesenses.com

Data Release Authorization:

Thomas Vallarino, A.Sc.T.
Laboratory Director

Reviewed and Approved:

Michael A. McGinley, P.E.
President

Odour Evaluation Report

St. Croix Sensory, Inc.

Client: **RWDI**
Project Name: **2101750.12**

Report Number: **C2318101**
Samples Evaluated: **6/30/23**

#	Field No.	Sample Description	DT	RT	I	HT	DR	Comments
1	WF-1	Working Face	82	45	- - -	- - -	- - -	Neat Pre-Dilution
2	WF-2	Working Face	81	53	- - -	- - -	- - -	Neat Pre-Dilution
3	WF-3	Working Face	68	49	- - -	- - -	- - -	Neat Pre-Dilution
4	FRU-1	Fresh Uncovered	426	277	- - -	- - -	- - -	Neat Pre-Dilution
5	FRU-2	Fresh Uncovered	586	437	- - -	- - -	- - -	Neat Pre-Dilution
6	FRU-3	Fresh Uncovered	655	464	- - -	- - -	- - -	Neat Pre-Dilution
7	MH-1	Manhole	97	63	- - -	- - -	- - -	Neat Pre-Dilution
8	MH-2	Manhole	138	97	- - -	- - -	- - -	Neat Pre-Dilution
9	MH-3	Manhole	138	89	- - -	- - -	- - -	Neat Pre-Dilution
10	CS-1	Soil Stockpile	116	75	- - -	- - -	- - -	Neat Pre-Dilution
11	CS-2	Soil Stockpile	126	106	- - -	- - -	- - -	Neat Pre-Dilution
12	CS-3	Soil Stockpile	116	89	- - -	- - -	- - -	Neat Pre-Dilution

Odour Detection Threshold Testing (Evaluations) conducted in compliance with and under all conditions specified or required by ASTM E679 and EN13725 unless noted in report "Comments" column. The Client Chain of Custody (COC) attached to the Odour Evaluation Report provides information that may include sampling location(s), methods, and/or environmental conditions during sampling. Client, designated agents, and/or reviewers provide interpretation of results based on sampling conditions.

DT - Detection Threshold as determined by ASTM E679 and EN13725. The Practical Detection Limit (PDL) of DT is 12, based on the nominal lowest dilution presentation ratio of 8. Result is dimensionless dilution ratio at which half the assessors detect the diluted air as different from the blank air. Odour Units (OU) or Odour Units per cubic meters (OU/m3) are commonly used as pseudo-units.

RT - Recognition Threshold as determined by ASTM E679 and EN13725. Result is dimensionless dilution ratio at which half the assessors recognize a character in the diluted odourous air. Odour Units (OU) or Odour Units per cubic meter (OU/m3) are commonly used pseudo-units.

I - Perceived odour intensity as determined by ASTM E544. Intensity is expressed as average reported scale value on 10pt n-butanol in water static scale.

HT – Hedonic Tone value. Average rating of assessors' opinion of odour pleasantness on scale of -10 (most unpleasant) to +10 (most pleasant).

DR – the slope of the dose-response relationship of odour intensity with dilution (persistency of odour).

Odour Evaluation Report

St. Croix Sensory, Inc.

Client: **RWDI**
Project Name: **2101750.12**

Report Number: **C2318101**
Samples Evaluated: **6/30/23**

#	Field No.	Sample Description	DT	RT	I	HT	DR	Comments
13	Blank	Blank	53	53	- - -	- - -	- - -	Neat Pre-Dilution
	Comment:	Field pre-dilutions have been noted in this report but not applied to calculate the net odour concentration for each odour sample.						

Odor Detection Threshold Testing (Evaluations) conducted in compliance with and under all conditions specified or required by ASTM E679 and EN13725 unless noted in report "Comments" column. The Client Chain of Custody (COC) attached to the Odor Evaluation Report provides information that may include sampling location(s), methods, and/or environmental conditions during sampling. Client, designated agents, and/or reviewers provide interpretation of results based on sampling conditions.

DT - Detection Threshold as determined by ASTM E679 and EN13725. The Practical Detection Limit (PDL) of DT is 12, based on the nominal lowest dilution presentation ratio of 8. Result is dimensionless dilution ratio at which half the assessors detect the diluted air as different from the blank air. Odour Units (OU) or Odour Units per cubic meters (OU/m3) are commonly used as pseudo-units.

RT - Recognition Threshold as determined by ASTM E679 and EN13725. Result is dimensionless dilution ratio at which half the assessors recognize a character in the diluted odourous air. Odour Units (OU) or Odour Units per cubic meter (OU/m3) are commonly used pseudo-units.

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HT – Hedonic Tone value. Average rating of assessors' opinion of odour pleasantness on scale of -10 (most unpleasant) to +10 (most pleasant).

DR – the slope of the dose-response relationship of odour intensity with dilution (persistency of odour).

Attachments

St. Croix Sensory, Inc. - Canada

St. Croix Sensory, Inc. - Canada • 2555 Meadowpine Blvd., Unit 2, Mississauga, ON L5N 6C3 • Tel: +1 905-580-3330 • Email: tvallarino@fivesenses.com

Client:	RWDI	Contact Name:	Dan Harrigan
Project/Site Name:	Twin Creeks EA	Cell Number:	905-373-2372
Collected By:	Dan Harrigan	Email:	dan.harrigan@rwdi.com Victoria.Latam@rwdi.com
Sample Date:	June 29, 2023	Project PO:	2101750.12
Comments:			

Scan for Odour Sampling Resources

Odour Evaluation Requests

Line No.	Field No.	Sample Description	Sample Time	Field H_2S (ppm)	Thresholds Detection & Recognition ASTM E679 & EN13725	Pre-Dilution 10:1 (If DT>60,000)	Intensity ASTM E544	Characterization Hedonic Tone & Descriptors	Persistency Dose-Response	Lab Use Only Evaluation Report No. LAB	CODE
1	WF-1	Working Face	11:12		✓					✓	
2	WF-2	"	11:22		✓					✓	
3	WF-3	"	11:31		✓					✓	
4	FRU-1	Fresh Uncovered	12:15		✓					✓	
5	FRU-2	"	12:24		✓					✓	
6	FRU-3	"	12:34		✓					✓	
7	MH-1	Manhole	1:25		✓					✓	
8	MH-2	"	1:34		✓					✓	
9	MH-3	"	1:43		✓					✓	
10	CS-1	Soil Stockpile	2:35		✓					✓	
11	CS-2	"	2:44		✓					✓	
12	CS-3	"	2:53		✓					✓	

Number of Boxes Shipped: _____

Carrier: O FedEx O UPS O Other: _____

Relinquished by	Date	Time	Received at Lab by	Date
Dan Harrigan	June 30/23	8:10 am	T. Vallarino	Jun 3/23

Prior to shipping, email a photo of this document to tvallarino@fivesenses.com

LAB COPIES WHITE & YELLOW ***CLIENT COPY PINK***

St. Croix Sensory, Inc. - Canada

St. Croix Sensory, Inc. - Canada • 2555 Meadowpine Blvd., Unit 2, Mississauga, ON L5N 6C3 • Tel: +1 905-580-3330 • Email: tvallarino@fivesenses.com

Client:	RWDI	Contact Name:	Dan Harrigan
Project/Site Name:	Twin Creeks EA	Cell Number:	905-373-2372
Collected By:	Dan Harrigan	Email:	dan.harrigan@rwdi.com Victoria.Latam@rwdi.com
Sample Date:	June 29, 2023	Project PO:	2101750.12
Comments:			

Page 2 of 2

Scan for Odour Sampling Resources

Odour Evaluation Requests

Line No.	Field No.	Sample Description	Sample Time	Field H_2S (ppm)	Thresholds Detection & Recognition ASTM E679 & EN13725	Pre-Dilution 10:1 (If DT>60,000)	Intensity ASTM E544	Characterization Hedonic Tone & Descriptors	Persistency Dose-Response	Lab Use Only Evaluation Report No. LAB	CODE
1	Blank	Blank	3:10		✓					✓	
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

Number of Boxes Shipped: _____

Carrier: ○ FedEx ○ UPS ○ Other: _____

Relinquished by	Date	Time	Received at Lab by	Date
Dan Harrigan	June 30/23	8:10 am	J. Vallarino	Jun 30/23

Prior to shipping, email a photo of this document to tvallarino@fivesenses.com

LAB COPIES WHITE & YELLOW ***CLIENT COPY PINK***

St. Croix Sensory, Inc.

Odour Evaluation Report

Report Number: C2327601

Project Name: Twin Creeks

Samples Collected: 10/2/23
Samples Received: 10/3/23
Samples Evaluated: 10/3/23

Report Prepared For: **RWDI**
600 Southgate Drive
Guelph, ON N1G 4P6
Canada

Report Prepared By: **St. Croix Sensory Canada, Inc.**
1005 Skyview Drive, Suite 175
Burlington, ON L7P 5B1 Canada
905-580-3330
tvallarino@fivesenses.com

Data Release Authorization:

Thomas Vallarino, A.Sc.T.
Laboratory Director

Reviewed and Approved:

Michael A. McGinley, P.E.
President

Odour Evaluation Report

St. Croix Sensory, Inc.

Client: **RWDI**
Project Name: **Twin Creeks**

Report Number: **C2327601**
Samples Evaluated: **10/3/23**

#	Field No.	Sample Description	DT	RT	I	HT	DR	Comments
1	IC-9	Intermediate Cover - 9	46	27	- - -	- - -	- - -	
2	IC-4	Intermediate Cover - 4	78	39	- - -	- - -	- - -	
3	IC-7	Intermediate Cover - 7	64	35	- - -	- - -	- - -	
4	FC-1	Final Cover - 1	71	42	- - -	- - -	- - -	
5	IC-6	Intermediate Cover - 6	59	32	- - -	- - -	- - -	
6	IC-5	Intermediate Cover - 5	114	73	- - -	- - -	- - -	
7	FC-2	Final Cover - 2	45	21	- - -	- - -	- - -	
8	IC-8	Intermediate Cover - 8	45	30	- - -	- - -	- - -	
9	FC-8	Final Cover - 8	72	42	- - -	- - -	- - -	
10	FC-4	Final Cover - 4	54	25	- - -	- - -	- - -	
11	IC-2	Intermediate Cover - 2	46	23	- - -	- - -	- - -	
12	FC-6	Final Cover - 6	78	42	- - -	- - -	- - -	

Odour Detection Threshold Testing (Evaluations) conducted in compliance with and under all conditions specified or required by ASTM E679 and EN13725 unless noted in report "Comments" column. The Client Chain of Custody (COC) attached to the Odour Evaluation Report provides information that may include sampling location(s), methods, and/or environmental conditions during sampling. Client, designated agents, and/or reviewers provide interpretation of results based on sampling conditions.

DT - Detection Threshold as determined by ASTM E679 and EN13725. The Practical Detection Limit (PDL) of DT is 12, based on the nominal lowest dilution presentation ratio of 8. Result is dimensionless dilution ratio at which half the assessors detect the diluted air as different from the blank air. Odour Units (OU) or Odour Units per cubic meters (OU/m3) are commonly used as pseudo-units.

RT - Recognition Threshold as determined by ASTM E679 and EN13725. Result is dimensionless dilution ratio at which half the assessors recognize a character in the diluted odourous air. Odour Units (OU) or Odour Units per cubic meter (OU/m3) are commonly used pseudo-units.

I - Perceived odour intensity as determined by ASTM E544. Intensity is expressed as average reported scale value on 10pt n-butanol in water static scale.

HT – Hedonic Tone value. Average rating of assessors' opinion of odour pleasantness on scale of -10 (most unpleasant) to +10 (most pleasant).

DR – the slope of the dose-response relationship of odour intensity with dilution (persistency of odour).

Odour Evaluation Report

St. Croix Sensory, Inc.

Client: **RWDI**
Project Name: **Twin Creeks**

Report Number: **C2327601**
Samples Evaluated: **10/3/23**

#	Field No.	Sample Description	DT	RT	I	HT	DR	Comments
13	FC-7	Final Cover - 7	79	35	- - -	- - -	- - -	
14	IC-1	Intermediate Cover - 1	71	36	- - -	- - -	- - -	
15	FC-9	Final Cover - 9	55	23	- - -	- - -	- - -	
16	FC-5	Final Cover - 5	54	27	- - -	- - -	- - -	
17	IC-3	Intermediate Cover - 3	46	25	- - -	- - -	- - -	
18	FC-3	Final Cover - 3	97	36	- - -	- - -	- - -	
19	B-1	Blank-1	35	17	- - -	- - -	- - -	
20	B-2	Blank-2	30	15	- - -	- - -	- - -	

Comment: Field Pre-Dilutions Not Available.

Odor Detection Threshold Testing (Evaluations) conducted in compliance with and under all conditions specified or required by ASTM E679 and EN13725 unless noted in report "Comments" column. The Client Chain of Custody (COC) attached to the Odor Evaluation Report provides information that may include sampling location(s), methods, and/or environmental conditions during sampling. Client, designated agents, and/or reviewers provide interpretation of results based on sampling conditions.

DT - Detection Threshold as determined by ASTM E679 and EN13725. The Practical Detection Limit (PDL) of DT is 12, based on the nominal lowest dilution presentation ratio of 8. Result is dimensionless dilution ratio at which half the assessors detect the diluted air as different from the blank air. Odour Units (OU) or Odour Units per cubic meters (OU/m3) are commonly used as pseudo-units.

RT - Recognition Threshold as determined by ASTM E679 and EN13725. Result is dimensionless dilution ratio at which half the assessors recognize a character in the diluted odourous air. Odour Units (OU) or Odour Units per cubic meter (OU/m3) are commonly used pseudo-units.

I - Perceived odour intensity as determined by ASTM E544. Intensity is expressed as average reported scale value on 10pt n-butanol in water static scale.

HT – Hedonic Tone value. Average rating of assessors' opinion of odour pleasantness on scale of -10 (most unpleasant) to +10 (most pleasant).

DR – the slope of the dose-response relationship of odour intensity with dilution (persistency of odour).

Attachments

St. Croix Sensory, Inc. - Canada

St. Croix Sensory, Inc. - Canada • 2555 Meadowpine Blvd., Unit 2, Mississauga, ON L5N 6C3 • Tel: +1 905-580-3330 • Email: tvallarino@fivesenses.com

Client:	RWDI	**Contact Name:**	Dan Harrigan
Project/Site Name:	Twin Creeks	**Cell Number:**	905-373-2372
Collected By:	DAJH/ SRS/ AW	**Email:**	dan.harrigan@rwdi.com
Sample Date:	Oct 2, 2023	**Project PO:**	2101750.12
Comments:			

Page 1 of 2

Scan for Odour Sampling Resources

Odour Evaluation Requests

Line No.	Field No.	Sample Description	Sample Time	Field H_2S (ppm)	Thresholds Detection & Recognition ASTM E679 & EN13725	Pre-Dilution 10:1 (if DT>60,000)	Intensity ASTM E544	Characterization Hedonic Tone & Descriptors	Persistency Dose-Response	Lab Use Only Evaluation Report No. LAB	CODE
1	IC-9	Intermediate Cover - 9	11:18	-	✔					✓	
2	IC-4	Intermediate Cover - 4	11:47	-	✔					✓	
3	IC-7	Intermediate Cover - 7	12:10	-	✔					✓	
4	FC-1	Final Cover - 1	12:22	-	✔					✓	
5	IC-6	Intermediate Cover - 6	12:34	-	✔					✓	
6	IC-5	Intermediate Cover - 5	12:50	-	✔					✓	
7	FC-2	Final Cover - 2	13:10	-	✔					✓	
8	IC-8	Intermediate Cover - 8	13:20	-	✔					✓	
9	FC-8	Final Cover - 8	13:40	-	✔					✓	
10	FC-4	Final Cover - 4	13:55	-	✔					✓	
11	IC-2	Intermediate Cover - 2	14:04	-	✔					✓	
12	FC-6	Final Cover - 6	14:30	-	✔					✓	

Number of Boxes Shipped: _____

Carrier: ○ FedEx ○ UPS ◉ Other: Drop-off

Relinquished by	Date	Time	Received at Lab by	Date
			T. Vallarino	Oct 3/23

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St. Croix Sensory, Inc. - Canada

St. Croix Sensory, Inc. - Canada • 2555 Meadowpine Blvd., Unit 2, Mississauga, ON L5N 6C3 • Tel: +1 905-580-3330 • Email: tvallarino@fivesenses.com

Client:	RWDI	**Contact Name:**	Dan Harrigan
Project/Site Name:	Twin Creeks	**Cell Number:**	905-373-2372
Collected By:	DAJH/ SRS/ AW	**Email:**	dan.harrigan@rwdi.com
Sample Date:	Oct 2, 2023	**Project PO:**	2101750.12
Comments:			

Page 2 of 2

Scan for Odour Sampling Resources

Odour Evaluation Requests

Line No.	Field No.	Sample Description	Sample Time	Field H_2S (ppm)	Thresholds Detection & Recognition ASTM E679 & EN13725	Pre-Dilution 10:1 (if DT>60,000)	Intensity ASTM E544	Characterization Hedonic Tone & Descriptors	Persistency Dose-Response	Lab Use Only Evaluation Report No. LAB	CODE
1	FC-7	Final Cover - 7	14:31	-	✔					✓	
2	IC-1	Intermediate Cover - 1	14:51	-	✔					✓	
3	FC-9	Final Cover - 9	15:25	-	✔					✓	
4	FC-5	Final Cover - 5	15:30	-	✔					✓	
5	IC-3	Intermediate Cover - 3	15:37	-	✔					✓	
6	FC-3	Final Cover - 3	16:14	-	✔					✓	
7	B-1	Blank - 1	16:30	-	✔					✓	
8	B-2	Blank - 2	16:35	-	✔					✓	
9											
10											
11											
12											

Number of Boxes Shipped: _____

Carrier: ○ FedEx ○ UPS ◉ Other: Drop-off

Relinquished by	Date	Time	Received at Lab by	Date
			T. Vallarino	Oct 7/23

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St. Croix Sensory, Inc.

Supplemental QA/QC Laboratory Report

Report Number: C2327601

Project Name: Twin Creeks

2101750.12

Report Prepared For: RWDI

600 Southgate Drive
Guelph, Ontario
N1G 4P6

Report Prepared By: St. Croix Sensory Canada, Inc.

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Data Release Authorization:

Thomas Vallarino A.Sc.T.
Laboratory Director

Reviewed and Approved:

Michael A. McGinley, P.E.
Laboratory Director

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Appendices

Appendix – A: Raw Olfactometry Responses

1. Sample Reception Summary

St. Croix Sensory Canada Inc. was retained to evaluate odour from air samples collected as part of a project for RWDI. In total, twenty (20) gas samples bags were received at the laboratory for evaluation of odour. An odour panel was scheduled for the evaluation of the samples on October 3, 2023, and details of the panel are as follows:

Date Samples Received:	October 3, 2023
Number of Samples:	Twenty (20)
Condition of Sample Bags:	no leaks or visible condensation
Additional Comments:	None
Session 1	October 3, 2023, 9:00 AM
Number of Panelists:	Eight (8)
Number of Samples Analyzed:	Eight (8) + n-butanol
Measurement Parameters:	Detection & Recognition Threshold (EN13725), One Round
Session 2	October 3, 2023, 11:00 AM
Number of Panelists:	Eight (8)
Number of Samples Analyzed:	Seven (7)
Measurement Parameters:	Detection & Recognition Threshold (EN13725), One Round
Session 3	October 3, 2023 1:00 PM
Number of Panelists:	Eight (8)
Number of Samples Analyzed:	Five (5)
Measurement Parameters:	Detection & Recognition Threshold (EN13725), One Round

2. Methodology

The samples were evaluated by an odour panel within 30 hours of sample collection to determine the detection threshold (odour concentration) of each sample following the principles described in the European Standard EN13725:2003, *Determination of odour concentration by dynamic olfactometry*, and methods described by ASTM E679-

19, "*Standard Practice for Determination of Odor and Taste Thresholds by Forced-Choice Ascending Concentrations Series Method of Limits".* The odour evaluation process involved obtaining the responses of pre-screened, independent panelists to the sample presented to them at various dilutions.

Olfactometry Lab – The evaluations all took place in St. Croix Sensory's odour laboratory facility in Burlington, Ontario, which includes a panelist staging room and specialized room designed to provide an odour-free environment for the odour assessment panelists to facilitate accurate and reliable measurements.

Olfactometer – An olfactometer is a device or system for presenting accurate dilutions of a sample to a panel of people, incorporating a means to record the responses of these "assessors" or "panelists". The olfactometer used in this odour sample evaluation was the commercial AC'SCENT® International triangular forced-choice, ascending concentration, dynamic dilution olfactometer. The olfactometer flow system is constructed of Teflon® tubing with Teflon® fittings, and the "sniff port" (olfactometer/nose interface) have been custom designed and manufactured to provide a uniform face velocity and allow the panelist to easily sniff from the port without the sample being diluted by ambient air.

A custom DataSense software program controls most aspects of the operation of the olfactometer. The olfactometer operator monitors the responses of the panelists, and controls the pace of the evaluation session, to ensure that panelists remain focused and do not become desensitized, and to monitor potential problems such as contamination of the olfactometer by high strength odour samples.

The air supply for the olfactometer is provided by a built-in compressor system and is filtered through stages of high-capacity activated carbon filtration. At the beginning of the day, the panel operator checks the odour from this system to ensure that it is odourless.

Panelists (Odour Assessors) – Panelists are the "sensors" in an olfactometry system. The maintenance of a pool of screened, trained, and motivated panelists is essential to obtaining reliable odour threshold data. The panelists employed by St. Croix

Sensory Canada Inc., have been drawn from the community near the laboratory, and have been selected based on a demonstration of a "normal" sense of smell, as shown by their responses to test odorants, in particular n-butanol, the reference odorant in the European Standard. St. Croix maintains a pool of screened trained panelists.

The panelists are required to adhere to the following code of behaviours:

- Each panelist must carry out his/her job conscientiously;
- Panelists must not cause interference with their own perception of that or others in the odour laboratory by lack of personal hygiene, or the use of perfumes, after-shaves, lotions or any other cosmetics;
- Panelists must not eat, chew gum, or drink (other than water) within 30 minutes of the start of an evaluation session, and;
- The panelist must not communicate with one another in the odour laboratory about their responses to odour presentations.

The panelist, when participating in odour evaluation sessions, must also follow certain other specific guidelines related to the actual test procedure.

Olfactometry Protocol – The AC'SCENT® olfactometer operates as a triangular "forced choice" mode, with an ascending presentation sequence (low concentration to high concentration). "Forced choice" means that the panelists are required to identify and choose which triangular setting contains the odour even if they cannot detect a difference between the triangular set points. The panelists then indicate whether their choice was a "guess", "detect", or "recognize". An ascending presentation sequence, i.e. from the most dilute (weakest) presentation to progressively stronger presentations, minimizes the possibility for "adaptation" or "olfactometry fatigue", by which exposure to odours causes a reduction in sensitivity.

Sessions were limited to 2 hours in length to ensure panelists remain alert and motivated, with consecutive session using the same panelists limited to only three (3) per day in order to ensure attentiveness.

At each presentation on the olfactometer the panelists were given 3 seconds to evaluate the air from the triangular setting and make their responses. The odorant concentration was increased by a factor of 2 or less at each presentation step.

Odour calculations were generally based on determination of individual threshold estimate for each panelist based on their "detection" responses in accordance with the guidance in EN 17325:2003. Using this approach, all panelists must detect the odour at or above 8X dilution (olfactometer minimum dilution limit) in order to calculate an individual odour threshold value, and then a value for the group. All responses, as the standard allows, were retrospectively screened and panelists whose individual threshold value differed by greater or lower than ± 5.0 ΔZ were eliminated from test results. The purpose of the retrospectively screening was to allow for exclusion of panelists that showed responses different from the group due to health factors, anosmia to the odour the sample analyzed, or general olfactometry fatigue.

3. Results

Table 1 shown below is a list of the panelists who participated in the odour panels for this sample report. Table 2 lists the sample evaluation time for each odour sample presented on the olfactometer, and Appendix - A provides the raw odour panel responses from each odour sample evaluated. Retrospective screening was completed where appropriate with Sample ID "FC-3" screened for this odour panel.

Table 1 – List of Panelists Participating in Odour Panel(s)

Session 1	Session 2	Session 3
Panelist Code	Panelist Code	Panelist Code
14853-3002	14853-3002	14853-3002
14853-719	14853-719	14853-719
3008	3008	3008
3011	3011	3011
3006	3006	3006
14853-946	14853-946	14853-946
14853-1231	14853-1231	14853-1231
3009	3009	3009

Table 2 – Sample Evaluation Times

Sample ID	Time
Lab Calibration	9:20
IC-9	9:36
IC-4	9:49
IC-7	10:01
FC-1	10:14
IC-6	10:28
IC-5	10:43
FC-2	10:55
IC-8	11:08
FC-8	11:21
FC-4	11:36
IC-2	11:49
FC-6	12:03
FC-7	12:20
IC-1	12:35
FC-9	12:51
FC-5	13:04
IC-3	13:21
FC-3	13:33
B-1	13:48
B-2	14:01

4. Quality Assurance and Control

To ensure quality odour measurements, St. Croix Sensory routinely performs laboratory calibration quality checks on the olfactometer system, including volumetric flow rate calibration checks of the mass flow controllers, screening of panelists with reference materials, as well as other routine maintenance of components in the laboratory. Specific quality assurance and control activities undertaken at the laboratory are described in the following headings below:

- The AC'SCENT® olfactometer was calibrated according to the manufacturer's guidelines.
- The Teflon® tubing through which the odorous sample is presented to the panelists was replaced prior to the odour evaluation session, and all sample delivery lines were purged continuously with odour free air between sample presentations.

4.1 Reference Material Testing

Primary grade standards of n-butanol (currently a concentration of 40.0 ppm, cylinder number: EA0018597 from Linde and historical concentration of 50.0 ppm, cylinder number: CC351818 from Praxair) have been used as reference materials to perform regular screening of panelists for their individual detection thresholds for n-butanol, and for assessing the response of the complete analysis system. Table 3 shows the most recent reference material screening results for the panelists used in this odour assessment. As stated in the European Standard EN13725:2003, each panelists' standard deviation value (calculated from the log values of the series of individual detection thresholds) must be equal to or less than 0.36 (antilog value of 2.3), and the panelists' individual threshold estimate value for the reference material must be between 20 and 80 parts per billion over the average values obtained.

In addition to the historical n-butanol data on individual panelists St. Croix Sensory uses a standard of n-butanol for every scheduled odour panel day, so that the response of the complete olfactometry system (hardware, software and panelists) is

verified on the day of analysis. A calibration sample was a Tedlar bag filled with the 40.0 ppm n-butanol primary standard gas mixture. Evaluation of this sample, and calculation in the same way as other samples on October 3, 2023, resulted in a value of 840 OU/m^3, which calculated to a group threshold level of 48 ppb for n-butanol.

4.2 Olfactometer Instrumentation Flow Measurement

All components of the olfactometer flow delivery are checked for accuracy and precision on a recurring schedule. In Table 4, shown below, are the most recent flow measurements of the olfactometer on October 3, 2023. The volumetric flow of both the sample delivery and total flow of the olfactometer was measured using a BIOS Defenders 510 DryCal instruments, which are frictionless piston technology true primary flow air calibrators, designed for industrial hygiene and scientific purposes. Measurements from the volumetric flow check determined all flow delivery equipment of the olfactometer was met the 13725:2003 criteria.

5. References

CEN – Committee for European Normalization (2003) *Air Quality – Determination of odour concentration by dynamic olfactometry*; EN13725:2003; Brussels, Belgium.

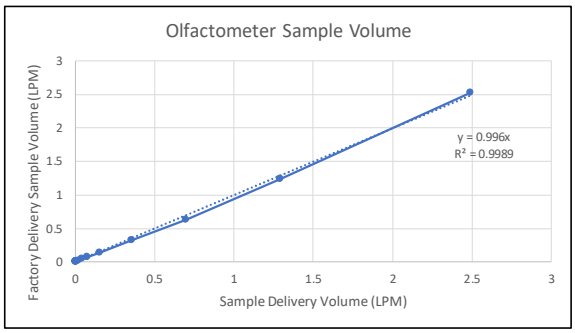
Table 3 – Panelist Screening Results

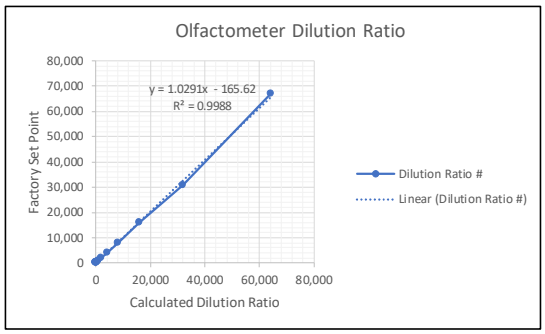
Panelist ID	*Reference Material: n-butanol*													
14853-3002	**13-Sep-23**	**19-Sep-23**	**20-Sep-23**	**21-Sep-23**	**26-Sep-23**	**27-Sep-23**	**28-Sep-23**	**29-Sep-23**	**2-Oct-23**	**3-Oct-23**			**Actual**	**Actual**
	y_{14}	y_{15}	y_{16}	y_{17}	y_{18}	y_{19}	y_{20}	y_{21}	y_{22}	y_{23}	**Avg $\log_{10}$**	**Std Dev**	**$10^{(Avg. ITE)}$**	**$10^{(Std Dev)}$**
	708	708	708	708	355	708	355	191	708	708				
	56.5	56.5	56.5	56.5	112.7	56.5	112.7	209.9	56.5	56.5				
	1.7521	**1.7521**	**1.7521**	**1.7521**	**2.0521**	**1.7521**	**2.0521**	**2.3221**	**1.7521**	**1.7521**	**1.8691**	**0.2022**	**74.0**	**1.6**
14853-719	**30-Aug-23**	**31-Aug-23**	**1-Sep-23**	**21-Sep-23**	**26-Sep-23**	**27-Sep-23**	**28-Sep-23**	**29-Sep-23**	**2-Oct-23**	**3-Oct-23**			**Actual**	**Actual**
	y_{37}	y_{38}	y_{39}	y_{40}	y_{41}	y_{42}	y_{43}	y_{44}	y_{45}	y_{46}	**Avg $\log_{10}$**	**Std Dev**	**$10^{(Avg. ITE)}$**	**$10^{(Std Dev)}$**
	708	708	355	708	708	708	1413	708	708	708				
	70.6	70.6	112.7	70.6	70.6	70.6	35.4	70.6	70.6	70.6				
	1.8490	**1.8490**	**2.0521**	**1.8490**	**1.8490**	**1.8490**	**1.5490**	**1.8490**	**1.8490**	**1.8490**	**1.8393**	**0.1203**	**69.1**	**1.3**
3008	**30-Aug-23**	**30-Aug-23**	**30-Aug-23**	**30-Aug-23**	**31-Aug-23**	**31-Aug-23**	**31-Aug-23**	**31-Aug-23**	**29-Sep-23**	**3-Oct-23**			**Actual**	**Actual**
	y_5	y_6	y_7	y_8	y_9	y_{10}	y_{11}	y_{12}	y_{13}	y_{14}	**Avg $\log_{10}$**	**Std Dev**	**$10^{(Avg. ITE)}$**	**$10^{(Std Dev)}$**
	355	708	708	708	708	708	708	708	708	708				
	112.7	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5				
	2.0521	**1.7521**	**1.7521**	**1.7521**	**1.7521**	**1.7521**	**1.7521**	**1.7521**	**1.7521**	**1.7521**	**1.7821**	**0.0949**	**60.5**	**1.2**
3011	**23-Sep-23**	**23-Sep-23**	**23-Sep-23**	**23-Sep-23**	**24-Sep-23**	**24-Sep-23**	**24-Sep-23**	**24-Sep-23**	**26-Sep-23**	**3-Oct-23**			**Actual**	**Actual**
	y_5	y_6	y_7	y_8	y_9	y_{10}	y_{11}	y_{12}	y_{13}	y_{14}	**Avg $\log_{10}$**	**Std Dev**	**$10^{(Avg. ITE)}$**	**$10^{(Std Dev)}$**
	1413	708	355	708	1413	708	708	708	1413	1413				
	28.3	56.5	112.7	56.5	28.3	56.5	56.5	56.5	28.3	28.3				
	1.4521	**1.7521**	**2.0521**	**1.7521**	**1.4521**	**1.7521**	**1.7521**	**1.7521**	**1.4521**	**1.4521**	**1.6621**	**0.2025**	**45.9**	**1.6**
3006	**31-Aug-23**	**31-Aug-23**	**31-Aug-23**	**31-Aug-23**	**15-Sep-23**	**15-Sep-23**	**19-Sep-23**	**20-Sep-23**	**26-Sep-23**	**2-Oct-23**	**3-Oct-23**		**Actual**	**Actual**
	y_9	y_{10}	y_{11}	y_{12}	y_{13}	y_{14}	y_{15}	y_{16}	y_{17}	y_{18}	y_{19}	**Avg $\log_{10}$**	**$10^{(Avg. ITE)}$**	**$10^{(Std Dev)}$**
	1413	708	708	355	355	708	708	708	355	708	355			
	28.3	56.5	56.5	112.7	112.7	56.5	56.5	56.5	112.7	56.5	112.7			
	1.4521	**1.7521**	**1.7521**	**2.0521**	**2.0521**	**1.7521**	**1.7521**	**1.7521**	**2.0521**	**1.7521**	**2.0521**	**1.8339**	**68.2**	**1.6**
14853-946	**15-Sep-23**	**19-Sep-23**	**20-Sep-23**	**21-Sep-23**	**26-Sep-23**	**27-Sep-23**	**28-Sep-23**	**29-Sep-23**	**2-Oct-23**	**3-Oct-23**			**Actual**	**Actual**
	y_{45}	y_{46}	y_{47}	y_{48}	y_{49}	y_{50}	y_{51}	y_{52}	y_{53}	y_{54}	**Avg $\log_{10}$**	**Std Dev**	**$10^{(Avg. ITE)}$**	**$10^{(Std Dev)}$**
	708	1413	708	1413	708	708	1413	1413	1413	1413				
	56.5	28.3	56.5	28.3	56.5	56.5	28.3	28.3	28.3	28.3				
	1.7521	**1.4521**	**1.7521**	**1.4521**	**1.7521**	**1.7521**	**1.4521**	**1.4521**	**1.4521**	**1.4521**	**1.5721**	**0.1549**	**37.3**	**1.4**
14853-1231	**14-Jul-23**	**10-Aug-23**	**11-Aug-23**	**15-Aug-23**	**16-Aug-23**	**23-Aug-23**	**24-Aug-23**	**30-Aug-23**	**13-Sep-23**	**3-Oct-23**			**Actual**	**Actual**
	y_{31}	y_{32}	y_{33}	y_{34}	y_{35}	y_{36}	y_{37}	y_{38}	y_{39}	y_{40}	**Avg $\log_{10}$**	**Std Dev**	**$10^{(Avg. ITE)}$**	**$10^{(Std Dev)}$**
	1413	1413	1413	2818	2818	2818	2818	1413	2818	1413				
	35.4	35.4	35.4	17.7	17.7	17.7	17.7	35.4	14.2	28.3				
	1.5490	**1.5490**	**1.5490**	**1.2490**	**1.2490**	**1.2490**	**1.2490**	**1.5490**	**1.1521**	**1.4521**	**1.3796**	**0.1631**	**24.0**	**1.6**
	12-Sep-23	**12-Sep-23**	**12-Sep-23**	**12-Sep-23**	**13-Sep-23**	**13-Sep-23**	**13-Sep-23**	**13-Sep-23**	**2-Oct-23**	**3-Oct-23**			**Actual**	**Actual**

3009	y_4	y_5	y_6	y_7	y_8	y_9	y_{10}	y_{11}	y_{12}	y_{13}	**Avg $\log_{10}$**	**Std Dev**	**$10^{(\text{Avg. ITE})}$**	**$10^{(\text{Std Dev})}$**
	1413	1413	708	708	708	708	708	708	708	708				
	28.3	28.3	56.5	56.5	56.5	56.5	56.5	56.5	56.5	56.5				
	1.4521	**1.4521**	**1.7521**	**1.7521**	**1.7521**	**1.7521**	**1.7521**	**1.7521**	**1.7521**	**1.7521**	**1.6921**	**0.1265**	**49.2**	**1.3**

Table 4 – Olfactometer Flow Calibration

Dilution Level	#	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume Factory Setting	(LPM)	0.0003	0.00063	0.00129	0.00254	0.00513	0.01	0.0202	0.0401	0.07784	0.1543	0.355	0.6993	1.289	2.489
Dilution Ratio Factory Setting	#	64,000	32,000	16,000	8,000	4,000	2,000	1,000	500	250	125	63	32	16	8
Sample Delivery Volume	(LPM)	0.0003	0.00065	0.00126	0.00251	0.00508	0.01012	0.02019	0.04021	0.0781	0.1431	0.326	0.634	1.238	2.525
Dilution Ratio	#	66,777	30,820	15,899	7,981	3,944	1,980	992	498	257	140	61	32	16	8
Total Volume	(LPM)	20.033	20.033	20.033	20.033	20.033	20.033	20.033	20.033	20.033	20.033	20.033	20.033	20.033	20.033





Appendix – A: Raw Olfactometry Responses

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** B-1

Description : blank 1

Sampling Date : 10/2/2023

Sampling Time : 16:30

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1										1	1	1	8	8	1.32	1.32	1.32
3011	1										1	6	8	8		1.93	1.93	1.60
14753-3002	1										2	1	2	6	6	1.60	1.32	0.76
3008	1										1	1	6	6	6	1.60	1.60	0.76
14853-719	1										1	2	6	6	8	1.93	1.60	1.05
3006	1										2	2	1	8	8	1.32	1.32	1.32
14853-1231	1										1	1	1	6	8	1.32	1.32	1.05
14853-946	1										2	8	8			2.26	1.93	1.93

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	1.66	1.55	1.22
Std. Dev.	0.35	0.27	0.41
Threshold	46	35	17

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** B-2

Description : blank 2

Sampling Date : 10/2/2023

Sampling Time : 16:35

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1										1	6	8	8		1.93	1.93	1.60
3011	1										1	1	8	8		1.60	1.60	1.60
14753-3002	1										2	2	2	6	6	2.26	1.32	0.76
3008	1										1	2	2	6	6	1.93	1.32	0.76
14853-719	1										1	1	2	6	8	1.60	1.32	1.05
3006	1										2	1	2	6	8	1.60	1.32	1.05
14853-1231	1										1	1	1	6	8	1.32	1.32	1.05
14853-946	1										1	5	8	8		1.60	1.60	1.60

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	1.73	1.47	1.18
Std. Dev.	0.29	0.23	0.37
Threshold	54	30	15

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** FC-1

Description : final cover 1

Sampling Date : 10/2/2023

Sampling Time : 12:22

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1									1	1	8	8			1.93	1.93	1.93
3011	1									1	5	8	8			1.93	1.93	1.93
14753-3002	1									1	2	2	6	6	6	2.26	1.60	0.76
3008	1									1	1	6	6	8	8	1.93	1.93	1.32
14853-719	1									1	2	8	8			2.26	1.93	1.93
3006	1									2	1	2	8	8		1.93	1.60	1.60
14853-1231	1									1	1	8	8			1.93	1.93	1.93
14853-946	1									2	1	6	8	8		1.93	1.93	1.60

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	2.01	1.85	1.63
Std. Dev.	0.15	0.15	0.42
Threshold	103	71	42

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** FC-2

Description : final cover 2

Sampling Date : 10/2/2023

Sampling Time : 13:10

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1									1	6	8	8		1.93	1.93	1.60
3011	1									1	5	8	8		1.60	1.60	1.60
14753-3002	1									1	1	6	8	8	1.60	1.60	1.32
3008	1									1	1	6	6	8	1.60	1.60	1.05
14853-719	1									1	2	6	8	8	1.93	1.60	1.32
3006	1									1	1	2	6	6	1.60	1.32	0.76
14853-1231	1									1	1	6	8	8	1.60	1.60	1.32
14853-946	1									1	6	8	8		1.93	1.93	1.60

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	1.73	1.65	1.32
Std. Dev.	0.17	0.20	0.30
Threshold	53	45	21

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** FC-3

Description : final cover 3

Sampling Date : 10/2/2023

Sampling Time : 16:14

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1									1	1	1	1	2	8			
3011	1									1	5	8	8			1.93	1.93	1.93
14753-3002	1									1	1	1	2	6	6	1.60	1.32	0.76
3008	1									1	2	6	6	6	8	2.26	1.93	1.05
14853-719	1									1	6	8	8	8		2.26	2.26	1.93
3006	1									1	1	6	6	8	8	1.93	1.93	1.32
14853-1231	1									1	6	8	8			2.26	2.26	1.93
14853-946	1									2	6	8	8			2.55	2.26	1.93

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	2.12	1.99	1.55
Std. Dev.	0.31	0.34	0.50
Threshold	131	97	36

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** FC-4

Description : final cover 4

Sampling Date : 10/2/2023

Sampling Time : 13:55

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1									1	6	8	8		1.93	1.93	1.60
3011	1									1	2	8	8		1.93	1.60	1.60
14753-3002	1									1	1	6	8	8	1.60	1.60	1.32
3008	1									1	1	6	6	6	1.60	1.60	0.76
14853-719	1									2	6	8	8		2.26	1.93	1.60
3006	1									1	2	5	6	8	1.32	1.32	1.05
14853-1231	1									1	6	8	8		1.93	1.93	1.60
14853-946	1									1	6	8	8		1.93	1.93	1.60

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	1.82	1.73	1.39
Std. Dev.	0.29	0.23	0.33
Threshold	65	54	25

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** FC-5

Description : final cover 5

Sampling Date : 10/2/2023

Sampling Time : 15:30

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1								2	1	6	8	8		1.93	1.93	1.60
3011	1								1	1	5	8	8		1.60	1.60	1.60
14753-3002	1								2	1	1	6	6	8	1.60	1.60	1.05
3008	1								1	2	2	6	6	6	2.26	1.60	0.76
14853-719	1								1	1	6	8	8		1.93	1.93	1.60
3006	1								1	1	2	2	8	8	1.93	1.32	1.32
14853-1231	1								1	1	6	8	8		1.93	1.93	1.60
14853-946	1								2	5	8	8			1.93	1.93	1.93

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	1.89	1.73	1.43
Std. Dev.	0.21	0.23	0.38
Threshold	78	54	27

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** FC-6

Description : final cover 6

Sampling Date : 10/2/2023

Sampling Time : 14:30

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1								1	2	6	8	8		2.26	1.93	1.60
3011	1								1	6	8	8			2.26	2.26	1.93
14753-3002	1								1	1	6	6	8	8	1.93	1.93	1.32
3008	1								1	1	2	6	6	8	1.93	1.60	1.05
14853-719	1								1	2	8	8			2.26	1.93	1.93
3006	1								2	1	2	8	8		1.93	1.60	1.60
14853-1231	1								1	2	8	8			2.26	1.93	1.93
14853-946	1									1	6	8	8		1.93	1.93	1.60

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	2.10	1.89	1.62
Std. Dev.	0.18	0.21	0.32
Threshold	125	78	42

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** FC-7

Description : final cover 7

Sampling Date : 10/2/2023

Sampling Time : 14:31

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1								1	2	6	8	8		2.26	1.93	1.60
3011	1								1	1	6	8	8		1.93	1.93	1.60
14753-3002	1								1	2	6	6	8	8	2.26	1.93	1.32
3008	1								1	2	2	1	6	8	1.32	1.32	1.05
14853-719	1								2	6	8	8			2.55	2.26	1.93
3006	1								1	2	1	6	8	8	1.60	1.60	1.32
14853-1231	1								1	6	8	8			2.26	2.26	1.93
14853-946	1								1	1	6	8	8		1.93	1.93	1.60

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	2.02	1.90	1.55
Std. Dev.	0.40	0.31	0.31
Threshold	104	79	35

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** FC-8

Description : final cover 8

Sampling Date : 10/2/2023

Sampling Time : 13:20

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1								2	1	1	8	8		1.60	1.60	1.60
3011	1								2	1	6	8	8		1.93	1.93	1.60
14753-3002	1								2	2	2	6	8	8	2.55	1.60	1.32
3008	1								1	1	1	6	8	8	1.60	1.60	1.32
14853-719	1								1	6	8	8			2.26	2.26	1.93
3006	1								1	1	2	2	8	8	1.93	1.32	1.32
14853-1231	1								1	6	8	8			2.26	2.26	1.93
14853-946	1								1	6	8	8			2.26	2.26	1.93

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	2.05	1.86	1.62
Std. Dev.	0.34	0.37	0.28
Threshold	113	72	42

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** FC-9

Description : final cover 9

Sampling Date : 10/2/2023

Sampling Time : 15:25

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1									1	6	1	8	8	1.32	1.32	1.32
3011	1									1	6	8	8		1.93	1.93	1.60
14753-3002	1									1	5	6	6	8	1.60	1.60	1.05
3008	1									2	6	6	6	6	2.26	1.93	0.76
14853-719	1									1	6	8	8		1.93	1.93	1.60
3006	1									2	1	1	8	8	1.32	1.32	1.32
14853-1231	1									1	6	8	8		1.93	1.93	1.60
14853-946	1									1	6	8	8		1.93	1.93	1.60

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	1.78	1.74	1.36
Std. Dev.	0.33	0.28	0.32
Threshold	60	55	23

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** IC-1

Description : intermediate cover 1

Sampling Date : 10/2/2023

Sampling Time : 14:51

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1								1	2	8	8			2.26	1.93	1.93
3011	1								1	2	6	8	8		2.26	1.93	1.60
14753-3002	1								1	1	1	6	6	6	1.60	1.60	0.76
3008	1								1	2	6	6	8	8	2.26	1.93	1.32
14853-719	1								2	1	8	8			1.93	1.93	1.93
3006	1								1	1	2	6	6	8	1.93	1.60	1.05
14853-1231	1								1	1	8	8			1.93	1.93	1.93
14853-946	1								1	5	8	8			1.93	1.93	1.93

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	2.01	1.85	1.56
Std. Dev.	0.23	0.15	0.47
Threshold	104	71	36

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** IC-2

Description : intermediate cover 2

Sampling Date : 10/2/2023

Sampling Time : 14:04

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1										2	1	1	8	8	1.32	1.32	1.32
3011	1										1	6	8	8		1.93	1.93	1.60
14753-3002	1										2	2	6	8	8	2.26	1.60	1.32
3008	1										2	1	6	6	6	1.60	1.60	0.76
14853-719	1										1	6	8	8		1.93	1.93	1.60
3006	1										2	2	2	1	8	1.05	1.05	1.05
14853-1231	1										1	6	8	8		1.93	1.93	1.60
14853-946	1										2	6	8	8		2.26	1.93	1.60

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	1.79	1.66	1.36
Std. Dev.	0.43	0.34	0.32
Threshold	61	46	23

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** IC-3

Description : intermediate cover 3

Sampling Date : 10/2/2023

Sampling Time : 15:37

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1										1	1	1	8	8	1.32	1.32	1.32
3011	1										1	6	8	8		1.93	1.93	1.60
14753-3002	1										2	1	1	6	8	1.32	1.32	1.05
3008	1										1	1	6	8	8	1.60	1.60	1.32
14853-719	1										1	6	8	8		1.93	1.93	1.60
3006	1										1	1	1	8	8	1.32	1.32	1.32
14853-1231	1										1	6	8	8		1.93	1.93	1.60
14853-946	1										2	6	6	8	8	2.26	1.93	1.32

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	1.70	1.66	1.39
Std. Dev.	0.36	0.30	0.20
Threshold	51	46	25

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** IC-4

Description : intermediate cover 4

Sampling Date : 10/2/2023

Sampling Time : 11:47

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1										1	8	8			1.93	1.93	1.93
3011	1										2	6	8	8		2.26	1.93	1.60
14753-3002	1										2	6	6	8	8	2.26	1.93	1.32
3008	1										2	6	8	8		2.26	1.93	1.60
14853-719	1										2	8	8			2.26	1.93	1.93
3006	1										1	2	6	6	6	1.93	1.60	0.76
14853-1231	1										1	6	8	8		1.93	1.93	1.60
14853-946	1										2	8	8			2.26	1.93	1.93

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	2.14	1.89	1.59
Std. Dev.	0.17	0.12	0.40
Threshold	138	78	39

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** IC-5

Description : intermediate cover 5

Sampling Date : 10/2/2023

Sampling Time : 12:50

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1									1	1	1	8	8		1.60	1.60	1.60
3011	1									1	6	8	8			2.26	2.26	1.93
14753-3002	1									1	1	6	6	8	8	1.93	1.93	1.32
3008	1									1	1	6	6	8	8	1.93	1.93	1.32
14853-719	1									1	8	8				2.26	2.26	2.26
3006	1									2	1	8	8			1.93	1.93	1.93
14853-1231	1									1	8	8				2.26	2.26	2.26
14853-946	1									2	8	8				2.55	2.26	2.26

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	2.09	2.06	1.86
Std. Dev.	0.30	0.24	0.40
Threshold	124	114	73

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** IC-6

Description : intermediate cover 6

Sampling Date : 10/2/2023

Sampling Time : 12:34

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1										2	8	8			2.26	1.93	1.93
3011	1										1	6	8	8		1.93	1.93	1.60
14753-3002	1										1	1	6	8	8	1.60	1.60	1.32
3008	1										1	1	6	8	8	1.60	1.60	1.32
14853-719	1										1	6	8	8		1.93	1.93	1.60
3006	1										1	2	6	8	8	1.93	1.60	1.32
14853-1231	1										1	1	6	8	8	1.60	1.60	1.32
14853-946	1										1	6	8	8		1.93	1.93	1.60

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	1.85	1.77	1.51
Std. Dev.	0.23	0.18	0.22
Threshold	71	59	32

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** IC-7

Description : intermediate cover 7

Sampling Date : 10/2/2023

Sampling Time : 12:10

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1										1	1	8	8		1.60	1.60	1.60
3011	1										1	6	8	8		1.93	1.93	1.60
14753-3002	1										2	6	6	8	8	2.26	1.93	1.32
3008	1										1	1	6	6	6	1.60	1.60	0.76
14853-719	1										2	8	8			2.26	1.93	1.93
3006	1										1	1	8	8		1.60	1.60	1.60
14853-1231	1										1	8	8			1.93	1.93	1.93
14853-946	1										2	6	8	8		2.26	1.93	1.60

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	1.93	1.81	1.55
Std. Dev.	0.30	0.17	0.38
Threshold	86	64	35

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** IC-8

Description : intermediate cover 8

Sampling Date : 10/2/2023

Sampling Time : 13:20

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1										1	8	8			1.93	1.93	1.93
3011	1										1	6	8	8		1.93	1.93	1.60
14753-3002	1										2	2	1	8	8	1.32	1.32	1.32
3008	1										1	1	6	8	8	1.60	1.60	1.32
14853-719	1										2	2	6	8	8	2.26	1.60	1.32
3006	1										1	1	5	6	8	1.32	1.32	1.05
14853-1231	1										1	1	6	8	8	1.60	1.60	1.32
14853-946	1										2	8	8			2.26	1.93	1.93

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	1.78	1.66	1.48
Std. Dev.	0.38	0.26	0.32
Threshold	60	45	30

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** IC-9

Description : intermediate cover 9

Sampling Date : 10/2/2023

Sampling Time : 11:18

Sample Collector :

Sample Source :

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1										2	8	8			2.26	1.93	1.93
3011	1										2	5	8	8		1.60	1.60	1.60
14753-3002	1										2	6	1	8	8	1.32	1.32	1.32
3008	1										2	1	5	6	8	1.32	1.32	1.05
14853-719	1										2	6	8	8		2.26	1.93	1.60
3006	1										1	2	5	6	6	1.32	1.32	0.76
14853-1231	1										2	6	8	8		2.26	1.93	1.60
14853-946	1										2	6	8	8		2.26	1.93	1.60

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical :

Concentration (ppm) :

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	1.83	1.66	1.43
Std. Dev.	0.47	0.30	0.38
Threshold	67	46	27

Olfactometer Evaluation Results
AC'SCENT International Olfactometer

Test Name : Twin Creeks **Test No. :** C2327601 **Test Date :** 10/3/2023

Test Administrator : Tom Vallarino **Test Method :** Triangular Forced Choice

Flow Rate (lpm) : 20 **Sniff Time (sec) :** 3

Sample Information

Lab No. : C2327601 **Field No. :** LAB

Description : QC n-butanol

Sampling Date : 10/3/2023

Sampling Time : 8:38

Sample Collector : SCS

Sample Source : cylinder

Dilution Level	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Sample Volume	0.30	0.63	1.29	2.54	5.13	10.0	20.2	40.1	77.84	154.3	355	699.8	1289	2489
Total Volume	20,033	20,033	20,033	20,033	20,033	20,033	20,033	20,036	20,033	20,033	20,033	20,033	20,033	20,033
Dilution Ratio	66,777	31,798	15,529	7,887	3,905	2,011	991	499	257	130	56.4	28.6	15.5	8.0
Geometric Mean	94,436	46,080	22,222	11,067	5,550	2,803	1,412	703	359	183	86	40.2	21.1	11.2
Log (Geo. Mean)	4.98	4.66	4.35	4.04	3.74	3.45	3.15	2.85	2.55	2.26	1.93	1.60	1.32	1.05

Calibration Date : 10/3/2023

THRESHOLDS
G = Guess
D = Detection
R = Recognition

Assessor/Round															Log G	Log D	Log R
3009	1					1	1	1	8	8						2.85	2.85	2.85
3011	1					2	1	6	8	8						3.15	3.15	2.85
14753-3002	1					2	2	1	6	6	8	8				2.85	2.85	2.26
3008	1					1	1	2	6	6	6	8	8			3.15	2.85	1.93
14853-719	1					1	1	1	6	6	8	8				2.85	2.85	2.26
3006	1					1	2	2	2	6	6	8	8			3.45	2.55	1.93
14853-1231	1					1	1	6	6	8	8					3.15	3.15	2.55
14853-946	1					1	2	6	6	8	8					3.45	3.15	2.55

NOTE : This Report represents data which includes any Retrospective Screening of data.

Sample Comments :

Specific Chemical Concentration Data

Chemical : n-butanol

Concentration (ppm) : 40

Response Key:
1 = Incorrect Guess
2 = Correct Guess
5 = Incorrect Detection
6 = Correct Detection
7 = Incorrect Recognition
8 = Correct Recognition

Final Results

	G	D	R
Avg. Log Value	3.11	2.92	2.40
Std. Dev.	0.25	0.21	0.36
Threshold	1,290	840	251

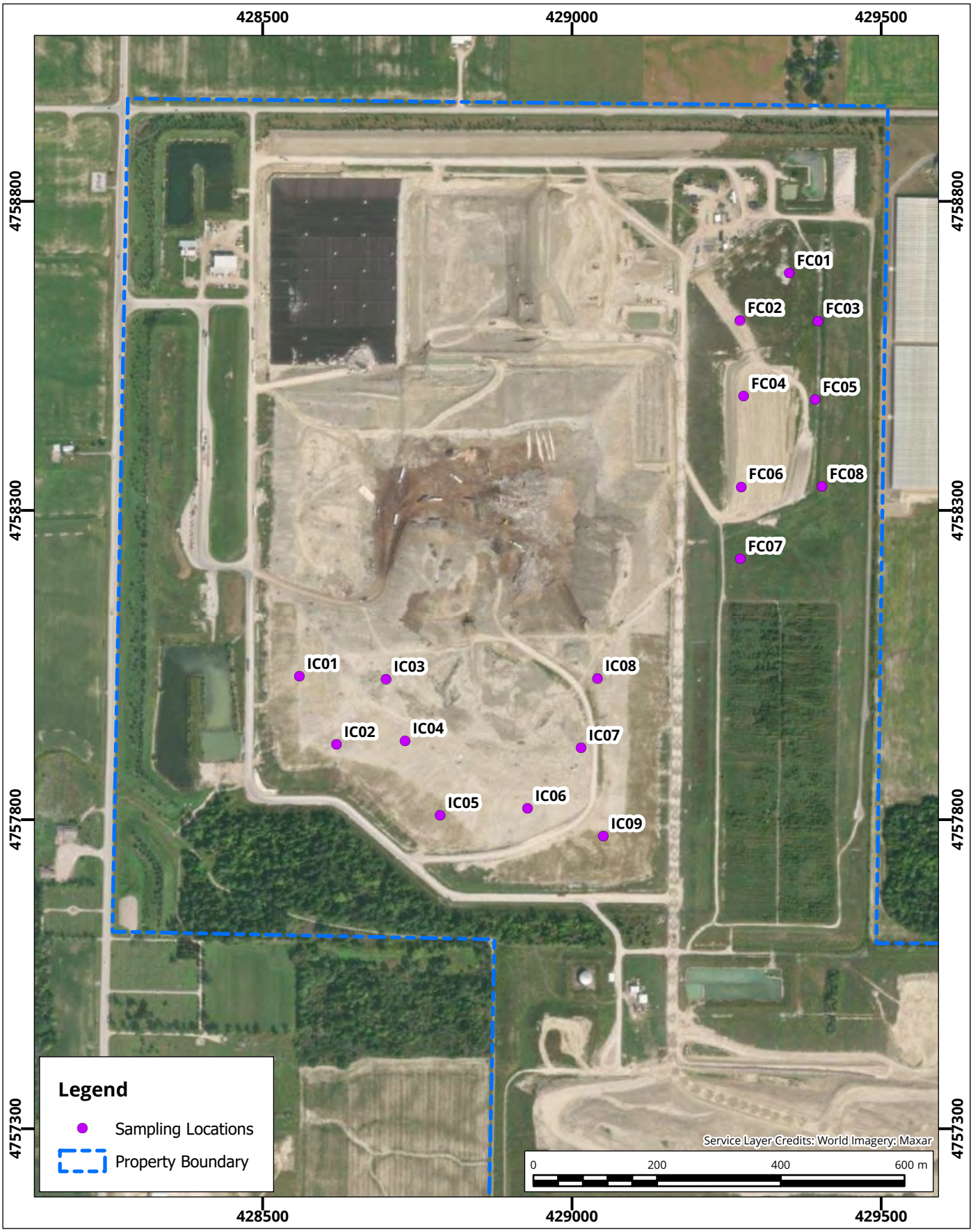
AC'SCENT ® DATA S ENSE ™ Olfactometry Software

APPENDIX 7B

Appendix 7B: Flux Chamber Sampling for TRS -Field Data

Client Waste Management
Location Twin Creeks Environmental Centre
Project No. 2101750

Date	Sample ID	Sample Location	Sample Coordinates		Bottle-Vac ID	Controller ID	Time	Chamber Pressure ("H2O)	Chamber Temperature (°F)	Chamber T	Sweep Flow		Soil T		Bottle Pressure ("Hg)	
			Northing	Easting						Initial	Initial	Final	Initial	Final	Initial	Final
21-Sep-23	IC01	New Interim Cover 01	42.9715972	-81.87608	01400-0253	G387	2:08 PM	0.100	24.9	39.600	5.0	5.000			-29	-4
21-Sep-23	IC02	New Interim Cover 02	42.9706111	-81.87533	01400-0098	-	1:04 PM	0.100	26.8	26.100	5.0	5.000	25.9	26.500		
21-Sep-23	IC03	New Interim Cover 03	42.9715639	-81.87436	01400-0369	-	1:59 PM	0.100	29.3	29.300	5.0	5.000	29.5	30.600		
21-Sep-23	IC04	New Interim Cover 04	42.9706667	-81.87397	01400-0530	G39	1:27 PM	0.100	43.0	41.000	5.0	5.000			-28	-6
21-Sep-23	IC05	New Interim Cover 05	42.9695917	-81.87326	01400-0384	-	11:01 AM	0.100	24.9	24.500	5.0	5.000	23.8	24.400		
21-Sep-23	IC06	New Interim Cover 06	42.9697056	-81.87153	01400-0259	G166	10:29 AM	0.100	23.0	23.300	5.0	5.000			-27.5	-3
21-Sep-23	IC07	New Interim Cover 07	42.9705944	-81.87048	01400-0521	-	10:04 AM	0.100	22.5	22.400	5.0	5.000	21.7	21.700		
21-Sep-23	IC08	New Interim Cover 08	42.9716056	-81.87017	01400-0413	G199	12:19 PM	0.100	32.3	29.800	5.0	5.000			-29	-5
21-Sep-23	IC09	New Interim Cover 09	42.9693111	-81.87002	01400-0324	G372	11:05 AM	0.100	33.2	30.100	5.0	5.000			-28	-5
22-Sep-23	FC01	New Final Cover 01	42.9775417	-81.86645	01400-0266	G159	10:02 AM	0.100	23.5	23.000	5.0	5.000	19.0	19.100	-29	-7
22-Sep-23	FC02	New Final Cover 02	42.9768417	-81.86742	01400-0348	G176	11:05 AM	0.100	23.6	23.500	5.0	5.000	20.5	21.100	-28	-8
22-Sep-23	FC03	New Final Cover 03	42.9768417	-81.86587	01400-0341	G288	11:57 AM	0.100	29.1	28.800	5.0	5.000	20.4	20.600	-28	-5
22-Sep-23	FC04	New Final Cover 04	42.9757417	-81.86733	01400-0360	G249	12:51 PM	0.100	31.9	31.800	5.0	5.000	21.7	21.600	-30	-8
22-Sep-23	FC05	New Final Cover 05	42.9757000	-81.86591	01400-0467	G382	1:45 PM	0.100	32.1	27.900	5.0	5.000	22.2	23.300	-28	-8
21-Sep-23	FC06	New Final Cover 06	42.9744194	-81.86736	01400-0534	G221	3:35 PM	0.100	34.9	28.600	5.0	5.000			-28	-6
21-Sep-23	FC07	New Final Cover 07	42.9733750	-81.86736	01400-0171	G146		0.100	--		5.0	5.000				
21-Sep-23	FC08	New Final Cover 08	42.9744389	-81.86576	01400-0135	G394	3:00 PM	0.100	38.1	37.600	5.0	5.000			-30	-5
21-Sep-23	FC09	New Final Cover 09	42.9733861	-81.76583	01400-0108	-	2:57 PM	0.100	30.7	30.400	5.0	5.000	30.1	30.700		
25-Sep-23	BLANK	Blank-EZH	-	-	01400-0122	G382	10:30 AM	0.100	-	-	5.0	5.000	-	-		
25-Sep-23	BLANK	Blank-DAJH	-	-	01400-0251	G382	10:45 AM	0.100	-	-	5.0	5.000	-	-		



Hydrogen Sulphide and TRS Flux Chamber Sampling Locations

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre - Watford, Ontario

Project #: 2101750

True North

Drawn by: MDKB	Figure: 7B
Exact Scale:	1:8,500
Date Revised:	Oct 12, 2023

Map Document: C:\GIS\2101750 Twin Creeks EA\02 Work\210312 Twin Creeks.aprx

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WT2330734**	Page	: 1 of 10
Amendment	: 1		
Client	: **RWDI Air Inc.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Victoria Latam	Account Manager	: Gayle Braun
Address	: 600 Southgate Drive Guelph ON Canada N1G 4P6	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 519 823 1311	Telephone	: +1 519 886 6910
Project	: 2101750	Date Samples Received	: 25-Sep-2023 13:00
PO	: ----	Issue Date	: 28-Sep-2023 08:37
C-O-C number	: ----		
Sampler	: DK		
Site	: ----		
Quote number	: NPRI TRS		
No. of samples received	: 20		
No. of samples analysed	: 20		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Method Blank value outliers occur.
- No Duplicate outliers occur.
- No Laboratory Control Sample (LCS) outliers occur
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Air**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Field Tests : Air Canister Information										
Canister Blank-DAJH - 01400-0251	EF001	25-Sep-2023	----	----	----		25-Sep-2023	----	0 days	
Field Tests : Air Canister Information										
Canister Blank-EZH - 01400-0122	EF001	25-Sep-2023	----	----	----		25-Sep-2023	----	0 days	
Field Tests : Air Canister Information										
Canister FC 01 - 01400-0266	EF001	22-Sep-2023	----	----	----		25-Sep-2023	----	3 days	
Field Tests : Air Canister Information										
Canister FC 02 - 01400-0348	EF001	22-Sep-2023	----	----	----		25-Sep-2023	----	3 days	
Field Tests : Air Canister Information										
Canister FC 03 - 01400-0341	EF001	22-Sep-2023	----	----	----		25-Sep-2023	----	3 days	
Field Tests : Air Canister Information										
Canister FC 04 - 01400-0360	EF001	22-Sep-2023	----	----	----		25-Sep-2023	----	3 days	
Field Tests : Air Canister Information										
Canister FC 05 - 01400-0467	EF001	22-Sep-2023	----	----	----		25-Sep-2023	----	3 days	

Matrix: **Air**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Field Tests : Air Canister Information										
Canister FC 06 - 01400-0534	EF001	21-Sep-2023	----	----	----		25-Sep-2023	----	4 days	
Field Tests : Air Canister Information										
Canister FC 08 - 01400-0135	EF001	21-Sep-2023	----	----	----		25-Sep-2023	----	4 days	
Field Tests : Air Canister Information										
Canister FC 09 - 01400-0108	EF001	21-Sep-2023	----	----	----		25-Sep-2023	----	4 days	
Field Tests : Air Canister Information										
Canister IC 01 - 01400-0253	EF001	21-Sep-2023	----	----	----		25-Sep-2023	----	4 days	
Field Tests : Air Canister Information										
Canister IC 02 - 01400-0098	EF001	21-Sep-2023	----	----	----		25-Sep-2023	----	4 days	
Field Tests : Air Canister Information										
Canister IC 03 - 01400-0369	EF001	21-Sep-2023	----	----	----		25-Sep-2023	----	4 days	
Field Tests : Air Canister Information										
Canister IC 04 - 01400-0530	EF001	21-Sep-2023	----	----	----		25-Sep-2023	----	4 days	
Field Tests : Air Canister Information										
Canister IC 05 - 01400-0384	EF001	21-Sep-2023	----	----	----		25-Sep-2023	----	4 days	
Field Tests : Air Canister Information										
Canister IC 06 - 01400-0259	EF001	21-Sep-2023	----	----	----		25-Sep-2023	----	4 days	

Matrix: **Air**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Field Tests : Air Canister Information										
Canister IC 07 - 01400-0521	EF001	21-Sep-2023	----	----	----		25-Sep-2023	----	4 days	
Field Tests : Air Canister Information										
Canister IC 08 - 01400-0413	EF001	21-Sep-2023	----	----	----		25-Sep-2023	----	4 days	
Field Tests : Air Canister Information										
Canister IC 09 - 01400-0324	EF001	21-Sep-2023	----	----	----		25-Sep-2023	----	4 days	
Field Tests : Air Canister Information										
Canister FC 07 - 01400-0171	EF001	21-Sep-2023	----	----	----		25-Sep-2023	----	5 days	
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister Blank-DAJH - 01400-0251	E630	25-Sep-2023	----	----	----		26-Sep-2023	7 days	1 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister Blank-EZH - 01400-0122	E630	25-Sep-2023	----	----	----		26-Sep-2023	7 days	1 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister FC 01 - 01400-0266	E630	22-Sep-2023	----	----	----		26-Sep-2023	7 days	4 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister FC 02 - 01400-0348	E630	22-Sep-2023	----	----	----		26-Sep-2023	7 days	4 days	✓

Matrix: **Air**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister FC 03 - 01400-0341	E630	22-Sep-2023	----	----	----		26-Sep-2023	7 days	4 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister FC 04 - 01400-0360	E630	22-Sep-2023	----	----	----		26-Sep-2023	7 days	4 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister FC 05 - 01400-0467	E630	22-Sep-2023	----	----	----		26-Sep-2023	7 days	4 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister FC 06 - 01400-0534	E630	21-Sep-2023	----	----	----		26-Sep-2023	7 days	5 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister FC 07 - 01400-0171	E630	21-Sep-2023	----	----	----		26-Sep-2023	7 days	5 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister FC 08 - 01400-0135	E630	21-Sep-2023	----	----	----		26-Sep-2023	7 days	5 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister FC 09 - 01400-0108	E630	21-Sep-2023	----	----	----		26-Sep-2023	7 days	5 days	✓

Matrix: **Air**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister IC 01 - 01400-0253	E630	21-Sep-2023	----	----	----		26-Sep-2023	7 days	5 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister IC 02 - 01400-0098	E630	21-Sep-2023	----	----	----		26-Sep-2023	7 days	5 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister IC 03 - 01400-0369	E630	21-Sep-2023	----	----	----		26-Sep-2023	7 days	5 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister IC 04 - 01400-0530	E630	21-Sep-2023	----	----	----		26-Sep-2023	7 days	5 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister IC 05 - 01400-0384	E630	21-Sep-2023	----	----	----		26-Sep-2023	7 days	5 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister IC 06 - 01400-0259	E630	21-Sep-2023	----	----	----		26-Sep-2023	7 days	5 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister IC 07 - 01400-0521	E630	21-Sep-2023	----	----	----		26-Sep-2023	7 days	5 days	✓

Matrix: **Air**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times		Eval	Analysis Date	Holding Times		Eval
				Rec	Actual			Rec	Actual	
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister IC 08 - 01400-0413	E630	21-Sep-2023	----	----	----		26-Sep-2023	7 days	5 days	✓
Sulfur Compounds : Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List)										
Canister IC 09 - 01400-0324	E630	21-Sep-2023	----	----	----		26-Sep-2023	7 days	5 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Air**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List) (ppbV)	E630	1153433	2	20	10.0	5.0	✓
Laboratory Control Samples (LCS)							
Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List) (ppbV)	E630	1153433	2	20	10.0	5.0	✓
Method Blanks (MB)							
Air Canister Information	EF001	1152110	1	20	5.0	5.0	✓
Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List) (ppbV)	E630	1153433	2	20	10.0	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List) (ppbV)	E630 ALS Environmental - Waterloo	Air	ASTM D5504	This analysis is performed using procedures adapted from ASTM D5504. Air samples are collected into cleaned evacuated silica-coated canisters. By means of a loop system, a volume of air is transferred from the canister and cryofocused before determining the sulfur compounds by GC-SCD. Silica coated passivated canisters may allow for reliable sample analysis after 24 hours. In such cases, analysis is recommended within 7 days of collection. Canister samples will be retained for 7 calendar days after final report. If you require a longer canister storage time, please contact your Project Manager.
Reduced Sulfur Compounds in Passivated Canisters by GC-SCD (All List) (ug/m3)	EC630 ALS Environmental - Waterloo	Air	ASTM D5504	convert ppbv to ug/m3
Air Canister Information	EF001 ALS Environmental - Waterloo	Air	In-house	Air canister information provided by client and recorded on ALS report may affect the validity of results.

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

ALS Environmental

AIR QUALITY CHAIN OF CUSTODY FORM - Canister/Tube/Gas Bag

Note: **All TAT Quoted** is in **business days** which exclude statutory holidays and weekends. TAT of samples received **past 3:00 pm or Saturday / Sunday** begin the next day.

DATE REQUIRED	SERVICE REQUESTED		Rush 3 day (100%)	☑
	10 day (regular)	☐	Rush 2 day (200%)	☐
	Rush 5 day (50%)	☐	Rush 1 day (300%) - Enquire	☐

COMPANY NAME	RWDI AIR Inc.
OFFICE	600 Southgate Dr., Guelph, ON N1G 4A6
PROJECT MANAGER	Khalid Hussein
PROJECT #	2101750
FAX	
ACCOUNT #	
QUOTATION #	

REGULATION	
CRITERIA	
OTHER INFORMATION	

REPORT FORMAT/DISTRIBUTION

EMAIL_X___FAX_____BOTH
SELECT: PDF_____DIGITAL_____BOTH_X_
EMAIL 1 victoria.latam@rwdi.com EMAIL 2 dan.harrigan@rwdi.com

All rush work requires lab approval before sample submission

SUBMISSION #: WT2330734
ENTERED BY:
DATE/TIME ENTERED:
BIN #:

SAMPLING INFORMATION

Sample Date/Time		Canister or Tube ID# (e.g. 060000-XXXX or G0XXXXXX SVI)	Regulator Serial # CS1200-XXXX or GXX	Matrix Type	SAMPLE DESCRIPTION TO APPEAR ON REPORT	TUBE AIR VOLUME - ☐ L ☐ or m³	STARTING PRESSURE - Pre-Sampling ("Hg)	ENDING PRESSURE - Post Sampling ("Hg)	COLLECTION TIME (min)	Reduced Sulfurs (NPRI)	TRS as H2S					Field Conditions (Rain/Wind/Dust/Odour) Field PID Reading	LAB ID
Date (dd-mmm-yy)	Time (24hr) (hh:mm)																
2023-09-22	10:02	01400-0266	g159	AA		-			10	x	x						
2023-09-22	11:05	01400-0348	g176	AA		-			10	x	x						
2023-09-22	11:57	01400-0341	g288						10	x	x						
2023-09-22	12:51	01400-0360	g249						10	x	x						
2023-09-22	13:45	01400-0467	g382						10	x	x						
2023-09-21	10:04	01400-0521							10	x	x						
2023-09-21	11:01	01400-0384							10	x	x						
2023-09-21	13:04	01400-0098							10	x	x						
2023-09-21	13:59	01400-0369							10	x	x						
2023-09-21	14:57	01400-0108							10	x	x						

SPECIAL INSTRUCTIONS/COMMENTS

This Chain of Custody Form is only to be used for Air Quality Samples

Matrix Type		
	Soil Gas Vapour = SG	Indoor Air = IA
	Ambient Air = AA	Industrial Hygiene = IH

SAMPLED BY:	DK	DATE & TIME	
RELINQUISHED BY:	DK	DATE & TIME	
RECEIVED BY:		DATE & TIME	
RECEIVED AT LAB BY: FH		DATE & TIME 2023-09-25 @ 13:00	

Notes

1. Quote number must be provided to ensure proper pricing

2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.

3. Any known or suspected hazards r of custody in comments section.

Environmental Division
Waterloo
Work Order Reference
WT2330734

Telephone : +1 519 886 6910

60 NORTHLAND ROAD, UNIT 1
WATERLOO, ON N2V 2B8
Phone: (519) 886-6910
Fax: (519) 886-9047
Toll Free: 1-800-668-9878

ALS Environmental

AIR QUALITY CHAIN OF CUSTODY FORM - Canister/Tube/Gas Bag

Note: All TAT **Quoted** is in **business days** which exclude statutory holidays and weekends. TAT of samples received **past 3:00 pm or Saturday / Sunday** begin the next day.

DATE REQUIRED

SERVICE REQUESTED
- 10 day (regular) ☐
- Rush 5 day (50%) ☐
- Rush 3 day (100%) ☑
- Rush 2 day (200%) ☐
- Rush 1 day (300%) - Enquire ☐

COMPANY NAME	RWDI AIR Inc.
OFFICE	600 Southgate Dr., Guelph, ON N1G 4A6
PROJECT MANAGER	Khalid Hussein
PROJECT #	2101750
FAX	
ACCOUNT #	
QUOTATION #	

REGULATION
CRITERIA
OTHER INFORMATION

REPORT FORMAT/DISTRIBUTION

EMAIL_X___FAX_____BOTH
SELECT: PDF_____DIGITAL_____BOTH_X_
EMAIL 1 victoria.latam@rwdi.com EMAIL 2 dan.harrigan@rwdi.com

ANALYSIS REQUEST

All rush work requires lab approval before sample submission

SUBMISSION #:
ENTERED BY:
DATE/TIME ENTERED:
BIN #:

SAMPLING INFORMATION

Sample Date/Time: Date (dd-mmm-yy)	Time (24hr) (hh:mm)	Canister or Tube ID# (e.g. 060000-XXXX or G0XXXXXX SVI)	Regulator Serial # CS1200-XXXX or GXX	Matrix Type	SAMPLE DESCRIPTION TO APPEAR ON REPORT	TUBE AIR VOLUME - L ☐ or m³ ☐	STARTING PRESSURE - Pre-Sampling ("Hg)	ENDING PRESSURE - Post Sampling ("Hg)	COLLECTION TIME (min)	Reduced Sulfurs (NPRI)	TRS as H2S					Field Conditions (Rain/Wind/Dust/Odour) Field PID Reading	LAB ID
2023-09-21	15:35	01400-0534	g221	AA		-			10	x	x						
2023-09-21	10:29	01400-0259	g166	AA		-			10	x	x						
2023-09-21	11:05	01400-0324	g372						10	x	x						
2023-09-21	12:19	01400-0413	g199						10	x	x						
2023-09-21	13:27	01400-0530	g39						10	x	x						
2023-09-21	14:08	01400-0253	g387						10	x	x						
2023-09-21	15:00	01400-0135	g394						10	x	x						
2023-09-21		01400-0171	g146						10	x	x						
2023-09-25	10:30	01400-0122	g382						10	x	x						
2023-09-25	10:45	01400-0251	g382						10	x	x						

SPECIAL INSTRUCTIONS/COMMENTS

This Chain of Custody Form is only to be used for Air Quality Samples

Matrix Type

Soil Gas Vapour = SG
Indoor Air = IA
Ambient Air = AA
Industrial Hygiene = IH

SAMPLE CONDITION AS RECEIVED

FROZEN ☐
COLD ☐
COOLING INITIATED ☐
AMBIENT ☐
MEAN TEMP

SAMPLED BY:	DK	DATE & TIME	RECEIVED BY:	DATE & TIME	OBSERVATIONS Yes ☐ No ☐ If yes add SIF
RELINQUISHED BY:	DK	DATE & TIME	RECEIVED AT LAB BY:	DATE & TIME 2023-09-25 @ 13:00	INIT

Notes

1. Quote number must be provided to ensure proper pricing

2. TAT may vary dependent on complexity of analysis and lab workload at time of submission. Please contact the lab to confirm TATs.

3. Any known or suspected hazards relating to a sample must be noted on the chain of custody in comments section.

REV6-2015

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **WT2330734-AA**	Page	: 1 of 4
Amendment	: **1**		
Client	: **RWDI Air Inc.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Victoria Latam	Account Manager	: Gayle Braun
Address	: 600 Southgate Drive Guelph ON Canada N1G 4P6	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: 519 823 1311	Telephone	: +1 519 886 6910
Project	: 2101750	Date Samples Received	: 25-Sep-2023 13:00
PO	: ----	Date Analysis Commenced	: 25-Sep-2023
C-O-C number	: ----	Issue Date	: 28-Sep-2023 08:37
Sampler	: DK		
Site	: ----		
Quote number	: NPRI TRS		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
David Tremblett	VOC Section Supervisor	Air Quality, Waterloo, Ontario

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	no units
µg/m³	micrograms per cubic metre
Inches Hg	inches of mercury
ppbv	parts per billion (volume/volume)

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

Amendment (28/09/2023): This report has been amended as a result of a request to change sample identification numbers (IDs) received by ALS. All analysis results are as per the previous report.

Analytical Results

Sub-Matrix: **Air**
(Matrix: **Air**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	FC 01 01400-0266	FC 02 01400-0348	FC 03 01400-0341	FC 04 01400-0360	FC 05 01400-0467
					Client sampling date / time	22-Sep-2023 10:02	22-Sep-2023 11:05	22-Sep-2023 11:57	22-Sep-2023 12:51	22-Sep-2023 13:45
						WT2330734-001	WT2330734-002	WT2330734-003	WT2330734-004	WT2330734-005
						Result	Result	Result	Result	Result
Field Tests										
ID, batch proof	----	EF001/WT	-	-		230905.215	230829.327	230829.204	230829.203	230829.210
ID, canister	----	EF001/WT	-	-		01400-0266	01400-0348	01400-0341	01400-0360	01400-0467
ID, regulator	----	EF001/WT	-	-		G159	G176	G288	G49	G382
Pressure on receipt	----	EF001/WT	0.10	Inches Hg		-5.32	-8.38	-3.89	-5.93	-7.97
Sulfur Compounds										
Carbon disulfide	75-15-0	EC630/WT	6.2	µg/m³		<6.2	<6.2	<6.2	<6.2	<6.2
Carbon disulfide	75-15-0	E630/WT	2.0	ppbv		<2.0	<2.0	<2.0	<2.0	<2.0
Carbonyl sulfide	463-58-1	EC630/WT	10	µg/m³		<10	<10	<10	<10	<10
Carbonyl sulfide	463-58-1	E630/WT	4.0	ppbv		<4.0	<4.0	<4.0	<4.1	<4.1
Dimethyl disulfide	624-92-0	EC630/WT	7.7	µg/m³		<7.7	<7.7	<7.7	<7.7	<7.7
Dimethyl disulfide	624-92-0	E630/WT	2.0	ppbv		<2.0	<2.0	<2.0	<2.0	<2.0
Dimethyl sulfide	75-18-3	EC630/WT	10	µg/m³		<10	<10	<10	<10	<10
Dimethyl sulfide	75-18-3	E630/WT	4.0	ppbv		<4.0	<4.0	<4.0	<4.1	<4.1
Hydrogen sulfide	7783-06-4	EC630/WT	5.6	µg/m³		<5.6	<5.6	<5.6	<5.7	<5.7
Hydrogen sulfide	7783-06-4	E630/WT	4.0	ppbv		<4.0	<4.0	<4.0	<4.1	<4.1
Methyl mercaptan	74-93-1	EC630/WT	7.9	µg/m³		<7.9	<7.9	<7.9	<8.1	<8.1
Methyl mercaptan	74-93-1	E630/WT	4.0	ppbv		<4.0	<4.0	<4.0	<4.1	<4.1
Sulfur, total reduced (as H2S), NPRI 6	----	EC630/WT	12	µg/m³		<12	<12	<12	<12	<12

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: **Air**
(Matrix: **Air**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	FC 09 01400-0108	FC 06 01400-0534	FC 08 01400-0135	FC 07 01400-0171	Blank-EZH 01400-0122
					Client sampling date / time	21-Sep-2023 14:57	21-Sep-2023 15:35	21-Sep-2023 15:00	21-Sep-2023 00:00	25-Sep-2023 10:30
						WT2330734-010	WT2330734-011	WT2330734-017	WT2330734-018	WT2330734-019
						Result	Result	Result	Result	Result
Field Tests										
ID, batch proof	----	EF001/WT	-	-		230829.205	230903.225	230903.207	230829.211	230829.316
ID, canister	----	EF001/WT	-	-		01400-0108	01400-0534	01400-0135	01400-0171	01400-0122
ID, regulator	----	EF001/WT	-	-		G132	G221	G394	G146	G382
Pressure on receipt	----	EF001/WT	0.10	Inches Hg		-5.52	-6.74	-5.52	-9.40	-9.40
Sulfur Compounds										
Carbon disulfide	75-15-0	EC630/WT	6.2	µg/m³		<6.2	<6.2	<6.2	<6.2	<6.2
Carbon disulfide	75-15-0	E630/WT	2.0	ppbv		<2.0	<2.0	<2.0	<2.0	<2.0
Carbonyl sulfide	463-58-1	EC630/WT	10	µg/m³		<10	<10	<10	<10	<10
Carbonyl sulfide	463-58-1	E630/WT	4.0	ppbv		<4.1	<4.0	<4.0	<4.0	<4.0
Dimethyl disulfide	624-92-0	EC630/WT	7.7	µg/m³		<7.7	<7.7	<7.7	<7.7	<7.7
Dimethyl disulfide	624-92-0	E630/WT	2.0	ppbv		<2.0	<2.0	<2.0	<2.0	<2.0
Dimethyl sulfide	75-18-3	EC630/WT	10	µg/m³		<10	<10	<10	<10	<10
Dimethyl sulfide	75-18-3	E630/WT	4.0	ppbv		<4.1	<4.0	<4.0	<4.0	<4.0
Hydrogen sulfide	7783-06-4	EC630/WT	5.6	µg/m³		<5.7	<5.6	<5.6	<5.6	<5.6
Hydrogen sulfide	7783-06-4	E630/WT	4.0	ppbv		<4.1	<4.0	<4.0	<4.0	<4.0
Methyl mercaptan	74-93-1	EC630/WT	7.9	µg/m³		<8.1	<7.9	<7.9	<7.9	<7.9
Methyl mercaptan	74-93-1	E630/WT	4.0	ppbv		<4.1	<4.0	<4.0	<4.0	<4.0
Sulfur, total reduced (as H2S), NPRI 6	----	EC630/WT	12	µg/m³		<12	<12	<12	<12	<12

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **WT2330734-AA**	Page	: 1 of 5
Amendment	: **1**		
Client	: RWDI Air Inc.	Laboratory	: ALS Environmental - Waterloo
Contact	: Victoria Latam	Account Manager	: Gayle Braun
Address	: 600 Southgate Drive Guelph ON Canada N1G 4P6	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	:	Telephone	: +1 519 886 6910
Project	: 2101750	Date Samples Received	: 25-Sep-2023 13:00
PO	: ----	Date Analysis Commenced	: 25-Sep-2023
C-O-C number	: ----	Issue Date	: 28-Sep-2023 08:37
Sampler	: DK 519 823 1311		
Site	: ----		
Quote number	: NPRI TRS		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
David Tremblett	VOC Section Supervisor	Waterloo Air Quality, Waterloo, Ontario

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Air**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Sulfur Compounds (QC Lot: 1153433)											
WT2330734-001	FC 01 01400-0266	Carbon disulfide	75-15-0	E630	2.0	ppbv	<2.0	<2.0	0	Diff <2x LOR	----
		Carbonyl sulfide	463-58-1	E630	4.0	ppbv	<4.0	<4.0	0	Diff <2x LOR	----
		Dimethyl disulfide	624-92-0	E630	2.0	ppbv	<2.0	<2.0	0	Diff <2x LOR	----
		Dimethyl sulfide	75-18-3	E630	4.0	ppbv	<4.0	<4.0	0	Diff <2x LOR	----
		Hydrogen sulfide	7783-06-4	E630	4.0	ppbv	<4.0	<4.0	0	Diff <2x LOR	----
		Methyl mercaptan	74-93-1	E630	4.0	ppbv	<4.0	<4.0	0	Diff <2x LOR	----
Sulfur Compounds (QC Lot: 1153567)											
WT2330734-006	Anonymous	Carbon disulfide	75-15-0	E630	2.0	ppbv	<2.0	<2.0	0	Diff <2x LOR	----
		Carbonyl sulfide	463-58-1	E630	4.0	ppbv	<4.0	<4.0	0	Diff <2x LOR	----
		Dimethyl disulfide	624-92-0	E630	2.0	ppbv	<2.0	<2.0	0	Diff <2x LOR	----
		Dimethyl sulfide	75-18-3	E630	4.0	ppbv	<4.0	<4.0	0	Diff <2x LOR	----
		Hydrogen sulfide	7783-06-4	E630	4.0	ppbv	<4.0	<4.0	0	Diff <2x LOR	----
		Methyl mercaptan	74-93-1	E630	4.0	ppbv	<4.0	<4.0	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Air**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Field Tests (QCLot: 1152110)						
Pressure on receipt	----	EF001	0.1	Inches Hg	-29.8	----
Sulfur Compounds (QCLot: 1153433)						
Carbon disulfide	75-15-0	E630	2	ppbv	<2.0	----
Carbonyl sulfide	463-58-1	E630	4	ppbv	<4.0	----
Dimethyl disulfide	624-92-0	E630	2	ppbv	<2.0	----
Dimethyl sulfide	75-18-3	E630	4	ppbv	<4.0	----
Hydrogen sulfide	7783-06-4	E630	4	ppbv	<4.0	----
Methyl mercaptan	74-93-1	E630	4	ppbv	<4.0	----
Sulfur Compounds (QCLot: 1153567)						
Carbon disulfide	75-15-0	E630	2	ppbv	<2.0	----
Carbonyl sulfide	463-58-1	E630	4	ppbv	<4.0	----
Dimethyl disulfide	624-92-0	E630	2	ppbv	<2.0	----
Dimethyl sulfide	75-18-3	E630	4	ppbv	<4.0	----
Hydrogen sulfide	7783-06-4	E630	4	ppbv	<4.0	----
Methyl mercaptan	74-93-1	E630	4	ppbv	<4.0	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Air**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Sulfur Compounds (QCLot: 1153433)									
Carbonyl sulfide	463-58-1	E630	4	ppbv	98.95 ppbv	96.8	60.0	140	----
Hydrogen sulfide	7783-06-4	E630	4	ppbv	120 ppbv	100.0	60.0	140	----
Methyl mercaptan	74-93-1	E630	4	ppbv	88.8 ppbv	104	60.0	140	----
Sulfur Compounds (QCLot: 1153567)									
Carbonyl sulfide	463-58-1	E630	4	ppbv	98.95 ppbv	97.4	60.0	140	----
Hydrogen sulfide	7783-06-4	E630	4	ppbv	120 ppbv	100	60.0	140	----
Methyl mercaptan	74-93-1	E630	4	ppbv	88.8 ppbv	102	60.0	140	----

CERTIFICATE OF ANALYSIS

Work Order	: **WT2330734-AB**	Page	: 1 of 4
Amendment	: **1**		
Client	: **RWDI Air Inc.**	Laboratory	: ALS Environmental - Waterloo
Contact	: Victoria Latam	Account Manager	: Gayle Braun
Address	: 600 Southgate Drive Guelph ON Canada N1G 4P6	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: 519 823 1311	Telephone	: +1 519 886 6910
Project	: 2101750	Date Samples Received	: 25-Sep-2023 13:00
PO	: ----	Date Analysis Commenced	: 25-Sep-2023
C-O-C number	: ----	Issue Date	: 28-Sep-2023 08:37
Sampler	: DK		
Site	: ----		
Quote number	: NPRI TRS		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
David Tremblett	VOC Section Supervisor	Air Quality, Waterloo, Ontario

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	no units
µg/m³	micrograms per cubic metre
Inches Hg	inches of mercury
ppbv	parts per billion (volume/volume)

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Workorder Comments

Amendment (28/09/2023): This report has been amended as a result of a request to change sample identification numbers (IDs) received by ALS. All analysis results are as per the previous report.

Analytical Results

Sub-Matrix: **Air**
(Matrix: **Air**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	IC 07 01400-0521	IC 05 01400-0384	IC 02 01400-0098	IC 03 01400-0369	IC 06 01400-0259
					Client sampling date / time	21-Sep-2023 10:04	21-Sep-2023 11:01	21-Sep-2023 13:04	21-Sep-2023 13:59	21-Sep-2023 10:29
						WT2330734-006	WT2330734-007	WT2330734-008	WT2330734-009	WT2330734-012
						Result	Result	Result	Result	Result
Field Tests										
ID, batch proof	----	EF001/WT	-	-		230829.212	230625.222	230829.206	23829.305	230829.208
ID, canister	----	EF001/WT	-	-		01400-0521	01400-0384	01400-0098	01400-0369	01400-0259
ID, regulator	----	EF001/WT	-	-		G351	G302	G149	G315	G166
Pressure on receipt	----	EF001/WT	0.10	Inches Hg		-7.15	-5.52	-9.40	-2.87	-3.48
Sulfur Compounds										
Carbon disulfide	75-15-0	EC630/WT	6.2	µg/m³		<6.2	<6.2	<6.2	<6.5	<6.2
Carbon disulfide	75-15-0	E630/WT	2.0	ppbv		<2.0	<2.0	<2.0	<2.1	<2.0
Carbonyl sulfide	463-58-1	EC630/WT	10	µg/m³		<10	<10	<10	<10	<10
Carbonyl sulfide	463-58-1	E630/WT	4.0	ppbv		<4.0	<4.0	<4.0	<4.2	<4.0
Dimethyl disulfide	624-92-0	EC630/WT	7.7	µg/m³		<7.7	<7.7	<7.7	<8.1	<7.7
Dimethyl disulfide	624-92-0	E630/WT	2.0	ppbv		<2.0	<2.0	<2.0	<2.1	<2.0
Dimethyl sulfide	75-18-3	EC630/WT	10	µg/m³		<10	<10	<10	<11	<10
Dimethyl sulfide	75-18-3	E630/WT	4.0	ppbv		<4.0	<4.0	<4.0	<4.2	<4.0
Hydrogen sulfide	7783-06-4	EC630/WT	5.6	µg/m³		<5.6	<5.6	<5.6	7.2	<5.6
Hydrogen sulfide	7783-06-4	E630/WT	4.0	ppbv		<4.0	<4.0	<4.0	5.2	<4.0
Methyl mercaptan	74-93-1	EC630/WT	7.9	µg/m³		<7.9	<7.9	<7.9	<8.3	<7.9
Methyl mercaptan	74-93-1	E630/WT	4.0	ppbv		<4.0	<4.0	<4.0	<4.2	<4.0
Sulfur, total reduced (as H2S), NPRI 6	----	EC630/WT	12	µg/m³		<12	<12	<12	<12	<12

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

Analytical Results

Sub-Matrix: **Air**
(Matrix: **Air**)

Analyte	CAS Number	Method/Lab	LOR	Unit	Client sample ID	IC 09 01400-0324	IC 08 01400-0413	IC 04 01400-0530	IC 01 01400-0253	Blank-DAJH 01400-0251
					Client sampling date / time	21-Sep-2023 11:05	21-Sep-2023 12:19	21-Sep-2023 13:27	21-Sep-2023 14:08	25-Sep-2023 10:45
						WT2330734-013	WT2330734-014	WT2330734-015	WT2330734-016	WT2330734-020
						Result	Result	Result	Result	Result
Field Tests										
ID, batch proof	----	EF001/WT	-	-		230829.201	230903.201	230830.108	230905.232	230903.228
ID, canister	----	EF001/WT	-	-		01400-0324	01400-0413	01400-0530	01400-0253	01400-0251
ID, regulator	----	EF001/WT	-	-		G372	G199	G39	G387	G387
Pressure on receipt	----	EF001/WT	0.10	Inches Hg		-6.74	-4.70	-7.97	-2.66	-8.78
Sulfur Compounds										
Carbon disulfide	75-15-0	EC630/WT	6.2	µg/m³		<6.2	<6.2	<6.2	<6.2	<6.5
Carbon disulfide	75-15-0	E630/WT	2.0	ppbv		<2.0	<2.0	<2.0	<2.0	<2.1
Carbonyl sulfide	463-58-1	EC630/WT	10	µg/m³		<10	<10	<10	<10	<10
Carbonyl sulfide	463-58-1	E630/WT	4.0	ppbv		<4.0	<4.0	<4.0	<4.0	<4.2
Dimethyl disulfide	624-92-0	EC630/WT	7.7	µg/m³		<7.7	<7.7	<7.7	<7.7	<8.1
Dimethyl disulfide	624-92-0	E630/WT	2.0	ppbv		<2.0	<2.0	<2.0	<2.0	<2.1
Dimethyl sulfide	75-18-3	EC630/WT	10	µg/m³		<10	<10	<10	<10	<11
Dimethyl sulfide	75-18-3	E630/WT	4.0	ppbv		<4.0	<4.0	<4.0	<4.0	<4.2
Hydrogen sulfide	7783-06-4	EC630/WT	5.6	µg/m³		<5.6	<5.6	<5.6	<5.6	<5.8
Hydrogen sulfide	7783-06-4	E630/WT	4.0	ppbv		<4.0	<4.0	<4.0	<4.0	<4.2
Methyl mercaptan	74-93-1	EC630/WT	7.9	µg/m³		<7.9	<7.9	<7.9	<7.9	<8.3
Methyl mercaptan	74-93-1	E630/WT	4.0	ppbv		<4.0	<4.0	<4.0	<4.0	<4.2
Sulfur, total reduced (as H2S), NPRI 6	----	EC630/WT	12	µg/m³		<12	<12	<12	<12	<12

Please refer to the General Comments section for an explanation of any result qualifiers detected.

Please refer to the Accreditation section for an explanation of analyte accreditations.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **WT2330734-AB**	Page	: 1 of 3
Amendment	: **1**		
Client	: RWDI Air Inc.	Laboratory	: ALS Environmental - Waterloo
Contact	: Victoria Latam	Account Manager	: Gayle Braun
Address	: 600 Southgate Drive Guelph ON Canada N1G 4P6	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	:	Telephone	: +1 519 886 6910
Project	: 2101750	Date Samples Received	: 25-Sep-2023 13:00
PO	: ----	Date Analysis Commenced	: 25-Sep-2023
C-O-C number	: ----	Issue Date	: 28-Sep-2023 08:37
Sampler	: DK 519 823 1311		
Site	: ----		
Quote number	: NPRI TRS		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Method Blank (MB) Report; Recovery and Data Quality Objectives
- Laboratory Control Sample (LCS) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
David Tremblett	VOC Section Supervisor	Waterloo Air Quality, Waterloo, Ontario

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Air**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Sulfur Compounds (QC Lot: 1153567)											
WT2330734-006	IC 07 01400-0521	Carbon disulfide	75-15-0	E630	2.0	ppbv	<2.0	<2.0	0	Diff <2x LOR	----
		Carbonyl sulfide	463-58-1	E630	4.0	ppbv	<4.0	<4.0	0	Diff <2x LOR	----
		Dimethyl disulfide	624-92-0	E630	2.0	ppbv	<2.0	<2.0	0	Diff <2x LOR	----
		Dimethyl sulfide	75-18-3	E630	4.0	ppbv	<4.0	<4.0	0	Diff <2x LOR	----
		Hydrogen sulfide	7783-06-4	E630	4.0	ppbv	<4.0	<4.0	0	Diff <2x LOR	----
		Methyl mercaptan	74-93-1	E630	4.0	ppbv	<4.0	<4.0	0	Diff <2x LOR	----

Method Blank (MB) Report

A Method Blank is an analyte-free matrix that undergoes sample processing identical to that carried out for test samples. Method Blank results are used to monitor and control for potential contamination from the laboratory environment and reagents. For most tests, the DQO for Method Blanks is for the result to be < LOR.

Sub-Matrix: **Air**

Analyte	CAS Number	Method	LOR	Unit	Result	Qualifier
Field Tests (QCLot: 1152110)						
Pressure on receipt	----	EF001	0.1	Inches Hg	-29.8	----
Sulfur Compounds (QCLot: 1153567)						
Carbon disulfide	75-15-0	E630	2	ppbv	<2.0	----
Carbonyl sulfide	463-58-1	E630	4	ppbv	<4.0	----
Dimethyl disulfide	624-92-0	E630	2	ppbv	<2.0	----
Dimethyl sulfide	75-18-3	E630	4	ppbv	<4.0	----
Hydrogen sulfide	7783-06-4	E630	4	ppbv	<4.0	----
Methyl mercaptan	74-93-1	E630	4	ppbv	<4.0	----

Laboratory Control Sample (LCS) Report

A Laboratory Control Sample (LCS) is an analyte-free matrix that has been fortified (spiked) with test analytes at known concentration and processed in an identical manner to test samples. LCS results are expressed as percent recovery, and are used to monitor and control test method accuracy and precision, independent of test sample matrix.

Sub-Matrix: **Air**

					Laboratory Control Sample (LCS) Report				
					Spike	Recovery (%)	Recovery Limits (%)		
Analyte	CAS Number	Method	LOR	Unit	Concentration	LCS	Low	High	Qualifier
Sulfur Compounds (QCLot: 1153567)									
Carbonyl sulfide	463-58-1	E630	4	ppbv	98.95 ppbv	97.4	60.0	140	----
Hydrogen sulfide	7783-06-4	E630	4	ppbv	120 ppbv	100	60.0	140	----
Methyl mercaptan	74-93-1	E630	4	ppbv	88.8 ppbv	102	60.0	140	----

APPENDIX 7C

Your P.O. #: 2101750.11
Your Project #: 2101750.11
Site Location: TWIN CREEKS EA
Your C.O.C. #: n/a

Attention: Data Reports - Twin Creeks

RWDI Air Inc
600 Southgate Drive
Guelph, ON
CANADA N1G 4P6

Report Date: 2023/07/13
Report #: R7712973
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3J2480
Received: 2023/06/30, 08:59

Sample Matrix: Tedlar Bag
Samples Received: 3

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Analytical Method
Matrix Gases (1)	3	N/A	2023/07/06	CAM SOP-00225	GC/TCD
Sulphur Compounds In Gaseous Samples (2)	3	N/A	2023/06/30	CAM SOP-00220	GC/FPD Direct Inject
Total Reduced Sulfurs	3	N/A	2023/06/30	CAM SOP-00220	
Volatile Organics in Air (TO-15) (3)	1	N/A	2023/06/30	BRL SOP-00304	EPA TO-15 m

Remarks:

Bureau Veritas is accredited to ISO/IEC 17025 for specific parameters on scopes of accreditation. Unless otherwise noted, procedures used by Bureau Veritas are based upon recognized Provincial, Federal or US method compendia such as CCME, MELCCFP, EPA, APHA.

All work recorded herein has been done in accordance with procedures and practices ordinarily exercised by professionals in Bureau Veritas' profession using accepted testing methodologies, quality assurance and quality control procedures (except where otherwise agreed by the client and Bureau Veritas in writing). All data is in statistical control and has met quality control and method performance criteria unless otherwise noted. All method blanks are reported; unless indicated otherwise, associated sample data are not blank corrected. Where applicable, unless otherwise noted, Measurement Uncertainty has not been accounted for when stating conformity to the referenced standard.

Bureau Veritas liability is limited to the actual cost of the requested analyses, unless otherwise agreed in writing. There is no other warranty expressed or implied. Bureau Veritas has been retained to provide analysis of samples provided by the Client using the testing methodology referenced in this report. Interpretation and use of test results are the sole responsibility of the Client and are not within the scope of services provided by Bureau Veritas, unless otherwise agreed in writing. Bureau Veritas is not responsible for the accuracy or any data impacts, that result from the information provided by the customer or their agent.

Solid sample results, except biota, are based on dry weight unless otherwise indicated. Organic analyses are not recovery corrected except for isotope dilution methods.
Results relate to samples tested. When sampling is not conducted by Bureau Veritas, results relate to the supplied samples tested.
This Certificate shall not be reproduced except in full, without the written approval of the laboratory.
Reference Method suffix “m” indicates test methods incorporate validated modifications from specific reference methods to improve performance.
* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.
(1) Argon interferes with Oxygen and is included in the reported Oxygen concentration. The atmosphere contains about 0.9% Argon.
(2) GC/FPD (Gas Chromatography/Flame Photometric Detection)
(3) Air sampling canisters have been cleaned in accordance with U.S. EPA Method TO15. At the end of the cleaning, evacuation, and pressurization cycles, one canister was selected and was pressurized with Zero Air. This canister was then analyzed via TO15 on a GC/MS. The canister must have been found to contain <0.2 ppbv concentration of all target analytes in order for the batch to have been considered clean. Each canister also underwent a leak check prior to shipment.

Please Note: SUMMA® canister samples will be retained by Bureau Veritas for a period of 5 calendar days or as contractually agreed from the date of this report, after which time they will be cleaned for reuse. If you require a longer sample storage period, please contact your service representative.

Bureau Veritas 6740 Campobello Road, Mississauga, Ontario, L5N 2L8 Tel: (905) 817-5700 Toll-Free: 800-563-6266 Fax: (905) 817-5777 www.bvna.com

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Your P.O. #: 2101750.11
Your Project #: 2101750.11
Site Location: TWIN CREEKS EA
Your C.O.C. #: n/a

Attention: Data Reports - Twin Creeks

RWDI Air Inc
600 Southgate Drive
Guelph, ON
CANADA N1G 4P6

Report Date: 2023/07/13
Report #: R7712973
Version: 1 - Final

CERTIFICATE OF ANALYSIS

BUREAU VERITAS JOB #: C3J2480
Received: 2023/06/30, 08:59

Encryption Key

Please direct all questions regarding this Certificate of Analysis to:
Clayton Johnson, CET LEAD-Air Toxics, Source Evaluation
Email: Clayton.Johnson@bureauveritas.com
Phone# (905)817-5769

==========

This report has been generated and distributed using a secure automated process.
Bureau Veritas has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per ISO/IEC 17025, signing the reports. For Service Group specific validation, please refer to the Validation Signatures page if included, otherwise available by request. For Department specific Analyst/Supervisor validation names, please refer to the Test Summary section if included, otherwise available by request. This report is authorized by Rodney Major, General Manager responsible for Ontario Environmental laboratory operations.

Bureau Veritas Job #: C3J2480
Report Date: 2023/07/13

RWDI Air Inc
Client Project #: 2101750.11
Site Location: TWIN CREEKS EA
Your P.O. #: 2101750.11

COMPRESSED GAS PARAMETERS (TEDLAR BAG)

Bureau Veritas ID		WGI894	WGI895	WGI896		
Sampling Date		2023/06/29	2023/06/29	2023/06/29		
COC Number		n/a	n/a	n/a		
	UNITS	**LFG-1**	**LFG-2**	**LFG-3**	**RDL**	**QC Batch**
Oxygen	% v/v	8.3	3.5	5.0	0.1	8773160
Nitrogen	% v/v	31.4	17.5	22.0	0.1	8773160
Carbon Monoxide	% v/v	ND	ND	ND	0.1	8773160
Methane	% v/v	33.3	44.0	40.7	0.1	8773160
Carbon Dioxide	% v/v	27.0	34.9	32.3	0.1	8773160
Total Reduced Sulfur as H2S	ppmv	290	340	370	50	8763224
Carbonyl sulfide	ppmv	ND	ND	ND	18	8766502
Hydrogen sulfide	ppmv	290	340	370	35	8766502
Carbon Disulfide	ppmv	ND	ND	ND	8.2	8766502
Sulphur dioxide	ppmv	ND	ND	ND	27	8766502
Methyl mercaptan	ppmv	ND	ND	ND	33	8766502
Ethyl Mercaptan	ppmv	ND	ND	ND	18	8766502
Dimethyl sulfide	ppmv	ND	ND	ND	34	8766502
1- Propyl mercaptan	ppmv	ND	ND	ND	19	8766502
Methyl ethyl sulfide	ppmv	ND	ND	ND	20	8766502
Dimethyl disulfide	ppmv	ND	ND	ND	4.3	8766502

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

VOLATILE ORGANICS BY GC/MS (TEDLAR BAG)

Bureau Veritas ID		WGI894		
Sampling Date		2023/06/29		
COC Number		n/a		
	UNITS	**LFG-1**	**RDL**	**QC Batch**
Dichlorodifluoromethane (FREON 12)	ppbv	763	46	8763161
1,2-Dichlorotetrafluoroethane	ppbv	ND	39	8763161
Chloromethane	ppbv	ND	95	8763161
Vinyl Chloride	ppbv	453	23	8763161
Chloroethane	ppbv	131	70	8763161
1,3-Butadiene	ppbv	ND	120	8763161
Trichlorofluoromethane (FREON 11)	ppbv	577	46	8763161
Ethanol (ethyl alcohol)	ppbv	28700	460	8763161
Trichlorotrifluoroethane	ppbv	ND	35	8763161
2-propanol	ppbv	ND	6200	8763161
2-Propanone	ppbv	14100	140	8763161
Methyl Ethyl Ketone (2-Butanone)	ppbv	18900	46	8763161
Methyl Isobutyl Ketone	ppbv	511	46	8763161
Methyl Butyl Ketone (2-Hexanone)	ppbv	ND	230	8763161
Methyl t-butyl ether (MTBE)	ppbv	ND	46	8763161
Ethyl Acetate	ppbv	1730	230	8763161
1,1-Dichloroethylene	ppbv	ND	23	8763161
cis-1,2-Dichloroethylene	ppbv	589	23	8763161
trans-1,2-Dichloroethylene	ppbv	ND	300	8763161
Methylene Chloride(Dichloromethane)	ppbv	514	140	8763161
Chloroform	ppbv	ND	23	8763161
Carbon Tetrachloride	ppbv	ND	23	8763161
1,1-Dichloroethane	ppbv	31	23	8763161
1,2-Dichloroethane	ppbv	237	23	8763161
Ethylene Dibromide	ppbv	ND	23	8763161
1,1,1-Trichloroethane	ppbv	ND	23	8763161
1,1,2-Trichloroethane	ppbv	ND	23	8763161
1,1,2,2-Tetrachloroethane	ppbv	ND	23	8763161
cis-1,3-Dichloropropene	ppbv	ND	23	8763161
trans-1,3-Dichloropropene	ppbv	ND	23	8763161
1,2-Dichloropropane	ppbv	68	23	8763161
Bromomethane	ppbv	ND	23	8763161
Bromoform	ppbv	ND	46	8763161
Bromodichloromethane	ppbv	ND	46	8763161

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

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VOLATILE ORGANICS BY GC/MS (TEDLAR BAG)

Bureau Veritas ID		WGI894		
Sampling Date		2023/06/29		
COC Number		n/a		
	UNITS	**LFG-1**	**RDL**	**QC Batch**
Dibromochloromethane	ppbv	ND	46	8763161
Trichloroethylene	ppbv	188	23	8763161
Tetrachloroethylene	ppbv	285	23	8763161
Benzene	ppbv	934	23	8763161
Toluene	ppbv	13400	23	8763161
Ethylbenzene	ppbv	3010	23	8763161
p+m-Xylene	ppbv	7240	46	8763161
o-Xylene	ppbv	1990	23	8763161
Styrene	ppbv	320	23	8763161
4-ethyltoluene	ppbv	166	120	8763161
1,3,5-Trimethylbenzene	ppbv	207	120	8763161
1,2,4-Trimethylbenzene	ppbv	474	120	8763161
Chlorobenzene	ppbv	33	23	8763161
Benzyl chloride	ppbv	ND	120	8763161
1,3-Dichlorobenzene	ppbv	ND	93	8763161
1,4-Dichlorobenzene	ppbv	56	23	8763161
1,2-Dichlorobenzene	ppbv	ND	23	8763161
1,2,4-Trichlorobenzene	ppbv	ND	120	8763161
Hexachlorobutadiene	ppbv	ND	120	8763161
Hexane	ppbv	1680	46	8763161
Heptane	ppbv	2980	70	8763161
Cyclohexane	ppbv	1230	46	8763161
Tetrahydrofuran	ppbv	3400	93	8763161
1,4-Dioxane	ppbv	ND	230	8763161
Naphthalene	ppbv	ND	46	8763161
Total Xylenes	ppbv	9230	70	8763161
1,1,1,2-Tetrachloroethane	ppbv	ND	23	8763161
Vinyl Bromide	ppbv	ND	46	8763161
Propene	ppbv	16100	120	8763161
2,2,4-Trimethylpentane	ppbv	507	46	8763161
Carbon Disulfide	ppbv	464	120	8763161
Vinyl Acetate	ppbv	ND	46	8763161
Surrogate Recovery (%)				
Bromochloromethane	%	98		8763161

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C3J2480
Report Date: 2023/07/13

RWDI Air Inc
Client Project #: 2101750.11
Site Location: TWIN CREEKS EA
Your P.O. #: 2101750.11

VOLATILE ORGANICS BY GC/MS (TEDLAR BAG)

Bureau Veritas ID		WGI894		
Sampling Date		2023/06/29		
COC Number		n/a		
	UNITS	**LFG-1**	**RDL**	**QC Batch**
D5-Chlorobenzene	%	97		8763161
Difluorobenzene	%	98		8763161

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Microbiology testing is conducted at 6660 Campobello Rd. Chemistry testing is conducted at 6740 Campobello Rd.

Bureau Veritas Job #: C3J2480
Report Date: 2023/07/13

RWDI Air Inc
Client Project #: 2101750.11
Site Location: TWIN CREEKS EA
Your P.O. #: 2101750.11

TEST SUMMARY

Bureau Veritas ID: WGI894 **Collected:** 2023/06/29
Sample ID: LFG-1 **Shipped:**
Matrix: Tedlar Bag **Received:** 2023/06/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Matrix Gases	GC/TCD	8773160	N/A	2023/07/06	Marina Tsoy
Sulphur Compounds In Gaseous Samples	GC/FPD	8766502	N/A	2023/06/30	Iqbal Hasan
Total Reduced Sulfurs	GC/FPD	8763224	N/A	2023/06/30	Automated Statchk
Volatile Organics in Air (TO-15)	GC/MS	8763161	N/A	2023/06/30	Ana Nunes

Bureau Veritas ID: WGI894 Dup **Collected:** 2023/06/29
Sample ID: LFG-1 **Shipped:**
Matrix: Tedlar Bag **Received:** 2023/06/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Matrix Gases	GC/TCD	8773160	N/A	2023/07/06	Marina Tsoy

Bureau Veritas ID: WGI895 **Collected:** 2023/06/29
Sample ID: LFG-2 **Shipped:**
Matrix: Tedlar Bag **Received:** 2023/06/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Matrix Gases	GC/TCD	8773160	N/A	2023/07/06	Marina Tsoy
Sulphur Compounds In Gaseous Samples	GC/FPD	8766502	N/A	2023/06/30	Iqbal Hasan
Total Reduced Sulfurs	GC/FPD	8763224	N/A	2023/06/30	Automated Statchk

Bureau Veritas ID: WGI895 Dup **Collected:** 2023/06/29
Sample ID: LFG-2 **Shipped:**
Matrix: Tedlar Bag **Received:** 2023/06/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Sulphur Compounds In Gaseous Samples	GC/FPD	8766502	N/A	2023/06/30	Iqbal Hasan

Bureau Veritas ID: WGI896 **Collected:** 2023/06/29
Sample ID: LFG-3 **Shipped:**
Matrix: Tedlar Bag **Received:** 2023/06/30

Test Description	Instrumentation	Batch	Extracted	Date Analyzed	Analyst
Matrix Gases	GC/TCD	8773160	N/A	2023/07/06	Marina Tsoy
Sulphur Compounds In Gaseous Samples	GC/FPD	8766502	N/A	2023/06/30	Iqbal Hasan
Total Reduced Sulfurs	GC/FPD	8763224	N/A	2023/06/30	Automated Statchk

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GENERAL COMMENTS

Sulfur gas analysis: Due to high concentrations of hydrogen sulphide, samples WGI894, WGI895 and WGI896 required dilution. Detection limits were adjusted accordingly.
Matrix Gas Analysis: Results normalized to 100% dry volume.

Sample WGI894 [LFG-1] : Sample was analyzed at a 232X dilution. Ethanol was analyzed at a 464X dilution. The DL's were adjusted accordingly. Increased DL for trans-1,2-dichloroethylene, chloromethane and 2-propanol due to interference.
Propene is a mixture of both propene and propane and this represents the highest possible concentration of propene.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
8763161	ANE	Spiked Blank	Bromochloromethane	2023/06/30		113	%	60 - 140
			D5-Chlorobenzene	2023/06/30		114	%	60 - 140
			Difluorobenzene	2023/06/30		113	%	60 - 140
			Dichlorodifluoromethane (FREON 12)	2023/06/30		100	%	70 - 130
			1,2-Dichlorotetrafluoroethane	2023/06/30		100	%	70 - 130
			Chloromethane	2023/06/30		105	%	70 - 130
			Vinyl Chloride	2023/06/30		108	%	70 - 130
			Chloroethane	2023/06/30		107	%	70 - 130
			1,3-Butadiene	2023/06/30		113	%	70 - 130
			Trichlorofluoromethane (FREON 11)	2023/06/30		98	%	70 - 130
			Ethanol (ethyl alcohol)	2023/06/30		92	%	70 - 130
			Trichlorotrifluoroethane	2023/06/30		98	%	70 - 130
			2-propanol	2023/06/30		100	%	70 - 130
			2-Propanone	2023/06/30		109	%	70 - 130
			Methyl Ethyl Ketone (2-Butanone)	2023/06/30		123	%	70 - 130
			Methyl Isobutyl Ketone	2023/06/30		110	%	70 - 130
			Methyl Butyl Ketone (2-Hexanone)	2023/06/30		109	%	70 - 130
			Methyl t-butyl ether (MTBE)	2023/06/30		96	%	70 - 130
			Ethyl Acetate	2023/06/30		119	%	70 - 130
			1,1-Dichloroethylene	2023/06/30		100	%	70 - 130
			cis-1,2-Dichloroethylene	2023/06/30		104	%	70 - 130
			trans-1,2-Dichloroethylene	2023/06/30		105	%	70 - 130
			Methylene Chloride(Dichloromethane)	2023/06/30		101	%	70 - 130
			Chloroform	2023/06/30		104	%	70 - 130
			Carbon Tetrachloride	2023/06/30		104	%	70 - 130
			1,1-Dichloroethane	2023/06/30		101	%	70 - 130
			1,2-Dichloroethane	2023/06/30		102	%	70 - 130
			Ethylene Dibromide	2023/06/30		104	%	70 - 130
			1,1,1-Trichloroethane	2023/06/30		100	%	70 - 130
			1,1,2-Trichloroethane	2023/06/30		106	%	70 - 130
			1,1,2,2-Tetrachloroethane	2023/06/30		97	%	70 - 130
			cis-1,3-Dichloropropene	2023/06/30		103	%	70 - 130
			trans-1,3-Dichloropropene	2023/06/30		112	%	70 - 130
			1,2-Dichloropropane	2023/06/30		105	%	70 - 130
			Bromomethane	2023/06/30		103	%	70 - 130
			Bromoform	2023/06/30		103	%	70 - 130
			Bromodichloromethane	2023/06/30		102	%	70 - 130
			Dibromochloromethane	2023/06/30		107	%	70 - 130
			Trichloroethylene	2023/06/30		104	%	70 - 130
			Tetrachloroethylene	2023/06/30		102	%	70 - 130
			Benzene	2023/06/30		106	%	70 - 130
			Toluene	2023/06/30		106	%	70 - 130
			Ethylbenzene	2023/06/30		106	%	70 - 130
			p+m-Xylene	2023/06/30		104	%	70 - 130
			o-Xylene	2023/06/30		100	%	70 - 130
			Styrene	2023/06/30		99	%	70 - 130
			4-ethyltoluene	2023/06/30		107	%	70 - 130
			1,3,5-Trimethylbenzene	2023/06/30		98	%	70 - 130
			1,2,4-Trimethylbenzene	2023/06/30		98	%	70 - 130
			Chlorobenzene	2023/06/30		99	%	70 - 130
			Benzyl chloride	2023/06/30		107	%	70 - 130

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			1,3-Dichlorobenzene	2023/06/30		94	%	70 - 130
			1,4-Dichlorobenzene	2023/06/30		93	%	70 - 130
			1,2-Dichlorobenzene	2023/06/30		90	%	70 - 130
			1,2,4-Trichlorobenzene	2023/06/30		96	%	70 - 130
			Hexachlorobutadiene	2023/06/30		89	%	70 - 130
			Hexane	2023/06/30		104	%	70 - 130
			Heptane	2023/06/30		114	%	70 - 130
			Cyclohexane	2023/06/30		109	%	70 - 130
			Tetrahydrofuran	2023/06/30		115	%	70 - 130
			1,4-Dioxane	2023/06/30		117	%	70 - 130
			Naphthalene	2023/06/30		100	%	70 - 130
			Total Xylenes	2023/06/30		103	%	70 - 130
			1,1,1,2-Tetrachloroethane	2023/06/30		105	%	70 - 130
			Vinyl Bromide	2023/06/30		95	%	70 - 130
			Propene	2023/06/30		106	%	70 - 130
			2,2,4-Trimethylpentane	2023/06/30		116	%	70 - 130
			Carbon Disulfide	2023/06/30		105	%	70 - 130
			Vinyl Acetate	2023/06/30		115	%	70 - 130
8763161	ANE	Method Blank	Bromochloromethane	2023/06/30		101	%	60 - 140
			D5-Chlorobenzene	2023/06/30		95	%	60 - 140
			Difluorobenzene	2023/06/30		102	%	60 - 140
			Dichlorodifluoromethane (FREON 12)	2023/06/30	ND, RDL=0.20		ppbv	
			1,2-Dichlorotetrafluoroethane	2023/06/30	ND, RDL=0.17		ppbv	
			Chloromethane	2023/06/30	ND, RDL=0.30		ppbv	
			Vinyl Chloride	2023/06/30	ND, RDL=0.10		ppbv	
			Chloroethane	2023/06/30	ND, RDL=0.30		ppbv	
			1,3-Butadiene	2023/06/30	ND, RDL=0.50		ppbv	
			Trichlorofluoromethane (FREON 11)	2023/06/30	ND, RDL=0.20		ppbv	
			Ethanol (ethyl alcohol)	2023/06/30	ND, RDL=1.0		ppbv	
			Trichlorotrifluoroethane	2023/06/30	ND, RDL=0.15		ppbv	
			2-propanol	2023/06/30	ND, RDL=1.0		ppbv	
			2-Propanone	2023/06/30	ND, RDL=0.60		ppbv	
			Methyl Ethyl Ketone (2-Butanone)	2023/06/30	ND, RDL=0.20		ppbv	
			Methyl Isobutyl Ketone	2023/06/30	ND, RDL=0.20		ppbv	
			Methyl Butyl Ketone (2-Hexanone)	2023/06/30	ND, RDL=1.0		ppbv	
			Methyl t-butyl ether (MTBE)	2023/06/30	ND, RDL=0.20		ppbv	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Ethyl Acetate	2023/06/30	ND, RDL=1.0		ppbv	
			1,1-Dichloroethylene	2023/06/30	ND, RDL=0.10		ppbv	
			cis-1,2-Dichloroethylene	2023/06/30	ND, RDL=0.10		ppbv	
			trans-1,2-Dichloroethylene	2023/06/30	ND, RDL=0.10		ppbv	
			Methylene Chloride(Dichloromethane)	2023/06/30	ND, RDL=0.60		ppbv	
			Chloroform	2023/06/30	ND, RDL=0.10		ppbv	
			Carbon Tetrachloride	2023/06/30	ND, RDL=0.10		ppbv	
			1,1-Dichloroethane	2023/06/30	ND, RDL=0.10		ppbv	
			1,2-Dichloroethane	2023/06/30	ND, RDL=0.10		ppbv	
			Ethylene Dibromide	2023/06/30	ND, RDL=0.10		ppbv	
			1,1,1-Trichloroethane	2023/06/30	ND, RDL=0.10		ppbv	
			1,1,2-Trichloroethane	2023/06/30	ND, RDL=0.10		ppbv	
			1,1,2,2-Tetrachloroethane	2023/06/30	ND, RDL=0.10		ppbv	
			cis-1,3-Dichloropropene	2023/06/30	ND, RDL=0.10		ppbv	
			trans-1,3-Dichloropropene	2023/06/30	ND, RDL=0.10		ppbv	
			1,2-Dichloropropane	2023/06/30	ND, RDL=0.10		ppbv	
			Bromomethane	2023/06/30	ND, RDL=0.10		ppbv	
			Bromoform	2023/06/30	ND, RDL=0.20		ppbv	
			Bromodichloromethane	2023/06/30	ND, RDL=0.20		ppbv	
			Dibromochloromethane	2023/06/30	ND, RDL=0.20		ppbv	
			Trichloroethylene	2023/06/30	ND, RDL=0.10		ppbv	
			Tetrachloroethylene	2023/06/30	ND, RDL=0.10		ppbv	
			Benzene	2023/06/30	ND, RDL=0.10		ppbv	
			Toluene	2023/06/30	ND, RDL=0.10		ppbv	
			Ethylbenzene	2023/06/30	ND, RDL=0.10		ppbv	
			p+m-Xylene	2023/06/30	ND, RDL=0.20		ppbv	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			o-Xylene	2023/06/30	ND, RDL=0.10		ppbv	
			Styrene	2023/06/30	ND, RDL=0.10		ppbv	
			4-ethyltoluene	2023/06/30	ND, RDL=0.50		ppbv	
			1,3,5-Trimethylbenzene	2023/06/30	ND, RDL=0.50		ppbv	
			1,2,4-Trimethylbenzene	2023/06/30	ND, RDL=0.50		ppbv	
			Chlorobenzene	2023/06/30	ND, RDL=0.10		ppbv	
			Benzyl chloride	2023/06/30	ND, RDL=0.50		ppbv	
			1,3-Dichlorobenzene	2023/06/30	ND, RDL=0.40		ppbv	
			1,4-Dichlorobenzene	2023/06/30	ND, RDL=0.10		ppbv	
			1,2-Dichlorobenzene	2023/06/30	ND, RDL=0.10		ppbv	
			1,2,4-Trichlorobenzene	2023/06/30	ND, RDL=0.50		ppbv	
			Hexachlorobutadiene	2023/06/30	ND, RDL=0.50		ppbv	
			Hexane	2023/06/30	ND, RDL=0.20		ppbv	
			Heptane	2023/06/30	ND, RDL=0.30		ppbv	
			Cyclohexane	2023/06/30	ND, RDL=0.20		ppbv	
			Tetrahydrofuran	2023/06/30	ND, RDL=0.40		ppbv	
			1,4-Dioxane	2023/06/30	ND, RDL=1.0		ppbv	
			Naphthalene	2023/06/30	ND, RDL=0.20		ppbv	
			Total Xylenes	2023/06/30	ND, RDL=0.30		ppbv	
			1,1,1,2-Tetrachloroethane	2023/06/30	ND, RDL=0.10		ppbv	
			Vinyl Bromide	2023/06/30	ND, RDL=0.20		ppbv	
			Propene	2023/06/30	ND, RDL=0.50		ppbv	
			2,2,4-Trimethylpentane	2023/06/30	ND, RDL=0.20		ppbv	
			Carbon Disulfide	2023/06/30	ND, RDL=0.50		ppbv	
			Vinyl Acetate	2023/06/30	ND, RDL=0.20		ppbv	
8766502	IH0	Method Blank	Carbonyl sulfide	2023/06/30	ND, RDL=0.40		ppmv	

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QUALITY ASSURANCE REPORT(CONT'D)

QA/QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	% Recovery	UNITS	QC Limits
			Hydrogen sulfide	2023/06/30	ND, RDL=0.40		ppmv	
			Carbon Disulfide	2023/06/30	ND, RDL=0.20		ppmv	
			Sulphur dioxide	2023/06/30	ND, RDL=0.40		ppmv	
			Methyl mercaptan	2023/06/30	ND, RDL=0.20		ppmv	
			Ethyl Mercaptan	2023/06/30	ND, RDL=0.20		ppmv	
			Dimethyl sulfide	2023/06/30	ND, RDL=0.20		ppmv	
			1- Propyl mercaptan	2023/06/30	ND, RDL=0.30		ppmv	
			Methyl ethyl sulfide	2023/06/30	ND, RDL=0.40		ppmv	
			Dimethyl disulfide	2023/06/30	ND, RDL=0.20		ppmv	
8766502	IH0	RPD - Sample/Sample Dup	Carbonyl sulfide	2023/06/30	NC		%	25
			Hydrogen sulfide	2023/06/30	8.3		%	25
			Carbon Disulfide	2023/06/30	NC		%	25
			Sulphur dioxide	2023/06/30	NC		%	25
			Methyl mercaptan	2023/06/30	NC		%	25
			Ethyl Mercaptan	2023/06/30	NC		%	25
			Dimethyl sulfide	2023/06/30	NC		%	25
			1- Propyl mercaptan	2023/06/30	NC		%	25
			Methyl ethyl sulfide	2023/06/30	NC		%	25
			Dimethyl disulfide	2023/06/30	NC		%	25
8773160	MT5	Method Blank	Oxygen	2023/07/06	ND, RDL=0.1		% v/v	
			Nitrogen	2023/07/06	ND, RDL=0.1		% v/v	
			Carbon Monoxide	2023/07/06	ND, RDL=0.1		% v/v	
			Methane	2023/07/06	ND, RDL=0.1		% v/v	
			Carbon Dioxide	2023/07/06	ND, RDL=0.1		% v/v	
8773160	MT5	RPD - Sample/Sample Dup	Oxygen	2023/07/06	0.36		%	20
			Nitrogen	2023/07/06	1.7		%	20
			Carbon Monoxide	2023/07/06	NC		%	20
			Methane	2023/07/06	0.39		%	20
			Carbon Dioxide	2023/07/06	1.3		%	20

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

Surrogate: A pure or isotopically labeled compound whose behavior mirrors the analytes of interest. Used to evaluate extraction efficiency.

NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (absolute difference <= 2x RDL).

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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by:

Melanie Mabini, Team Leader

Tom Mitchell, B.Sc, Supervisor, Compressed Gases

Vasan Thiagarajah, Analyst, Compressed Gases

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ENV COC - 00026/1

Chain of Custody Form - Summa™ Canister

Page 1 of 1

INVOICE INFORMATION

Company Name: RWDI
Contact Name: Dan Harrigan
Address: 600 Southgate Dr
City: Guelph Prov: ON
Postal Code: N1G 4P6 Prov Other:
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REPORT INFORMATION

Company Name: RWDI
Project Manager: Khalid Hussein
Address: 600 Southgate Dr
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Postal Code: N1G 4P6 Prov Other:
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Ph: 519-823-1311 x 2105

ANALYSIS REQUESTED

Field Sample ID	Canister Serial #	Flow Regulator Serial #	Collection Date YYYY	MM	DD	START VACUUM (inches of Hg)	END VACUUM (inches of Hg)	SOIL VAPOUR	AMBIENT/INDOOR AIR	AMBIENT/COMMERCIAL/INDUSTRIAL	SUB-SLAB GAS	FULL LIST OF VOCs (reference TO15A)	BTEX/Aromatic/Aliphatic Hydrocarbon Fractions	BTEX/F1 (C6-C10) and F2 (C10-C16)	Selected VOC's - please specify	REG 153 VOCs			CANISTERS NOT USED
~~Flare 1~~ LFG-1			2023	06	29										✓				
~~Flare 2~~ LFG-2			2023	06	29										✓				
~~Flare 3~~ LFG-3			2023	06	29										✓				

30-Jun-23 08:59
Patricia Legette
C3J2480
AN4 AIR-RmTmp

TAT Requirement
Choose TAT in drop down menu, of select other, specify in "Other RUSH TAT box"

Other RUSH TAT

* need approval from Bureau Veritas

PROJECT INFORMATION

Project #: 2101750.11
Name: Twin Creeks EA
PO#: 2101750.11
Bureau Veritas Quote #:
Bureau Veritas Contact:
Task Order/Line Item:

REPORTING REQUIREMENTS

EDD
Regulations
Other Regulation

Notes

1) please indicate on chain of custody if your samples are soil vapour or ambient air
2) please list all canisters on the chain of custody even if unused

PROJECT SPECIFIC COMMENTS

* Please see reverse of page for full analysis target list *

Client Signature: Dan Harrigan
Date (YYYY-MM-DD): 2023/06/30
Time, 24hr (HH:MM): 8 45

Received by (lab use only):
Date (YYYY-MM-DD): 2023/06/30
Time, 24hr (HH:MM): 08 59

PLEASE RETURN ALL UNUSED EQUIPMENT

*UNLESS OTHERWISE AGREED TO IN WRITING, WORK SUBMITTED ON THIS CHAIN OF CUSTODY IS SUBJECT TO BUREAU VERITAS STANDARD TERMS AND CONDITIONS. SIGNING OF THIS CHAIN OF CUSTODY DOCUMENT IS ACKNOWLEDGMENT AND ACCEPTANCE OF OUR TERMS AND CONDITIONS WHICH ARE AVAILABLE FOR VIEWING AT WWW.BVNA.COM/TERMS-AND-CONDITIONS OR BY CALLING THE LABORATORY LISTED ABOVE TO OBTAIN A COPY.

Analysis list:

- O_2
- CO_2
- N_2
- CH_4
- CO
- NO_x
- All Sulphurs
- All VOC's
- Reduced Sulphurs and VOC's

* high methane content *

Necessary:

- Vinyl chloride
- Benzene
- 1,2 - Dichloroethane
- Ammonia
- Hydrogen Sulphide
- TRS

APPENDIX 7D

Roadway and Daily Cover Sampling Locations

True North

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre - Watford, Ontario

Project #: 2101750

Drawn by: MDKB	Figure: 7D
Exact Scale:	1:8,500
Date Revised:	Oct 12, 2023

Map Document: C:\GIS\2101750 Twin Creeks EA\02 Work\210312 Twin Creeks.aprx

SAMPLING DATA FOR PAVED ROADS

Date Collected Oct 5 / 22 (1-2) Recorded by MDKB

Sampling location* Main Entrance ~~outbound~~ Paved haul road (3-4) No. of Lanes 1

Surface type (e.g., asphalt, concrete, etc.) Concrete

Surface condition (e.g., good, rutted, etc.) good

* Use code given on plant or road map for segment identification. Indication sampling location on map.

METHOD:

1. Sampling device: portable vacuum cleaner (whisk broom and dustpan if heavy loading present)
2. Sampling depth: loose surface material (do not sample curb areas or other untravelled portions of the road)
3. Sample container: tared and numbered vacuum cleaner bags (bucket with sealable liner if heavy loading present)
4. Gross sample specifications: Vacuum swept samples should be at least 200 g (0.5 lb), with the exposed filter bag weight should be at least 3 to 5 times greater than the empty bag tare weight.

Refer to AP-42 Appendix C.1 for more detailed instructions.

Indicate any deviations from the above: _____

SAMPLING DATA COLLECTED:

Sample No.	Vacuum Bag ID	Vacuum Bag Tare Wgt (g)	Sampling Surface Dimensions (l x w)	Time	Mass of Broom-Swept Sample +	Lanes
R1	PR 1	28.8	7m x 12.7/m	11:12		2
2	PR 2	28.2	3.30 x 3.61m + 6.72 x 4.44m +	11:50		2
3	PR 3	28.3	5.28m + 3.69m + 3.54 x 2.64m +	12:40		2
4	PR4	28.0	1.1m x 6.6m	13:14		1

Asphalt —

+ Enter "0" if no broom sweeping is performed.

Figure C.1-4. Example data form for paved roads.

SAMPLING DATA FOR UNPAVED ROADS

Date Collected Oct. 5/22 Recorded by MDKB

Road Material (e.g., gravel, slag, dirt, etc.):* UP1 - Crushed concrete
UP2 - Gravel/ mix UP3 - CRUSHED CONCRETE

Site of Sampling: TWIN CREEKS LF

METHOD:

1. Sampling device: whisk broom and dustpan
2. Sampling depth: loose surface material (do not abrade road base)
3. Sample container: bucket with sealable liner
4. Gross sample specifications:
   a. Uncontrolled surfaces -- 5 kg (10 lb) to 23 kg (50 lb)
   b. Controlled surfaces -- minimum of 400 g (1 lb) is required for analysis

Refer to AP-42 Appendix B.1 for more detailed instructions.

Indicate any deviations from the above:

SAMPLING DATA COLLECTED:

Sample No.	Time	Location +	Surf. Area	Depth	Mass of Sample	Lanes
UP 1	13:47	Base of Haul route	5.63 x 0.3 m	3cm		1
UP2	14:22	Haul Road Construction	5.74 x 0.3m	1mm		2
UP 3	14:52	Working face Road E	5.73 x 0.3	1mm		1
UP 4	15:57	North Construction Haul Rd	7.48 x 0.53	1mm		2
UP 5	16:18	Active Face #1 (higher)	5.55 x 0.3	1mm		2
UP 6	16:48	Active Face #2 (lower)	5.2 x 03	1mm		1

* Indicate and give details if roads are controlled.
\+ Use code given on plant or road map for segment identification. Indicate sampling location on map.

Figure C.1-2. Example data form for unpaved road samples.

APPENDIX C.1

PROCEDURES FOR SAMPLING SURFACE/BULK DUST LOADING

Appendix C.1

Procedures For Sampling Surface/Bulk Dust Loading

This appendix presents procedures recommended for the collection of material samples from paved and unpaved roads and from bulk storage piles. (AP-42, Appendix C.2, "Procedures For Laboratory Analysis Of Surface/Bulk Dust Loading Samples", presents analogous information for the analysis of the samples.) These recommended procedures are based on a review of American Society For Testing And Materials (ASTM) methods, such as C-136 (sieve analysis) and D-2216 (moisture content). The recommendations follow ASTM standards where practical, and where not, an effort has been made to develop procedures consistent with the intent of the pertinent ASTM standards.

This appendix emphasizes that, before starting any field sampling program, one must first define the study area of interest and then determine the number of samples that can be collected and analyzed within the constraints of time, labor, and money available. For example, the study area could be defined as an individual industrial plant with its network of paved/unpaved roadways and material piles. In that instance, it is advantageous to collect a separate sample for each major dust source in the plant. This level of resolution is useful in developing cost-effective emission reduction plans. On the other hand, if the area of interest is geographically large (say a city or county, with a network of public roads), collecting at least 1 sample from each source would be highly impractical. However, in such an area, it is important to obtain samples representative of different source types within the area.

C.1.1 Samples From Unpaved Roads

Objective -

The overall objective in an unpaved road sampling program is to inventory the mass of particulate matter (PM) emissions from the roads. This is typically done by:

1. Collecting "representative" samples of the loose surface material from the road;
2. Analyzing the samples to determine silt fractions; and
3. Using the results in the predictive emission factor model given in AP-42, Section 13.2.2, Unpaved Roads, together with traffic data (e. g., number of vehicles traveling the road each day).

Before any field sampling program, it is necessary to define the study area of interest and to determine the number of unpaved road samples that can be collected and analyzed within the constraints of time, labor, and money available. For example, the study area could be defined as a very specific industrial plant having a network of roadways. Here it is advantageous to collect a separate sample for each major unpaved road in the plant. This level of resolution is useful in developing cost-effective emission reduction plans involving dust suppressants or traffic rerouting. On the other hand, the area of interest may be geographically large, and well-defined traffic information may not be easily obtained. In this case, resolution of the PM emission inventory to specific road segments would not be feasible, and it would be more important to obtain representative road-type samples within the area by aggregating several sample increments.

Procedure -

For a network consisting of many relatively short roads contained in a *well-defined study area* (as would be the case at an industrial plant), it is recommended that one collect a sample for each 0.8 kilometers (km) (0.5 miles [mi]) length, or portion thereof, for each major road segment. Here, the term "road segment" refers to the length of road between intersections (the nodes of the network)

with other paved or unpaved roads. Thus, for a major segment 1 km (0.6 mi) long, 2 samples are recommended.

For longer roads in *study areas that are spatially diverse*, it is recommended that one collect a sample for each 4.8 km (3 mi) length of the road. Composite a sample from a minimum of 3 incremental samples. Collect the first sample increment at a random location within the first 0.8 km (0.5 mi), with additional increments taken from each remaining 0.8 km (0.5 mi) of the road, up to a maximum length of 4.8 km (3 mi). For a road less than 1.5 mi in length, an acceptable method for selecting sites for the increments is based on drawing 3 random numbers (x1, x2, x3) between zero and the length. Random numbers may be obtained from tabulations in statistical reference books, or scientific calculators may be used to generate pseudorandom numbers. See Figure C.1-1.

The following steps describe the collection method for samples (increments).

1. Ensure that the site offers an unobstructed view of traffic and that sampling personnel are visible to drivers. If the road is heavily traveled, use 1 person to "spot" and route traffic safely around another person collecting the surface sample (increment).

2. Using string or other suitable markers, mark a 0.3 meters (m) (1 foot [ft]) wide portion across the road. (WARNING: *Do not mark the collection area with a chalk line or in any other method likely to introduce fine material into the sample*.)

3. With a whisk broom and dustpan, remove the loose surface material from the hard road base. Do not abrade the base during sweeping. Sweeping should be performed slowly so that fine surface material is not injected into the air. NOTE: *Collect material only from the portion of the road over which the wheels and carriages routinely travel* (i. e., not from berms or any "mounds" along the road centerline).

4. Periodically deposit the swept material into a clean, labeled container of suitable size, such as a metal or plastic 19 liter (L) (5 gallon [gal]) bucket, having a sealable polyethylene liner. Increments may be mixed within this container.

5. Record the required information on the sample collection sheet (Figure C.1-2).

Sample Specifications -

For uncontrolled unpaved road surfaces, a gross sample of 5 kilograms (kg) (10 pounds [lb]) to 23 kg (50 lb) is desired. Samples of this size will require splitting to a size amenable for analysis (see Appendix C.2). For unpaved roads having been treated with chemical dust suppressants (such as petroleum resins, asphalt emulsions, etc.), the above goal may not be practical in well-defined study areas because a very large area would need to be swept. In general, a minimum of 400 grams (g) (1 lb) is required for silt and moisture analysis. Additional increments should be taken from heavily controlled unpaved surfaces, until the minimum sample mass has been achieved.

C.1.2 Samples From Paved Roads

Objective -

The overall objective in a paved road sampling program is to inventory the mass of particulate emissions from the roads. This is typically done by:

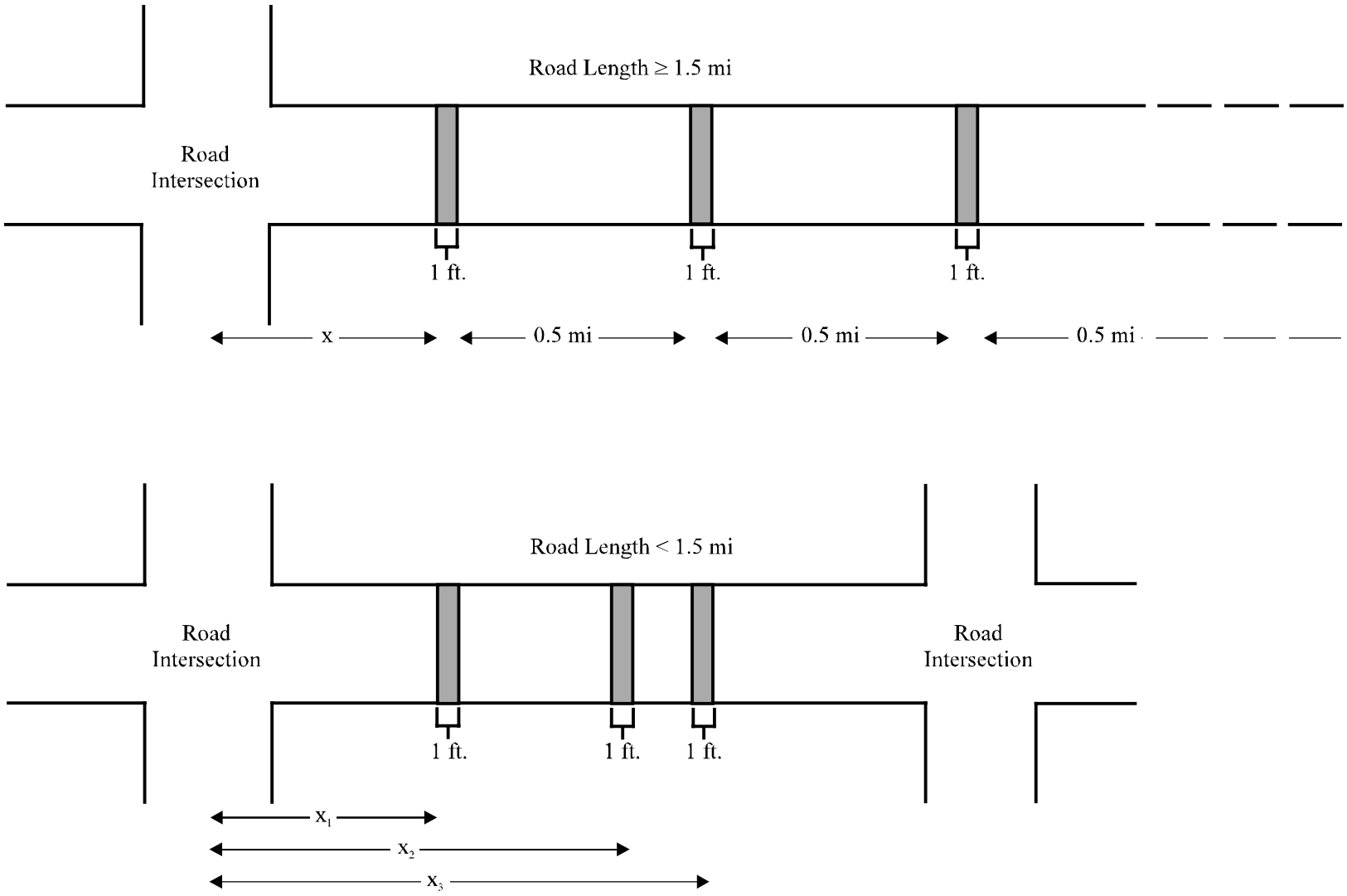

Figure C.1-1. Sampling locations for unpaved roads.

SAMPLING DATA FOR UNPAVED ROADS

Date Collected _____ Recorded by _____

Road Material (e.g., gravel, slag, dirt, etc.):* _____

_____

_____

Site of Sampling: _____

METHOD:

1. Sampling device: whisk broom and dustpan
2. Sampling depth: loose surface material (do not abrade road base)
3. Sample container: bucket with sealable liner
4. Gross sample specifications:
   a. Uncontrolled surfaces -- 5 kg (10 lb) to 23 kg (50 lb)
   b. Controlled surfaces -- minimum of 400 g (1 lb) is required for analysis

Refer to AP-42 Appendix B.1 for more detailed instructions.

Indicate any deviations from the above: _____

_____

_____

SAMPLING DATA COLLECTED:

Sample No.	Time	Location +	Surf. Area	Depth	Mass of Sample

* Indicate and give details if roads are controlled.

\+ Use code given on plant or road map for segment identification. Indicate sampling location on map.

Figure C.1-2. Example data form for unpaved road samples.

1. Collecting "representative" samples of the loose surface material from the road;
2. Analyzing the sample to determine the silt fraction; and
3. Combining the results with traffic data in a predictive emission factor model.

The remarks above about definition of the study area and the appropriate level of resolution for sampling unpaved roads are equally applicable to paved roads. Before a field sampling program, it is necessary first to define the study area of interest and then to determine the number of paved road samples that can be collected and analyzed. For example, in a well-defined study area (e. g., an industrial plant), it is advantageous to collect a separate sample for each major paved road, because the resolution can be useful in developing cost-effective emission reduction plans. Similarly, in geographically large study areas, it may be more important to obtain samples representative of road types within the area by aggregating several sample increments.

Compared to unpaved road sampling, planning for a paved road sample collection exercise necessarily involves greater consideration as to types of equipment to be used. Specifically, provisions must be made to accommodate the characteristics of the vacuum cleaner chosen. For example, paved road samples are collected by cleaning the surface with a vacuum cleaner with "tared" (i. e., weighed before use) filter bags. Upright "stick broom" vacuums use relatively small, lightweight filter bags, while bags for industrial-type vacuums are bulky and heavy. Because the mass collected is usually several times greater than the bag tare weight, uprights are thus well suited for collecting samples from lightly loaded road surfaces. On the other hand, on heavily loaded roads, the larger industrial-type vacuum bags are easier to use and can be more readily used to aggregate incremental samples from all road surfaces. These features are discussed further below.

Procedure -

For a network of many relatively short roads *contained in a well-defined study area* (as would be the case at an industrial plant), it is recommended that one collect a sample for each 0.8 km (0.5 mi) length, or portion thereof, for each major road segment. For a 1 km long (0.6 mi) segment, then, 2 samples are recommended. As mentioned, the term "road segment" refers to the length of road between intersections with other paved or unpaved roads (the nodes of the network).

For longer roads *in spatially heterogeneous study areas*, it is recommended that one collect a sample for each 4.8 km (3 mi) of sampled road length. Create a composite sample from a minimum of 3 incremental samples. Collect the first increment at a random location within the first 0.8 km (0.5 mi), with additional increments taken from each remaining 0.8 km (0.5 mi) of the road, up to a maximum length of 4.8 km (3 mi.) For a road less than 2.4 km (1.5 mi) long, an acceptable method for selecting sites for the increments is based on drawing 3 random numbers (x1, x2, x3) between zero and the length (See Figure C.1-3). Random numbers may be obtained from tabulations in statistical reference books, or scientific calculators may be used to generate pseudorandom numbers.

The following steps describe the collection method for samples (increments).

1. Ensure that the site offers an unobstructed view of traffic and that sampling personnel are visible to drivers. If the road is heavily traveled, use 1 crew member to "spot" and route traffic safely around another person collecting the surface sample (increment).

2. Using string or other suitable markers, mark the sampling portion across the road. (WARNING: *Do not mark the collection area with a chalk line or in any other method likely to introduce fine material into the sample*.) The widths may be varied between 0.3 m (1 ft) for visibly dirty roads and 3 m (10 ft) for clean roads. When an industrial-

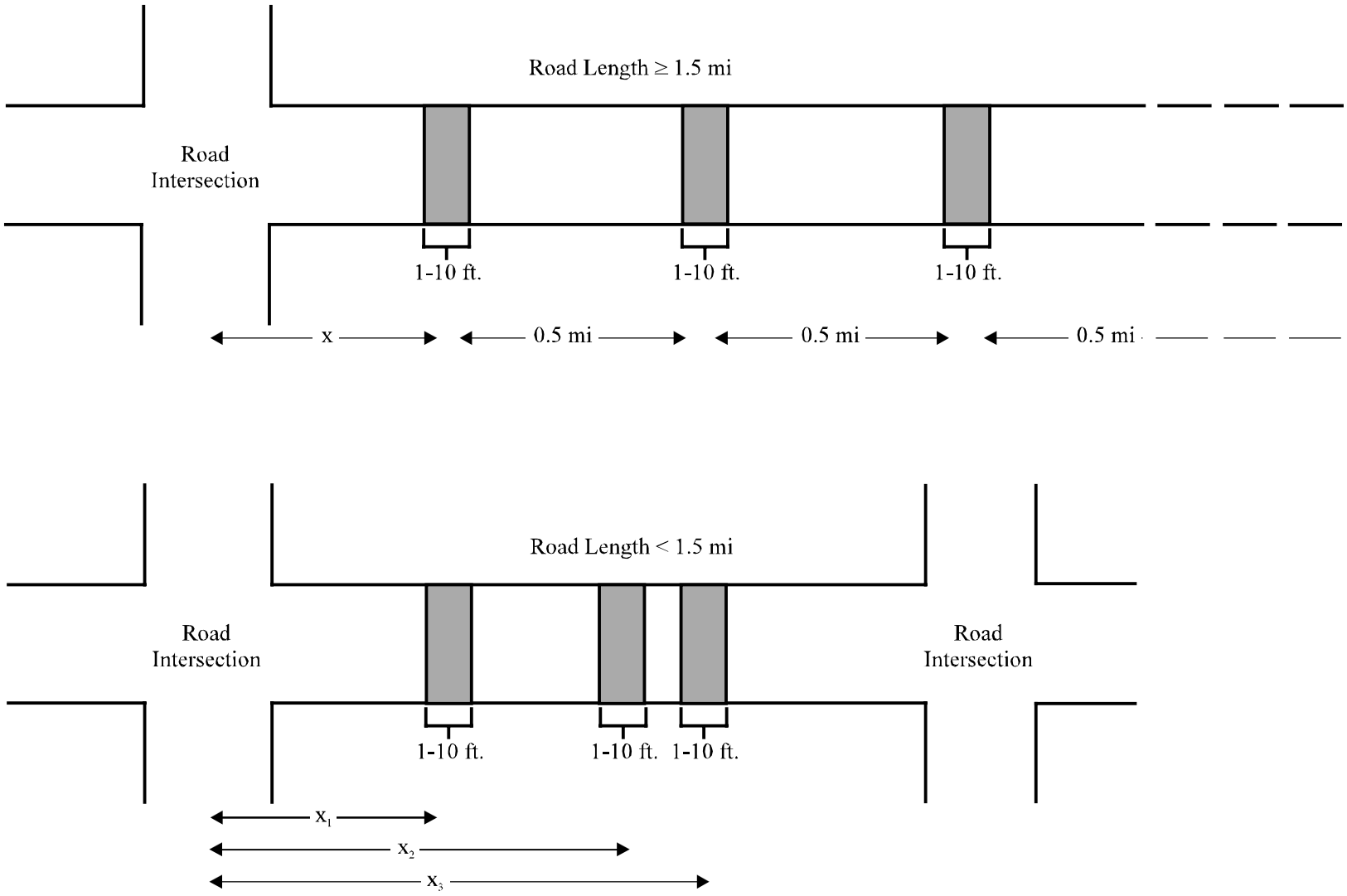

Figure C.1-3. Sampling locations for paved roads.

type vacuum is used to sample lightly loaded roads, a width greater than 3 m (10 ft) may be necessary to meet sample specifications, unless increments are being combined.

3. If large, loose material is present on the surface, it should be collected with a whisk broom and dustpan. NOTE: *Collect material only from the portion of the road over which the wheels and carriages routinely travel* (i. e., not from berms or any "mounds" along the road centerline). On roads with painted side markings, collect material "from white line to white line" (but avoid centerline mounds). Store the swept material in a clean, labeled container of suitable size, such as a metal or plastic 19 L (5 gal) bucket, with a sealable polyethylene liner. Increments for the same sample may be mixed within the container.

4. Vacuum the collection area using a portable vacuum cleaner fitted with an empty tared (preweighed) filter bag. NOTE: *Collect material only from the portion of the road over which the wheels and carriages routinely travel* (i. e., not from berms or any "mounds" along the road centerline). On roads with painted side markings, collect material "from white line to white line" (but avoid centerline mounds). The same filter bag may be used for different increments for 1 sample. For heavily loaded roads, more than 1 filter bag may be needed for a sample (increment).

5. Carefully remove the bag from the vacuum sweeper and check for tears or leaks. If necessary, reduce samples (using the procedure in Appendix C.2) from broom sweeping to a size amenable to analysis. Seal broom-swept material in a clean, labeled plastic jar for transport (alternatively, the swept material may be placed in the vacuum filter bag). Fold the unused portion of the filter bag, wrap a rubber band around the folded bag, and store the bag for transport.

6. Record the required information on the sample collection sheet (Figure C.1-4).

Sample Specifications -

When broom swept samples are collected, they should be at least 400 g (1 lb) for silt and moisture analysis. Vacuum swept samples should be at least 200 g (0.5 lb). Also, the weight of an "exposed" filter bag should be at least 3 to 5 times greater than when empty. Additional increments should be taken until these sample mass goals have been attained.

C.1.3 Samples From Storage Piles

Objective -

The overall objective of a storage pile sampling and analysis program is to inventory particulate matter emissions from the storage and handling of materials. This is done typically by:

1. Collecting "representative" samples of the material;
2. Analyzing the samples to determine moisture and silt contents; and
3. Combining analytical results with material throughput and meteorological information in an emission factor model.

As initial steps in storage pile sampling, it is necessary to decide (a) what emission mechanisms - material load-in to and load-out from the pile, wind erosion of the piles - are of interest, and (b) how many samples can be collected and analyzed, given time and monetary constraints. (In general, annual average PM emissions from material handling can be expected to be

SAMPLING DATA FOR PAVED ROADS

Date Collected _____ Recorded by _____

Sampling location* _____ No. of Lanes _____

Surface type (e.g., asphalt, concrete, etc.)_____

Surface condition (e.g., good, rutted, etc.) _____

* Use code given on plant or road map for segment identification. Indication sampling location on map.

METHOD:

1. Sampling device: portable vacuum cleaner (whisk broom and dustpan if heavy loading present)
2. Sampling depth: loose surface material (do not sample curb areas or other untravelled portions of the road)
3. Sample container: tared and numbered vacuum cleaner bags (bucket with sealable liner if heavy loading present)
4. Gross sample specifications: Vacuum swept samples should be at least 200 g (0.5 lb), with the exposed filter bag weight should be at least 3 to 5 times greater than the empty bag tare weight.

Refer to AP-42 Appendix C.1 for more detailed instructions.

Indicate any deviations from the above: _____

_____

_____

SAMPLING DATA COLLECTED:

Sample No.	Vacuum Bag ID	Vacuum Bag Tare Wgt (g)	Sampling Surface Dimensions (l x w)	Time	Mass of Broom-Swept Sample +

\+ Enter "0" if no broom sweeping is performed.

Figure C.1-4. Example data form for paved roads.

much greater than those from wind erosion.) For an industrial plant, it is recommended that at least 1 sample be collected for each major type of material handled within the facility.

In a program to characterize load-in emissions, representative samples should be collected from material recently loaded into the pile. Similarly, representative samples for load-out emissions should be collected from areas that are worked by load-out equipment such as front end loaders or clamshells. For most "active" piles (i. e., those with frequent load-in and load-out operations), 1 sample may be considered representative of both loaded-in and loaded-out materials. Wind erosion material samples should be representative of the surfaces exposed to the wind.

In general, samples should consist of increments taken from all exposed areas of the pile (i. e., top, middle, and bottom). If the same material is stored in several piles, it is recommended that piles with at least 25 percent of the amount in storage be sampled. For large piles that are common in industrial settings (e. g., quarries, iron and steel plants), access to some portions may be impossible for the person collecting the sample. In that case, increments should be taken no higher than it is practical for a person to climb carrying a shovel and a pail.

Procedure -

The following steps describe the method for collecting samples from storage piles:

1. Sketch plan and elevation views of the pile. Indicate if any portion is not accessible. Use the sketch to plan where the N increments will be taken by dividing the perimeter into N-1 roughly equivalent segments.

    a. For a large pile, collect a minimum of 10 increments, as near to mid-height of the pile as practical.

    b. For a small pile, a sample should be a minimum of 6 increments, evenly distributed among the top, middle, and bottom.

    "Small" or "large" piles, for practical purposes, may be defined as those piles which can or cannot, respectively, be scaled by a person carrying a shovel and pail.

2. Collect material with a straight-point shovel or a small garden spade, and store the increments in a clean, labeled container of suitable size (such as a metal or plastic 19 L [5 gal] bucket) with a sealable polyethylene liner. Depending upon the ultimate goals of the sampling program, choose 1 of the following procedures:

    a. To characterize emissions from *material handling operations at an active pile*, take increments from the portions of the pile which most recently had material added and removed. Collect the material with a shovel to a depth of 10 to 15 centimeters (cm) (4 to 6 inches [in]). Do not deliberately avoid larger pieces of aggregate present on the surface.

    b. To characterize *handling emissions from an inactive pile*, obtain increments of the core material from a 1 m (3 ft) depth in the pile. A sampling tube 2 m (6 ft) long, with a diameter at least 10 times the diameter of the largest particle being sampled, is recommended for these samples. Note that, for piles containing large particles, the diameter recommendation may be impractical.

c. If characterization of *wind erosion*, rather than material handling is the goal of the sampling program, collect the increments by skimming the surface in an upwards direction. The depth of the sample should be 2.5 cm (1 in), or the diameter of the largest particle, whichever is less. Do not deliberately avoid collecting larger pieces of aggregate present on the surface.

In most instances, collection method "a" should be selected.

3. Record the required information on the sample collection sheet (Figure C.1-5). Note the space for deviations from the summarized method.

Sample Specifications -

For any of the procedures, the sample mass collected should be at least 5 kg (10 lb). When most materials are sampled with procedures 2a or 2b, 10 increments will normally result in a sample of at least 23 kg (50 lb). Note that storage pile samples usually require splitting to a size more amenable to laboratory analysis.

SAMPLING DATA FOR STORAGE PILES

Date Collected _____ Recorded by _____

Type of material sampled _____

Sampling location* _____

METHOD:

1. Sampling device: pointed shovel (hollow sampling tube if inactive pile is to be sampled)
2. Sampling depth:
   For material handling of active piles: 10-15 cm (4-6 in.)
   For material handling of inactive piles: 1 m (3 ft)
   For wind erosion samples: 2.5 cm (1 in.) or depth of the largest particle (whichever is less)
3. Sample container: bucket with sealable liner
4. Gross sample specifications:
   For material handling of active or inactive piles: minimum of 6 increments with total sample weight of 5 kg (10 lb) [10 increments totalling 23 kg (50 lb) are recommended]
   For wind erosion samples: minimum of 6 increments with total sample weight of 5 kg (10 lb)

Refer to AP-42 Appendix C.1 for more detailed instructions.

Indicate any deviations from the above: _____
_____
_____

SAMPLING DATA COLLECTED:

Sample No.	Time	Location* of Sample Collection	Device Used S/T **	Depth	Mass of Sample

* Use code given of plant or area map for pile/sample identification. Indicate each sampling location on map.

** Indicate whether shovel or tube.

Figure C.1-5. Example data form for storage piles.

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right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **WT2217491**	Page	: 1 of 6
Client	: **RWDI Air Inc.**	Laboratory	: Waterloo - Environmental
Contact	: Brad Bergeron	Account Manager	: Gayle Braun
Address	: 600 Southgate Drive Guelph ON Canada N1G 4P6	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: 519 823 1311	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 11-Oct-2022 14:30
PO	: ----	Date Analysis Commenced	: 19-Oct-2022
C-O-C number	: ----	Issue Date	: 31-Oct-2022 13:06
Sampler	: ----		
Site	: ----		
Quote number	: Grain Size		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Colby Bingham	Quality Systems Coordinator	Inorganics, Saskatoon, Saskatchewan
Colby Bingham	Quality Systems Coordinator	Sask Soils, Saskatoon, Saskatchewan

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Sample Comments

Sample	Client Id	*Comment*
WT2217491-001	PR1 (Paved Roads)	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.
WT2217491-002	PR2 (Paved Roads)	Sample(s) XXX: Limited sample was available for PSA (100g minimum is standard). Measurement Uncertainty for PSA results may be higher than usual.

Analytical Results

Sub-Matrix: Soil/Solid
(Matrix: Soil/Solid)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	PR1 (Paved Roads)	PR2 (Paved Roads)	PR3 (Paved Roads)	PR4 (Paved Roads)	UP1 (Unpaved Roads)
					Client sampling date / time	05-Oct-2022 11:12	05-Oct-2022 11:50	05-Oct-2022 12:40	05-Oct-2022 13:14	05-Oct-2022 13:47
						WT2217491-001	WT2217491-002	WT2217491-003	WT2217491-004	WT2217491-005
						Result	Result	Result	Result	Result
Particle Size										
passing (9.5 mm)	----	E181	1.0	%		100	100	100	100	89.6
sand (2.0mm - 0.05mm)	----	E180	1.0	%		58.3	51.6	78.1	73.1	74.2
passing (4.75 mm)	----	E181	1.0	%		100	95.5	94.3	95.6	74.1
silt (0.05mm - 0.002mm)	----	E180	1.0	%		29.6	29.0	11.7	15.6	18.5
clay (<0.002mm)	----	E180	1.0	%		12.1	19.4	10.2	11.2	7.2
passing (19 mm)	----	E181	1.0	%		100	100	100	100	100
passing (25.4 mm)	----	E181	1.0	%		100	100	100	100	100
texture class	----	E180	-	-		Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Loam
passing (38.1 mm)	----	E181	1.0	%		100	100	100	100	100
passing (50.8 mm)	----	E181	1.0	%		100	100	100	100	100
passing (76.2 mm)	----	E181	1.0	%		100	100	100	100	100
passing (1.0 mm)	----	E182	1.0	%		91.5	78.8	65.8	78.2	50.4
passing (0.841 mm)	----	E182	1.0	%		90.6	77.2	62.8	76.4	48.5
passing (0.50 mm)	----	E182	1.0	%		86.2	71.0	49.3	64.3	39.2
passing (0.420 mm)	----	E182	1.0	%		85.0	69.4	46.1	61.3	36.9
passing (0.250 mm)	----	E182	1.0	%		77.7	63.2	36.1	48.4	29.1
passing (0.149 mm)	----	E182	1.0	%		66.8	56.4	27.3	36.6	22.8
passing (0.125 mm)	----	E182	1.0	%		61.3	51.4	24.5	33.0	20.9
passing (0.075 mm)	----	E182	1.0	%		49.8	41.1	18.8	25.6	16.8
passing (0.063 mm)	----	E182	1.0	%		43.0	39.9	17.2	23.4	15.1
passing (0.05 mm)	----	E182	1.0	%		35.7	38.6	15.7	21.0	13.2
passing (0.0312 mm)	----	E183	1.0	%		23.4	32.8	14.3	17.5	10.4
passing (0.020 mm)	----	E183	1.0	%		18.4	27.8	12.1	15.2	8.7
passing (0.005 mm)	----	E183	1.0	%		13.6	20.1	9.8	11.6	5.2
passing (0.004 mm)	----	E183	1.0	%		12.8	18.9	9.0	11.0	4.5
passing (0.002 mm)	----	E183	1.0	%		11.6	16.6	8.0	9.1	3.4
grain size curve	----	E185	-	-		See Attached	See Attached	See Attached	See Attached	See Attached
passing (2.0 mm)	----	E181	1.0	%		96.7	87.7	83.4	88.7	61.1

Please refer to the General Comments section for an explanation of any qualifiers detected.

Analytical Results

Sub-Matrix: Soil/Solid
(Matrix: Soil/Solid)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	UP2 (Unpaved Roads)	UP3 (Unpaved Roads)	UP4 (Unpaved Roads)	UP5 (Unpaved Roads)	UP6 (Unpaved Roads)
					Client sampling date / time	05-Oct-2022 14:22	05-Oct-2022 14:52	05-Oct-2022 15:57	05-Oct-2022 16:18	05-Oct-2022 16:48
						WT2217491-006	WT2217491-007	WT2217491-008	WT2217491-009	WT2217491-010
						Result	Result	Result	Result	Result
Particle Size										
passing (9.5 mm)	----	E181	1.0	%		100	100	98.9	89.3	94.5
sand (2.0mm - 0.05mm)	----	E180	1.0	%		16.7	20.0	40.8	76.5	69.5
passing (4.75 mm)	----	E181	1.0	%		99.4	97.9	93.6	79.1	78.0
silt (0.05mm - 0.002mm)	----	E180	1.0	%		43.6	45.8	35.2	15.2	18.4
clay (<0.002mm)	----	E180	1.0	%		39.7	34.2	24.0	8.3	12.1
passing (19 mm)	----	E181	1.0	%		100	100	100	93.9	100
passing (25.4 mm)	----	E181	1.0	%		100	100	100	100	100
texture class	----	E180	-	-		Silty Clay	Clay Loam	Loam	Sandy Loam	Sandy Loam
passing (38.1 mm)	----	E181	1.0	%		100	100	100	100	100
passing (50.8 mm)	----	E181	1.0	%		100	100	100	100	100
passing (76.2 mm)	----	E181	1.0	%		100	100	100	100	100
passing (1.0 mm)	----	E182	1.0	%		93.5	89.8	74.5	47.7	50.8
passing (0.841 mm)	----	E182	1.0	%		93.0	89.4	72.8	44.8	48.8
passing (0.50 mm)	----	E182	1.0	%		91.4	87.5	66.2	34.8	39.9
passing (0.420 mm)	----	E182	1.0	%		91.0	87.0	64.6	32.3	37.7
passing (0.250 mm)	----	E182	1.0	%		89.5	84.2	59.7	25.1	29.3
passing (0.149 mm)	----	E182	1.0	%		86.0	79.5	54.9	19.7	23.6
passing (0.125 mm)	----	E182	1.0	%		84.6	78.1	53.5	18.3	22.2
passing (0.075 mm)	----	E182	1.0	%		81.5	75.2	50.7	15.4	19.2
passing (0.063 mm)	----	E182	1.0	%		81.0	72.6	48.3	13.4	17.5
passing (0.05 mm)	----	E182	1.0	%		80.5	69.7	45.7	11.5	15.8
passing (0.0312 mm)	----	E183	1.0	%		76.5	65.1	42.1	9.8	14.3
passing (0.020 mm)	----	E183	1.0	%		69.9	59.6	37.4	8.6	13.0
passing (0.005 mm)	----	E183	1.0	%		46.6	38.4	24.4	6.2	8.9
passing (0.004 mm)	----	E183	1.0	%		43.3	34.8	22.9	5.6	7.6
passing (0.002 mm)	----	E183	1.0	%		34.8	26.2	18.1	5.0	5.7
grain size curve	----	E185	-	-		See Attached	See Attached	See Attached	See Attached	See Attached
passing (2.0 mm)	----	E181	1.0	%		96.6	92.3	85.1	65.0	62.8

Please refer to the General Comments section for an explanation of any qualifiers detected.

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QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WT2217491**	Page	: 1 of 10
Client	: **RWDI Air Inc.**	Laboratory	: Waterloo - Environmental
Contact	: Brad Bergeron	Account Manager	: Gayle Braun
Address	: 600 Southgate Drive Guelph ON Canada N1G 4P6	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 519 823 1311	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 11-Oct-2022 14:30
PO	: ----	Issue Date	: 31-Oct-2022 13:11
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: Grain Size		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Duplicate outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : CSSC Particle Size Classification by Hydrometer										
Glass soil jar/Teflon lined cap PR1 (Paved Roads)	E180	05-Oct-2022	----	----	----		24-Oct-2022	365 days	19 days	✓
Particle Size : CSSC Particle Size Classification by Hydrometer										
Glass soil jar/Teflon lined cap PR2 (Paved Roads)	E180	05-Oct-2022	----	----	----		24-Oct-2022	365 days	19 days	✓
Particle Size : CSSC Particle Size Classification by Hydrometer										
Glass soil jar/Teflon lined cap PR3 (Paved Roads)	E180	05-Oct-2022	----	----	----		24-Oct-2022	365 days	19 days	✓
Particle Size : CSSC Particle Size Classification by Hydrometer										
Glass soil jar/Teflon lined cap PR4 (Paved Roads)	E180	05-Oct-2022	----	----	----		24-Oct-2022	365 days	19 days	✓
Particle Size : CSSC Particle Size Classification by Hydrometer										
Glass soil jar/Teflon lined cap UP1 (Unpaved Roads)	E180	05-Oct-2022	----	----	----		24-Oct-2022	365 days	19 days	✓
Particle Size : CSSC Particle Size Classification by Hydrometer										
Glass soil jar/Teflon lined cap UP2 (Unpaved Roads)	E180	05-Oct-2022	----	----	----		24-Oct-2022	365 days	19 days	✓
Particle Size : CSSC Particle Size Classification by Hydrometer										
Glass soil jar/Teflon lined cap UP3 (Unpaved Roads)	E180	05-Oct-2022	----	----	----		24-Oct-2022	365 days	19 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : CSSC Particle Size Classification by Hydrometer										
Glass soil jar/Teflon lined cap UP4 (Unpaved Roads)	E180	05-Oct-2022	----	----	----		24-Oct-2022	365 days	19 days	✓
Particle Size : CSSC Particle Size Classification by Hydrometer										
Glass soil jar/Teflon lined cap UP5 (Unpaved Roads)	E180	05-Oct-2022	----	----	----		24-Oct-2022	365 days	19 days	✓
Particle Size : CSSC Particle Size Classification by Hydrometer										
Glass soil jar/Teflon lined cap UP6 (Unpaved Roads)	E180	05-Oct-2022	----	----	----		24-Oct-2022	365 days	19 days	✓
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap PR1 (Paved Roads)	E185	05-Oct-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap PR2 (Paved Roads)	E185	05-Oct-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap PR3 (Paved Roads)	E185	05-Oct-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap PR4 (Paved Roads)	E185	05-Oct-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap UP1 (Unpaved Roads)	E185	05-Oct-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap UP2 (Unpaved Roads)	E185	05-Oct-2022	----	----	----		26-Oct-2022	----	----	

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap UP3 (Unpaved Roads)	E185	05-Oct-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap UP4 (Unpaved Roads)	E185	05-Oct-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap UP5 (Unpaved Roads)	E185	05-Oct-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap UP6 (Unpaved Roads)	E185	05-Oct-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap PR1 (Paved Roads)	E183	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap PR2 (Paved Roads)	E183	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap PR3 (Paved Roads)	E183	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap PR4 (Paved Roads)	E183	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap UP1 (Unpaved Roads)	E183	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap UP2 (Unpaved Roads)	E183	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap UP3 (Unpaved Roads)	E183	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap UP4 (Unpaved Roads)	E183	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap UP5 (Unpaved Roads)	E183	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap UP6 (Unpaved Roads)	E183	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap PR1 (Paved Roads)	E182	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap PR2 (Paved Roads)	E182	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap PR3 (Paved Roads)	E182	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap PR4 (Paved Roads)	E182	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap UP1 (Unpaved Roads)	E182	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap UP2 (Unpaved Roads)	E182	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap UP3 (Unpaved Roads)	E182	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap UP4 (Unpaved Roads)	E182	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap UP5 (Unpaved Roads)	E182	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap UP6 (Unpaved Roads)	E182	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap PR1 (Paved Roads)	E181	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap PR2 (Paved Roads)	E181	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap PR3 (Paved Roads)	E181	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap PR4 (Paved Roads)	E181	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap UP1 (Unpaved Roads)	E181	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap UP2 (Unpaved Roads)	E181	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap UP3 (Unpaved Roads)	E181	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap UP4 (Unpaved Roads)	E181	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap UP5 (Unpaved Roads)	E181	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap UP6 (Unpaved Roads)	E181	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
CSSC Particle Size Classification by Hydrometer	E180	711525	1	13	7.6	5.0	✓
Particle Size Analysis - Hydrometer	E183	706746	1	14	7.1	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	706744	1	14	7.1	5.0	✓
Laboratory Control Samples (LCS)							
CSSC Particle Size Classification by Hydrometer	E180	711525	1	13	7.6	5.0	✓
Particle Size Analysis - Hydrometer	E183	706746	1	14	7.1	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	706744	1	14	7.1	5.0	✓
Particle Size Analysis - Sieve >2mm	E181	706743	1	14	7.1	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
CSSC Particle Size Classification by Hydrometer	E180 Saskatoon - Environmental	Soil/Solid	CCME Vol 4 Analytical Methods	A soil sample is disaggregated to pass a 2mm sieve. The <2mm specimen is then further disaggregated using Calgon solution and suspended in solution. Two hydrometer readings are measured at specific times to determine %clay and %silt+clay using the principles of Stokes' law. %silt and %sand are determined mathematically.
Particle Size Analysis - Sieve >2mm	E181 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material retained on the sieve is then further sieved through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Sieve <2mm	E182 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material passed through the sieve is then further disaggregated using calgon solution and passed through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Hydrometer	E183 Saskatoon - Environmental	Soil/Solid	ASTM D7928-21 (mod)	Soil material is separated from coarse material (>2mm). A specimen is then disaggregated through mixing with Calgon solution. The material is then suspended in solution wherein regular hydrometer readings are taken at specific time intervals. The principles of Stokes' Law are applied to determine the amount of material remaining in solution as well as the maximum particle size remaining in solution at the specified time.
Grain Size Report (Attachment) Hydrometer/Sieve Method	E185 Saskatoon - Environmental	Soil/Solid	ASTM D6913/D7928	A grain size curve is a graphical representation of the particle sizing of a sample representing the percent passing against the effective particle size.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dry and Grind in Soil/Solid <60°C	EPP442 Waterloo - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **WT2217491**	Page	: 1 of 6
Client	: RWDI Air Inc.	Laboratory	: Waterloo - Environmental
Contact	: Brad Bergeron	Account Manager	: Gayle Braun
Address	: 600 Southgate Drive Guelph ON Canada N1G 4P6	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	:	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 11-Oct-2022 14:30
PO	: ----	Date Analysis Commenced	: 19-Oct-2022
C-O-C number	: ----	Issue Date	: 31-Oct-2022 13:07
Sampler	: ---- 519 823 1311		
Site	: ----		
Quote number	: Grain Size		
No. of samples received	: 10		
No. of samples analysed	: 10		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Colby Bingham	Quality Systems Coordinator	Saskatoon Inorganics, Saskatoon, Saskatchewan
Colby Bingham	Quality Systems Coordinator	Saskatoon Sask Soils, Saskatoon, Saskatchewan

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	Client sample ID	Analyte	CAS Number	Method	LOR	Unit	Original Result	Duplicate Result	RPD(%) or Difference	Duplicate Limits	Qualifier
Particle Size (QC Lot: 706744)											
SK2205976-012	Anonymous	passing (0.05 mm)	----	E182	1.0	%	53.7	52.5	2.22%	15%	----
		passing (0.063 mm)	----	E182	1.0	%	61.8	61.4	0.684%	15%	----
		passing (0.075 mm)	----	E182	1.0	%	69.2	69.5	0.401%	15%	----
		passing (0.125 mm)	----	E182	1.0	%	79.5	80.0	0.658%	15%	----
		passing (0.149 mm)	----	E182	1.0	%	84.4	85.0	0.759%	15%	----
		passing (0.250 mm)	----	E182	1.0	%	91.3	91.6	0.400%	15%	----
		passing (0.420 mm)	----	E182	1.0	%	97.4	97.5	0.0587%	15%	----
		passing (0.50 mm)	----	E182	1.0	%	98.0	98.0	0.0286%	15%	----
		passing (0.841 mm)	----	E182	1.0	%	99.5	99.4	0.0638%	15%	----
		passing (1.0 mm)	----	E182	1.0	%	99.6	99.5	0.0575%	15%	----
Particle Size (QC Lot: 706746)											
SK2205976-012	Anonymous	passing (0.002 mm)	----	E183	1.0	%	8.7	7.7	1.0	Diff <2x LOR	----
		passing (0.004 mm)	----	E183	1.0	%	11.0	9.9	10.7%	20%	----
		passing (0.005 mm)	----	E183	1.0	%	12.4	11.2	10.3%	20%	----
		passing (0.020 mm)	----	E183	1.0	%	27.0	24.3	10.7%	20%	----
		passing (0.0312 mm)	----	E183	1.0	%	37.8	34.6	9.10%	20%	----
Particle Size (QC Lot: 711525)											
WT2217491-001	PR1 (Paved Roads)	clay (<0.002mm)	----	E180	1.0	%	12.1	11.2	0.8	Diff <2x LOR	----
		sand (2.0mm - 0.05mm)	----	E180	1.0	%	58.3	60.2	3.33%	10%	----
		silt (0.05mm - 0.002mm)	----	E180	1.0	%	29.6	28.5	3.82%	10%	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Particle Size (QCLot: 706743)									
	RM	passing (19 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (2.0 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (25.4 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (38.1 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (4.75 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (50.8 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (76.2 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (9.5 mm)	----	E181	100 %	100	90.0	110	----
Particle Size (QCLot: 706744)									
	RM	passing (0.05 mm)	----	E182	49.81 %	101	90.0	110	----
	RM	passing (0.063 mm)	----	E182	54.27 %	99.2	90.8	109	----
	RM	passing (0.075 mm)	----	E182	58.38 %	98.0	91.4	109	----
	RM	passing (0.125 mm)	----	E182	68.06 %	97.9	92.7	107	----
	RM	passing (0.149 mm)	----	E182	72.71 %	97.9	93.1	107	----
	RM	passing (0.250 mm)	----	E182	85.38 %	98.9	94.1	106	----
	RM	passing (0.420 mm)	----	E182	92.78 %	99.8	94.6	105	----
	RM	passing (0.50 mm)	----	E182	93.78 %	99.8	94.7	105	----
	RM	passing (0.841 mm)	----	E182	97.34 %	99.8	94.9	105	----
	RM	passing (1.0 mm)	----	E182	97.77 %	99.8	94.9	105	----
Particle Size (QCLot: 706746)									
	RM	passing (0.002 mm)	----	E183	21.14 %	102	76.0	124	----
	RM	passing (0.004 mm)	----	E183	24.64 %	104	80.0	120	----
	RM	passing (0.005 mm)	----	E183	25.91 %	104	82.0	118	----
	RM	passing (0.020 mm)	----	E183	37.12 %	102	87.0	113	----
	RM	passing (0.0312 mm)	----	E183	42.58 %	102	88.0	112	----
Particle Size (QCLot: 711525)									
	RM	clay (<0.002mm)	----	E180	24.39 %	93.6	80.0	120	----
	RM	sand (2.0mm - 0.05mm)	----	E180	47.72 %	100	90.0	110	----

Sub-Matrix:

Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Particle Size (QCLot: 711525) - continued									
	RM	silt (0.05mm - 0.002mm)	----	E180	27.88 %	106	82.0	118	----

ALS Laboratory Group

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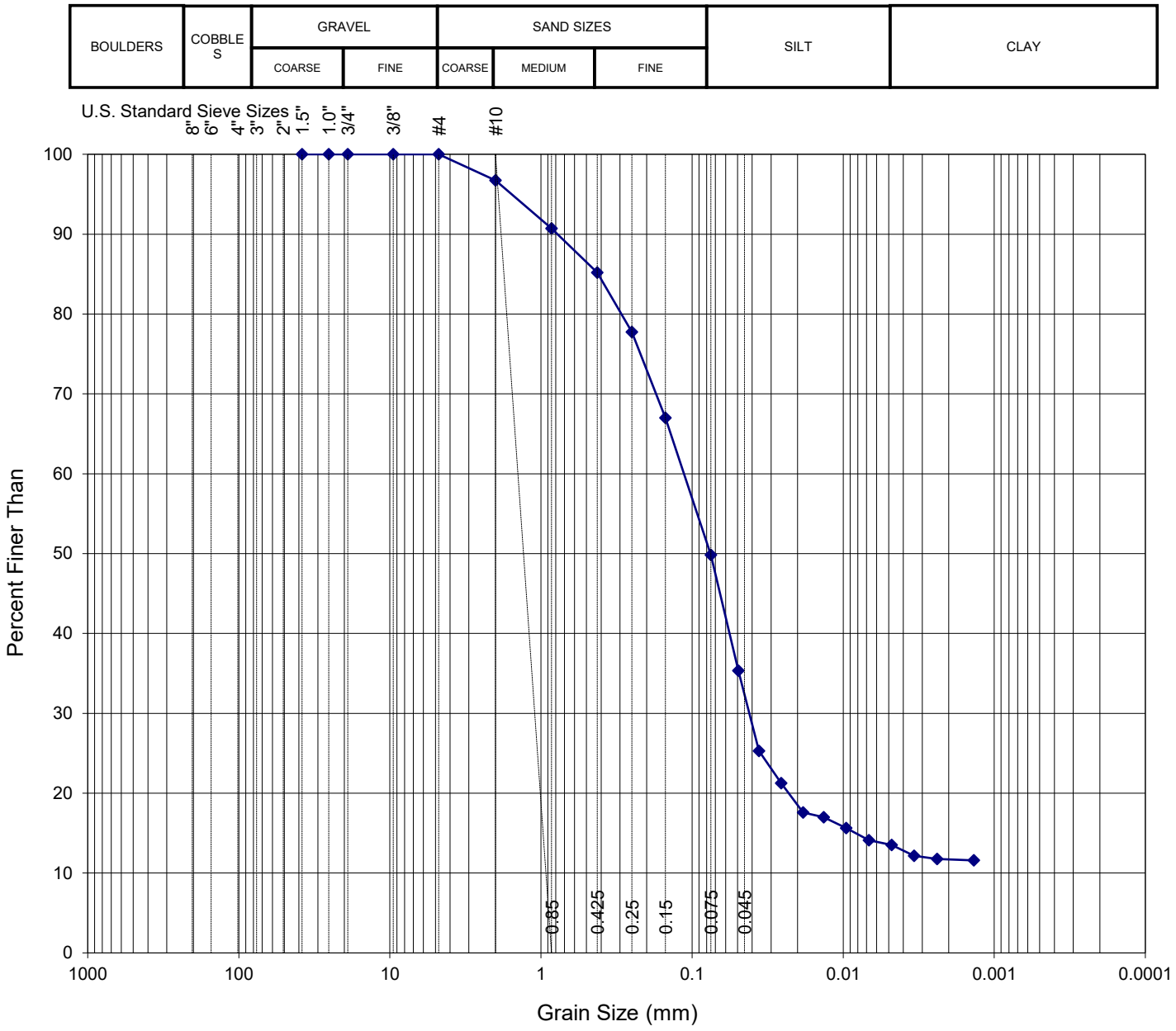
PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	WT2217491001
Project Number:	
Client Sample ID	PR1 (Paved Roads)
Lab Sample ID	WT2217491001
Date Sample Received	00-Jan-00
Test Completion Date:	26-Oct-22
Analyst:	AC97



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	<1	> 4.75
% COARSE SAND :	3.28	2.0 - 4.75
% MEDIUM SAND :	11.52	0.425 - 2.0
% FINE SAND :	35.37	0.075 - 0.425
% SILT :	36.24	0.075 - 0.005
% CLAY :	13.59	< 0.005

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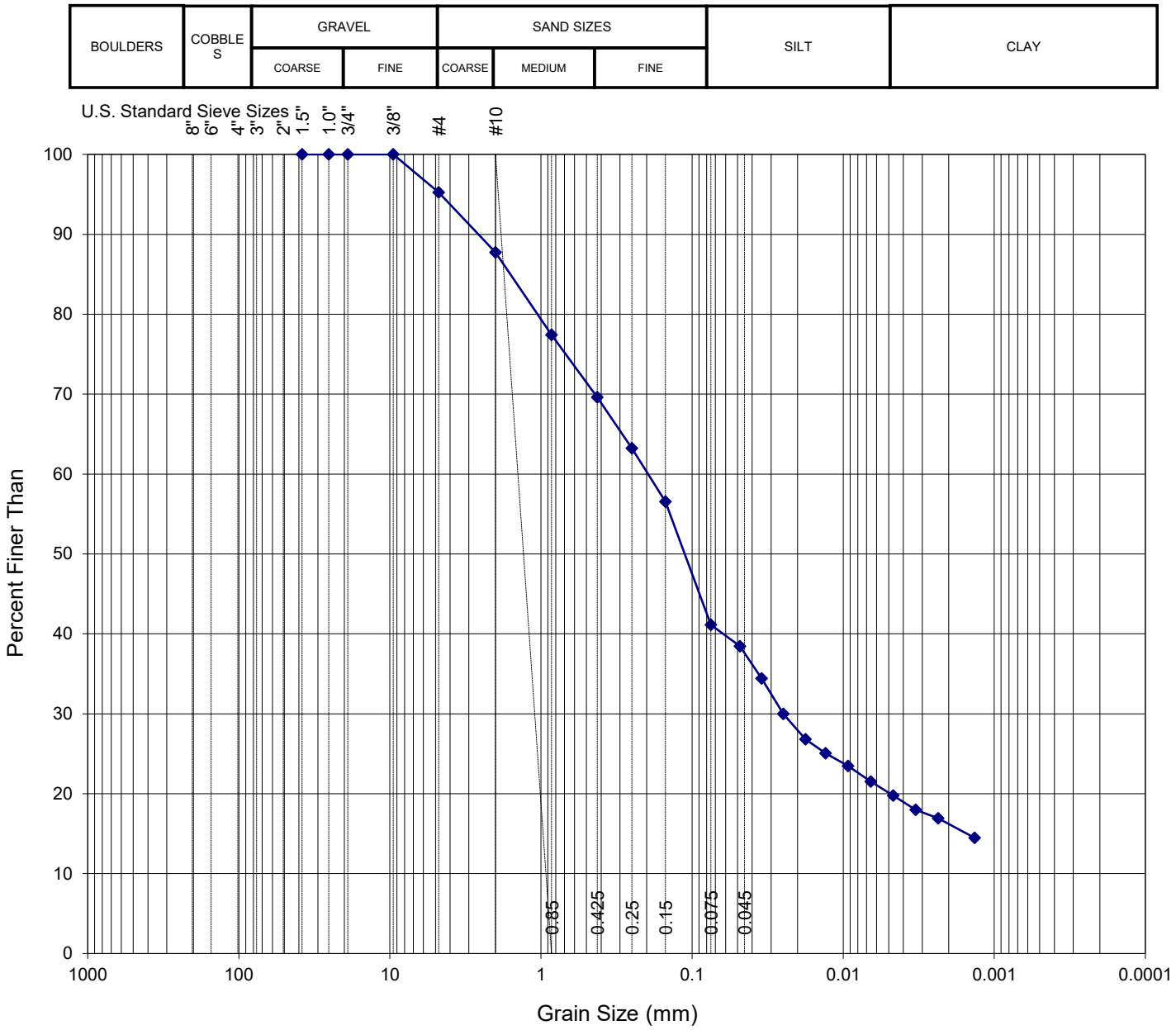
PARTICLE SIZE DISTRIBUTION CURVE

Client Name: WT2217491002
Project Number:
Client Sample ID PR2 (Paved Roads)
Lab Sample ID WT2217491002
Date Sample Received 00-Jan-00
Test Completion Date: 26-Oct-22
Analyst: AC97



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	4.75	> 4.75
% COARSE SAND :	7.53	2.0 - 4.75
% MEDIUM SAND :	18.10	0.425 - 2.0
% FINE SAND :	28.49	0.075 - 0.425
% SILT :	21.01	0.075 - 0.005
% CLAY :	20.12	< 0.005

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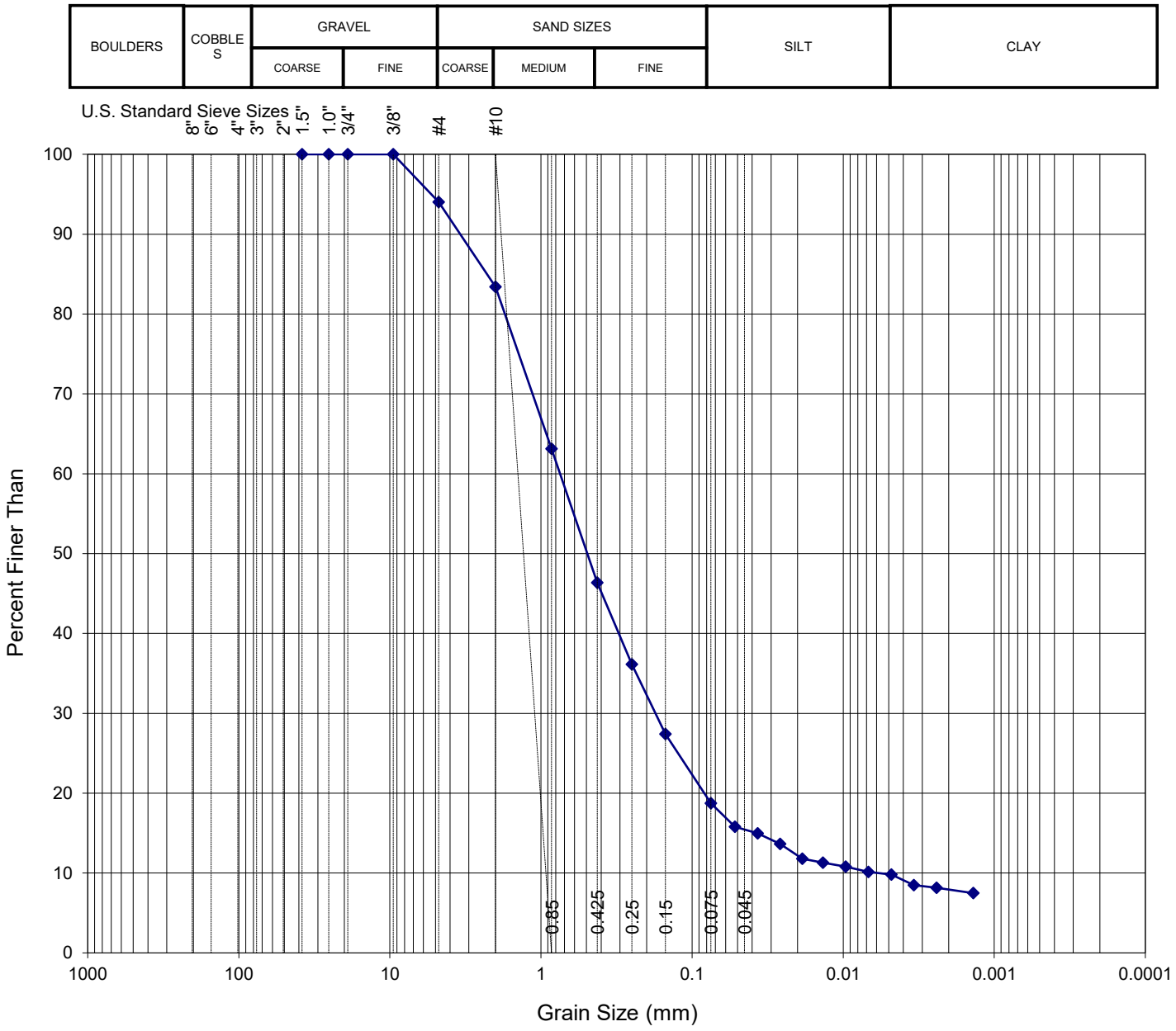
PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	WT2217491003
Project Number:	
Client Sample ID	PR3 (Paved Roads)
Lab Sample ID	WT2217491003
Date Sample Received	00-Jan-00
Test Completion Date:	26-Oct-22
Analyst:	AC97



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	5.97	> 4.75
% COARSE SAND :	10.64	2.0 - 4.75
% MEDIUM SAND :	37.02	0.425 - 2.0
% FINE SAND :	27.61	0.075 - 0.425
% SILT :	8.90	0.075 - 0.005
% CLAY :	9.85	< 0.005

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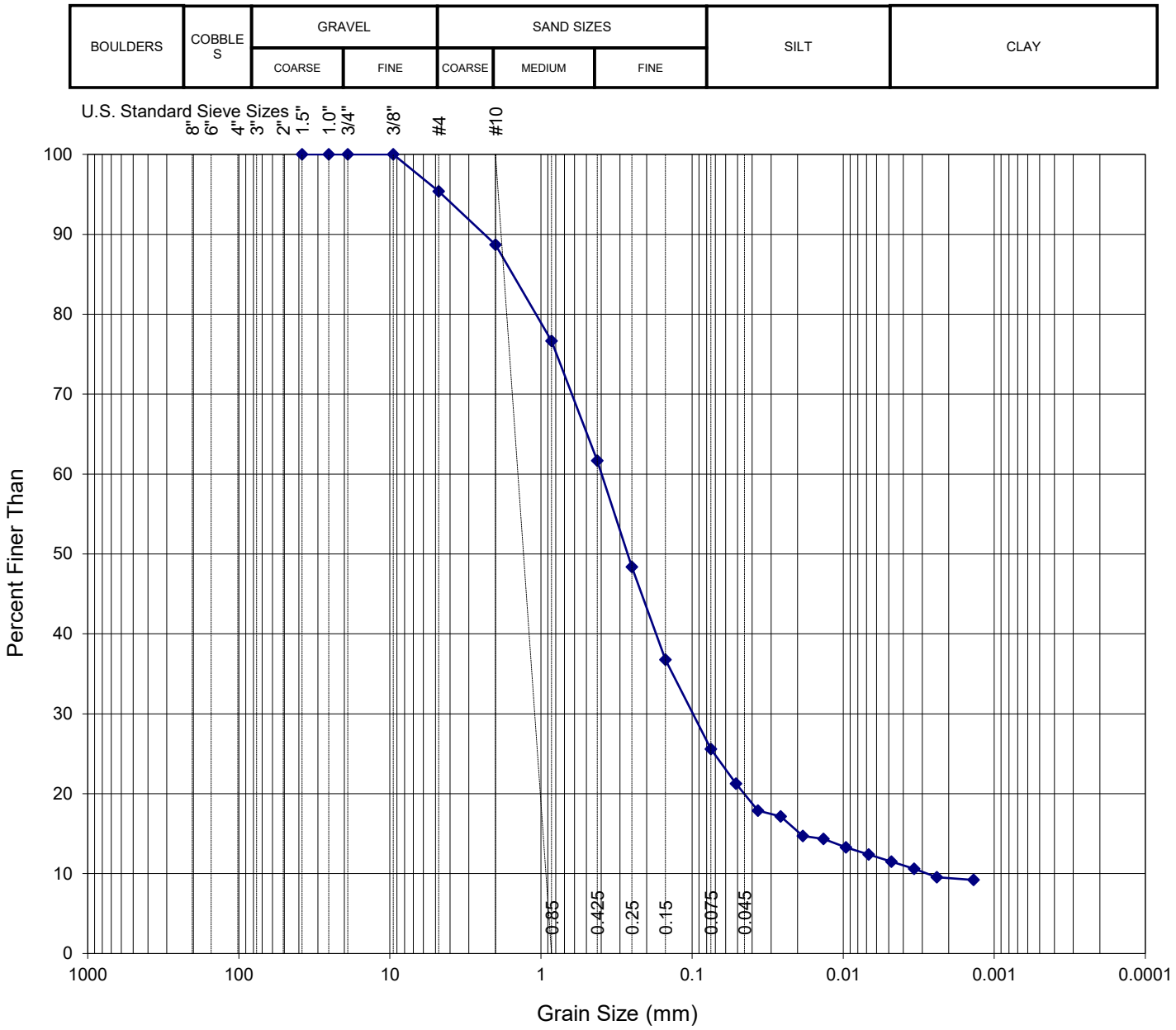
PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	WT2217491004
Project Number:	
Client Sample ID	PR4 (Paved Roads)
Lab Sample ID	WT2217491004
Date Sample Received	00-Jan-00
Test Completion Date:	26-Oct-22
Analyst:	AC97



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	4.64	> 4.75
% COARSE SAND :	6.66	2.0 - 4.75
% MEDIUM SAND :	27.02	0.425 - 2.0
% FINE SAND :	36.11	0.075 - 0.425
% SILT :	13.96	0.075 - 0.005
% CLAY :	11.62	< 0.005

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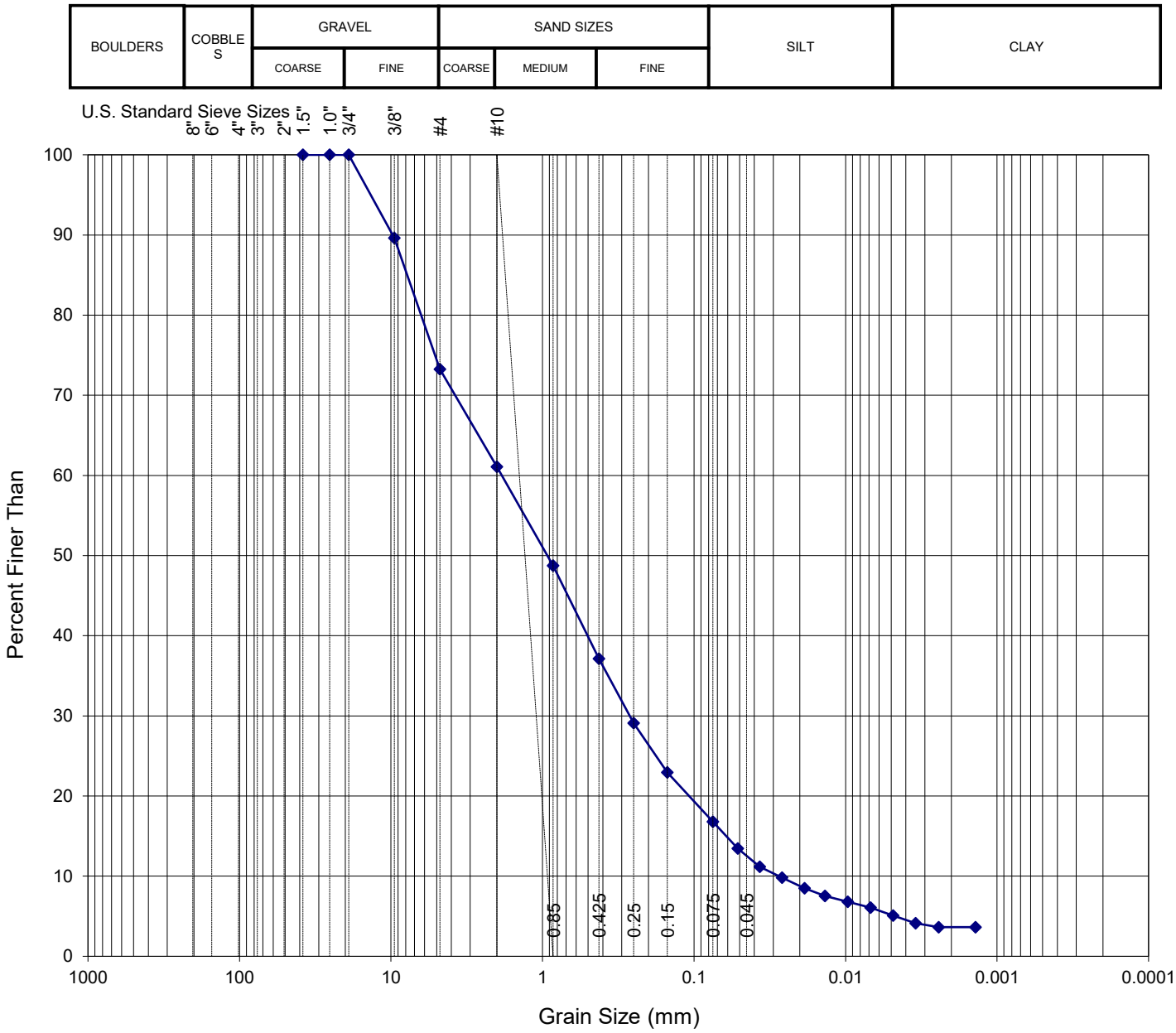
PARTICLE SIZE DISTRIBUTION CURVE

Client Name: WT2217491005
Project Number:
Client Sample ID UP1 (Unpaved Roads)
Lab Sample ID WT2217491005
Date Sample Received 00-Jan-00
Test Completion Date: 26-Oct-22
Analyst: AC97



METHOD DESCRIPTION
Method Reference: ASTM D6913 & D7928
Dispersion method: Mechanical
Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES
Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	26.74	> 4.75
% COARSE SAND :	12.17	2.0 - 4.75
% MEDIUM SAND :	23.95	0.425 - 2.0
% FINE SAND :	20.33	0.075 - 0.425
% SILT :	11.63	0.075 - 0.005
% CLAY :	5.18	< 0.005

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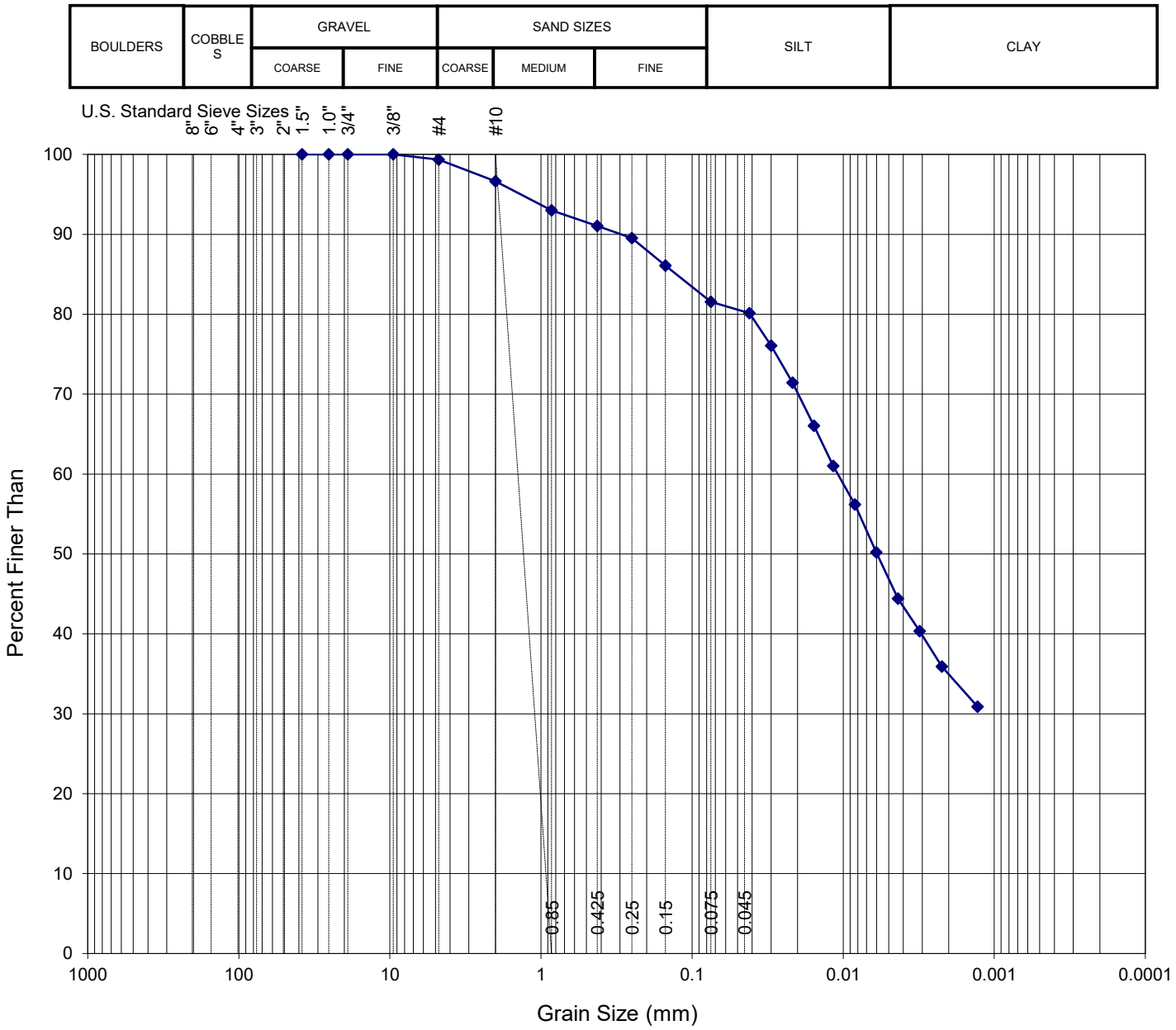
PARTICLE SIZE DISTRIBUTION CURVE

Client Name: WT2217491006
Project Number:
Client Sample ID UP2 (Unpaved Roads)
Lab Sample ID WT2217491006
Date Sample Received 00-Jan-00
Test Completion Date: 26-Oct-22
Analyst: AC97



METHOD DESCRIPTION
Method Reference: ASTM D6913 & D7928
Dispersion method: Mechanical
Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES
Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	<1	> 4.75
% COARSE SAND :	2.74	2.0 - 4.75
% MEDIUM SAND :	5.57	0.425 - 2.0
% FINE SAND :	9.51	0.075 - 0.425
% SILT :	34.66	0.075 - 0.005
% CLAY :	46.88	< 0.005

ALS Laboratory Group

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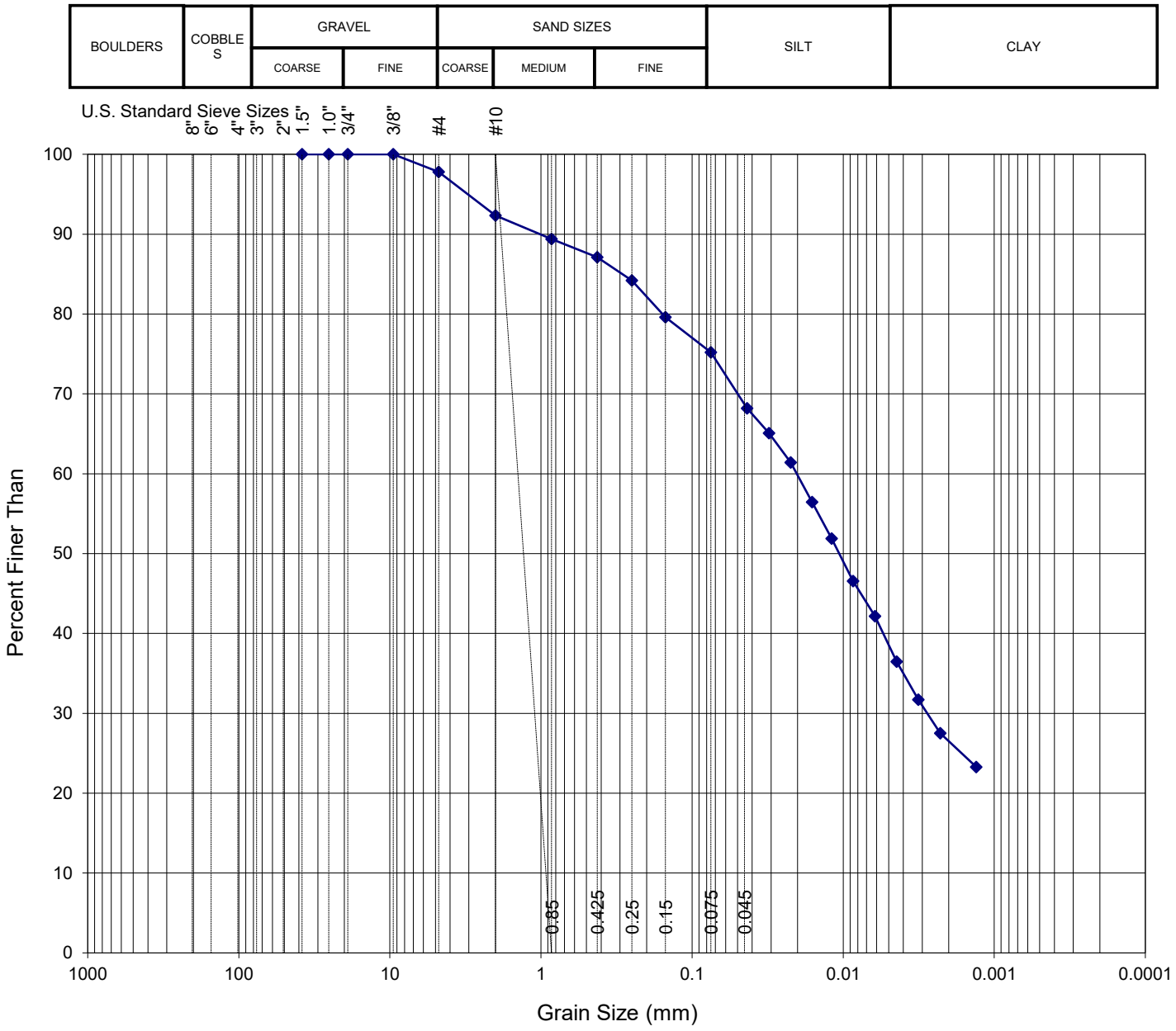
PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	WT2217491007
Project Number:	
Client Sample ID	UP3 (Unpaved Roads)
Lab Sample ID	WT2217491007
Date Sample Received	00-Jan-00
Test Completion Date:	26-Oct-22
Analyst:	AC97



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

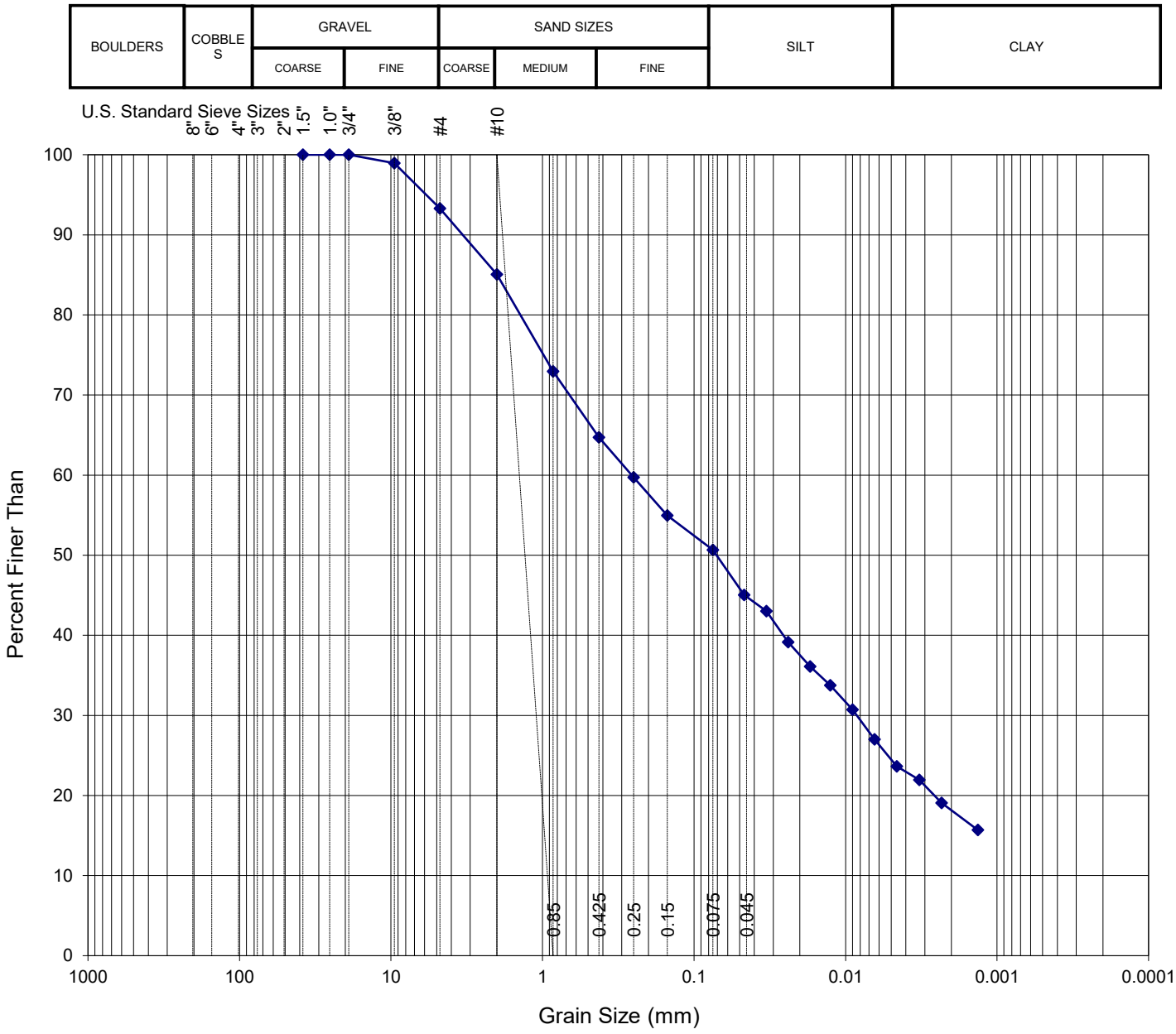
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	2.20	> 4.75
% COARSE SAND :	5.47	2.0 - 4.75
% MEDIUM SAND :	5.21	0.425 - 2.0
% FINE SAND :	11.91	0.075 - 0.425
% SILT :	36.64	0.075 - 0.005
% CLAY :	38.57	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name: WT2217491008
Project Number:
Client Sample ID UP4 (Unpaved Roads)
Lab Sample ID WT2217491008
Date Sample Received 00-Jan-00
Test Completion Date: 26-Oct-22
Analyst: AC97



METHOD DESCRIPTION
Method Reference: ASTM D6913 & D7928
Dispersion method: Mechanical
Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES
Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

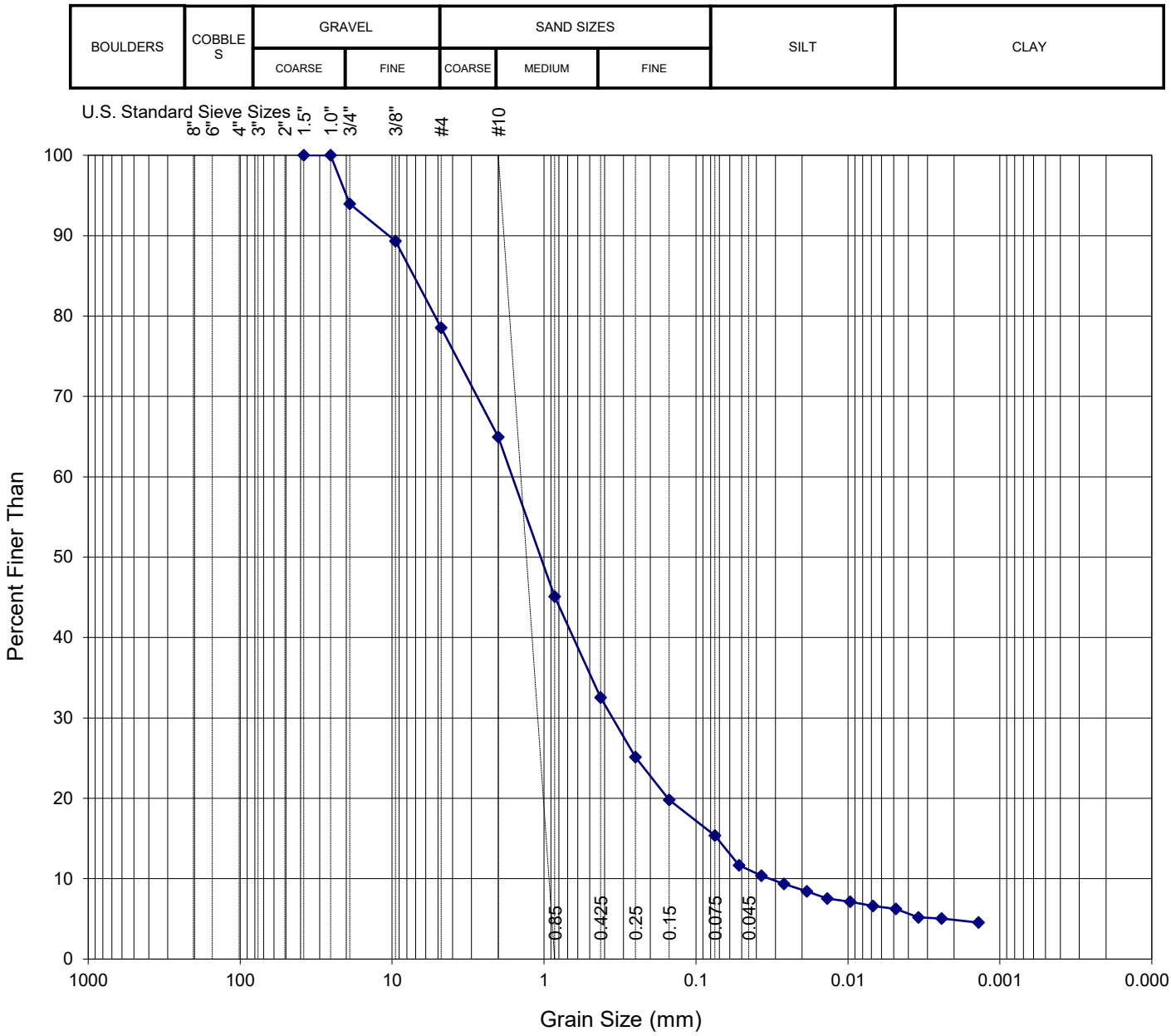
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	6.69	> 4.75
% COARSE SAND :	8.24	2.0 - 4.75
% MEDIUM SAND :	20.34	0.425 - 2.0
% FINE SAND :	14.06	0.075 - 0.425
% SILT :	26.19	0.075 - 0.005
% CLAY :	24.48	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	WT2217491009
Project Number:	
Client Sample ID	UP5 (Unpaved Roads)
Lab Sample ID	WT2217491009
Date Sample Received	00-Jan-00
Test Completion Date:	26-Oct-22
Analyst:	AC97



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

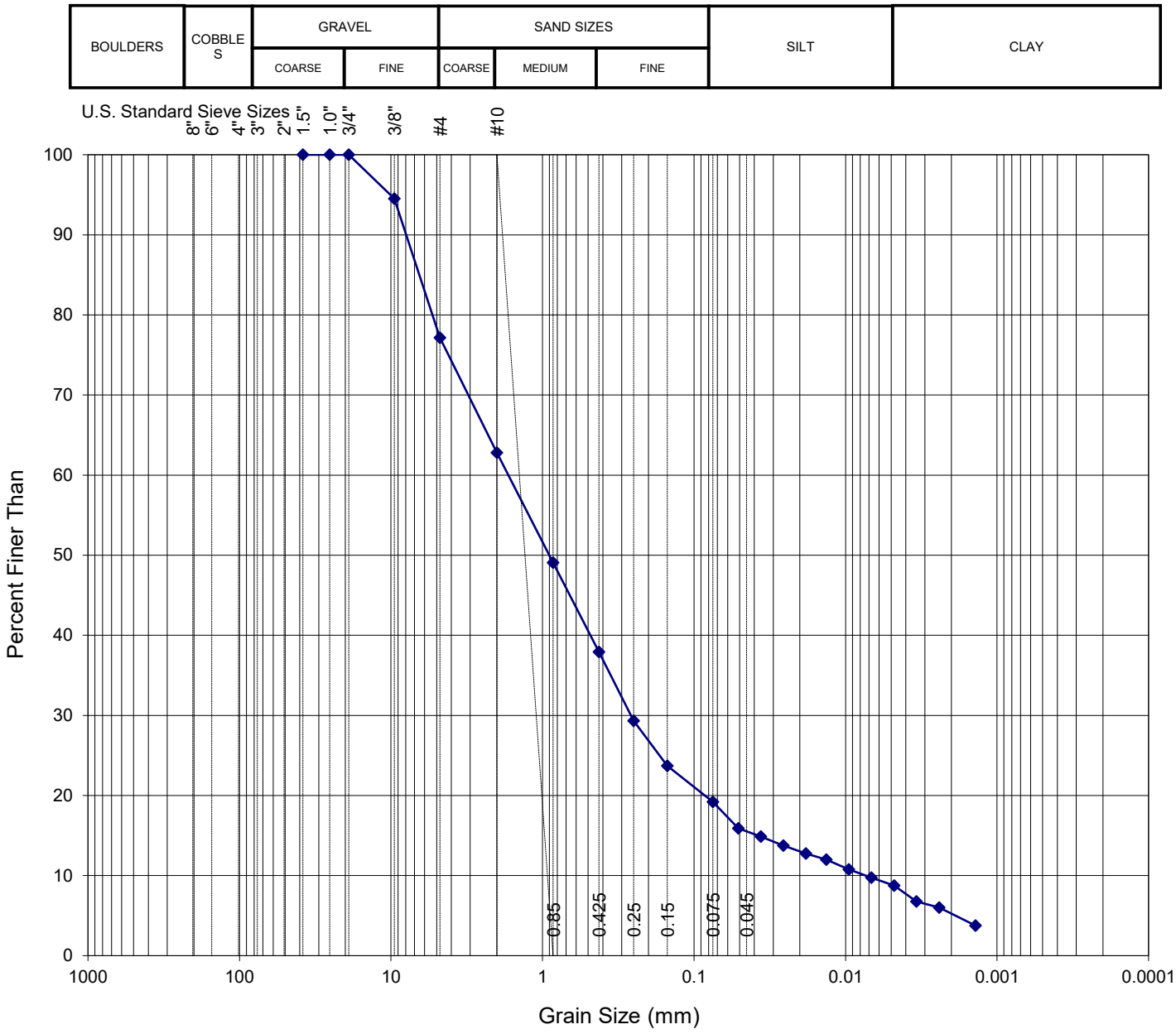
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	21.47	> 4.75
% COARSE SAND :	13.58	2.0 - 4.75
% MEDIUM SAND :	32.40	0.425 - 2.0
% FINE SAND :	17.19	0.075 - 0.425
% SILT :	9.09	0.075 - 0.005
% CLAY :	6.27	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name: WT2217491010
Project Number:
Client Sample ID UP6 (Unpaved Roads)
Lab Sample ID WT2217491010
Date Sample Received 00-Jan-00
Test Completion Date: 26-Oct-22
Analyst: AC97



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular
Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	22.86	> 4.75
% COARSE SAND :	14.36	2.0 - 4.75
% MEDIUM SAND :	24.85	0.425 - 2.0
% FINE SAND :	18.74	0.075 - 0.425
% SILT :	10.30	0.075 - 0.005
% CLAY :	8.89	< 0.005

Chain of Custody (COC) / Analytical Request Form

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 -

Page of

Report To	Contact and company name below will appear on the final report
Company:	RWDI
Contact:	Brad Bergeron
Phone:	519-823-1311
	Company address below will appear on the final report
Street:	600 Southgate DR
City/Province:	Guelph ON
Postal Code:	N1G 4P6
Invoice To	Same as Report To ☒ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☐ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☒ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: Matthew.Butts@RWDI.com

Email 2: Sarah.Pellatt@RWDI.com

Email 3: Brad.Bergeron@RWDI.com

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: Brad.Bergeron@RWDI.com

Email 2: Sarah.Pellatt@RWDI.com

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ | 3 day [P3-25%] ☐ | 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E - 100%] ☐ | Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information

ALS Account # / Quote #:	
Job #:	
PO / AFE:	
LSD:	
ALS Lab Work Order # (lab use only):	WT2217491

Oil and Gas Required Fields (client use)

AFE/Cost Center:	PO#
Major/Minor Code:	Routing Code:
Requisitioner:	
Location:	
ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Full grain size	Moisture Content	Silt content	PM 2.44	PM 10	PM 2.5
	PR1 (Paved Roads)	05/Oct/22	11:02	Soil	1	✓	✓	✓	✓	✓	✓
	PR2 " "	"	11:50	"	1	✓	✓	✓	✓	✓	✓
	PR3 " "	"	12:40	"	1	✓	✓	✓	✓	✓	✓
	PR4 " "	"	13:14	"	1	✓	✓	✓	✓	✓	✓
	UP1 (Unpaved Roads)	"	13:47	"	1	✓	✓	✓	✓	✓	✓
	UP2 " "	"	14:22	"	1	✓	✓	✓	✓	✓	✓
	UP3 " "	"	14:52	"	1	✓	✓	✓	✓	✓	✓
	UP4 " "	"	15:57	"	1	✓	✓	✓	✓	✓	✓
	UP5 " "	"	16:18	"	1	✓	✓	✓	✓	✓	✓
	UP6 " "	"	16:48	"	1	✓	✓	✓	✓	✓	✓

Environmental Division Waterloo

Work Order Reference WT2217491

Telephone : +1 519 886 6910

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ | SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ | Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	16.4

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
	Oct. 07/22	09:11					10/11/22	2:30 pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

WHITE - LABORATORY COPY YELLOW - CLIENT COPY

NOV 2014 FRONT

Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

SOL542/543

ALS Canada Ltd.

right solutions. right partner.

CERTIFICATE OF ANALYSIS

Work Order	: **WT2217637**	Page	: 1 of 4
Client	: **RWDI Air Inc.**	Laboratory	: Waterloo - Environmental
Contact	: Brad Bergeron	Account Manager	: Gayle Braun
Address	: 600 Southgate Drive Guelph ON Canada N1G 4P6	Address	: 60 Northland Road, Unit 1 Waterloo ON Canada N2V 2B8
Telephone	: 519 823 1311	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 11-Oct-2022 14:30
PO	: ----	Date Analysis Commenced	: 19-Oct-2022
C-O-C number	: ----	Issue Date	: 31-Oct-2022 17:07
Sampler	: ----		
Site	: ----		
Quote number	: Grain Size		
No. of samples received	: 5		
No. of samples analysed	: 3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QC Interpretive report to assist with Quality Review and Sample Receipt Notification (SRN).

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Colby Bingham	Quality Systems Coordinator	Inorganics, Saskatoon, Saskatchewan
Colby Bingham	Quality Systems Coordinator	Sask Soils, Saskatoon, Saskatchewan

General Comments

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Refer to the ALS Quality Control Interpretive report (QCI) for applicable references and methodology summaries. Reference methods may incorporate modifications to improve performance.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Please refer to Quality Control Interpretive report (QCI) for information regarding Holding Time compliance.

Key : CAS Number: Chemical Abstracts Services number is a unique identifier assigned to discrete substances

LOR: Limit of Reporting (detection limit).

Unit	*Description*
-	No Unit
%	percent

<: less than.

>: greater than.

Surrogate: An analyte that is similar in behavior to target analyte(s), but that does not occur naturally in environmental samples. For applicable tests, surrogates are added to samples prior to analysis as a check on recovery.

Test results reported relate only to the samples as received by the laboratory.

UNLESS OTHERWISE STATED on SRN or QCI Report, ALL SAMPLES WERE RECEIVED IN ACCEPTABLE CONDITION.

Analytical Results

Sub-Matrix: Soil/Solid
(Matrix: Soil/Solid)

Analyte	CAS Number	Method	LOR	Unit	Client sample ID	B1 Grey Clay	B2 CONT Soil	B5 Brown Clay	----	----
					Client sampling date / time	05-Oct-2022 14:00	05-Oct-2022 14:30	05-Oct-2022 16:30	----	----
						WT2217637-001	WT2217637-002	WT2217637-005	--------	--------
						Result	Result	Result	----	----
Particle Size										
passing (9.5 mm)	----	E181	1.0	%		97.9	87.1	100	----	----
sand (2.0mm - 0.05mm)	----	E180	1.0	%		14.8	32.6	18.2	----	----
passing (4.75 mm)	----	E181	1.0	%		96.8	77.9	96.4	----	----
silt (0.05mm - 0.002mm)	----	E180	1.0	%		57.8	34.6	40.4	----	----
clay (<0.002mm)	----	E180	1.0	%		27.4	32.8	41.5	----	----
passing (19 mm)	----	E181	1.0	%		100	89.0	100	----	----
passing (25.4 mm)	----	E181	1.0	%		100	100	100	----	----
texture class	----	E180	-	-		Silty Clay Loam	Clay Loam	Silty Clay	----	----
passing (38.1 mm)	----	E181	1.0	%		100	100	100	----	----
passing (50.8 mm)	----	E181	1.0	%		100	100	100	----	----
passing (76.2 mm)	----	E181	1.0	%		100	100	100	----	----
passing (1.0 mm)	----	E182	1.0	%		87.6	61.6	82.4	----	----
passing (0.841 mm)	----	E182	1.0	%		87.5	61.1	81.6	----	----
passing (0.50 mm)	----	E182	1.0	%		87.0	57.8	78.6	----	----
passing (0.420 mm)	----	E182	1.0	%		86.9	56.9	77.9	----	----
passing (0.250 mm)	----	E182	1.0	%		86.4	52.6	75.6	----	----
passing (0.149 mm)	----	E182	1.0	%		85.5	48.1	73.5	----	----
passing (0.125 mm)	----	E182	1.0	%		84.1	47.0	72.8	----	----
passing (0.075 mm)	----	E182	1.0	%		81.1	44.7	71.4	----	----
passing (0.063 mm)	----	E182	1.0	%		75.7	42.7	71.0	----	----
passing (0.05 mm)	----	E182	1.0	%		69.7	40.6	70.5	----	----
passing (0.0312 mm)	----	E183	1.0	%		60.2	37.2	68.8	----	----
passing (0.020 mm)	----	E183	1.0	%		53.7	35.0	65.6	----	----
passing (0.005 mm)	----	E183	1.0	%		29.0	25.4	44.0	----	----
passing (0.004 mm)	----	E183	1.0	%		25.7	23.5	40.4	----	----
passing (0.002 mm)	----	E183	1.0	%		19.3	18.7	31.0	----	----
grain size curve	----	E185	-	-		See Attached	See Attached	See Attached	----	----
passing (2.0 mm)	----	E181	1.0	%		88.1	64.3	87.3	----	----

Please refer to the General Comments section for an explanation of any qualifiers detected.

ALS Canada Ltd.

QUALITY CONTROL INTERPRETIVE REPORT

Work Order	: **WT2217637**	Page	: 1 of 6
Client	: **RWDI Air Inc.**	Laboratory	: Waterloo - Environmental
Contact	: Brad Bergeron	Account Manager	: Gayle Braun
Address	: 600 Southgate Drive Guelph ON Canada N1G 4P6	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	: 519 823 1311	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 11-Oct-2022 14:30
PO	: ----	Issue Date	: 31-Oct-2022 17:08
C-O-C number	: ----		
Sampler	: ----		
Site	: ----		
Quote number	: Grain Size		
No. of samples received	: 5		
No. of samples analysed	: 3		

This report is automatically generated by the ALS LIMS (Laboratory Information Management System) through evaluation of Quality Control (QC) results and other QA parameters associated with this submission, and is intended to facilitate rapid data validation by auditors or reviewers. The report highlights any exceptions and outliers to ALS Data Quality Objectives, provides holding time details and exceptions, summarizes QC sample frequencies, and lists applicable methodology references and summaries.

Key

Anonymous: Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number: Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO: Data Quality Objective.
LOR: Limit of Reporting (detection limit).
RPD: Relative Percent Difference.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Summary of Outliers

Outliers : Quality Control Samples

- No Duplicate outliers occur.
- No Test sample Surrogate recovery outliers exist.

Outliers: Reference Material (RM) Samples

- No Reference Material (RM) Sample outliers occur.

Outliers : Analysis Holding Time Compliance (Breaches)

- No Analysis Holding Time Outliers exist.

Outliers : Frequency of Quality Control Samples

- No Quality Control Sample Frequency Outliers occur.

Analysis Holding Time Compliance

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times, which are selected to meet known provincial and /or federal requirements. In the absence of regulatory hold times, ALS establishes recommendations based on guidelines published by organizations such as CCME, US EPA, APHA Standard Methods, ASTM, or Environment Canada (where available). Dates and holding times reported below represent the first dates of extraction or analysis. If subsequent tests or dilutions exceeded holding times, qualifiers are added (refer to COA).

If samples are identified below as having been analyzed or extracted outside of recommended holding times, measurement uncertainties may be increased, and this should be taken into consideration when interpreting results.

Where actual sampling date is not provided on the chain of custody, the date of receipt with time at 00:00 is used for calculation purposes.

Where only the sample date without time is provided on the chain of custody, the sampling date at 00:00 is used for calculation purposes.

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : CSSC Particle Size Classification by Hydrometer										
Glass soil jar/Teflon lined cap B1 Grey Clay	E180	05-Oct-2022	----	----	----		24-Oct-2022	365 days	19 days	✓
Particle Size : CSSC Particle Size Classification by Hydrometer										
Glass soil jar/Teflon lined cap B2 CONT Soil	E180	05-Oct-2022	----	----	----		24-Oct-2022	365 days	19 days	✓
Particle Size : CSSC Particle Size Classification by Hydrometer										
Glass soil jar/Teflon lined cap B5 Brown Clay	E180	05-Oct-2022	----	----	----		24-Oct-2022	365 days	19 days	✓
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap B1 Grey Clay	E185	05-Oct-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap B2 CONT Soil	E185	05-Oct-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Grain Size Report (Attachment) Hydrometer/Sieve Method										
Glass soil jar/Teflon lined cap B5 Brown Clay	E185	05-Oct-2022	----	----	----		26-Oct-2022	----	----	
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap B1 Grey Clay	E183	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓

Matrix: **Soil/Solid**

Evaluation: × = Holding time exceedance ; ✓ = Within Holding Time

Analyte Group / Container / Client Sample ID(s)	Method	Sampling Date	Extraction / Preparation				Analysis			
			Preparation Date	Holding Times Rec	Holding Times Actual	Eval	Analysis Date	Holding Times Rec	Holding Times Actual	Eval
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap B2 CONT Soil	E183	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Hydrometer										
Glass soil jar/Teflon lined cap B5 Brown Clay	E183	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap B1 Grey Clay	E182	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap B2 CONT Soil	E182	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve <2mm										
Glass soil jar/Teflon lined cap B5 Brown Clay	E182	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap B1 Grey Clay	E181	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap B2 CONT Soil	E181	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓
Particle Size : Particle Size Analysis - Sieve >2mm										
Glass soil jar/Teflon lined cap B5 Brown Clay	E181	05-Oct-2022	20-Oct-2022	----	----		20-Oct-2022	365 days	15 days	✓

Legend & Qualifier Definitions

Rec. HT: ALS recommended hold time (see units).

Quality Control Parameter Frequency Compliance

The following report summarizes the frequency of laboratory QC samples analyzed within the analytical batches (QC lots) in which the submitted samples were processed. The actual frequency should be greater than or equal to the expected frequency.

Matrix: **Soil/Solid**

Evaluation: × = *QC frequency outside specification*; ✓ = *QC frequency within specification.*

Quality Control Sample Type			Count		Frequency (%)		
Analytical Methods	*Method*	*QC Lot #*	*QC*	*Regular*	*Actual*	*Expected*	*Evaluation*
Laboratory Duplicates (DUP)							
CSSC Particle Size Classification by Hydrometer	E180	711525	1	13	7.6	5.0	✓
Particle Size Analysis - Hydrometer	E183	706746	1	14	7.1	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	706744	1	14	7.1	5.0	✓
Laboratory Control Samples (LCS)							
CSSC Particle Size Classification by Hydrometer	E180	711525	1	13	7.6	5.0	✓
Particle Size Analysis - Hydrometer	E183	706746	1	14	7.1	5.0	✓
Particle Size Analysis - Sieve <2mm	E182	706744	1	14	7.1	5.0	✓
Particle Size Analysis - Sieve >2mm	E181	706743	1	14	7.1	5.0	✓

Methodology References and Summaries

The analytical methods used by ALS are developed using internationally recognized reference methods (where available), such as those published by US EPA, APHA Standard Methods, ASTM, ISO, Environment Canada, BC MOE, and Ontario MOE. Reference methods may incorporate modifications to improve performance (indicated by "mod").

Analytical Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
CSSC Particle Size Classification by Hydrometer	E180 Saskatoon - Environmental	Soil/Solid	CCME Vol 4 Analytical Methods	A soil sample is disaggregated to pass a 2mm sieve. The <2mm specimen is then further disaggregated using Calgon solution and suspended in solution. Two hydrometer readings are measured at specific times to determine %clay and %silt+clay using the principles of Stokes' law. %silt and %sand are determined mathematically.
Particle Size Analysis - Sieve >2mm	E181 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material retained on the sieve is then further sieved through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Sieve <2mm	E182 Saskatoon - Environmental	Soil/Solid	ASTM D6913-17 (mod)	Soil samples are disaggregated and sieved through a 2mm sieve. Material passed through the sieve is then further disaggregated using calgon solution and passed through a series of sieves. The amount passing through the sieves is measured gravimetrically.
Particle Size Analysis - Hydrometer	E183 Saskatoon - Environmental	Soil/Solid	ASTM D7928-21 (mod)	Soil material is separated from coarse material (>2mm). A specimen is then disaggregated through mixing with Calgon solution. The material is then suspended in solution wherein regular hydrometer readings are taken at specific time intervals. The principles of Stokes' Law are applied to determine the amount of material remaining in solution as well as the maximum particle size remaining in solution at the specified time.
Grain Size Report (Attachment) Hydrometer/Sieve Method	E185 Saskatoon - Environmental	Soil/Solid	ASTM D6913/D7928	A grain size curve is a graphical representation of the particle sizing of a sample representing the percent passing against the effective particle size.

Preparation Methods	Method / Lab	Matrix	Method Reference	Method Descriptions
Dry and Grind in Soil/Solid <60°C	EPP442 Waterloo - Environmental	Soil/Solid	Soil Sampling and Methods of Analysis, Carter 2008	After removal of any coarse fragments and reservation of wet subsamples a portion of homogenized sample is set in a tray and dried at less than 60°C until dry. The sample is then particle size reduced with an automated crusher or mortar and pestle, typically to <2 mm. Further size reduction may be needed for particular tests.

ALS Canada Ltd.

QUALITY CONTROL REPORT

Work Order	: **WT2217637**	Page	: 1 of 6
Client	: RWDI Air Inc.	Laboratory	: Waterloo - Environmental
Contact	: Brad Bergeron	Account Manager	: Gayle Braun
Address	: 600 Southgate Drive Guelph ON Canada N1G 4P6	Address	: 60 Northland Road, Unit 1 Waterloo, Ontario Canada N2V 2B8
Telephone	:	Telephone	: +1 519 886 6910
Project	: ----	Date Samples Received	: 11-Oct-2022 14:30
PO	: ----	Date Analysis Commenced	: 19-Oct-2022
C-O-C number	: ----	Issue Date	: 31-Oct-2022 17:07
Sampler	: ---- 519 823 1311		
Site	: ----		
Quote number	: Grain Size		
No. of samples received	: 5		
No. of samples analysed	: 3		

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percent Difference (RPD) and Data Quality Objectives
- Reference Material (RM) Report; Recovery and Data Quality Objectives

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is conducted in accordance with US FDA 21 CFR Part 11.

Signatories	*Position*	*Laboratory Department*
Colby Bingham	Quality Systems Coordinator	Saskatoon Inorganics, Saskatoon, Saskatchewan
Colby Bingham	Quality Systems Coordinator	Saskatoon Sask Soils, Saskatoon, Saskatchewan

General Comments

The ALS Quality Control (QC) report is optionally provided to ALS clients upon request. ALS test methods include comprehensive QC checks with every analysis to ensure our high standards of quality are met. Each QC result has a known or expected target value, which is compared against predetermined Data Quality Objectives (DQOs) to provide confidence in the accuracy of associated test results. This report contains detailed results for all QC results applicable to this sample submission. Please refer to the ALS Quality Control Interpretation report (QCI) for applicable method references and methodology summaries.

Key :

Anonymous = Refers to samples which are not part of this work order, but which formed part of the QC process lot.
CAS Number = Chemical Abstracts Service number is a unique identifier assigned to discrete substances.
DQO = Data Quality Objective.
LOR = Limit of Reporting (detection limit).
RPD = Relative Percent Difference
# = Indicates a QC result that did not meet the ALS DQO.

Workorder Comments

Holding times are displayed as "---" if no guidance exists from CCME, Canadian provinces, or broadly recognized international references.

Laboratory Duplicate (DUP) Report

A Laboratory Duplicate (DUP) is a randomly selected intralaboratory replicate sample. Laboratory Duplicates provide information regarding method precision and sample heterogeneity. ALS DQOs for Laboratory Duplicates are expressed as test-specific limits for Relative Percent Difference (RPD), or as an absolute difference limit of 2 times the LOR for low concentration duplicates within ~ 4-10 times the LOR (cut-off is test-specific).

Sub-Matrix: **Soil/Solid**

					Laboratory Duplicate (DUP) Report						
Laboratory sample ID	*Client sample ID*	*Analyte*	*CAS Number*	*Method*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD(%) or Difference*	*Duplicate Limits*	*Qualifier*
Particle Size (QC Lot: 706744)											
SK2205976-012	Anonymous	passing (0.05 mm)	----	E182	1.0	%	53.7	52.5	2.22%	15%	----
		passing (0.063 mm)	----	E182	1.0	%	61.8	61.4	0.684%	15%	----
		passing (0.075 mm)	----	E182	1.0	%	69.2	69.5	0.401%	15%	----
		passing (0.125 mm)	----	E182	1.0	%	79.5	80.0	0.658%	15%	----
		passing (0.149 mm)	----	E182	1.0	%	84.4	85.0	0.759%	15%	----
		passing (0.250 mm)	----	E182	1.0	%	91.3	91.6	0.400%	15%	----
		passing (0.420 mm)	----	E182	1.0	%	97.4	97.5	0.0587%	15%	----
		passing (0.50 mm)	----	E182	1.0	%	98.0	98.0	0.0286%	15%	----
		passing (0.841 mm)	----	E182	1.0	%	99.5	99.4	0.0638%	15%	----
		passing (1.0 mm)	----	E182	1.0	%	99.6	99.5	0.0575%	15%	----
Particle Size (QC Lot: 706746)											
SK2205976-012	Anonymous	passing (0.002 mm)	----	E183	1.0	%	8.7	7.7	1.0	Diff <2x LOR	----
		passing (0.004 mm)	----	E183	1.0	%	11.0	9.9	10.7%	20%	----
		passing (0.005 mm)	----	E183	1.0	%	12.4	11.2	10.3%	20%	----
		passing (0.020 mm)	----	E183	1.0	%	27.0	24.3	10.7%	20%	----
		passing (0.0312 mm)	----	E183	1.0	%	37.8	34.6	9.10%	20%	----
Particle Size (QC Lot: 711525)											
WT2217491-001	Anonymous	clay (<0.002mm)	----	E180	1.0	%	12.1	11.2	0.8	Diff <2x LOR	----
		sand (2.0mm - 0.05mm)	----	E180	1.0	%	58.3	60.2	3.33%	10%	----
		silt (0.05mm - 0.002mm)	----	E180	1.0	%	29.6	28.5	3.82%	10%	----

Reference Material (RM) Report

A Reference Material (RM) is a homogenous material with known and well-established analyte concentrations. RMs are processed in an identical manner to test samples, and are used to monitor and control the accuracy and precision of a test method for a typical sample matrix. RM results are expressed as percent recovery of the target analyte concentration. RM targets may be certified target concentrations provided by the RM supplier, or may be ALS long-term mean values (for empirical test methods).

Sub-Matrix:

					Reference Material (RM) Report				
					RM Target	Recovery (%)	Recovery Limits (%)		
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Concentration	RM	Low	High	Qualifier
Particle Size (QCLot: 706743)									
	RM	passing (19 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (2.0 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (25.4 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (38.1 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (4.75 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (50.8 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (76.2 mm)	----	E181	100 %	100	90.0	110	----
	RM	passing (9.5 mm)	----	E181	100 %	100	90.0	110	----
Particle Size (QCLot: 706744)									
	RM	passing (0.05 mm)	----	E182	49.81 %	101	90.0	110	----
	RM	passing (0.063 mm)	----	E182	54.27 %	99.2	90.8	109	----
	RM	passing (0.075 mm)	----	E182	58.38 %	98.0	91.4	109	----
	RM	passing (0.125 mm)	----	E182	68.06 %	97.9	92.7	107	----
	RM	passing (0.149 mm)	----	E182	72.71 %	97.9	93.1	107	----
	RM	passing (0.250 mm)	----	E182	85.38 %	98.9	94.1	106	----
	RM	passing (0.420 mm)	----	E182	92.78 %	99.8	94.6	105	----
	RM	passing (0.50 mm)	----	E182	93.78 %	99.8	94.7	105	----
	RM	passing (0.841 mm)	----	E182	97.34 %	99.8	94.9	105	----
	RM	passing (1.0 mm)	----	E182	97.77 %	99.8	94.9	105	----
Particle Size (QCLot: 706746)									
	RM	passing (0.002 mm)	----	E183	21.14 %	102	76.0	124	----
	RM	passing (0.004 mm)	----	E183	24.64 %	104	80.0	120	----
	RM	passing (0.005 mm)	----	E183	25.91 %	104	82.0	118	----
	RM	passing (0.020 mm)	----	E183	37.12 %	102	87.0	113	----
	RM	passing (0.0312 mm)	----	E183	42.58 %	102	88.0	112	----
Particle Size (QCLot: 711525)									
	RM	clay (<0.002mm)	----	E180	24.39 %	93.6	80.0	120	----
	RM	sand (2.0mm - 0.05mm)	----	E180	47.72 %	100	90.0	110	----

Sub-Matrix:

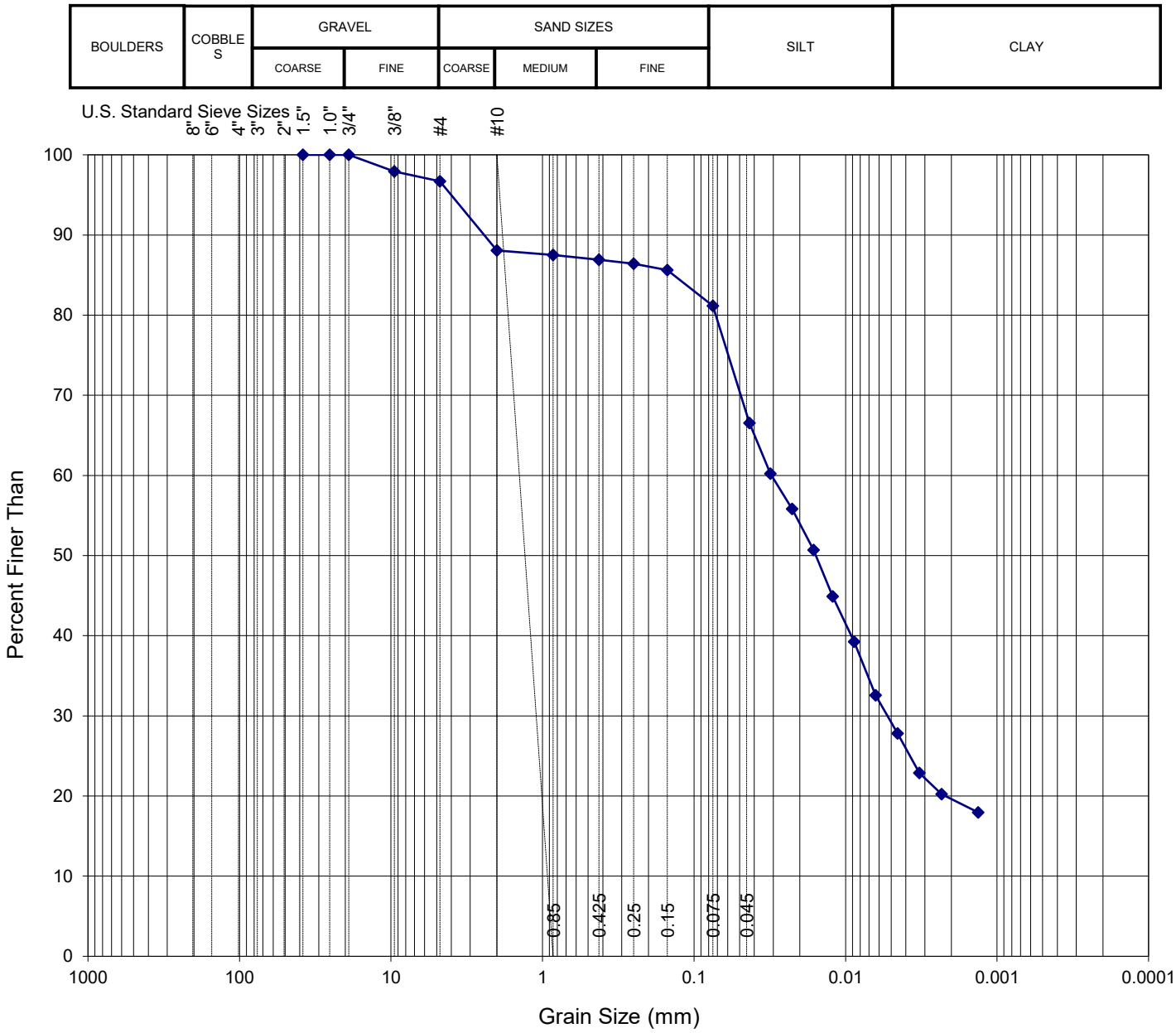
Laboratory sample ID	Reference Material ID	Analyte	CAS Number	Method	Reference Material (RM) Report: RM Target Concentration	Recovery (%): RM	Recovery Limits (%): Low	Recovery Limits (%): High	Qualifier
Particle Size (QCLot: 711525) - continued									
	RM	silt (0.05mm - 0.002mm)	----	E180	27.88 %	106	82.0	118	----

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	WT2217637001
Project Number:	
Client Sample ID	B1 Grey Clay
Lab Sample ID	WT2217637001
Date Sample Received	00-Jan-00
Test Completion Date:	26-Oct-22
Analyst:	AC97



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

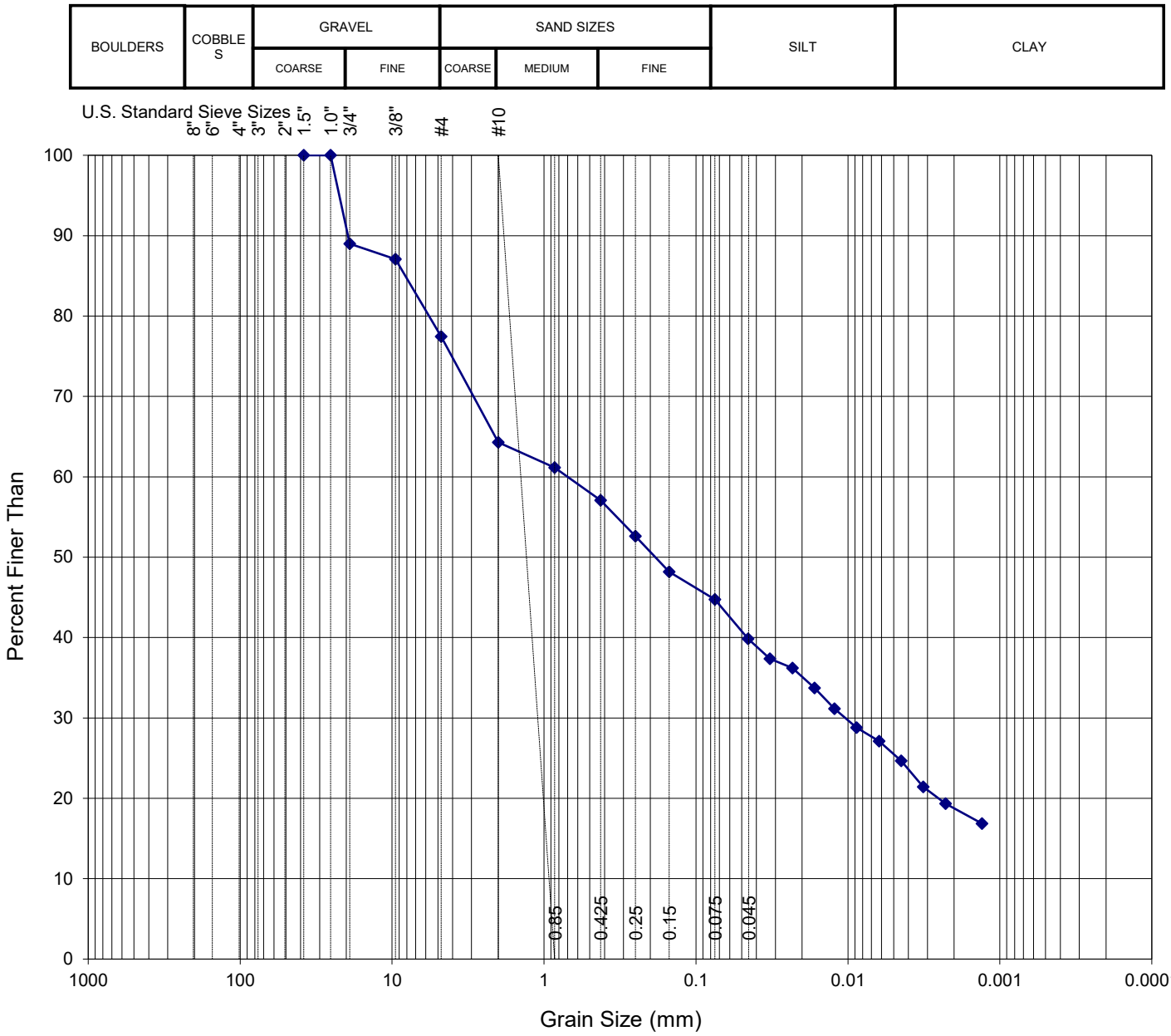
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	3.30	> 4.75
% COARSE SAND :	8.62	2.0 - 4.75
% MEDIUM SAND :	1.15	0.425 - 2.0
% FINE SAND :	5.78	0.075 - 0.425
% SILT :	51.96	0.075 - 0.005
% CLAY :	29.19	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	WT2217637002
Project Number:	
Client Sample ID	B2 CONT Soil
Lab Sample ID	WT2217637002
Date Sample Received	00-Jan-00
Test Completion Date:	26-Oct-22
Analyst:	AC97



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

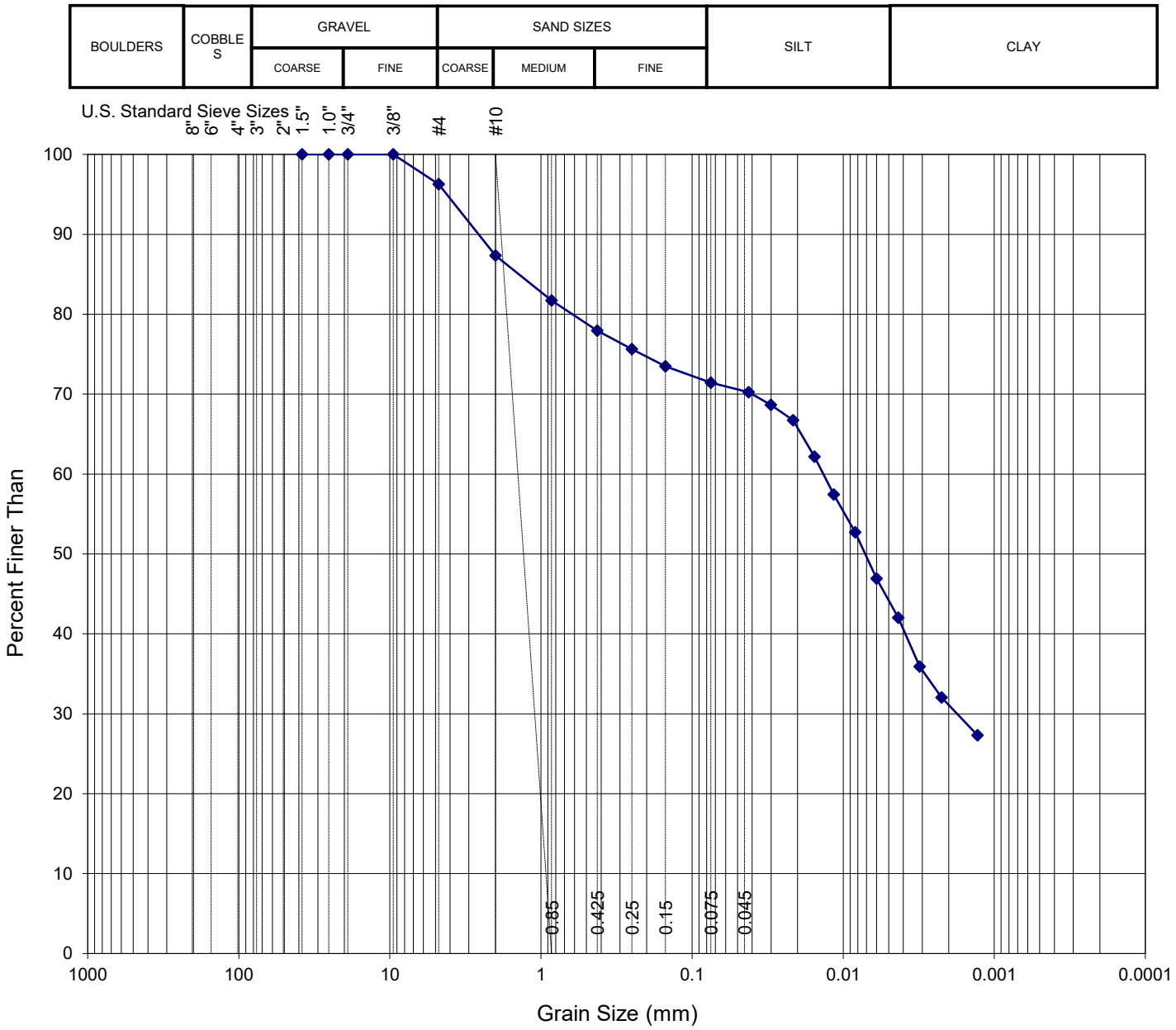
GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	22.56	> 4.75
% COARSE SAND :	13.14	2.0 - 4.75
% MEDIUM SAND :	7.23	0.425 - 2.0
% FINE SAND :	12.32	0.075 - 0.425
% SILT :	19.25	0.075 - 0.005
% CLAY :	25.49	< 0.005

ALS Laboratory Group

819-58th Street, Saskatoon,SK

PARTICLE SIZE DISTRIBUTION CURVE

Client Name:	WT2217637005
Project Number:	
Client Sample ID	B5 Brown Clay
Lab Sample ID	WT2217637005
Date Sample Received	00-Jan-00
Test Completion Date:	26-Oct-22
Analyst:	AC97



METHOD DESCRIPTION

Method Reference: ASTM D6913 & D7928

Dispersion method: Mechanical

Dispesion period: 1 minute cm/s

DESCRIPTION OF SAND AND GRAVEL PARTICLES

Shape: Angular

Hardness: Hard

SUMMARY OF RESULTS

GRAIN SIZE	WT %	DIA. RANGE (mm)
% GRAVEL :	3.74	> 4.75
% COARSE SAND :	8.93	2.0 - 4.75
% MEDIUM SAND :	9.40	0.425 - 2.0
% FINE SAND :	6.49	0.075 - 0.425
% SILT :	27.22	0.075 - 0.005
% CLAY :	44.22	< 0.005

Chain of Custody (COC) / Analytical Request Form

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 -

Page of

Report To	Contact and company name below will appear on the final report
Company:	RWDI
Contact:	Brad Bergeron
Phone:	519-823-1311
Company address below will appear on the final report	
Street:	600 Southgate Dr
City/Province:	Guelph, ON
Postal Code:	N1G 4P6
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution	
Select Report Format:	☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)
Quality Control (QC) Report with Report	☐ YES ☐ NO
☐ Compare Results to Criteria on Report - provide details below if box checked	
Select Distribution:	☐ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	Matthew.Butts@rwdi.com
Email 2	Sarah.Pellatt@rwdi.com
Email 3	Brad.Bergeron@rwdi.com
Invoice Distribution	
Select Invoice Distribution:	☑ EMAIL ☐ MAIL ☐ FAX
Email 1 or Fax	Brad.Bergeron@rwdi.com
Email 2	Sarah.Pellatt@rwdi.com

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)			
Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply			
PRIORITY (Business Days)	4 day [P4-20%] ☐	EMERGENCY	1 Business day [E - 100%] ☐
	3 day [P3-25%] ☐		Same Day, Weekend or Statutory holiday [E2 -200%] (Laboratory opening fees may apply)] ☐
	2 day [P2-50%] ☐		
Date and Time Required for all E&P TATs:		dd-mmm-yy hh:mm	
For tests that can not be performed according to the service level selected, you will be contacted.			

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:	JN	Location:	
ALS Lab Work Order # (lab use only):		ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Full grain size	Moisture Content	Silt content	PHC144	PHC10	PHC2.5	SAMPLES ON HOLD	SUSPECTED HAZARD (see Special Instructions)
	B1 Grey Clay	05/Oct/22	14:00		1	✓	✓	✓	✓	✓	✓		
	B2 CONT Soil	" "	14:30		1	✓	✓	✓	✓	✓	✓		
	B3 ASR	" "	15:30		1	✓	✓	✓	✓	✓	✓		
	B4 Wood Chips.	" "	16:00		1	✓	✓	✓	✓	✓	✓		
	B5 Brown Clay	" "	16:30		1	✓	✓	✓	✓	✓	✓		

Drinking Water (DW) Samples[1] (client use)	Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)
Are samples taken from a Regulated DW System? ☐ YES ☐ NO	
Are samples for human consumption/ use? ☐ YES ☐ NO	

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐		SIF Observations	Yes ☐	No ☐	
Ice Packs ☐	Ice Cubes ☐	Custody seal intact	Yes ☐	No ☐	
Cooling Initiated ☐					

INITIAL COOLER TEMPERATURES °C				FINAL COOLER TEMPERATURES °C			
				16.4			

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by:	Date:	Time:	Received by:	Date:	Time:	Received by:	Date:	Time:
Matthew Butts	Oct. 07/22	9:11					10/11/22	2:30 pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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Failure to complete all portions of this form may delay analysis. Please fill in this form LEGIBLY. By the use of this form the user acknowledges and agrees with the Terms and Conditions as specified on the back page of the white - report copy.

1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

Chain of Custody (COC) / Analytical Request Form

www.alsglobal.com

Canada Toll Free: 1 800 668 9878

Affix ALS barcode label here (lab use only)

COC Number: 17 -

Page of

Report To	Contact and company name below will appear on the final report
Company:	RW DI
Contact:	Brad Bergeron
Phone:	519 - 823 - 1311
	Company address below will appear on the final report
Street:	600 Southgate DR
City/Province:	Guelph, ON
Postal Code:	N1G 4P6
Invoice To	Same as Report To ☑ YES ☐ NO
	Copy of Invoice with Report ☐ YES ☐ NO
Company:	
Contact:	

Report Format / Distribution

Select Report Format: ☑ PDF ☑ EXCEL ☐ EDD (DIGITAL)

Quality Control (QC) Report with Report ☐ YES ☐ NO

☐ Compare Results to Criteria on Report - provide details below if box checked

Select Distribution: ☐ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: Matthew.Butts@rwdi.com

Email 2: Sarah.Pellatt@rwdi.com

Email 3: Brad.Bergeron@rwdi.com

Invoice Distribution

Select Invoice Distribution: ☑ EMAIL ☐ MAIL ☐ FAX

Email 1 or Fax: Brad.Bergeron@rwdi.com

Email 2: Sarah.Pellatt@rwdi.com

Select Service Level Below - Contact your AM to confirm all E&P TATs (surcharges may apply)

Regular [R] ☑ Standard TAT if received by 3 pm - business days - no surcharges apply

PRIORITY (Business Days): 4 day [P4-20%] ☐ ; 3 day [P3-25%] ☐ ; 2 day [P2-50%] ☐

EMERGENCY: 1 Business day [E - 100%] ☐ ; Same Day, Weekend or Statutory holiday [E2 -200% (Laboratory opening fees may apply)] ☐

Date and Time Required for all E&P TATs: dd-mmm-yy hh:mm

For tests that can not be performed according to the service level selected, you will be contacted.

Project Information		Oil and Gas Required Fields (client use)	
ALS Account # / Quote #:		AFE/Cost Center:	PO#
Job #:		Major/Minor Code:	Routing Code:
PO / AFE:		Requisitioner:	
LSD:	JD	Location:	
ALS Lab Work Order # (lab use only):	WT2217637	ALS Contact:	Sampler:

Analysis Request

Indicate Filtered (F), Preserved (P) or Filtered and Preserved (F/P) below

LD

ALS Sample # (lab use only)	Sample Identification and/or Coordinates (This description will appear on the report)	Date (dd-mmm-yy)	Time (hh:mm)	Sample Type	NUMBER OF CONTAINERS	Full grain size	Moisture Content	Silt content	PH < 4.4	PH < 10	PH < 2.5
	B1 Grey Clay	05/Oct/22	14:00		1	✓	✓	✓	✓	✓	✓
	B2 CONT Soil	" "	14:30		1	✓	✓	✓	✓	✓	✓
	B3 ASR	" "	15:30		1	✓	✓	✓	✓	✓	✓
	BH Wood Chips	" "	16:00		1	✓	✓	✓	✓	✓	✓
	B5 Brow Clay	" "	16:30		1	✓	✓	✓	✓	✓	✓

Environmental Division
Waterloo
Work Order Reference
WT2217637

Telephone : +1 519 886 6910

Drinking Water (DW) Samples[1] (client use)

Are samples taken from a Regulated DW System? ☐ YES ☐ NO

Are samples for human consumption/ use? ☐ YES ☐ NO

Special Instructions / Specify Criteria to add on report by clicking on the drop-down list below (electronic COC only)

SAMPLE CONDITION AS RECEIVED (lab use only)

Frozen ☐ SIF Observations Yes ☐ No ☐

Ice Packs ☐ Ice Cubes ☐ Custody seal intact Yes ☐ No ☐

Cooling Initiated ☐

INITIAL COOLER TEMPERATURES °C	FINAL COOLER TEMPERATURES °C
	16.4

SHIPMENT RELEASE (client use)			INITIAL SHIPMENT RECEPTION (lab use only)			FINAL SHIPMENT RECEPTION (lab use only)		
Released by: Matthew Butts	Date: Oct. 07/22	Time: 9:11	Received by:	Date:	Time:	Received by:	Date: 10/11/22	Time: 2:30 pm

REFER TO BACK PAGE FOR ALS LOCATIONS AND SAMPLING INFORMATION

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1. If any water samples are taken from a Regulated Drinking Water (DW) System, please submit using an Authorized DW COC form.

SOLS43 KSH

APPENDIX 7E

Appendix 7E: Summary of Odour Source Testing Results, September and October 2025

Summary of Odour Source Testing Results, September and October 2025

Proposed Landfill

Well No.	Gas Flow (m^3/hr)	Odour (OU/m^3)	H2S (ppm)	Methane (ppm)
89	27.9	29,100	208	50
	28.2		384	51.9
	27.9		78	50.9
	27.6		105	50.3
66	40.1	15,700	-	55.7
	47.6		48	55.9
	49.3		19	58.9
26	26.7	29,100	48	54.4
	23.9		-	51.4
	29.8		117	57.8
14	22	96,100	10	53.4
	17		-	51.7
	12.1		178	56.5
257	24.4	79	8	53.9
	28.1		3	55.5
	28.5		6	43.1
2	14.7	111,200	6	59.6
	20.5		14	57.6
	17.6		54	57.1
244	43.4	61	10	43.4
	44.1		2	44.1
	51.6		5	50.4
219	94.5	26,700	8	57.8
	94.5		8	57.8
	73.7		3	50.8
	92		11	54.2
	106		46	56
270	32.9	13,400	6	58.5
	33.9		10	55.9
	29.2		60	57.7
236	76.5	299,100	8	42.4
	76.5		3	38.3
	85.6		1078	55.9
282	59.9	114,200	6	58.5
	66.3		187	57.2
98	34.9	148,200	104	58.2
	60.6		1290	57.1
292	44.6	29,000	6	54.8
	49.8		-	57.1
	45.6		0	0
	20		0	57.4

Old Landfill

Well No.	Gas Flow (m^3/hr)	Odour (OU/m^3)	H2S (ppm)	Methane (ppm)
GW16	14.8	1030	3	42.5
	14.7		2	46.5
GW3	6.7	61	8	41.5
	6.7		8	41.5
	5.7		7	44

New Landfill Odour Summary

Total Number of Wells:	13	nos.
Percentage of Wells with H2S > 150ppm:	3.9	%
Percentage of Wells with H2S < 150ppm:	96.1	%

from Average Frequency of High Samples

For Wells with > 150ppm H2S @ Testing Event:

Average Odour Concentration:	153,760	OU
Weighted Average Odour Concentration:	5,989	OU

For Wells with < 150ppm H2S @ Testing Event:

Average Odour Concentration:	17,893	OU
Weighted Average Odour Concentration:	17,196	OU

Overall Averaged Odour Concentration (based on weighted average):	**23,185**	OU

St. Croix Sensory, Inc.

Odour Evaluation Report

Report Number: C2530402

Project Name: WM Twin Creek Landfill

Samples Collected: 10-30-25
Samples Received: 10-31-24
Samples Evaluated: 10-31-25

Report Prepared For: RWDI
600 Southgate Drive
Guelph, Ontario, N1G 4P6
Canada

Report Prepared By: St. Croix Sensory Canada, Inc.
1005 Skyview Drive, Suite 175
Burlington, ON L7P 5B1 Canada
905-635-0064
tvallarino@fivesenses.com

Data Release Authorization:

Alicia Tran, M.Sc.
Laboratory Coordinator

Reviewed and Approved:

Thomas Vallarino, A.Sc.T.
Laboratory Director

St. Croix Sensory is ISO/IEC 17025:2017 Accredited

Perry Johnson Laboratory Accreditation, Inc.
Certificate No.: L24-186-2

Accreditation No.: 81047
Initial Accreditation Date: 10 March 2024

Odour Evaluation Report

St. Croix Sensory, Inc.

Client: **RWDI** Report Number: **C2530402**

Project Name: **WM Twin Creek Landfill** Samples Evaluated: **10/31/25**

#	Field No.	Sample Description	DT	RT	I	HT	DR	Comments
1	TCLW89	WM Twin Creeks Landfill Well #89	29,100	10,200	- - -	- - -	- - -	Very High H2S Concentration. 100:1 Laboratory Dilution Requierd.
2	TCLW66	WM Twin Creeks Landfill Well #66	15,700	7,100	- - -	- - -	- - -	Very High H2S Concentration. 100:1 Laboratory Dilution Requierd.
3	TCLWEW16	WM Twin Creeks Landfill Well #EW16 (GW16 Old Landfill)	1,030	560	- - -	- - -	- - -	High H2S Concentration. 10:1 Laboratory Dilution Requierd.
4	TCLW26	WM Twin Creeks Landfill Well #26	29,100	20,500	- - -	- - -	- - -	Very High H2S Concentration. 100:1 Laboratory Dilution Requierd.
5	TCLWEW3	WM Twin Creeks Landfill Well #EW3 (GW3 Old Landfill)	61	43	- - -	- - -	- - -	
6	TCLW14	WM Twin Creeks Landfill Well #14	96,100	57,700	- - -	- - -	- - -	Very High H2S Concentration. 100:1 Laboratory Dilution Requierd.
7	TCLW257	WM Twin Creeks Landfill Well #257	79	43	- - -	- - -	- - -	
8	TCLW2	WM Twin Creeks Landfill Well #2	111,200	68,500	- - -	- - -	- - -	Very High H2S Concentration. 100:1 Laboratory Dilution Requierd.
9	TCLW244	WM Twin Creeks Landfill Well #244	61	40	- - -	- - -	- - -	
10	TCLW219	WM Twin Creeks Landfill Well #219	26,700	9,400	- - -	- - -	- - -	Very High H2S Concentration. 100:1 Laboratory Dilution Requierd.
11	TCLW270	WM Twin Creeks Landfill Well #270	13,400	7,900	- - -	- - -	- - -	Very High H2S Concentration. 100:1 Laboratory Dilution Requierd.
12	TCLW236	WM Twin Creeks Landfill Well #236	299,100	137,400	- - -	- - -	- - -	Very High H2S Concentration. 100:1 Laboratory Dilution Requierd.

Odour Detection Threshold Testing (Evaluations) conducted in compliance with and under all conditions specified or required by ASTM E679 and EN13725 unless noted in report "Comments" column. The Client Chain of Custody (COC) attached to the Odour Evaluation Report provides information that may include sampling location(s), methods, and/or environmental conditions during sampling. Client, designated agents, and/or reviewers provide interpretation of results based on sampling conditions.

DT - Detection Threshold as determined by ASTM E679 and EN13725. The Practical Detection Limit (PDL) of DT is 12, based on the nominal lowest dilution presentation ratio of 8. Result is dimensionless dilution ratio at which half the assessors detect the diluted air as different from the blank air. Odour Units (OU) or Odour Units per cubic meters (OU/m3) are commonly used as pseudo-units.

RT - Recognition Threshold as determined by ASTM E679 and EN13725. Result is dimensionless dilution ratio at which half the assessors recognize a character in the diluted odourous air. Odour Units (OU) or Odour Units per cubic meter (OU/m3) are commonly used pseudo-units.

I - Perceived odour intensity as determined by ASTM E544. Intensity is expressed as average reported scale value on 10pt n-butanol in water static scale.

HT – Hedonic Tone value. Average rating of assessors' opinion of odour pleasantness on scale of -10 (most unpleasant) to +10 (most pleasant).

DR – the slope of the dose-response relationship of odour intensity with dilution (persistency of odour).

Odour Evaluation Report

St. Croix Sensory, Inc.

Client: **RWDI** Report Number: **C2530402**

Project Name: **WM Twin Creek Landfill** Samples Evaluated: **10/31/25**

#	Field No.	Sample Description	DT	RT	I	HT	DR	Comments
13	TCLW282	WM Twin Creeks Landfill Well #282	114,200	53,100	- - -	- - -	- - -	Very High H2S Concentration. 100:1 Laboratory Dilution Requierd.
14	TCLW98	WM Twin Creeks Landfill Well #98	148,200	88,400	- - -	- - -	- - -	Very High H2S Concentration. 100:1 Laboratory Dilution Requierd.
15	TCLW292	WM Twin Creeks Landfill Well #292	29,000	12,200	- - -	- - -	- - -	Very High H2S Concentration. 100:1 Laboratory Dilution Requierd.
16	BLANK	WM Twin Creeks Landfill Blank N2	34	28	- - -	- - -	- - -	

Comment: Field Pre-Dilution Values Not Available.

Odor Detection Threshold Testing (Evaluations) conducted in compliance with and under all conditions specified or required by ASTM E679 and EN13725 unless noted in report "Comments" column. The Client Chain of Custody (COC) attached to the Odor Evaluation Report provides information that may include sampling location(s), methods, and/or environmental conditions during sampling. Client, designated agents, and/or reviewers provide interpretation of results based on sampling conditions.

DT - Detection Threshold as determined by ASTM E679 and EN13725. The Practical Detection Limit (PDL) of DT is 12, based on the nominal lowest dilution presentation ratio of 8. Result is dimensionless dilution ratio at which half the assessors detect the diluted air as different from the blank air. Odour Units (OU) or Odour Units per cubic meters (OU/m3) are commonly used as pseudo-units.

RT - Recognition Threshold as determined by ASTM E679 and EN13725. Result is dimensionless dilution ratio at which half the assessors recognize a character in the diluted odourous air. Odour Units (OU) or Odour Units per cubic meter (OU/m3) are commonly used pseudo-units.

I - Perceived odour intensity as determined by ASTM E544. Intensity is expressed as average reported scale value on 10pt n-butanol in water static scale.

HT – Hedonic Tone value. Average rating of assessors' opinion of odour pleasantness on scale of -10 (most unpleasant) to +10 (most pleasant).

DR – the slope of the dose-response relationship of odour intensity with dilution (persistency of odour).

Attachments

St. Croix Sensory

Chain of Custody - Canada

St. Croix Sensory • 1005 Skyview Drive, Suite 175, Burlington, ON L7P 5B1 • Tel: +1 905-580-3330 • Email: tvallarino@fivesenses.com

Client:	RWDI	**Contact Name:**	Anthony Vanderhayden
Project/Site Name:	WM Twin Creek Landfill	**Cell Number:**	226-962-4394
Collected By:	Adam Tran, Darren Govan	**Email:**	anthony.vanderhayden@rwdi.com oluwatobi.odumoye@rwdi.com
Sample Date:	2025/10/30	**Project PO:**	2101750.38
Comments:	WARNING: Landfill gas - neat, no dilution		

Page 1 of 2

Odour Evaluation Requests

(please check all that apply for each sample)

Scan for Odour Sampling Resources

Lab Use Only

Evaluation Report No. C2530402

Line No.	Field No.	Sample Description	Sample Time	Field H_2S (ppm)	Thresholds Detection & Recognition ASTM E679 & EN13725	Intensity ASTM E544	Characterization Hedonic Tone & Descriptors	Persistency Dose Response	Predilution 10:1 (If DT>60,000)	LAB	CODE
1	TCLW89	WM Twin Creeks Landfill Well #89	09:09	-	✔					2	
2	TCLW66	WM Twin Creeks Landfill Well #66	09:37	-	✔					2	
3	TCLWEW16	WM Twin Creeks Landfill Well #EW16 (GW16 Old Landfill)	09:42	-	✔					2	
4	TCLW26	WM Twin Creeks Landfill Well #26	10:06	-	✔					2	
5	TCLWEW3	WM Twin Creeks Landfill Well #EW3 (GW3 Old Landfill)	10:17	-	✔					2	
6	TCLW14	WM Twin Creeks Landfill Well #14	10:40	-	✔					2	
7	TCLW257	WM Twin Creeks Landfill Well #257	10:46	-	✔					2	
8	TCLW2	WM Twin Creeks Landfill Well #2	11:15	-	✔					2	
9	TCLW244	WM Twin Creeks Landfill Well #244	11:22	-	✔					2	
10	TCLW219	WM Twin Creeks Landfill Well #219	12:57	-	✔					2	
11	TCLW270	WM Twin Creeks Landfill Well #270	12:59	-	✔					2	
12	TCLW236	WM Twin Creeks Landfill Well #236	13:23	~300ppm	✔					2	

Number of Boxes Shipped: 2 bags

Carrier (check): Purolator ___ | FedEx ___ | UPS ___

DHL ___ | Other: by hand

Relinquished by	Date	Time
Adam Tran	2025/10/30	

Received at Lab by	Date	Time	Comments & Exceptions Noted
A Tran	10/31/25	7:56	

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St. Croix Sensory

Chain of Custody - Canada

St. Croix Sensory • 1005 Skyview Drive, Suite 175, Burlington, ON L7P 5B1 • Tel: +1 905-580-3330 • Email: tvallarino@fivesenses.com

Client:	RWDI	**Contact Name:**	Anthony Vanderhayden
Project/Site Name:	WM Twin Creek Landfill	**Cell Number:**	226-962-4394
Collected By:	Adam Tran, Darren Govan	**Email:**	anthony.vanderhayden@rwdi.com oluwatobi.odumoye@rwdi.com
Sample Date:	2025/10/30	**Project PO:**	2101750.38
Comments:	WARNING: Landfill gas - neat, no dilution		

Scan for Odour Sampling Resources

Odour Evaluation Requests

(please check all that apply for each sample)

Line No.	Field No.	Sample Description	Sample Time	Field H_2S (ppm)	Thresholds Detection & Recognition ASTM E679 & EN13725	Intensity ASTM E544	Characterization Hedonic Tone & Descriptors	Persistency Dose Response	Predilution 10:1 (If DT>60,000)	Lab Use Only LAB	Lab Use Only CODE
1	TCLW282	WM Twin Creeks Landfill Well #282	13:40	-	✔					2	
2	TCLW98	WM Twin Creeks Landfill Well #98	13:50	-	✔					2	
3	TCLW292	WM Twin Creeks Landfill Well #292	14:02	-	✔					2	
4	Blank	WM Twin Creeks Landfill Blank N2	-	-	✔					2	
5											
6											
7											
8											
9											
10											
11											
12											

Lab Use Only

Evaluation Report No. C2530402

Number of Boxes Shipped: 2 bags

Carrier (check): Purolator ___ | FedEx ___ | UPS ___

DHL ___ | Other: by hand

Relinquished by	Date	Time
Adam Tran	2025/10/30	

Received at Lab by	Date	Time	Comments & Exceptions Noted
A Tran	10/31/25	7:56	

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APPENDIX 8A

Summary of Ambient Air Quality Measurements for D&F

TCEC Existing Conditions

RWDI Project #2101750

MECP ID	NAPS ID	Station Name	City	Address	Year	90th
n/a	62601	EXPERIMENTAL FARM _SIMCOE_	SIMCOE	EXPERIMENTAL FARM	2017	0.02
					2018	0.01
					2019	0.02
					2020	0.03
					2021	0.02
					AVERAGE (µg/m^3):	0.02

Summary of Ambient Air Quality Measurements for Nitrogen Dioxide

TCEC Existing Conditions

RWDI Project #2101750

MECP ID	NAPS ID	Station Name	City	Address	Year	Concentration (ppb)						
						1-hr Percentiles				Annual Mean	MAX	
						50th	70th	90th	99th		1-hr	24-hr
15026	60904	LONDON	LONDON	42 St. Julien Street	2017	4.4	6.4	11.1	23.6	5.8	39.9	20.7
					2018	4.2	6.1	10.5	23.8	5.4	39.4	20.3
					2019	4.3	6.3	10.9	27.4	5.8	45.3	25.8
					2020	3.6	5.2	8.6	18.3	4.5	38.6	20.3
					2021	4	5.8	10.1	22.3	5.2	36.3	18.0
					AVERAGE (ppb):	4.1	6.0	10.2	23.1	5.3	39.9	21.0
					AVERAGE (µg/m^3):	7.7	11.2	19.2	43.4	10.0	75.0	39.5

MECP ID	NAPS ID	Station Name	City	Location	Year	Concentration (ppb)						
						24-hr Percentiles						
						50th	70th	90th	99th			
15026	60904	LONDON	LONDON	42 St. Julien Street	2017	4.9	6.3	9.9	16			
					2018	4.7	6.1	9.1	15.5			
					2019	4.7	6.3	10	19			
					2020	4	5.2	7.6	13.2			
					2021	4.4	5.8	8.9	13.6			
					AVERAGE (ppb):	4.5	5.9	9.1	15.5			
					AVERAGE (µg/m^3):	8.5	11.2	17.1	29.1			

Summary of Ambient Air Quality Measurements for Sulphur Dioxide

TCEC Existing Conditions

RWDI Project #2101750

MECP ID	NAPS ID	Station Name	City	Address	Year	Concentration (ppb)					
						1-hr Percentiles				Annual Mean	MAX
						50th	70th	90th	99th		1-hr
n/a	62601	EXPERIMENTAL FARM _SIMCOE_	SIMCOE	EXPERIMENTAL FARM	2017	0.6	0.8	0.9	2.2	0.6	9.9
					2018	0.4	1	1.2	3.3	0.5	11.9
					2019	0.3	0.4	0.6	2.7	0.3	13.9
					2020	0.7	1.1	1.2	2.4	0.8	5.8
					2021	0.4	0.6	0.7	1.9	0.4	19.8
				AVERAGE (ppb):		0.5	0.8	0.9	2.5	0.5	12.3
				AVERAGE (µg/m^3):		1.3	2.0	2.4	6.5	1.4	32.1

MECP ID	NAPS ID	Station Name	City	Location	Year	Concentration (ppb)					
						24-hr Percentiles					MAX
						50th	70th	90th	99th		24-hr
n/a	62601	EXPERIMENTAL FARM _SIMCOE_	SIMCOE	EXPERIMENTAL FARM	2019	0.3	0.5	0.6	1.6		2.6
					2020	0.8	1.1	1.2	1.8		2.5
					2021	0.4	0.6	0.7	1.3		3.1
				AVERAGE (ppb):		0.6	0.9	1.0	1.6		2.7
				AVERAGE (µg/m^3):		1.6	2.2	2.5	4.1		7.1

APPENDIX 9A

Appendix 9A: Source Summary Table

Twin Creeks Environmental Centre

RWDI# 2101750

Source ID	Source Type	Source Description	Source Data								Emission Data							
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temperature (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate [3] (g/s)	Maximum Flux Rate [3] ($g/m^2/s$)	Averaging Period (hours)	Emission Estimating Technique [1]	Emissions Data Quality [2]	Percentage of Overall Emissions (%)
FLARE5	POINT	Landfill Gas Flare 5 - RNG Plant Startup	41.67	871	3.66	3.97	15.24	N/A	429140	4757490	Benzene	71-43-2	1.15E-04	N/A	24, Annual	EC	Average	1%
											Vinyl Chloride (Chloroethylene)	75-01-4	4.45E-05	N/A	24	EC	Average	<1%
											1,2-Dichloroethane	107-06-2	3.68E-05	N/A	24	EC	Average	<1%
											Nitrogen Oxides (NOx)	10102-44-0	5.96E-01	N/A	1, 24	EC	Average	7%
											Particulate Matter (PM)	PM	2.25E-01	N/A	24	EC	Average	<1%
											Sulphur Dioxide (SO2)	7446-09-5	3.53E-01	N/A	1, Annual	EC	Average	13%
											Dioxins and Furans	DF	2.08E-11	N/A	24	EF	Marginal	12%
											Total Reduced Sulphur (TRS)	TRS	1.78E-02	N/A	10-minute, 24	EC	Marginal	1%
											Hydrogen Sulfide	7783-06-4	1.78E-02	N/A	10-minute, 24	EC	Average	2%
FLARE6	POINT	Landfill Gas Flare 6 - RNG Plant Startup	41.67	871	3.66	3.97	15.24	N/A	429149	4757490	Benzene	71-43-2	1.15E-04	N/A	24, Annual	EC	Average	1%
											Vinyl Chloride (Chloroethylene)	75-01-4	4.45E-05	N/A	24	EC	Average	<1%
											1,2-Dichloroethane	107-06-2	3.68E-05	N/A	24	EC	Average	<1%
											Nitrogen Oxides (NOx)	10102-44-0	5.96E-01	N/A	1, 24	EC	Average	7%
											Particulate Matter (PM)	PM	2.25E-01	N/A	24	EC	Average	<1%
											Sulphur Dioxide (SO2)	7446-09-5	3.53E-01	N/A	1, Annual	EC	Average	13%
											Dioxins and Furans	DF	2.08E-11	N/A	24	EF	Marginal	12%
											Total Reduced Sulphur (TRS)	TRS	1.78E-02	N/A	10-minute, 24	EC	Marginal	1%
											Hydrogen Sulfide	7783-06-4	1.78E-02	N/A	10-minute, 24	EC	Average	2%
RNG_TO1	POINT	RNG Plant Pre-Treatment Thermal Oxidizer	2.51	816	1.22	2.15	15.24	N/A	429116	4757455	Benzene	71-43-2	4.24E-05	N/A	24, Annual	EC	Marginal	<1%
											1,2-Dichloroethane	107-06-2	6.14E-06	N/A	24	EC	Marginal	<1%
											Vinyl Chloride	75-01-4	1.78E-05	N/A	24	EC	Marginal	<1%
											Total Reduced Sulphur (TRS)	TRS	9.13E-04	N/A	10-minute, 24	EC	Marginal	<1%
											Oxides of Nitrogen	10102-44-0	1.30E-01	N/A	1, 24	EC	Marginal	1%
											Sulphur Dioxide	7446-09-5	9.13E-02	N/A	1, Annual	EC	Marginal	3%
											Dioxins and Furans	DF	3.58E-12	N/A	24	EF	Marginal	2%
											Particulate Matter	PM	4.65E-03	N/A	24	EC	Marginal	<1%
RNG_TO2	POINT	RNG Plant Main Thermal Oxidizer	18.03	816	2.90	2.74	15.24	N/A	429124	4757456	Benzene	71-43-2	1.24E-05	N/A	24, Annual	EC	Marginal	<1%
											1,2-Dichloroethane	107-06-2	4.04E-05	N/A	24	EC	Marginal	1%
											Vinyl Chloride	75-01-4	9.36E-05	N/A	24	EC	Marginal	2%
											Total Reduced Sulphur (TRS)	TRS	3.08E-04	N/A	10-minute, 24	EC	Marginal	<1%
											Oxides of Nitrogen	10102-44-0	1.20E+00	N/A	1, 24	EC	Marginal	13%
											Sulphur Dioxide	7446-09-5	3.08E-02	N/A	1, Annual	EC	Marginal	1%
											Dioxins and Furans	DF	2.54E-11	N/A	24	EF	Marginal	15%
											Particulate Matter	PM	7.71E-02	N/A	24	EC	Marginal	<1%
FLARE5BP	POINT	Landfill Gas Flare 5 - Thermal Oxidizer Bypass Scenario	37.15	871	3.66	3.54	15.24	N/A	429140	4757490	Benzene	71-43-2	2.46E-04	N/A	24, Annual	EC	Marginal	2%
											1,2-Dichloroethane	107-06-2	3.56E-05	N/A	24	EC	Marginal	<1%
											Vinyl Chloride	75-01-4	1.03E-04	N/A	24	EC	Marginal	2%
											Total Reduced Sulphur (TRS)	TRS	5.29E-03	N/A	10-minute, 24	EC	Marginal	<1%
											Oxides of Nitrogen	10102-44-0	5.78E-01	N/A	1, 24	EC	Marginal	6%
											Sulphur Dioxide	7446-09-5	2.65E-01	N/A	1, Annual	EC	Marginal	10%
											Dioxins and Furans	DF	1.04E-11	N/A	24	EF	Marginal	6%
											Particulate Matter	PM	2.18E-01	N/A	24	EC	Marginal	<1%
FLARE6BP	POINT	Landfill Gas Flare 6 - Thermal Oxidizer Bypass Scenario	37.15	871	3.66	3.54	15.24	N/A	429149	4757490	Benzene	71-43-2	1.01E-05	N/A	24, Annual	EC	Marginal	<1%
											1,2-Dichloroethane	107-06-2	3.30E-05	N/A	24	EC	Marginal	<1%
											Vinyl Chloride	75-01-4	7.64E-05	N/A	24	EC	Marginal	2%
											Total Reduced Sulphur (TRS)	TRS	2.51E-04	N/A	10-minute, 24	EC	Marginal	<1%
											Oxides of Nitrogen	10102-44-0	5.78E-01	N/A	1, 24	EC	Marginal	6%
											Sulphur Dioxide	7446-09-5	1.26E-02	N/A	1, Annual	EC	Marginal	<1%
											Dioxins and Furans	DF	1.04E-11	N/A	24	EF	Marginal	6%
											Particulate Matter	PM	2.18E-01	N/A	24	EC	Marginal	<1%
AMINE	POINT-CAP	Amine Reboiler	0.59	204	0.39	5.00	4.92	1.87	429070	4757462	Nitrogen Oxides (NOx)	10102-44-0	8.99E-02	N/A	1, 24	EF	Average	1%
											Particulate Matter	PM	3.28E-03	N/A	24	EF	Average	<1%

Appendix 9A: Source Summary Table

Twin Creeks Environmental Centre

RWDI# 2101750

Source ID	Source Type	Source Description	Source Data								Emission Data							
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temperature (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate [3] (g/s)	Maximum Flux Rate [3] ($g/m^2/s$)	Averaging Period (hours)	Emission Estimating Technique [1]	Emissions Data Quality [2]	Percentage of Overall Emissions (%)
GEN4	POINT	RNG Plant 360 kW Emergency Diesel Generator	0.48	491	0.15	26.50	2.15	N/A	429125	4757401	Nitrogen Oxides	10102-44-0	5.26E-01	N/A	1, 24	EF	Above-Average	6%
											Particulate Matter	PM	3.01E-02	N/A	24	EF	Above-Average	<1%
											Sulphur Dioxide	7446-09-5	1.26E-01	N/A	1, Annual	EF	Above-Average	5%
L4	POINT-HOR	Passive Exhaust Louvre Serving SBR and Aeration Tanks	1.96	25	1.38	1.31	2.13	N/A	429013	4757497	Benzene	71-43-2	1.43E-04	N/A	24, Annual	EC	Average	1%
											Vinyl Chloride (Chloroethylene)	75-01-4	3.09E-04	N/A	24	EC	Average	6%
											1,2-Dichloroethane	107-06-2	1.21E-04	N/A	24	EC	Average	3%
											Ammonia	7664-41-7	1.39E-02	N/A	24	EC	Average	24%
											Odour	ODOUR	4.76E+02	N/A	10-minute	EC	Average	1%
L3	POINT-HOR	Passive Exhaust Louvre Serving SBR and Aeration Tanks	1.96	25	1.38	1.31	2.13	N/A	429013	4757490	Benzene	71-43-2	1.43E-04	N/A	24, Annual	EC	Average	1%
											Vinyl Chloride (Chloroethylene)	75-01-4	3.09E-04	N/A	24	EC	Average	6%
											1,2-Dichloroethane	107-06-2	1.21E-04	N/A	24	EC	Average	3%
											Ammonia	7664-41-7	1.39E-02	N/A	24	EC	Average	24%
											Odour	ODOUR	4.76E+02	N/A	10-minute	EC	Average	1%
EF_2	POINT	Process Exhaust Fan Serving RO System Area	1.71	25	0.51	8.37	3.96	N/A	429073	4757502	Benzene	71-43-2	2.55E-04	N/A	24, Annual	EC	Average	2%
											Vinyl Chloride (Chloroethylene)	75-01-4	2.59E-04	N/A	24	EC	Average	5%
											1,2-Dichloroethane	107-06-2	2.39E-04	N/A	24	EC	Average	6%
											Ammonia	7664-41-7	9.49E-06	N/A	24	EC	Average	<1%
											Odour	ODOUR	3.59E+00	N/A	10-minute	EC	Average	<1%
SD_1	POINT-CAP	Slurry Dryer Exhaust	0.24	25	0.30	3.34	5.00	N/A	429057	4757483	Benzene	71-43-2	6.40E-04	N/A	24, Annual	EC	Average	6%
											Vinyl Chloride (Chloroethylene)	75-01-4	6.40E-04	N/A	24	EC	Average	13%
											1,2-Dichloroethane	107-06-2	6.40E-04	N/A	24	EC	Average	17%
											Ammonia	7664-41-7	4.40E-04	N/A	24	EC	Average	<1%
											Odour	ODOUR	2.36E+01	N/A	10-minute	EC	Average	<1%
GEN1	POINT	1,000 kW Emergency Diesel Generator Serving Landfill Gas Plant	3.56	477	0.25	72.52	3.60	0.00	429119	4757554	Nitrogen Oxides	10102-44-0	2.72E-01	N/A	1, 24	EF	Above-Average	3%
											Particulate Matter	PM	4.53E-02	N/A	24	EF	Above-Average	<1%
											Sulphur Dioxide	7446-09-5	4.53E-02	N/A	1, Annual	EF	Above-Average	2%
GEN2	POINT	50 kW Diesel Generator Serving Leachate Pumps	0.24	477	0.10	30.56	3.60	0.00	429246	4757604	Nitrogen Oxides	10102-44-0	7.05E-02	N/A	1, 24	EF	Marginal	<1%
											Particulate Matter	PM	2.32E-02	N/A	24	EF	Marginal	<1%
											Sulphur Dioxide	7446-09-5	2.16E-02	N/A	1, Annual	EF	Marginal	<1%
GEN3	POINT	250 kW Emergency Diesel Generator Serving the Maintenance Offices	0.97	477	0.15	54.89	3.60	0.00	428415	4758689	Nitrogen Oxides	10102-44-0	3.53E-01	N/A	1, 24	EF	Marginal	4%
											Particulate Matter	PM	1.16E-01	N/A	24	EF	Marginal	<1%
											Sulphur Dioxide	7446-09-5	1.08E-01	N/A	1, Annual	EF	Marginal	4%
FLARE1	POINT	Landfill Gas Flare (Based on Full Load)	61.30	950	3.70	5.70	15.20	N/A	429117	4757504	Benzene	71-43-2	1.26E-04	N/A	24, Annual	EC	Average	1%
											Vinyl Chloride (Chloroethylene)	75-01-4	4.91E-05	N/A	24	EC	Average	1%
											1,2-Dichloroethane	107-06-2	4.06E-05	N/A	24	EC	Above-Average	1%
											Nitrogen Oxides	10102-44-0	6.57E-01	N/A	1, 24	EF	Average	7%
											Particulate Matter	PM	2.48E-01	N/A	24	EF	Average	<1%
											Sulphur Dioxide	7446-09-5	3.89E-01	N/A	1, Annual	EC	Marginal	14%
											Dioxins and Furans	DF	2.29E-11	N/A	24	EF	Marginal	13%
											Total Reduced Sulphur (TRS)	TRS	1.97E-02	N/A	10-minute, 24	EC	Marginal	2%
											Hydrogen Sulfide	7783-06-4	1.97E-02	N/A	10-minute, 24	EC	Above-Average	2%
FLARE2	POINT	Landfill Gas Flare (Based on Full Load)	61.30	950	3.70	5.70	15.20	N/A	429154	4757504	Benzene	71-43-2	1.26E-04	N/A	24, Annual	EC	Average	1%
											Vinyl Chloride (Chloroethylene)	75-01-4	4.91E-05	N/A	24	EC	Average	1%
											1,2-Dichloroethane	107-06-2	4.06E-05	N/A	24	EC	Above-Average	1%
											Nitrogen Oxides	10102-44-0	6.57E-01	N/A	1, 24	EF	Average	7%
											Particulate Matter	PM	2.48E-01	N/A	24	EF	Average	<1%
											Sulphur Dioxide	7446-09-5	3.89E-01	N/A	1, Annual	EC	Marginal	14%
											Dioxins and Furans	DF	2.29E-11	N/A	24	EF	Marginal	13%
											Total Reduced Sulphur (TRS)	TRS	1.97E-02	N/A	10-minute, 24	EC	Marginal	2%
											Hydrogen Sulfide	7783-06-4	1.97E-02	N/A	10-minute, 24	EC	Above-Average	2%

Appendix 9A: Source Summary Table

Twin Creeks Environmental Centre

RWDI# 2101750

Source ID	Source Type	Source Description	Source Data								Emission Data							
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temperature (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate [3] (g/s)	Maximum Flux Rate [3] ($g/m^2/s$)	Averaging Period (hours)	Emission Estimating Technique [1]	Emissions Data Quality [2]	Percentage of Overall Emissions (%)
FLARE3	POINT	Proposed Landfill Gas Flare (Based on Full Load)	61.30	950	3.70	5.70	15.20	N/A	429142	4757504	Benzene	71-43-2	1.26E-04	N/A	24, Annual	EC	Average	1%
											Vinyl Chloride (Chloroethylene)	75-01-4	4.91E-05	N/A	24	EC	Average	1%
											1,2-Dichloroethane	107-06-2	4.06E-05	N/A	24	EC	Above-Average	1%
											Nitrogen Oxides	10102-44-0	6.57E-01	N/A	1, 24	EF	Average	7%
											Particulate Matter	PM	2.48E-01	N/A	24	EF	Average	<1%
											Sulphur Dioxide	7446-09-5	3.89E-01	N/A	1, Annual	EC	Marginal	14%
											Dioxins and Furans	DF	2.29E-11	N/A	24	EF	Marginal	13%
											Total Reduced Sulphur (TRS)	TRS	1.97E-02	N/A	10-minute, 24	EC	Marginal	2%
											Hydrogen Sulfide	7783-06-4	1.97E-02	N/A	10-minute, 24	EC	Above-Average	2%
FLARE4	POINT	Proposed Landfill Gas Flare (Based on Full Load)	25.79	950	3.20	3.21	12.19	N/A	429129	4757504	Benzene	71-43-2	5.73E-05	N/A	24, Annual	EC	Average	<1%
											Vinyl Chloride (Chloroethylene)	75-01-4	2.22E-05	N/A	24	EC	Average	<1%
											1,2-Dichloroethane	107-06-2	1.84E-05	N/A	24	EC	Above-Average	<1%
											Nitrogen Oxides	10102-44-0	2.98E-01	N/A	1, 24	EF	Average	3%
											Particulate Matter	PM	1.12E-01	N/A	24	EF	Average	<1%
											Sulphur Dioxide	7446-09-5	1.76E-01	N/A	1, Annual	EC	Marginal	6%
											Dioxins and Furans	DF	1.04E-11	N/A	24	EF	Marginal	6%
											Total Reduced Sulphur (TRS)	TRS	8.92E-03	N/A	10-minute, 24	EC	Marginal	<1%
											Hydrogen Sulfide	7783-06-4	8.92E-03	N/A	10-minute, 24	EC	Above-Average	<1%
AREA1	AREA	Expansion Landfill Phases 1 Through 3 Approximate Area = 244,004 m^2 (Emissions Based on Year 2033)	N/A	N/A	N/A	N/A	N/A	N/A	428626	4757721	Benzene	71-43-2	7.78E-05	5.46E-09	24, Annual	EC	Average	<1%
											Vinyl Chloride (Chloroethylene)	75-01-4	5.17E-04	2.12E-09	24	EC	Average	11%
											1,2-Dichloroethane	107-06-2	4.29E-04	1.76E-09	24	EC	Above-Average	12%
											Total Reduced Sulphur (TRS)	TRS	2.08E-01	1.07E-08	10-minute, 24	EC	Marginal	17%
											Hydrogen Sulfide	7783-06-4	2.08E-01	3.61E-09	10-minute, 24	EC	Above-Average	18%
											Odour	ODOUR	1.05E+04	4.31E-02	10-minute	ST	Average	24%
AREA2	AREA	Expansion Landfill Phases 4 Through 5 Approximate Area = 165,611 m^2 (Emissions Based on Year 2033)	N/A	N/A	N/A	N/A	N/A	N/A	428634	4758149	Benzene	71-43-2	1.50E-03	9.05E-09	24, Annual	EC	Average	13%
											Vinyl Chloride (Chloroethylene)	75-01-4	5.82E-04	3.51E-09	24	EC	Average	12%
											1,2-Dichloroethane	107-06-2	4.82E-04	2.91E-09	24	EC	Above-Average	13%
											Total Reduced Sulphur (TRS)	TRS	2.33E-01	1.07E-08	10-minute, 24	EC	Marginal	20%
											Hydrogen Sulfide	7783-06-4	2.33E-01	3.61E-09	10-minute, 24	EC	Above-Average	20%
											Odour	ODOUR	7.14E+03	4.31E-02	10-minute	ST	Average	16%
AREA3	AREA	Expansion Landfill Phases 6 Through 7 Approximate Area = 179,092 m^2 (Emissions Based on Year 2033)	N/A	N/A	N/A	N/A	N/A	N/A	428637	4758461	Benzene	71-43-2	1.85E-03	1.03E-08	24, Annual	EC	Average	16%
											Vinyl Chloride (Chloroethylene)	75-01-4	7.18E-04	4.01E-09	24	EC	Average	15%
											1,2-Dichloroethane	107-06-2	5.95E-04	3.32E-09	24	EC	Above-Average	16%
											Total Reduced Sulphur (TRS)	TRS	2.88E-01	1.07E-08	10-minute, 24	EC	Marginal	24%
											Hydrogen Sulfide	7783-06-4	2.88E-01	3.61E-09	10-minute, 24	EC	Above-Average	24%
											Odour	ODOUR	7.72E+03	4.31E-02	10-minute	ST	Average	18%
AREA4	AREA	Expansion Landfill Phases 8 Through 9 Approximate Area = 99,012 m^2 (Emissions Based on Year 2033)	N/A	N/A	N/A	N/A	N/A	N/A	429027	4758463	Benzene	71-43-2	2.17E-03	2.19E-08	24, Annual	EC	Average	19%
											Vinyl Chloride (Chloroethylene)	75-01-4	8.41E-04	8.50E-09	24	EC	Average	18%
											1,2-Dichloroethane	107-06-2	6.97E-04	7.04E-09	24	EC	Above-Average	19%
											Total Reduced Sulphur (TRS)	TRS	3.38E-01	1.07E-08	10-minute, 24	EC	Marginal	28%
											Hydrogen Sulfide	7783-06-4	3.38E-01	3.69E-09	10-minute, 24	EC	Above-Average	29%
											Odour	ODOUR	5.07E+03	5.12E-02	10-minute	ST	Average	12%
AREA5	AREA	Existing Landfill Approximate Area = 208,263 m^2 (Emissions Based on Year 2033)	N/A	N/A	N/A	N/A	N/A	N/A	429208	4757609	Benzene	71-43-2	8.91E-05	3.23E-10	24, Annual	EC	Average	<1%
											Vinyl Chloride (Chloroethylene)	75-01-4	3.46E-05	1.25E-10	24	EC	Average	<1%
											1,2-Dichloroethane	107-06-2	2.86E-05	1.04E-10	24	EC	Above-Average	<1%
											Total Reduced Sulphur (TRS)	TRS	1.50E-02	1.07E-08	10-minute, 24	EC	Marginal	1%
											Hydrogen Sulfide	7783-06-4	1.39E-02	3.61E-09	10-minute, 24	EC	Above-Average	1%
											Odour	ODOUR	1.20E+04	4.35E-02	10-minute	ST	Average	28%
DC_WF	VOLUME	Daily Cover Dropped at Working Face	N/A	N/A	N/A	N/A	N/A	N/A	429284	4758760	Particulate Matter	PM	Variable [4]	N/A	24	EF	Average	N/A
											PM10	PM10	Variable [4]	N/A	24	EF	Average	N/A
											PM2.5	PM25	Variable [4]	N/A	24	EF	Average	N/A

Appendix 9A: Source Summary Table

Twin Creeks Environmental Centre

RWDI# 2101750

Source ID	Source Type	Source Description	Source Data								Emission Data							
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temperature (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate [3] (g/s)	Maximum Flux Rate [3] ($g/m^2/s$)	Averaging Period (hours)	Emission Estimating Technique [1]	Emissions Data Quality [2]	Percentage of Overall Emissions (%)
DC_SS	VOLUME	Daily Cover Dropped at Soil Stockpile	N/A	N/A	N/A	N/A	N/A	N/A	429308	4757217	Particulate Matter	PM	Variable [4]	N/A	24	EF	Average	N/A
											PM10	PM10	Variable [4]	N/A	24	EF	Average	N/A
											PM2.5	PM25	Variable [4]	N/A	24	EF	Average	N/A
CDA1	VOLUME	Compost Material Dropped at Compost Diversion Area 1 (North)	N/A	N/A	N/A	N/A	N/A	N/A	429300	4758717	Particulate Matter	PM	Variable [4]	N/A	24	EF	Average	N/A
											PM10	PM10	Variable [4]	N/A	24	EF	Average	N/A
											PM2.5	PM25	Variable [4]	N/A	24	EF	Average	N/A
CDA2	VOLUME	Compost Material Dropped at Compost Diversion Area 2 (South)	N/A	N/A	N/A	N/A	N/A	N/A	429299	4758655	Particulate Matter	PM	Variable [4]	N/A	24	EF	Average	N/A
											PM10	PM10	Variable [4]	N/A	24	EF	Average	N/A
											PM2.5	PM25	Variable [4]	N/A	24	EF	Average	N/A
CS_WF	VOLUME	Contaminated Soil Dropped at Working Face	N/A	N/A	N/A	N/A	N/A	N/A	429275	4758749	Particulate Matter	PM	Variable [4]	N/A	24	EF	Average	N/A
											PM10	PM10	Variable [4]	N/A	24	EF	Average	N/A
											PM2.5	PM25	Variable [4]	N/A	24	EF	Average	N/A
WIND_SS	AREA	Wind Erosion at Soil Stockpile	N/A	N/A	N/A	N/A	N/A	N/A	429216	4757189	Particulate Matter	PM	N/A	Variable [4]	24	EF	Average	N/A
											PM10	PM10	N/A	Variable [4]	24	EF	Average	N/A
											PM2.5	PM25	N/A	Variable [4]	24	EF	Average	N/A
WIND_WF	AREA	Wind Erosion at Working Face	N/A	N/A	N/A	N/A	N/A	N/A	429322	4758707	Particulate Matter	PM	N/A	Variable [4]	24	EF	Average	N/A
											PM10	PM10	N/A	Variable [4]	24	EF	Average	N/A
											PM2.5	PM25	N/A	Variable [4]	24	EF	Average	N/A
WIND_CDA	AREA	Wind Rrosion at Compost Diversion Area	N/A	N/A	N/A	N/A	N/A	N/A	429270	4758654	Particulate Matter	PM	N/A	Variable	24	EF	Average	N/A
											PM10	PM10	N/A	Variable	24	EF	Average	N/A
											PM2.5	PM25	N/A	Variable	24	EF	Average	N/A
FC_CAP	AREA	Final Cap Construction Clay Drop-off	N/A	N/A	N/A	N/A	N/A	N/A	429208	4758760	Particulate Matter	PM	N/A	Variable [4]	24	EF	Average	N/A
											PM10	PM10	N/A	Variable [4]	24	EF	Average	N/A
											PM2.5	PM25	N/A	Variable [4]	24	EF	Average	N/A
FC_SS	AREA	Final Cap Clay Storage Pile Truck Loading	N/A	N/A	N/A	N/A	N/A	N/A	429278	4757247	Particulate Matter	PM	N/A	Variable [4]	24	EF	Average	N/A
											PM10	PM10	N/A	Variable [4]	24	EF	Average	N/A
											PM2.5	PM25	N/A	Variable [4]	24	EF	Average	N/A
WIND_CAP	AREA	Wind Erosion at the Final Cap Construction Area	N/A	N/A	N/A	N/A	N/A	N/A	429244	4758705	Particulate Matter	PM	N/A	Variable [4]	24	EF	Average	N/A
											PM10	PM10	N/A	Variable [4]	24	EF	Average	N/A
											PM2.5	PM25	N/A	Variable [4]	24	EF	Average	N/A
MH5AB	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429468	4758257	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH4A	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429461	4758000	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH3SA	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429461	4757794	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH16	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429423	4757612	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH6AB	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429198	4758220	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
SUMP	AREA	Leachate Maintenance Sump	N/A	N/A	N/A	N/A	N/A	N/A	429247	4758070	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH3SF	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429334	4757819	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH18	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429266	4757613	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
CONSOIL	AREA	Contaminated Soil Pile	N/A	N/A	N/A	N/A	N/A	N/A	429301	4758762	Vinyl Chloride (Chloroethylene)	75-01-4	7.34E-07	3.67E-08	24	ST	Average	<1%
											1,2-Dichloroethane	107-06-2	1.59E-05	7.97E-07	24	ST	Average	<1%
											Benzene	71-43-2	6.76E-04	3.38E-05	24, Annual	ST	Average	6%
											Odour	ODOUR	1.53E+00	7.65E-02	10-minute	ST	Average	<1%
WF	AREA	Working Face / Scrape Down Area	N/A	N/A	N/A	N/A	N/A	N/A	429255	4758714	Odour	ODOUR	N/A	Variable [5]	10-minute	ST	Average	N/A
DOZE1	VOLUME	Cat Dozers at Working Face, Dugitive Dust	N/A	N/A	N/A	N/A	N/A	N/A	429286	4758740	Particulate Matter	PM	4.44E+00	N/A	24	EC	Average	6%
											PM10	PM10	1.31E+00	N/A	24	EC	Average	6%
											PM2.5	PM25	4.66E-01	N/A	24	EC	Average	15%
DOZE2	VOLUME	Cat Dozers at Working Face, Tailpipe	N/A	N/A	N/A	N/A	N/A	N/A	429286	4758740	Particulate Matter	PM	2.84E-03	N/A	24	EC	Average	<1%
											PM10	PM10	2.84E-03	N/A	24	EC	Average	<1%
											PM2.5	PM25	2.75E-03	N/A	24	EC	Average	<1%
											Benzene	71-43-2	1.81E-04	N/A	24, Annual	EC	Average	2%
											Ammonia	7664-41-7	8.37E-04	N/A	24	EC	Average	1%
											Nitrogen Dioxide	NO2	4.65E-02	N/A	24	EC	Average	12%
											Nitrogen Oxides	10102-44-0	4.65E-02	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	2.76E-04	N/A	1, Annual	EC	Average	<1%
DOZE3	VOLUME	Cat Dozers at Soil Stockpile, Fugitive Dust	N/A	N/A	N/A	N/A	N/A	N/A	429314	4757233	Particulate Matter	PM	2.73E+00	N/A	24	EC	Average	3%

Appendix 9A: Source Summary Table

Twin Creeks Environmental Centre

RWDI# 2101750

Source ID	Source Type	Source Description	Source Data								Emission Data							
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temperature (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate [3] (g/s)	Maximum Flux Rate [3] ($g/m^2/s$)	Averaging Period (hours)	Emission Estimating Technique [1]	Emissions Data Quality [2]	Percentage of Overall Emissions (%)
											PM10	PM10	8.65E-01	N/A	24	EC	Average	4%
											PM2.5	PM25	2.87E-01	N/A	24	EC	Average	9%
DOZE4	VOLUME	Cat Dozers at Soil Stockpile, Tailpipe	N/A	N/A	N/A	N/A	N/A	N/A	429314	4757233	Particulate Matter	PM	5.45E-04	N/A	24	EC	Average	<1%
											PM10	PM10	5.45E-04	N/A	24	EC	Average	<1%
											PM2.5	PM25	5.28E-04	N/A	24	EC	Average	<1%
											Benzene	71-43-2	3.80E-05	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	2.26E-04	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	9.40E-03	N/A	24	EC	Average	2%
											Nitrogen Oxides	10102-44-0	9.40E-03	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	7.38E-05	N/A	1, Annual	EC	Average	<1%
DOZE1CAP	VOLUME	Cat Dozers at Working Face, Dugitive Dust	N/A	N/A	N/A	N/A	N/A	N/A	429210	4758740	Particulate Matter	PM	5.67E+00	N/A	24	EC	Average	7%
											PM10	PM10	2.04E+00	N/A	24	EC	Average	10%
											PM2.5	PM25	5.96E-01	N/A	24	EC	Average	19%
DOZE2CAP	VOLUME	Cat Dozers at Working Face, Tailpipe	N/A	N/A	N/A	N/A	N/A	N/A	429210	4758740	Particulate Matter	PM	8.01E-04	N/A	24	EC	Average	<1%
											PM10	PM10	8.01E-04	N/A	24	EC	Average	<1%
											PM2.5	PM25	7.77E-04	N/A	24	EC	Average	<1%
											Benzene	71-43-2	5.93E-05	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	1.19E-04	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	0.00E+00	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	1.03E-02	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	3.95E-05	N/A	1, Annual	EC	Average	<1%
DOZE2SS	VOLUME	Cat Dozers at Soil Stockpile, Tailpipe	N/A	N/A	N/A	N/A	N/A	N/A	429460	4757232	Particulate Matter	PM	2.89E-04	N/A	24	EC	Average	<1%
											PM10	PM10	2.89E-04	N/A	24	EC	Average	<1%
											PM2.5	PM25	2.80E-04	N/A	24	EC	Average	<1%
											Benzene	71-43-2	1.67E-05	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	3.33E-04	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	0.00E+00	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	8.51E-03	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	1.08E-04	N/A	1, Annual	EC	Average	<1%
IDLE01	VOLUME	Trucks Idling at the Scale House	N/A	N/A	N/A	N/A	N/A	N/A	428420	4758417	Particulate Matter	PM	3.84E-04	N/A	24	EC	Average	<1%
											PM10	PM10	3.84E-04	N/A	24	EC	Average	<1%
											PM2.5	PM25	3.53E-04	N/A	24	EC	Average	<1%
											Benzene	71-43-2	4.39E-06	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	2.13E-04	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	1.03E-02	N/A	24	EC	Average	3%
											Nitrogen Oxides	10102-44-0	2.75E-02	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	2.41E-05	N/A	1, Annual	EC	Average	<1%

Appendix 9A: Source Summary Table

Twin Creeks Environmental Centre

RWDI# 2101750

Source ID	Source Type	Source Description	Source Data								Emission Data							
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temperature (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate [3] (g/s)	Maximum Flux Rate [3] ($g/m^2/s$)	Averaging Period (hours)	Emission Estimating Technique [1]	Emissions Data Quality [2]	Percentage of Overall Emissions (%)
IDLE02	VOLUME	Trucks Idling at the Working Face	N/A	N/A	N/A	N/A	N/A	N/A	429285	4758740	Particulate Matter	PM	3.84E-04	N/A	24	EC	Average	<1%
											PM10	PM10	3.84E-04	N/A	24	EC	Average	<1%
											PM2.5	PM25	3.53E-04	N/A	24	EC	Average	<1%
											Benzene	71-43-2	4.39E-06	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	2.13E-04	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	1.03E-02	N/A	24	EC	Average	3%
											Nitrogen Oxides	10102-44-0	2.75E-02	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	2.41E-05	N/A	1, Annual	EC	Average	<1%
PR01	LINE_VOLUME	Main Entrance Road	N/A	N/A	N/A	N/A	N/A	N/A	428277	4758638	Particulate Matter	PM	1.02E-01 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	4.55E-02 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	7.19E-03 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	1.16E-05 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	2.31E-04 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	2.00E-02 [6]	N/A	24	EC	Average	5%
											Nitrogen Oxides	10102-44-0	5.47E-02 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	6.44E-05 [6]	N/A	1, Annual	EC	Average	<1%
PR01Z	LINE_VOLUME	Main Entrance Road, Onsite Equipment	N/A	N/A	N/A	N/A	N/A	N/A	428277	4758638	Particulate Matter	PM	3.00E-03 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	1.84E-03 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	2.72E-04 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	2.68E-07 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	9.26E-06 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	9.02E-04 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	2.46E-03 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	2.63E-06 [6]	N/A	1, Annual	EC	Average	<1%
PR02	LINE_VOLUME	Road to CDA	N/A	N/A	N/A	N/A	N/A	N/A	428485	4758871	Particulate Matter	PM	0.00E+00 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	0.00E+00 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	0.00E+00 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	0.00E+00 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	0.00E+00 [6]	N/A	1, Annual	EC	Average	<1%
PR03	LINE_VOLUME	Road to CDA	N/A	N/A	N/A	N/A	N/A	N/A	428483	4758640	Particulate Matter	PM	0.00E+00 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	0.00E+00 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	0.00E+00 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	0.00E+00 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	0.00E+00 [6]	N/A	1, Annual	EC	Average	<1%
PR04A	LINE_VOLUME	Entrance to Scale House	N/A	N/A	N/A	N/A	N/A	N/A	428404	4758633	Particulate Matter	PM	1.30E-01 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	5.51E-02 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	8.81E-03 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	1.38E-05 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	2.73E-04 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	2.36E-02 [6]	N/A	24	EC	Average	6%
											Nitrogen Oxides	10102-44-0	6.47E-02 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	7.62E-05 [6]	N/A	1, Annual	EC	Average	<1%
PR04AZ	LINE_VOLUME	Entrance to Scale House, Onsite Equipment	N/A	N/A	N/A	N/A	N/A	N/A	428404	4758633	Particulate Matter	PM	2.78E-03 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	1.24E-03 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	1.96E-04 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	2.50E-07 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	6.00E-06 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	5.46E-04 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	1.49E-03 [6]	N/A	1, 24	EC	Average	<1%

Appendix 9A: Source Summary Table

Twin Creeks Environmental Centre

RWDI# 2101750

Source ID	Source Type	Source Description	Source Data								Emission Data							
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temperature (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate [3] (g/s)	Maximum Flux Rate [3] ($g/m^2/s$)	Averaging Period (hours)	Emission Estimating Technique [1]	Emissions Data Quality [2]	Percentage of Overall Emissions (%)
											Sulphur Dioxide	7446-09-5	1.69E-06 [6]	N/A	1, Annual	EC	Average	<1%
UR06	LINE_VOLUME	Across Working Face	N/A	N/A	N/A	N/A	N/A	N/A	428637	4757835	Particulate Matter	PM	3.15E+01 [6]	N/A	24	EC	Average	39%
											PM10	PM10	7.33E+00 [6]	N/A	24	EC	Average	35%
											PM2.5	PM25	7.43E-01 [6]	N/A	24	EC	Average	24%
											Benzene	71-43-2	7.72E-05 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	1.53E-03 [6]	N/A	24	EC	Average	3%
											Nitrogen Dioxide	NO2	1.32E-01 [6]	N/A	24	EC	Average	35%
											Nitrogen Oxides	10102-44-0	3.63E-01 [6]	N/A	1, 24	EC	Average	4%
											Sulphur Dioxide	7446-09-5	4.27E-04 [6]	N/A	1, Annual	EC	Average	<1%
UR06Z	LINE_VOLUME	Across Working Face, Onsite Equipment	N/A	N/A	N/A	N/A	N/A	N/A	428637	4757835	Particulate Matter	PM	1.27E+01 [6]	N/A	24	EC	Average	16%
											PM10	PM10	2.89E+00 [6]	N/A	24	EC	Average	14%
											PM2.5	PM25	3.03E-01 [6]	N/A	24	EC	Average	10%
											Benzene	71-43-2	1.03E-03 [6]	N/A	24, Annual	EC	Average	9%
											Ammonia	7664-41-7	1.12E-02 [6]	N/A	24	EC	Average	19%
											Nitrogen Dioxide	NO2	2.80E-03 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	3.55E-01 [6]	N/A	1, 24	EC	Average	4%
											Sulphur Dioxide	7446-09-5	3.65E-03 [6]	N/A	1, Annual	EC	Average	<1%

Appendix 9A: Source Summary Table

Twin Creeks Environmental Centre

RWDI# 2101750

Source ID	Source Type	Source Description	Source Data								Emission Data							
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temperature (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate [3] (g/s)	Maximum Flux Rate [3] ($g/m^2/s$)	Averaging Period (hours)	Emission Estimating Technique [1]	Emissions Data Quality [2]	Percentage of Overall Emissions (%)
PR08Z	LINE_VOLUME	Working Face to Soil Stockpile/LTF	N/A	N/A	N/A	N/A	N/A	N/A	428628	4757836	Particulate Matter	PM	5.53E-01 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	1.45E-01 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	3.10E-02 [6]	N/A	24	EC	Average	1%
											Benzene	71-43-2	3.75E-04 [6]	N/A	24, Annual	EC	Average	3%
											Ammonia	7664-41-7	4.44E-03 [6]	N/A	24	EC	Average	8%
											Nitrogen Dioxide	NO2	4.25E-02 [6]	N/A	24	EC	Average	11%
											Nitrogen Oxides	10102-44-0	2.40E-01 [6]	N/A	1, 24	EC	Average	3%
											Sulphur Dioxide	7446-09-5	1.43E-03 [6]	N/A	1, Annual	EC	Average	<1%
UR09Z	LINE_VOLUME	Working Face to Soil Stockpile	N/A	N/A	N/A	N/A	N/A	N/A	429039	4757671	Particulate Matter	PM	4.93E-01 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	1.48E-01 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	1.52E-02 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	2.43E-05 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	2.68E-04 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	8.33E-03 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	8.72E-05 [6]	N/A	1, Annual	EC	Average	<1%
UR11Z	LINE_VOLUME	Across Soil Stockpile	N/A	N/A	N/A	N/A	N/A	N/A	429160	4757399	Particulate Matter	PM	1.52E+01 [6]	N/A	24	EC	Average	19%
											PM10	PM10	4.58E+00 [6]	N/A	24	EC	Average	22%
											PM2.5	PM25	4.67E-01 [6]	N/A	24	EC	Average	15%
											Benzene	71-43-2	6.44E-04 [6]	N/A	24, Annual	EC	Average	6%
											Ammonia	7664-41-7	7.11E-03 [6]	N/A	24	EC	Average	12%
											Nitrogen Dioxide	NO2	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	2.21E-01 [6]	N/A	1, 24	EC	Average	2%
											Sulphur Dioxide	7446-09-5	2.32E-03 [6]	N/A	1, Annual	EC	Average	<1%
UR12	LINE_VOLUME	Across Soil Stockpile	N/A	N/A	N/A	N/A	N/A	N/A	429512	4757267	Particulate Matter	PM	0.00E+00 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	0.00E+00 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	0.00E+00 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	0.00E+00 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	0.00E+00 [6]	N/A	1, Annual	EC	Average	<1%
PR13Z	LINE_VOLUME	Working Face to LTF	N/A	N/A	N/A	N/A	N/A	N/A	429035	4757669	Particulate Matter	PM	1.91E-02 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	5.77E-03 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	1.21E-03 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	1.69E-05 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	2.00E-04 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	1.91E-03 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	1.08E-02 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	6.41E-05 [6]	N/A	1, Annual	EC	Average	<1%
PR14Z	LINE_VOLUME	Working Face to LTF	N/A	N/A	N/A	N/A	N/A	N/A	429077	4757516	Particulate Matter	PM	2.92E-03 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	8.05E-04 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	1.44E-04 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	7.87E-08 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	2.72E-06 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	2.65E-04 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	7.22E-04 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	7.74E-07 [6]	N/A	1, Annual	EC	Average	<1%
PR15	LINE_VOLUME	Entrance to CDA	N/A	N/A	N/A	N/A	N/A	N/A	429260	4758870	Particulate Matter	PM	0.00E+00 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	0.00E+00 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	0.00E+00 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	0.00E+00 [6]	N/A	1, 24	EC	Average	<1%

Source ID	Source Type	Source Description	Source Data								Emission Data							
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temperature (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate [3] (g/s)	Maximum Flux Rate [3] ($g/m^2/s$)	Averaging Period (hours)	Emission Estimating Technique [1]	Emissions Data Quality [2]	Percentage of Overall Emissions (%)
											Sulphur Dioxide	7446-09-5	0.00E+00 [6]	N/A	1, Annual	EC	Average	<1%
UR16	LINE_VOLUME	Entrance to CDA	N/A	N/A	N/A	N/A	N/A	N/A	429342	4758866	Particulate Matter	PM	0.00E+00 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	0.00E+00 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	0.00E+00 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	0.00E+00 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	0.00E+00 [6]	N/A	1, Annual	EC	Average	<1%
UR17	LINE_VOLUME	Across CDA	N/A	N/A	N/A	N/A	N/A	N/A	429344	4758647	Particulate Matter	PM	0.00E+00 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	0.00E+00 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	0.00E+00 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	0.00E+00 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	0.00E+00 [6]	N/A	1, Annual	EC	Average	<1%
UR18	LINE_VOLUME	Across Working Face	N/A	N/A	N/A	N/A	N/A	N/A	429301	4758745	Particulate Matter	PM	0.00E+00 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	0.00E+00 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	0.00E+00 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	0.00E+00 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	0.00E+00 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	0.00E+00 [6]	N/A	1, Annual	EC	Average	<1%
UR18Z	LINE_VOLUME	Across Working Face, Onsite Equipment	N/A	N/A	N/A	N/A	N/A	N/A	429301	4758745	Particulate Matter	PM	3.94E+00 [6]	N/A	24	EC	Average	5%
											PM10	PM10	1.20E+00 [6]	N/A	24	EC	Average	6%
											PM2.5	PM25	1.23E-01 [6]	N/A	24	EC	Average	4%
											Benzene	71-43-2	1.94E-04 [6]	N/A	24, Annual	EC	Average	2%
											Ammonia	7664-41-7	2.12E-03 [6]	N/A	24	EC	Average	4%
											Nitrogen Dioxide	NO2	5.27E-04 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	6.69E-02 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	6.88E-04 [6]	N/A	1, Annual	EC	Average	<1%
PR04B	LINE_VOLUME	Scale House to Working Face	N/A	N/A	N/A	N/A	N/A	N/A	428477	4758211	Particulate Matter	PM	3.13E-01 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	1.23E-01 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	2.00E-02 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	2.97E-05 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	5.88E-04 [6]	N/A	24	EC	Average	1%
											Nitrogen Dioxide	NO2	5.09E-02 [6]	N/A	24	EC	Average	14%
											Nitrogen Oxides	10102-44-0	1.39E-01 [6]	N/A	1, 24	EC	Average	2%
											Sulphur Dioxide	7446-09-5	1.64E-04 [6]	N/A	1, Annual	EC	Average	<1%

Appendix 9A: Source Summary Table

Twin Creeks Environmental Centre

RWDI# 2101750

Source ID	Source Type	Source Description	Source Data								Emission Data							
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temperature (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate [3] (g/s)	Maximum Flux Rate [3] ($g/m^2/s$)	Averaging Period (hours)	Emission Estimating Technique [1]	Emissions Data Quality [2]	Percentage of Overall Emissions (%)
PR04BZ	LINE_VOLUME	Scale House to Working Face, Onsite Equipment	N/A	N/A	N/A	N/A	N/A	N/A	428477	4758211	Particulate Matter	PM	8.86E-03 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	4.97E-03 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	7.48E-04 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	1.16E-06 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	2.63E-05 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	2.36E-03 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	6.46E-03 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	7.38E-06 [6]	N/A	1, Annual	EC	Average	<1%
PR04C	LINE_VOLUME	Exit Road from Working Face	N/A	N/A	N/A	N/A	N/A	N/A	428477	4758211	Particulate Matter	PM	1.26E-01 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	4.93E-02 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	8.02E-03 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	1.19E-05 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	2.36E-04 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	2.04E-02 [6]	N/A	24	EC	Average	5%
											Nitrogen Oxides	10102-44-0	5.59E-02 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	6.58E-05 [6]	N/A	1, Annual	EC	Average	<1%
PR04CZ	LINE_VOLUME	Exit Road from Working Face, Onsite Equipment	N/A	N/A	N/A	N/A	N/A	N/A	428477	4758211	Particulate Matter	PM	2.67E-03 [6]	N/A	24	EC	Average	<1%
											PM10	PM10	1.11E-03 [6]	N/A	24	EC	Average	<1%
											PM2.5	PM25	1.77E-04 [6]	N/A	24	EC	Average	<1%
											Benzene	71-43-2	2.16E-07 [6]	N/A	24, Annual	EC	Average	<1%
											Ammonia	7664-41-7	5.18E-06 [6]	N/A	24	EC	Average	<1%
											Nitrogen Dioxide	NO2	4.72E-04 [6]	N/A	24	EC	Average	<1%
											Nitrogen Oxides	10102-44-0	1.29E-03 [6]	N/A	1, 24	EC	Average	<1%
											Sulphur Dioxide	7446-09-5	1.46E-06 [6]	N/A	1, Annual	EC	Average	<1%
MH17	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429326	4757612	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
LW6	AREA	Leachate Monitoring Well	N/A	N/A	N/A	N/A	N/A	N/A	429295	4757641	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
LW5	AREA	Leachate Monitoring Well	N/A	N/A	N/A	N/A	N/A	N/A	429414	4757638	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH3SB	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429460	4757818	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH3SD	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429216	4757819	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH3SC	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429211	4757771	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH3SE	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429326	4757780	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH4B	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429448	4758128	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
LW4	AREA	Leachate Monitoring Well	N/A	N/A	N/A	N/A	N/A	N/A	429414	4758056	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
LW3	AREA	Leachate Monitoring Well	N/A	N/A	N/A	N/A	N/A	N/A	429437	4758227	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH8AB	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429215	4758370	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH10	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429205	4758622	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH12AB	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429195	4758697	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH7AB	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429471	4758461	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
LW2	AREA	Leachate Monitoring Well	N/A	N/A	N/A	N/A	N/A	N/A	429451	4758527	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH9AB	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429473	4758617	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH11AB	AREA	Leachate Maintenance Hole	N/A	N/A	N/A	N/A	N/A	N/A	429473	4758632	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
LW1	AREA	Leachate Monitoring Well	N/A	N/A	N/A	N/A	N/A	N/A	429457	4758703	Odour	ODOUR	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
Total		Total of All Listed Sources									Benzene	71-43-2	1.13E-02					100%
											Vinyl Chloride (Chloroethylene)	75-01-4	4.76E-03					100%
											1,2-Dichloroethane	107-06-2	3.70E-03					100%
											Ammonia	7664-41-7	5.85E-02					100%
											Nitrogen Oxides	10102-44-0	8.98E+00					100%
											Particulate Matter	PM	8.00E+01					100%
											Sulphur Dioxide	7446-09-5	2.76E+00					100%
											Hydrogen Sulfide	7783-06-4	1.18E+00					100%
											Total Reduced Sulphur (TRS)	TRS	1.19E+00					100%
											PM10	PM10	2.08E+01					100%
											PM2.5	PM25	3.08E+00					100%
											Odour	ODOUR	4.34E+04					100%
											Dioxins and Furans	DF	1.70E-10					100%

Appendix 9A: Source Summary Table

RWDI# 2101750

Twin Creeks Environmental Centre

Source ID	Source Type	Source Description	Source Data								Emission Data							
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temperature (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate [3] (g/s)	Maximum Flux Rate [3] ($g/m^2/s$)	Averaging Period (hours)	Emission Estimating Technique [1]	Emissions Data Quality [2]	Percentage of Overall Emissions (%)
											Nitrogen Dioxide	NO2	3.76E-01					100%

Notes:

[1] Emission Estimating Technique Short-Forms are V-ST (Validated Source Test), ST (Source Test), EF (Emission Factor), MB (Mass Balance), and EC (Engineering Calculation).

[2] Data Quality Categories: Highest; Above-Average; Average; and Marginal.

[3] For Odour, the units are OU/s and $OU/m^2/s$ for emission rate and flux rate.

[4] Material handling and wind erosion emissions vary by time of day depending on wind conditions in each hour. Hourly emission rates have been applied during modelling.

[5] Odour emissions from the active working face vary depending on the time of day. From 6 a.m. to 9 a.m. the active face is freshly uncovered waste as the daily cover is stripped and new waste is deposited. By 9 a.m. the entire active face has been covered by at least 1 foot to 1 metre of new waste. After 9 a.m. the emission factor for new waste at the active face is applied.

[6] Roadway traffic varies by time of day. The maximum emission rate (g/s) for the entire road segment is shown in this table; hourly emissions rates have been applied during modelling.

APPENDIX 10A

REPORT

BEST MANAGEMENT PRACTICES PLAN (LITTER) WARWICK LANDFILL WATFORD, ON

Project Number: #W07-5191A **December 11, 2007**

SUBMITTED TO: **Mr. Wayne Jenken**
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Companion studies: Best Management Practices Plan (Dust)
Best Management Practices Plan (Odour)

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ATTACHMENT A: Example of WM Litter Training Form
ATTACHMENT B: Example of WM Litter Inspection and Dispatch Form
ATTACHMENT C: Example of WM Litter Complaint Form

1. PURPOSE

Wind-blown litter has the potential to cause a nuisance at nearby residences. The Interim Waste Authority (IWA) concluded that wind blown litter has a maximum potential travel distance of 1 km. Approximately 50% of escaping litter goes beyond 500 m[1]. The IWA classified the zone from 0 to 500m as medium impact, and the zone from 500 to 1000 m as low impact. RWDI's experience is that this represents a reasonable classification.

In an effort to minimize the potential for litter events for the existing and future operations of the Warwick Landfill site, Waste Management of Canada Corporation (WMCC) has developed this Best Management Practices Plan outlining measure that will be taken throughout the life of the landfill. As litter events from solid waste landfills are sometimes difficult to manage, due to weather condition variability, this plan identifies the control methods, implantation times and record keeping procedures for minimizing this potential nuisance. The following sections outline the procedure that WMCC will implement to control blowing litter events and site and adjacent property cleanups.

2. RESPONSIBILITIES

WMCC is responsible for ensuring the requirements of this plan. To accomplish this employees will be trained in this plan, including the deployment, maintenance, monitoring and inspections of equipment and operations and employee responsibilities will be designated.

The Site Superintendent, is responsible for:

- Providing training to staff
- Providing guidance on litter control measures
- Maintaining this plan
- Maintaining the Litter Control log

3. GENERAL INFORMATION

In the operation of the Warwick Landfill, it is important to minimize any adverse nuisance impacts on surrounding lands. A potential nuisance created by the landfill is blowing litter, which may be transported off-site during events with above average wind speeds. Although it is not feasible to completely eliminate blowing litter, litter can be reduced significantly with proper control practices. The zones of impacts are summarized in Table 2.1.

Table 2.1: Zones of Impact for Blowing Litter

Distance from Landfill Parameter	Finding	Impact Category
0 to 500 m	50% of escaping litter retained	Medium
500 to 1,000 m	Remaining 50% retained	Low
Beyond 1,000 m	Very little escapes beyond this distance	None

In a previous study, RWDI conducted wind tunnel tests on actual samples of residential and commercial waste to determine the threshold speed for wind-blown litter. The threshold speed was found to be approximately 22 km/h (measured at 2.0 m above the surface). Further characterization of the amount of blowing litter as a function of wind speed is summarized in Table 2.2.

Table 2.2: Summary of Threshold Speeds for Blowing Litter

Wind Speed Range*	Litter Description	Impact Category
0 to 22 km/h	No blowing litter	None
22 to 33 km/h	Newsprint, tissues, paper towels and some light bond paper	Light
33 to 47 km/h	All of the above plus plastic bags, small boxes, small cardboard tubes, paper bags and plastic sheets	Moderate
Above 47 km/h	All the above plus extensive heavy bond paper	Heavy

Notes: * Wind speeds are based on a measurement height of 2.0 m above grade

Another potential source of litter is from trucks coming and going from the site. Trucks should ensure that loads are secure prior to arriving at the site as well as ensure that the loads have been completely cleared of the material to avoid litter escaping from the vehicles when leaving.

Standard landfill practices include applying soil cover to the active tipping area at the end of each working day and continuously moving the compactor over new waste throughout the day. This practice is intended to minimize blowing litter after hours. As a result, blowing litter will primarily be restricted to the hours of operation, which are 7:00 am to 7:00 pm Monday to Saturday. However, it is anticipated that Saturday would be a somewhat shortened day for the most part since Saturday work at the transfer stations consists mainly of clean up as opposed to a full receiving day.

4. TRAINING

The site superintendent will be responsible for identifying a list of personnel who are trained in the placement of temporary litter screens. This training will include a description of default positions for the litter screen around the south and east sides of the working face (i.e., downwind for north and west winds). The staff will be able to identify conditions that necessitate the moving of screens to down-wind locations. This will be done when the wind blows from directions other than west or north at speeds greater than 22 km/hr, or, more practically, when papers are observed to be becoming airborne. The list of individuals identified to place the screens will be listed in the Litter log as well as the date when they were trained. This list will be updated at annual intervals. Attachment A includes an example of the WM Litter Training Log.

As noted in the Design and Operations Plan, an inclement weather area should be defined and utilized under high and sustained moderate wind events. In general winds gusting to or exceeding 47 kilometres per hour (short term events) indicating a high litter event or sustained (hourly or daily) moderate litter events (33 to 47 kilometres per hour) should be considered as trigger for landfilling in the inclement weather area. WM employees will be trained in the procedure for reviewing and documenting the predicted weather (wind) forecast. At a minimum the Environment Canada Weather Office under the current website of www.weatheroffice.gc.ca. will be checked. If the wind events of heavy or sustained moderate levels are forecasted landfilling for the following day will be planned within the inclement weather area (air space permitting). If heavy wind events occur that are not forecasted the operations will be moved to the inclement weather area (air space permitting). The procedure and training may be updated based on actual working conditions as required.

WM will also provide training to representatives regarding the recordkeeping requirements as well as the frequency of reporting.

5. INSPECTION AND MAINTENANCE PROCEDURES

For the permanent litter fences that will be installed, the site superintendent will inspect the perimeter litter fences on a weekly basis and enter the results in the litter log. The permanent litter fences will not contain holes greater than 6 inches in diameter. If required, repairs to litter fencing will be ordered and implemented within three weeks. All repairs will be noted in the litter log as well as the date that they are implemented.

Portable screens, located around the working face, will be inspected on an on-going basis. If the screens are improperly placed the superintendent will instruct trained personnel to move the screens. The site superintendent will also note, in the litter log, if the screens were placed inappropriately.

The site superintendent and other identified individuals will routinely monitor litter around the site and note inspections in the litter log. Areas of excessive litter build-up will be noted in the log and a crew will be dispatched within 3 working days to clean the area. This will help to minimize the amount of litter that may leave the site if not captured by the portable or permanent litter fences.

Trucks entering and exiting the site should be inspected for potential for load to release litter from the vehicle movements.

Attachment B includes examples of the WM Litter Inspection and Dispatch Form.

6. CONTROL METHODS FOR IDENTIFIED SOURCES

Light blowing litter conditions have the potential to occur on an occasional basis at the Warwick Landfill site, and moderate to heavy blowing litter conditions will occur infrequently. The predicted zones of impact, extends to a distance of 1,000 m from the site boundary being rated as low beyond 500 m and medium within 500 m.

Blowing litter will be mitigated through a variety of techniques. Below is a summary of blowing litter mitigation techniques that will be used.

1) Installation of portable litter fences that can be moved around the working face area to capture blowing litter on a day-to-day basis based on forecasted meteorological conditions.

2) Installation of permanent litter fences, downwind of the new proposed phases to capture the blowing litter for the predominant wind directions. The permanent litter fences will not contain holes greater than 6 inches in diameter. If required, repairs to litter fencing will be ordered and implemented within three weeks. All repairs will be noted in the litter log as well as the date that they are implemented.

3) Trucks entering and leaving the site should ensure that loads are secure or have been completely removed prior to leaving the site. If operators continue to bring in unsecured loads or failure to ensure all loose waste has been removed, warnings should be issued to the operator of the truck(s).

4) Loads of waste received at the working face with material noted as being a potential for litter should be covered as soon as possible or suppressed with water to prevent the potential for litter events.

5) Creation of an inclement weather area for each landfill expansion phase per the Site Development and Operations Report. The inclement weather area should be utilized under high and sustained moderate wind events. In general winds gusting to or exceeding 47 kilometres per hour (short term events) indicating a high litter event or sustained (hourly or daily) moderate litter events (33 to 47 kilometres per hour) should be considered as trigger for landfilling in the inclement weather area. At a minimum the Environment Canada Weather Office under the current website of www.weatheroffice.gc.ca. will be checked. If the wind events of heavy or sustained moderate levels are forecasted landfilling for the following day will be planned within the inclement weather area (air space permitting). If heavy wind events occur that are not forecasted the operations will be moved to the inclement weather area (air space permitting).

6) Within an hour of a blowing litter event, a site crew will be dispatched to the noted area(s) to retrieve the waste. This applies to litter not only at adjacent properties but also for litter on the main access roads. This only applies during the hours of operation for the landfill. When events occur during hours when the landfill is not operational, the site crew will be dispatched within an hour of the site opening.

7. SCHEDULE OF IMPLEMENATION

The following table provides the proposed schedule for implementation of the plan:

Table 5.1: Schedule for Control Methods

Task	Implementation Time Lines
Installation of portable litter fences	Current practice and on-going through the lifespan of the landfill
Installation of permanent litter fences	Installed in First Phase and should be expanded/supplemented with the construction of each new phase
Creation of inclement weather area.	Area set-aside during each phase for landfilling activities during inclement weather.
Within an hour of a blowing litter event, site crew should be dispatched to the identified area(s) to retrieve the waste.	On-going and through the lifespan of the landfill
Perimeter fence inspection	Ongoing and weekly through lifespan of landfill
Routinely monitor litter around site.	This will occur based on number of litter events.
Maintain a log of all blowing litter complaints and recorded concurrent meteorological conditions during each event.	On-going and through the lifespan of the landfill

8. RECORD KEEPING

Throughout this document there is reference to a Litter log that will be maintained on site. This log will include notation of the items listed previously as well as any other notes relevant to litter at the site. The log will be three-ringed binder that will contain portioned sections for training, inspection, dispatch of site crews for cleanup, general notes complaints. The litter log will contain all litter training, inspection, dispatch and complaint records for the previous 2 years.

From time to time there may be complaints regarding blowing litter. Attachment C includes a sample log including the following information:

- Name of complainant
- Time of complaint
- Time that the incident occurred
- Nature of complaint
- Operational details at the time of the complaint
- Wind conditions at the time of the complaint
- Details of investigation

All complaints will be included in the litter log. On an annual basis, the logs will be reviewed and any unfavourable trends will be further examined to identify corrective actions. These corrective actions will be included in the site annual report.

9. REFERENCES

[1] Interim Waste Authority: Detailed Assessment of the Proposed Site V4A, Summary Document. 1994.

[2] Henderson Paddon & Associates Limited: Development and Operations Report Warwick Landfill Expansion Waste Management of Canada Corporation Project # 105716. March 2006.

Warwick Landfill Best Management Plan
Litter Control Training Log

Trained Employee Name	Date of Training	Supervisor Signature

Warwick Landfill Best Management Plan
Litter Inspection and Dispatch Log

Inspected By: _____ **Inspection Date: _____**

Areas to inspect include: Permanent Litter Fences, Portable Litter Screens, Areas of Litter Build-Up

Area Inspected/Date/Reason for Inspection	Extent of Litter/Identification of Source	Date and Time of Clean-up	Notes/Remedial Action Required
Example *SW Corner of Site* *2007/11/29* *During regular inspection noticed a build-up of paper debris*	*Contained within a 5 metre radius.* *Likely from working face*	*2007/11/29 @noon*	*Small area. Potential re-alignment of portable litter screen*

Warwick Landfill Best Management Plan
Litter Complaint Form

WM Personnel:	

Date of Call		Time of Call	
Complainant Name		Complainant Contact Number	
Complainant Address			

Date of Litter Incident		Time of Litter Incident	
Description of Event			

Operations at Time of Incident	
Winds at Time of Incident	
Investigation Results and Corrective Action	

APPENDIX 10B

Appendix 10B - Complaints History Summary

Year	Date	Type	Investigation and Corrective Action	Response
2011	Thursday, November 3, 2011	Litter	Garbage truck drove by with cardboard flying out.	Cardboard was cleaned up although investigation determined in all likelihood this truck was not from the Landfill.
2019	Monday, January 7, 2019	Litter	Contine to inspect road daily and sweep daily	No additional comment
2019	Friday, April 12, 2019	Litter	Collected litter from field	No additional comment
2019	Saturday, May 4, 2019	Litter	Collected litter from road	No additional comment
2019	Wednesday, July 17, 2019	Litter	Collected litter from road	No additional comment
2019	Thursday, August 23, 2029	Litter	Sweeper and Labourers dispatched	No additional comment
2020	Monday, February 24, 2020	Litter	Confirmed with Ops Mgr patch of litter on West Berm, Op logs indicate observed in perimeter inspect., Collection for same day, re-assigned labourer to address area.	No Response at this time
2021	Sunday, March 7, 2021	Litter	Equipment dispatched, Haulers complete on site route.	No response at this time.
2021	Saturday, April 3, 2021	Litter	Collectors dispatched as per BMP.	Thanked for call.
2021	Friday, June 11, 2021	Litter	OMT dispatched to investigate, identified some fluff, tire shred (possibly not LF related), Sweeper dispatched immediately.	Thx for attending to this matter. I don't understand why wm isn't more on top of this situation. It's a very unwelcoming site for anyone coming and leaving our community. Also reflects very badly on WM operating integrity, and shows that they have no concern for our community.
2022	Wednesday, April 6, 2022	Litter	Completed Verification as required by D&O, investigation confirmed material not associated with Landfill, coordination with the County to address ditch maintenance	No Response at this time
2022	Sunday, October 16, 2022	Litter	Ops Manager investigated first thing, minimal litter observed- mattress fluff by Stop sign, pieces of paper on opposite corner, had picked that morning	actually there was a fair amount of debris along Nauvoo from Zion Line to the first detour sign on the east side of the road too.
2022	Friday, October 28, 2022	Litter	Ops Manager investigated, two labourers dispatched (included in complaint description felt the clean up first time was completely unacceptable)	Ok
2022	Saturday, November 26, 2022	Litter	Litter collectors dispatched	Thank you
2023	Monday, January 2, 2023	Litter	Litter collection focuses on off site litter, then ditches and waterways, then on-site • We had 2 pickers out each day on Dec 28th, 29th and 30th following the snow melt. • This litter was from the litter event on Dec 29th	Complainant followed up 25 hours later, and was concerned that action had not been completed

APPENDIX 10C

Appendix C: Summary of MECP Inspection Logs

Inspection Period	Inspection Log Notes Related to Litter	Action Items Provided by MECP Related to Litter
2019/01/01 - 2019/01/31	High wind events throughout January led to blowing litter observed by the inspector during all four site visits. During the 9, 17, & 25 the Company retained services of a Contractor to supplement their own labourers to deal with the blowing litter issues. On January 8, 2019 the Ministry received a call from the Company in regards to a high wind event that took place late January 07, 2019. The Company informed the Ministry that a significant wind event caused some blowing litter to travel offsite onto fields across from Nauvoo Road (west of the site). The Company had a plan in place to ensure that all liter blown off site was dealt with first. During the January 9, 17 & 25 site inspections, no litter was observed off site by the Ministry inspector. On January 30, 2019 litter was observed in several areas of the site but none beyond the property boundary. During this inspection it was noted that an extreme cold warning had been issued by Environment Canada. As per Company policy no personnel was to be working outside. Company staff assured the inspector that once the temperatures were reasonable work would continue. Any litter identified off site would continue to be dealt with in a timely manner.	No outstanding action items were noted
2019/02/01 - 2019/02/28	High wind events throughout January & February 2019 led to blowing litter on-site which was observed by the inspector during all site visits. However, the inspector did not observe any off site litter during the review period. Unfavourable weather was encountered on several occasions during this review period. It should be noted that Company policy dictates that no personnel are to work outside during extreme weather conditions. That being said, Company staff assured the inspector that once temperatures were reasonable work would continue. In the event that litter were to be identified off-site the company committed to dealing with it in a timely manner. Based on observations made by the inspector, several of the areas where litter was observed on-site have been locations where litter was previously observed indicating that the issue has not been adequately addressed. These areas include, but are not limited to: - Surround Sedimentation Pond 3 - Eastern property boundary - west slope of landfill expansion - near ditches on west side of landfill expansion - slopes on east side of landfill expansion - slopes on west side of existing landfill - snow covered all over site Complaints: - The Ministry received one (1) litter related complain and immediately notified the Company. The Complainant had claimed litter was blown into the field west of the landfill off Company property. - The Company followed up with immediate observation of the area, including pictures. No litter observed but possibly under snow. - Labourers sent out to the area next working day to ensure any litter is picked (weather restricted day of complaint) - continued use of Contractors to puck and own labourers - continued inspections on and off site during high wind events Daily Logs During the February 28, 2019 inspection it was noted that the February 27, 2019 logs were not completed. When asked by the inspector, Company personnel in charge of the logs had stated that the drive around and inspections had been completed and no problems were found, however nothing was written down.	Action given: - Within five (5) days of receiving this report, submit in writing to the undersigned Officer a proposed plan that will address the pick up of all blown litter onsite including all snow covered litter, and all areas identified in section 2.2 of this inspection report.
2019/03/01 - 2019/03/31	Some windblown litter was identified by the on site inspector and site representatives. Waste Management staff were observed picking up litter actively on site.	
2019/04/01 - 2019/04/30	During the month of April the landfill closed early and was closed all day due to the prediction of High wind events. These high wind events had the potential for extreme litter events, and health and safety issues. Areas identified in the February 2019 inspection report have all been dealt with. Litter is an ongoing issue at the site, however WM staff continue to respond appropriately to both onsite and offsite litter events. WM staff were observed on several occasions picking up litter. One complaint was received regarding litter that had blown offsite during a high wind event. Litter was picked up by the Company within the timeline outlined in the ECA. The caller was very grateful for the timely response provided by WM.	No actions required.
2019/05/01 - 2019/05/31	During several of the site inspections litter was identified outside of the active face. WM staff were observed continually picking up litter during the review period. One complaint was received regarding off-site litter.	No actions required
2019/06/01 - 2019/06/30	Litter is an ongoing issue at the site, however WM staff continue to respond appropriately to both onsite and offsite litter events. WM staff were observed on occasions picking up litter.	
	During this review period, there was litter found in the eastern ditch on the construction road. The Ministry requested a plan to remove this litter, recognizing that this ditch is periodically used for pumping out of the "borrow pit". WM staff expressed safety concerns (e.g. high volume of trucks hauling clay on the construction road). As a result, WM staff provided a plan to remove the litter in the eastern ditch by October 30th, which coincides with the anticipated construction completion date.	
	During this review period, litter was observed in the eastern ditch along the construction road of the landfill. The Company provided the Ministry a plan on June 19, 2019 to remove the litter by October 30th (i.e. once excavation/construction activities have completed and there are less roadside safety concerns on site).	Implement the action plan submitted to the Ministry on June 19, 2019, which addresses the litter in the eastern ditch on the construction road.
2019/07/01 - 2019/07/31	Litter is an ongoing issue at the site, however WM staff continue to respond appropriately to both onsite and offsite litter events. Some windblown litter was identified during the review period and WM staff was observed promptly responding to pick up the litter. Litter remains a concern and was first identified in the June 2019 Inspection Report. Due to safety concerns related to on-site construction, WM staff provided a plan to remove the litter in this area by October 30th. This coincides with the expected construction completion date.	No action required
2019/08/01 - 2019/08/31	Litter remained problematic for areas identified in the June 2019 Inspection Report. This situation is expected to continue into the fall due to safety concerns associated with construction work at the site. WM staff provided a plan to remove the litter in this area by October 30th. This coincides with the expected construction completion date. In other, safely accessible areas of the site the Ministry observed WM staff picking up litter and sweeping roads during this review period. One litter complaint was received.	No action required
2019/09/01 - 2019/09/30	Windblown litter was observed along the eastern slope (along Construction Road) and northern slope (facing Cell 4) of the landfill. WM staff continues to commit two pickers for one hour during each operational day to removal litter on Site.	Litter removal between cell 2 and 4 by December 31, 2019
2019/10/01 - 2019/10/31	Windblown litter was observed along the eastern slope (along Construction Road) and northern slope (facing Cell 4) of the landfill. WM staff continues to commit two pickers for one hour during each operational day to removal litter on Site.	No action required
2019/11/01 - 2019/11/30	Windblown litter continues to be observed along the eastern slope (along Construction Road) and northern slope (facing cell 4) of the landfill. WM staff reported limited ability to pick up litter during this review period due to safety concerns associated with snowy/icy conditions. The Ministry continues to monitor these areas as the Company works towards completing the Action Items from the September 2019 inspection.	No action required
2019/12/01 - 2019/12/31	Windblown litter is an ongoing issue at the site. During this review period, litter was observed along the eastern slope (along Construction Road) and northern slope (facing Cell 4) of the landfill. During exceptionally windy conditions, windblown litter was observed scattered throughout the Site and accumulating downwind of the property line. WM staff was observed re-locating litter fences and prioritizing litter puck up along the property boundary to prevent any off-site impacts, as per the Site's BMP for litter. However, the Company reported limited ability to pick up litter during this review period due to safety concerns associated with snowy/icy conditions. The Ministry continues to monitor the Site as the Company works towards completing Action Items from the September 2019 inspection report, which is scheduled to be completed by February 29th.	No action required

Inspection Period	Inspection Log Notes Related to Litter	Action Items Provided by MECP Related to Litter
2020/01/01 - 2020/01/31	Windblown litter was observed along the Construction Road and between Cell 2 and 4 of the landfill. The Company continues to address this area by working towards completing Action Items from the September 2019 inspection report (scheduled to be completed by February 29th). Exceptionally windy conditions (e.g. windspeeds up to 50 km/h) were observed during the inspection of January 9, 2020. As a result, the Ministry observed windblown litter scattered throughout the Site and accumulating at the northwest corner of the Site and along the perimeter of Pond 3. WM staff quickly responded by re-locating the litter fences downwind, tightening the working face of the landfill, and restricting the use of tippers to low-elevated areas of Cell 4. In addition, two (2) WM staff and four (4) externally contracted staff were committed full-time to pick up litter, prioritizing litter pick up along the property boundary to prevent any off-site impacts. One (1) complaint was related to litter. The following steps were taken by the Company to address the litter complaint: - Reviewed Operational Log and confirmed presence of litter on west Berm; - Collection of litter was scheduled for same day with re-assigned labourer to address this area; - Completed and filed complaint log; and, - Continue Site's Litter BMP.	No actions required
2020/02/01 - 2020/02/29	Some windblown litter was identified by the on site inspector. Waste Management staff were observed actively picking up litter on site.	No actions required
2020/03/01 - 2020/05/31	At times, windblown litter was identified by the Environmental Inspector. Waste Management staff were observed following the Site's BMP for Litter by picking up litter on site and using the sweeper as required.	No actions required
2020/06/01 - 2020/08/31	No comments	No actions required
2020/12/01 - 2021/02/28	During weekly inspections 5 instances of off-site litter were recorded. When the undersigned officer observed off-Site litter during some of the inspections, the Company was notified and responded accordingly. No litter complaints were received in Q4.	No actions required
2021/03/01 - 2021/08/18	(Spring 2021) Off-Site litter was observed during 12 out of 13 inspections. These observations consisted of windblown litter and/or ASR track-out from waste haulers onto Nauvoo Rd. During the months of spring there were several high wind events which caused excessive litter on and off-Site. Required action items from some of the weekly inspection reports were issued to the Company to ensure that they took additional measures to prevent and remediate litter impacts within a timely manner. The Company kept the impacted property owners informed, which consisted mainly of farm fields, and coordinated clean-up times prior to the commencement of agricultural field work. No complaints from nearby property owners were received during this time. One complaint was received from a member of the public as they drove down Zion Ln. and observed blowing litter. The Company responded by dispatching employees that weekend to pick up the litter. The Company has since caught up with the management of windblown litter both on and off-Site, and windblown litter has not been observed off-Site since April 29th. There were 4 complaints received during this inspection review period of March - May 2021 related to litter, dirt track-out, and site access. All complaints were reported to the Ministry within 24 hours and were responded to by the Company in accordance with Condition 11.	No actions required
2021/12/01 - 2022/02/28	Off-Site litter was observed during 6/12 inspections, mainly due to windblown litter around Zion Line. There were several high wind events that caused windblown litter on and off Site in January and February. The property owners of the agricultural fields across from Zion Line were contacted promptly by the Company to schedule a time for litter retrieval. During the February 16th weekly inspection, the undersigned officer reviewed the Company's written litter logs and identified noncompliance with the Company's frequency and timing of on-Site litter retrieval. The Company has since increased the frequency of litter retrieval and implemented additional measures in order to demonstrate compliance. No litter-related complaints were received in Q4.	No actions required

APPENDIX 11A

REPORT

WASTE MANAGEMENT OF CANADA CORPORATION

WATFORD, ONTARIO

TWIN CREEKS LANDFILL: BEST MANAGEMENT PRACTICES PLAN (ODOUR) – VERSION 7

RWDI #1600984

April 3, 2017

SUBMITTED TO

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LIST OF ATTACHMENTS

Attachment A: Example of WM Odour Training Form
Attachment B: Example of WM Odour Inspection and Dispatch Form
Attachment C: Example of WM Odour Complaint Form
Attachment D: Standard Operating Procedure – Daily Landfill Inspections
Attachment E: Assessment/Decision Flow Chart for Evaluating Odours

1 PURPOSE

An odour is deemed a nuisance if it is detected and considered unpleasant. In an effort to minimize the potential for off-site odour events for the existing and future operations of the Twin Creeks Landfill site, Waste Management of Canada Corporation (WM) has developed this Best Management Practices Plan that outlines measure that will be taken throughout the life of the landfill. Odours from solid waste landfills can occasionally be difficult to manage due to the various fugitive sources on site. The most effective process for minimizing potential odours is:

- to develop this plan identifying the main sources at the site
- outlining the intended target
- listing the control methods, implementation times and record keeping procedures.

The following sections outline the procedure that WM will implement to control the potential for odourous emissions from the site.

2 RESPONSIBILITIES

WM is responsible for ensuring the requirements of this plan. To accomplish this, employees will be trained in this plan, including the deployment, maintenance, monitoring and inspections of equipment and operations and employee responsibilities will be designated.

The Site Superintendent is responsible for:

- Providing training to staff
- Providing guidance on odour control measures
- Maintaining this plan
- Maintaining an Odour Control log

3 GENERAL INFORMATION

Solid waste landfills have the potential to produce odour sources at several locations including the active face and adjacent working area, within the leachate collection system and leachate treatment system and within the waste diversion area. Landfill gas escaping through the daily and interim covers and final cap are also a potential odour source. The active face and adjacent working area are expected to be the dominant odour source at the facility.

Due to this potential, landfill odours have been evaluated for nuisance impacts and this plan identifies methods for minimizing the impacts of site odours.

Each day, prior to landfilling the daily or interim cover is scarred to promote hydraulic conductivity within the landfill. This activity provides an opportunity for landfill gas to be released. The active face will be approximately 3,720 square meters. At the end of each day the top and exposed faces of the cell will be covered with 0.15 metres of daily cover or an alternative cover system.

In addition to odour emissions from the active face, there is a potential for the release of odourous gases from areas that have been covered by interim cover or final cap. The interim cover area will be provided with 0.3 to 0.45 metres of cover graded to promote precipitation run-off. Final cap includes 2.0 metres of material.

The landfill gas collection system will consist initially of horizontal gas collection pipes and finally of vertical collection wells all connected by below ground sub-lateral pipes. The pipes are connected to the main landfill gas collection header pipe. The collection system is designed to achieve a minimum of 70% collection efficiency from the entire site. The collected gas will be sent to up to four (4) landfill gas flares for destruction. As required, the four (4) flares will be progressively installed based on the amount of gas collected from the site. The gas collection and destruction system is critical to the reduction of odours from the site.

Leachate manholes around the existing landfill site are another potential source of odour. To minimize the potential for odour the leachate collection system will be operated under vacuum to prevent fugitive odours from being emitted. The gasses from the leachate system are also destroyed in the flares. The integrity of this system is also critical to controlling nuisance odours.

The waste diversion area (compost area) is also a potential source of nuisance odour. However, if compost is properly processed the potential for nuisance odour is greatly reduced. If, however compost is not processed properly it has the potential to become anaerobic and in turn odourous. The compost area is designed 3,600 m^2 and will operate from Year 1 through 21 of the landfill. The compost area will be removed during the construction and landfilling activities in the final phases of operation.

Alternative cover material for use at the working face for covering material received is included for the WM site. The alternative cover material can consist of a variety of products (in accordance with ECA A032203 Condition 115, other approved alternative cover materials include contaminated soil, wood chips, and auto fluff (ASR)) in addition to the tarps. In the case of tarp material to be placed on the working face, the tarps will be designed for use at landfill sites and will include the following provisions:

a) made of tear resistant, durable material and water resistant;
b) incorporate a system that would be used to either anchor or ballast the tarp down to prevent windlift; and
c) have the ability to provide odour and vapour suppression.

Further details are provided in the Design and Operations Plan for the site. [2] In consultation with the MOECC and various stakeholders, a Standard Operating Procedure (SOP) was developed for the use of alternative cover. The SOP incorporates components of existing regulatory Conditions of the Twin Creeks Landfill Waste ECA, components of the Design & Operations Report [Henderson, Paddon Associates, March 2008] (D&O) and considerations toward the Ministry of the Environment and Climate Change (MOECC) Landfill Standards [MOECC, January 2012] (Landfill Standards), and Ontario Regulation 232/98 (O. Reg. 232). Components of the Operations and Maintenance Manual (OMM, 2008), as well as the Best Management Practices (BMP) for litter, dust, and odour (BMPs, 2007), were also taken into consideration while preparing this SOP. A copy of the SOP is provided in Attachment D.

4 TRAINING

The site superintendent will be responsible for identifying a list of personnel who are trained in the landfill gas collection and flaring system and landfill cap maintenance program. Heavy equipment operators will be trained in proper procedures for daily and interim cover placement as well as use and operation of alternative cover systems and waste load screening procedures as outlined in the Design and Operations plan [2]. This training will include a description of the operating system from the landfill gas collection and destruction system, training on fail-safe features of the equipment, as well as cap maintenance procedures. The list of individuals identified will be listed in the Odour log as well as the date when they were trained. The list will be updated at annual intervals. Attachment A includes an example of the WM Odour Training Log.

Training will be completed outlining the procedures and controls for the poplar plantation with leachate irrigation. The training should involve overview of system operations, control measures, routine inspection requirements, and contingency plans in the event of an upset condition.

In addition, WM personnel will be screened for odour sensitivity using screening kits. WM will be trained on how to administer the tests as well as the frequency of on-going screening. The representatives that best meet the normal range of sensitivity for odours will be utilized to complete the “walkabout” surveys.

Training for WM representatives will also be provided for recordkeeping requirements as outline in the Design & Operations Plan, Environmental Compliance Approvals, etc, as well as the minimum required response time to ensure these requirements are achieved.

For the use of alternative cover systems to be implemented at the site, WM will ensure that proper training is provided to all applicable staff and contractors on the use of the systems, proper techniques for installing and removing, inspection techniques, maintenance of existing systems as well as proper techniques to replace the system in the event that the alternative cover system is beyond repair.

5 INSPECTION AND MAINTENANCE PROCEDURES

The site superintendent or individuals that have been identified by the site superintendent will be responsible for inspecting the landfill gas collection and flaring system to ensure the equipment is running properly. The inspection will include:

- Record of vacuum at points in the collection system particularly at the extremities of the system
- Record of gas flows entering the flares
- Composition of gas entering the flare
- Temperature of the combustion flares

These items will be recorded in a separate logging regime but all anomalies will be noted in the site odour log. The notation will include the time the anomaly was noted, the corrective action taken and the time the corrective measure was implemented. For example, low vacuum, flare temperature low, gas volumes lower or higher than anticipated.

The site superintendent will inspect, oversee the construct and maintain the installation of the horizontal pipes and vertical wells is implemented as presented in the Design & Operations plan for the site to ensure the collection of landfill gas continues with high collection efficiency. [2]

The site superintendent and other identified individuals will routinely monitor areas of the landfill where final cap is installed to ensure that cap erosion or odourous areas can be remediated as soon as possible. The integrity of the cap cover material will be confirmed with a walk about survey on a semi-annual basis.

The “walkabout” survey will consist of a grid survey of the entire landfill mound using a handheld THC analyzer (FID). A portable FID will be used throughout the surveys. The FID will be calibrated using a methane gas standard and zeroed using ultra zero pure air. Measured THC concentrations will be measured as methane. The instrument used will have the following characteristics:

1) A response time of at least 15 seconds;
2) An accuracy of 3% or better; and
3) A minimum detectable limit of 5 ppmv (or lower).

The "walkabout" survey will be completed in a grid like formation gathering data at 7.6 cm or lower (3 inches or lower) above the ground. "Hotspots" or "breakout points" consisting of cracks, fissures, areas of bubbling surface water, or patches of dead (burnt) vegetation on the mound will be visually observed and noted for THC concentrations exceeding 500 ppm (methane). Only readings of 500 ppm or greater should be noted during the instantaneous monitoring survey. The "walkabout" surveys should be completed at winds less than 8 kilometres per hour (5 miles per hour) and during dry conditions (no measurable precipitation for the proceeding 72 hours prior to sampling). In addition, for the instantaneous readings, the surveys should be completed when the ambient temperatures are within 0 to 50 degrees Celsius.

Areas that display THC concentrations of 500 ppm or greater will be considered of concern and will assist WM in defining the potential landfill gas release points that require remedial action.

All THC concentrations measured will be expressed as methane based on the calibration standard used. After the "hotspot" or "breakout points" are fixed, documentation of the corrective actions taken as well as confirmation of adequate actions taken (THC concentration less than 500 ppm) will be presented to the MOE. The "walkabout" survey will include the following:

- Precise locations of all sampling sites on the site map
- Identification of all data obtained in the field measurements
- Documentation of all remedial action

The walkabout surveys are scheduled for completion in the spring and the early fall. The measured areas should include the landfill cover areas as well as the poplar plantation. Additionally, this method will be used to identify otherwise unexplained odour events. Problem areas identified will be repaired as soon as possible and no later than within 2 months of identification. The results of these walkabout surveys, the times they were completed and any remedial actions will each be noted in the site odour log. It is possible that other equivalent or superior methods capable of identifying leaks in the landfill cover exist and these methods would also be acceptable. The walkabout surveys will be performed twice per year or in response to otherwise unexplained odour events. Routine visual inspections of the landfill cap integrity will also occur on a monthly basis to identify possible problem areas

In addition, during the survey of site and during regular inspection periods, detectable odours from the site will be noted and recorded. At a minimum, the odour information will include a description of the odour, time of day (to correspond with wind conditions) and if possible an indication of the main sources contributing to the odour.

The site superintendent and other identified individuals will also routinely monitor the leachate collection and treatment system to ensure that it is operating as designed. This will include a visual survey of any access points (cracks and/or fissures) and soils around access points. Leaking areas can be readily identified by a blackened discolouration and a rotten egg odour. The vacuum in the leachate collection system should be monitored at points roughly every 200 metres on a monthly basis. The vacuum within the leachate collection system will be recorded and all should be negative with respect to ambient conditions. Any anomalies in the system should be noted in the odour log as well together with any corrective actions required. The monitoring of vacuum in the collection system will help maintain the system and will make locating leaks in the system easier. The reduction

of leaks within the system will reduce the amount of fan power required to maintain the system under vacuum. Vacuum should be monitored at several points.

The site superintendent and other identified individuals will also routinely monitor the size of the active working face of the landfill. The size of the working face will be minimized, accounting for traffic at the working face. If for any reason the size of the working face exceeds 3,720 square metres, an explanation will be included in the odour log. The size of the working face must be reduced as quickly as possible should this situation occur.

The site superintendent and other identified individuals will also routinely monitor the compost area. All trucks will be inspected upon entry and any unacceptable waste loads will be either refused or transferred to the landfill operations on-site for disposal. The inspection will be completed on loads that have the tendency to be overly odourous in comparison to normal day-to-day waste. In the event that these loads are received, they should be moved to the landfill and covered upon disposal, Compost material received at the facility must be transferred to windrows by the end of each day. Material in windrows will be inspected daily and signed off on by an operator. The compost operations within the waste diversion area will be operated according to the Ministry of the Environment's "Guidelines for Aerobic Composting Facilities and Compost Use" (November 2004) and as outlined in the Design and Operations Plan [2]. Monitoring for temperature and moisture content within the windrows should be implemented. In the event that waste from the diversion area becomes unacceptable for composting or overly odourous, the material should be removed from this area and landfilled.

Additionally, an annual monitoring program is proposed for volatile organic compounds at the property line during the worst-case, summer, conditions. However, not all odours are the results of VOCs and are therefore not necessarily indicative of proper odour control. This testing will provide on-going supporting evidence that the landfill gas and all potential site odour issues are being properly controlled. This testing includes the upstream and downstream testing for VOCs. Monitoring for VOC's will be conducted through the summer months, with samples to be taken in upwind and downwind pairs, during normal operating hours of the landfill. There would be a total of 5 sample pairs taken between June and September. No more than two (2) samples will be collected in any calendar month. The samples will be 24-hours in duration and compared to their respective Schedule 3 Standards and other guidelines listed in the Ministry document Air Contaminants Benchmarks (ACB) List.

For the use of alternative cover material, in particular the use of tarp material, WM representatives and/or applicable contractors will complete the following inspections and maintenance activities:

a) Visual monitoring of the tarps to be completed on a daily basis as the tarp is removed in the morning, prior to landfilling activities;
b) Inspections for wear and tears as well as other evidence of other damage and longterm use; and
c) Proper repair techniques to ensure that wears and tears can be corrected prior to the next use or provisions to replace the tarp with proper working tarp.

Attachment B includes an example of the WM Odour Inspection and Dispatch Form. In addition, to aid WM field personnel completing the daily inspections, an assessment/decision flow chart for evaluating odours, and where necessary correcting odours, at the TCLS is included in Attachment E.

6 CONTROL METHODS FOR IDENTIFIED SOURCES

The odour control measures relate largely to on-going monitoring and maintenance that has been identified in the previous section. However, there are a number of specific details that are listed below:

- Progressively expand and activate the landfill gas collection and flaring system (total of up to four (4) flares proposed) to minimize the amount of odourous landfill gas that escapes through the mound. The systems should be constructed in a manner to ensure that a minimum of 70% collection efficiency is achieved on a regular basis.

- Regular inspections of the landfill gas collection and flaring system to ensure the equipment is running properly at a minimum should include the following: record of vacuum at points in the collection system particularly at the extremities of the system; record of gas flows entering the flares; composition of gas entering the flare; and temperature of the combustion flares.

- Regular repairs to the covered landfill areas (existing and future landfill areas) based on identifying any fissures, cracks or erosion of the soil cover that would allow for unmitigated landfill gas to escape directly to the atmosphere. These areas will be identified in the "walkabout" survey as described above. The areas requiring repair should be covered with clay, compacted and then covered with topsoil.

- Routinely monitor the size of the active working face of the landfill. The size of the working face will be minimized, accounting for traffic at the working face. If for any reason the size of the working face exceeds 3,720 square metres, an explanation will be included in the odour log. The size of the working face must be reduced as quickly as possible should this situation occur.

- Regular inspection and monitoring of temperature and moisture of the compost windrows. In the event that waste from the diversion area becomes unacceptable for composting or overly odourous, the material should be removed from this area and landfilled.

- Cap completed cells as quickly as possible with final cover to minimize odourous emissions.

- For the use of alternative daily cover systems, the following operational measures will be employed to prevent odour issues arising:

    - Alternative cover systems will be used in a similar fashion to daily cover practices. The alternative cover system will be removed during the next business day during normal landfill periods. Alternative cover system(s) will not be employed for interim or final cover areas.

    - WM will continue to screen incoming loads to identify highly odourous loads. In the case of highly odourous loads, cover material (consisting of soil or low odour waster material) should be immediately applied. The use of alternative daily cover techniques should only be used for loads or areas where waste is not identified as being highly odourous or can be applied to areas with higher odour loads provided that the cover material is first applied to prevent odours from the site.

- During the removal of the alternative daily cover, operators will be trained and instructed to identify times when odours are strong from the waste under the covers. In this case, cover material should be immediately applied as the alternative cover is removed to prevent odours from occurring. WM will keep a stockpile of cover material at the active face to ensure it is readily available for instances where strong odours are detected during the removal of the alternative daily cover system.

Although new waste can have odours, it typically is not the source of significant odours. Once landfilled, the level of the odours and subsequent degree to which it is perceived is directly related to the maintenance of the site. If the additional mitigations measures (as listed above) are implemented along with the proposed monitoring recommendations, the potential for off-site impacts are significantly reduced. The potential for off-site odours to be detectable at nearby residences is always possible and depends on a variety of conditions including meteorological conditions, site maintenance, and possible upset conditions (i.e., landfill gas flare shutting down, etc.). To control this potential upset condition a flame out indicator will be installed with an automatic shut-off to prevent landfill gas from flowing though the collection system during an upset condition.

7 SCHEDULE OF IMPLEMENATION

The following table provides the proposed schedule for implementation of the plan:

Table 7.1: Schedule for Control Methods

Task	Implementation Time Lines
Installation of Landfill Gas Collection System	The main header pipe will be installed in advance of landfilling operations. During landfilling, the horizontal gas collection system would be installed as per the Design & Operations plan. The horizontal collectors will continue to be installed at approximately 12 metre lifts during each phase of the landfill. After capping of a phase, the vertical well system would be installed. These activities will be on-going until site completion.
Installation of Landfill Gas Flares	Installation of the flares, landfill gas building, blowers and main header pipes will likely be in advance of landfill operations. The timing for when the flares will be initiated is dependant on the amount of gas generated from the waste. During initial stages of site preparation, as gas volumes will be low, WM will initiate the flares and blowers once the gas volumes have reached the lowest turndown capacity of the blowers. This may be expedited by placement of interim lower capacity blowers being installed initially and replaced with the first permanent blower once gas volumes increase. The timing for the second and third flares will be based on gas production over the lifespan of the landfill.
Leachate Collection Systems under vacuum and routed to the landfill gas flares	During the initial construction of the landfill gas collection system and on-going during the phases of the landfill life.
Ambient VOC Monitoring	Annual sampling program to occur during the summer months with a total of five (5) samples upwind and five (5) samples downwind.
Total Hydrocarbon Surveys	Total hydrocarbon surveys will be completed annually during the spring and fall seasons or if unexplained odours events persist. Any identified areas should be repaired as soon as possible and no later than within two (2) months
Monitoring of Incoming Odours Loads	Each load should be check for excessive odour upon receipt of the waste. If a waste shipment is deemed to be highly odourous it will be handled in a fashion to mitigate control the odours (ie: cover immediately)

Task	Implementation Time Lines
Alternative Daily Cover Material Use	Alternative daily cover systems will be limited to use on the daily working area(s) and will be employed in a similar fashion to traditional daily cover activities. Alternative cover system(s) will not be employed on interim or final cover area(s). Each load should be checked for excessive odour upon receipt of the waste. If a waste shipment is deemed to be highly odourous it will be handled in a fashion to mitigate control the odours (ie: cover material immediately applied). Alternative Daily Cover systems can be employed on waste material not identified as being highly odourous or on material that was identified as being odourous provided cover material is first applied. Daily Inspections of the alternative cover material will occur each morning to ensure that there are no wears or tears or other concerns with the cover system that would prevent the systems from its ability to prevent odour and vapour suppression. Each business day morning when removing the Alternative Cover Material, the operation must assess the odours from the waste and determine whether or not strong odours are perceived from the waste. If strong odours are detected, WM will apply cover material to the waste area. WM will ensure that a supply of suitable cover material is readily available for use at the working face each business day during the alternative cover material removal period in case strong odours are detected. Five times per year, during the summer, WM will complete an odour survey as the tarp is removed. The survey will be completed on a Monday following a weekend and will be completed by a trained employee, screened for odour sensitivity.

8 RECORD KEEPING

Throughout this document there is reference to an Odour log that will be maintained on site. This log will include notation of the items listed previously as well as any other notes relevant to odour at the site. The log will be three-ringed binder that will contain portioned sections for training, inspection, remediation activities, general notes and the complaint log. The odour log will contain all odour training, inspection, dispatch and complaint records for the previous 2 years.

From time to time there may be complaints regarding odour from the local residents. There will be individual logs with standard forms for odour complaints (Attachment C). Sampling logs will include the following at a minimum:

- Name of complainant
- Time of complaint
- Time that the incident occurred
- Nature of complaint
- Operational details at the time of the complaint
- Wind conditions at the time of the complaint
- Details of any investigation

All complaints will be included in the odour log. On an annual basis, the logs will be reviewed and any unfavourable trends will be examined further to identify corrective actions. These corrective actions will be included in the site annual report.

9 REFERENCES

[1] Ontario Ministry of the Environment. Interim Guide to Estimate and Assess Landfill Air Impacts. Air Resources Branch, October 1992.

[2] Henderson Paddon & Associates Limited: Development and Operations Report Warwick Landfill Expansion Waste Management of Canada Corporation Project #105716. March, 2008.

RWDI aims to accommodate. If you require this document in a different format in order to aid accessibility, please contact the sender of this document, email solutions@rwdi.com or call +1.519.823.1311

ATTACHMENT A

Warwick Landfill Best Management Plan
Odour Control Training Log

Trained Employee Name	Date of Training	Supervisor Signature

ATTACHMENT B

Warwick Landfill Best Management Plan
Odour Inspection and Dispatch Log

Inspected By: _____ **Inspection Date:** _____

Areas to inspect include: Active Face & Working Area, Interim & Final Cap, Gas Collection System & Flares, Waste Diversion Area (including compost area) and poplar forest irrigation system

Area Inspected/Date and Time	Quality / Characteristic of Odour	Source Identified and Distance Downwind Odours are Detectable	Corrective Action to be Complete?	Notes
Example *Leachate Collection System* *2007/11/29 @ 10:30am*	*Strong odour, smells like rotten eggs*	*SW corner of Cell 1* *Detectable 20 metres from source* No detectable off-site	*Replace leaking piping in collection system* *Action completed within 20 minutes of notable odour*	*Once repair complete, odour survey to ensure corrected*

ATTACHMENT C

Warwick Landfill Best Management Plan
Odour Complaint Form

WM Personnel:			

Date of Call		Time of Call	
Complainant Name		Complainant Contact Number	
Complainant Address			

Date of Odour Incident		Time of Odour Incident	
Description of Event			

Operations at Time of Incident	
Winds at Time of Incident	
Investigation Results and Corrective Action	

ATTACHMENT D

Tel: 519.823.1311
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Twin Creeks Landfill

Township of Warwick, Ontario

Final Report

Standard Operating Procedure – Daily Landfill Inspections

RWDI # 1501190, 3000
December 5, 2015

SUBMITTED TO

Reid Cleland
Director of Operations
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Appendix A: Daily Landfill Inspection Form

1. BACKGROUND

The Twin Creeks Landfill is a solid, non-hazardous waste landfill that contains an existing landfill (Existing Site) and an area approved for expansion (Expansion Site). The Twin Creeks Landfill is located on Part of Lots 19 and 20, Concession 3, South of Egremont Road (SER) and Part of Lots 20 to 22, Concession 4 SER, in the Township of Warwick, County of Lambton, Ontario (Site). The property occupies an area of 301 ha with 101.8 ha licensed for landfilling.

The Site operates in conformance with the following Ministry of Environment and Climate Change (MOECC) documents.

- Environmental Compliance Approval (ECA) No. A032203, dated December 13, 2011, and amended to January 26, 2015 (Waste ECA).
- ECA for an Industrial Sewage Works No. 3506-7M5PU3, dated July 9, 2009, and amended to February 20, 2013 (Sewage ECA).
- Amended ECA for Air No. 4365-7VXJ5G, dated November 10, 2009 (Air ECA).
- Amended Permit To Take Water (PTTW) No. 4430-8PLMKV, dated January 17, 2012.

Historically, landfill operations have not adversely affected local surface water and groundwater resources. To continue to maintain good operational measures, which are implemented to protect surrounding water resources and minimize off-Site environmental and human impacts, this document will focus on the Standard Operating Procedure (SOP) for daily landfill inspections, in accordance with Condition 9.4 of the Waste ECA.

This SOP incorporates components of existing regulatory Conditions of the Twin Creeks Landfill Waste ECA, components of the *Design & Operations Reports* [Henderson, Paddon Associates, March 2008], (D&O) and considerations toward the Ministry of the Environment and Climate Change (MOECC) *Landfill Standards* [MOECC, January 2012] (Landfill Standards), and Ontario Regulation 232/98 (O. Reg. 232). Components of the *Operations and Maintenance Manual* (OMM, 2008), as well as the Best Management Practices (BMP) for litter, dust, and odour (BMPs, 2007), were also taken into consideration while preparing this SOP.

2. DAILY INSPECTION DEFINITION

2.1 General Regulatory Definition

Section 6 of the Landfill Standards and Section 20 of O. Reg. 232 require that daily operational records be completed to assess the effectiveness and efficiency of Site design and operation. The records of operational activities can be utilized to evaluate the effects or relationships to nuisances, environmental impacts, and any public complaints. Documentation of landfill activities are incorporated into the annual operations report and can assist in planning future site operations. Section 20 of O. Reg. 232 describes the requirement of daily record keeping: "*The owner and operator of a landfilling site shall ensure that daily records of site operations are made during the operation of the site and that the records are retained for at least two years after they are made.*"

2.2 Site Specific Definition

Condition 9.3 and 9.4 of the Waste ECA detail the specific Site requirements for daily inspections.

Condition 9.3 denotes: "*An inspection of the entire Site and all equipment on the Site shall be conducted each day the Site is in operation to ensure that the site is being operated in compliance with this ECA. Any deficiencies discovered as a result of the inspection shall be remedied immediately, including temporarily ceasing operations at the Site if needed.*"

Condition 9.4 denotes: "*A record of the inspections shall be kept in a daily log book or a dedicated electronic file that includes:*

i. the name and signature of person that conducted the inspection;
ii. the date and time of the inspection;
iii. the list of any deficiencies discovered;
iv. the recommendations for remedial action; and
v. the date, time and description of actions taken."

In addition to the above-noted general regulatory and specific Site requirements, the SOP for Daily Inspections incorporates components of the best management practices plan (BMPs) for dust, litter, and odour. Inspection forms have been prepared under each of the BMPs for the Twin Creeks Landfill and are included in the aforementioned BMPS, for reference.

3. COMPONENTS OF THE DAILY INSPECTION

3.1 General

The daily inspection entails making observations on the following activities at the Site, and considers the requirements of Condition 9.3 and 9.4 of the Waste ECA, as well as the BMPs for litter, dust, and odour, the O&M, D&O, Landfill Standards, and O. Reg. 232. The Daily Inspection form that WM is to use, in accordance with this SOP, is attached as **Appendix A**.

In general, the Daily Inspection Form addresses the following key items.

1. Name of inspector and date of inspection
2. Litter
3. Dust
4. Odour
5. Daily Cover Integrity
6. Surface Water Management
7. Waste Cap Integrity

3.1.1 Incoming Waste – Scale Records

Section 5.20 of the O&M lists the records required to be maintained at the scale house as it relates to incoming wastes. Observations are made on a daily basis as it relates to the following items.

- Waste type
- Source information
- Date and time of arrival
- Hauler information
- Quantities imported
- Area of disposal operations
- Testing results (i.e. contaminated soil tests completed on a quarterly basis)
- Documentation for non-hazardous industrial wastes
- Date and quantity of leachate removed
- Record of waste rejection and reasons for rejection (in accordance with Condition 9.5 of the Waste ECA)

Waste screening and inspection controls are provided in greater detail within Section 7.5 of the D&O.

3.1.2 Litter, Dust, and Odour Inspections

3.1.2.1 Litter

On a daily basis, visual observations are completed in and around the landfill property to assess the significance of windblown litter. Portable litter fences may be moved to account for wind direction and speed. The portable litter fences should be inspected daily for their overall condition. Areas of the litter fence requiring repair should be noted in the inspection logs and repair records should also be included in the inspection log on the date the repairs took place. Litter pickup for windblown litter beyond the waste tipping/work face should be completed as needed and recorded daily. More details with respect to litter inspections and control measures are provided in the Litter BMP (RWDI, 2007).

3.1.2.2 Dust

Dust inspections will also be completed on a daily basis. Visual observations should be made with respect to the size of dust clouding behind waste hauler trucks and/or waste heavy equipment. Dust inspections rely on the observation of dust cloud formation, as well as cursory inspections of road conditions whereby the accumulation of mud, if not removed from paved surfaces for instance, will eventually dry and turn into dust. Watering of internal roads may be required based on dust accumulation observations. More details with respect to dust inspection and control measures are provided in the Dust BMP (RWDI, 2007).

3.1.2.3 Odour

In accordance with the Odour BMP (RWDI, 2007), odours are assessed at the landfill property boundaries on a routine basis (note not required to be daily). To assess the efficiency of daily cover materials, an odour inspection should be completed in the morning prior to removing the daily cover, and immediately after daily cover removal. Additionally, an odour assessment may be completed during operation to evaluate odours at the landfill boundaries while waste is being deposited at the landfill. More details with respect to odour inspection and control measures are provided in the Odour BMP (RWDI, 2007).

3.1.3 Daily Cover Inspection

The Standard Operating Procedure for Daily Cover (SOP for Daily Cover, RWDI 2015) should be referenced for inspection and maintenance of daily cover materials. In general, daily inspections will include the observation of the condition of daily cover materials. The inspections are completed while the cover materials are being placed, in accordance with the SOP for Daily Cover. The Daily Inspection Form will include observations made as to the type and area of coverage of the daily cover, as well as the thickness of the cover materials placed, other than tarpaulin.

3.1.4 Machinery, Equipment, and Diesel Tank

Heavy equipment used to manage the waste at the Site should be inspected on a daily basis, prior to startup/during startup every day, as well as at the end of the day at shut down. The main focus of the inspection is such that observations are made to whether or not any fluids are leaking from the equipment (i.e. hydraulic fluids, brake fluid, etc.). Repairs should be conducted on any equipment that is noted to be leaking significant amounts of mechanical fluids prior to its usage for operations outside of the waste footprint. Repair records should be maintained on file.

Various diesel tanks are located around the Site for the equipment being used to manage incoming waste, as well as machinery that is used to manage cover materials such as soil. Section 5.16.1 of the O&M describes the daily inspection requirements for the diesel aboveground storage tanks (ASTs). A suggested inspection form for the ASTs at the site is also presented as Table 3.6 in the O&M. Similar to this SOP for Daily Inspections, the O&M is a living document, which is reviewd annually, and updated, as necessary such that the Site operates as effectively as possible.

4. DAILY INSPECTION FORM

The Daily Inspection Form is utilized as a living document, which records daily observations at the landfill. Similar to the Monthly Inspection Form, the Daily Inspection Form lists several items to inspect and make note whether or not any specific items require further attention, or if an item is in good condition/repair or does not require further action. Actions taken, if any, are also recorded on the Daily Inspection Form. A copy of the Daily Inspection Form is attached for reference.

5. REVISIONS AND TRAINING

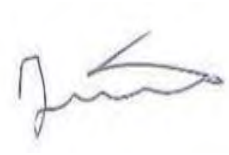
This document is considered a live document and may be subject to changes in the future such that continuous improvements can be made with respect to performing daily inspections. This SOP for daily inspections will be reviewed on a biennially basis, or updated intermittently in consideration of any significant changes to operations. Routine training (i.e. annually) by WM management should be issue to individuals that complete capping activities, such that those individuals are reminded of the requirements of this SOP, as amended from time to time.

6. CLOSURE

We trust that this Standard Operating Procedure for performing Daily Inspections is sufficient for your requirements. Please do not hesitate to contact us with any questions you may have.

Sincerely,

RWDI AIR Inc.



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Senior Consultant / Associate

DAILY LANDFILL INSPECTION FORM (LM-07-F1)

Facility Name/Address: **TWIN CREEKS LANDFILL – 5768 Nauvoo Rd, RR #4, Watford, Ontario, N0M 2S0**			
Date:			Time:
Performed By:			Signature:
Weather	Temperature:		Wind (Direction):
Site Conditions:			
	Yes	No	Comments
LITTER			
Site entrance free of significant liter			
Haul roads free of significant liter			
Ditches/Ponds are free of significant liter			
Portable litter fence free of significant liter			
Permeant litter fences free of significant litter			
Waste drop-off area free of significant litter			
Maintenance yard free of significant litter			
DUST			
Asphalt haul roads free of significant mud/dirt			
Gravel/clay haul roads not causing dust			
ODOUR			
Odour not present outside of landfill foot-print			
Working face kept to a minimum (1,100 m^2)			
Proper compaction of waste taking place			
DAILY COVER			
Amount & type of daily cover placed	NA	NA	___Soil, ___Cont. Soil, ___ASR, ___Tarp, ___Chips
Thickness of Daily cover $\geq$ 150 mm			Tarp thickness does not need to be measured
Daily cover, fully covering waste			
Daily cover reused from previous day			
SURFACE WATER MANAGEMENT			
Daily/intermediate cover able to shed water			
Drainage ditches able to adequately flow water			
Drainage culverts not plugged with debris and can flow water			
No excessively silty water flowing into ponds			
WASTE CAP INTEGRITY			
No abnormal gas/liquid discharges through cap			
No presence of leachate seeps through cap			
No erosion rills showing exposed waste			
Vegetation – green and healthy			

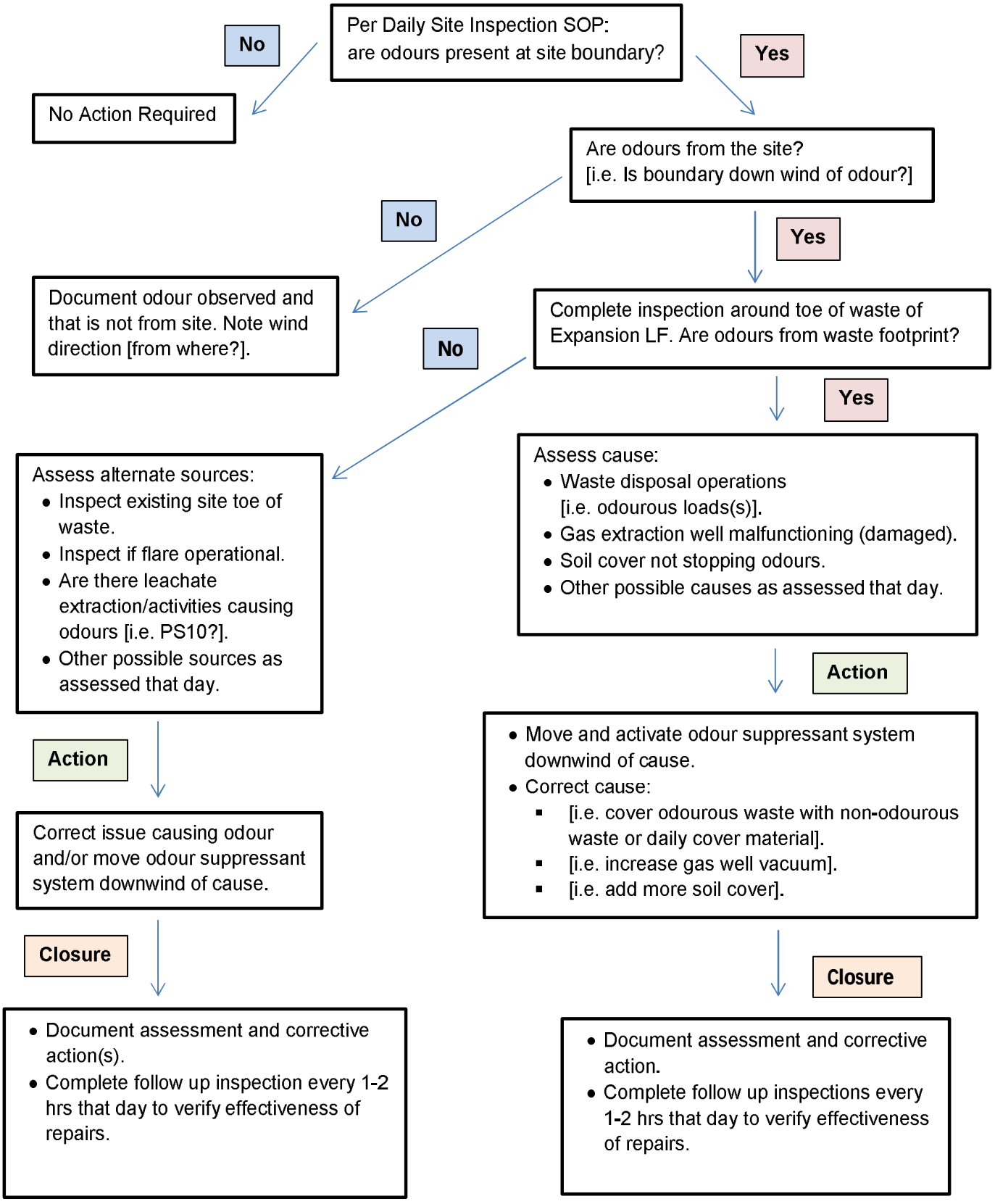
Equipment on Site (Brief Comment of any Construction / Site Maintenance taking place):

Deficiencies/Observations Noted:	**Date / Time / Deficiencies Reported to WM Management**

ATTACHMENT E

TWIN CREEKS LANDFILL
Figure 1

ODOUR ASSESSMENT



APPENDIX 11B

Appendix 11B - Complaints History Summary

Year	Date	Type	Investigation and Corrective Action	Response
2009	Monday, July 27, 2009	Odour	Resi drop off too full	bins to be dumped first thing Monday Morning
2011	Monday, August 8, 2011	Odour	Resident could smell Landfill	Immediately investigated, could smell an odour intermittently, source could not be identified. Correct cover was in place and no unusual loads had arrived. Was blue box and waste collection day. Monday morning trucks may have been preloaded from weekend. Advised complainant to call whenever smells odour so we can develop a consistent pattern.
2012	Thursday, June 21, 2012	Odour	Strong odour this week was unable to open windows or hang laundry	Extremely warm weather, went to residence to investigate, no unusual loads, will continue to monitor.
2012	Thursday, June 28, 2012	Odour	Smell was bad, garbage smelt raw	Very hot, during investigation neighbour advised there was loading and unloading of manure, verified cover was adequate, visited residence with Lead Hand.
2012	Monday, July 23, 2012	Odour	Called at 9:23 pm said wife could smell garbage on and off all day	Complaint came in after, so could not investigate source at time, checked weather-very hot, verified use of cover, as well as no unusual loads. Advise resident to call as soon as odour detected.
2012	Thursday, August 2, 2012	Odour	Last night had windows open, smelt garbage in house when woke up	Verified with Operators on correct use of cover, checked weather conditions for morning, resident said could still smell odour, I was at residence and could not, resident mentioned we are taking Toronto garbage now, in last 3-6 months waste stream has not changed. Will continue to monitor conditions and check for overly odorous loads.
2012	Saturday, August 11, 2012	Odour	Smell coming from Twin Creeks on and off since Wednesday night.	Director of Operations could not smell odour from Landfill, could smell manure from nearby farm. Lead Hand also could not detect odour, and verified use of cover. 3rd Party techs on site did not detect odour and VOCs levels have been well within standard. Will continue to monitor and asked resident to call in as soon as any odours detected.
2012	Saturday, September 1, 2012	Odour	Called to say odour was back, causing his COPD to worsen.	Operators had advised Lead Hand that morning of strong odour of pig manure, Lead Hand and Director of Operations could not detect landfill odour, Scalehouse had also smelt strong odour of pig manure. Offered tour of Landfill, which later declined. Continue to monitor.
2012	Saturday, September 1, 2012	Odour	when wind was from North could smell but not very strong	as above.
2012	Thursday, September 6, 2012	Odour	Smelling garbage	Operators advised to progressively cover the waste over the work day
2014	Monday, September 29, 2014	Odour	could smell odour from LF	construction of ramp - one time occurrence -odour unit to be deployed
2017	Thursday, August 17, 2017	Odour	Warwick Cemetery Board at Watford Cemetery could detect an odour coming from landfill	Field operations Manager immediately went to Cemetary could not detect an odour coming from the landfill. Verified with the cale during that time (prior to 11 a.m. we did not receive any unusual loads, nor did the scale attendant note any odours. continue to follow Landfill operations and procedures
2018	Monday, August 13, 2018	Odour	able to smell landfill, this weekend was particularly bad, can't sleep with windows open on a beautiful night	Operations Manager drove the Site as well as went to complaint location, Cemetery and Dog Park was unable to smell odour (approx. 10:05 a.m.) Operations Manager and Environmental Compliance Manager – both drove Site again and Nauvoo – unable to identify an off-site odour, slight odour on internal road directly in front of Workface continued use of daily cover Requested Complainant notify WM as soon as Odour detected Note: employees arriving on Site did detect strong manure odour 5:30-8:00 a.m. Continued use of daily cover Additional Landfill Gas wells as waste grades allow
2018	Monday, August 13, 2018	Odour	-smell Twin Creeks Landfill on a regular basis -would like to open windows instead of using central air	Requested Complainant notify WM as soon as Odour detected for investigation completion, Continued use of daily cover Additional Landfill Gas Wells as waste grades allow
2018	Monday, August 13, 2018	Odour	dump smells like cesspool -hang laundry…on beautiful day…but that isn't an option….Neither is having windows open	Operations Manager drove the Site as well as went to: Cemetery and Dog Park was unable to smell odour (approx. 10:05 a.m.) Operations Manager and Environmental Compliance Manager – both drove Site again and Nauvoo – unable to identify an off-site odour, slight odour on internal road directly in front of Workface continued use of daily cover Requested Complainant notify WM as soon as Odour detected Note: employees arriving on Site did detect strong manure odour 5:30-8:00 a.m. Continued use of daily cover Additional Landfill Gas Wells as waste grades allow

Year	Date	Type	Investigation and Corrective Action	Response
2018	Thursday, August 30, 2018	Odour	can always smell Landfill, (when asked for a specific time said 9 a.m. this morning) birds on roof of building, is trying to sell building	Environmental Compliance Manager and Engineer on site at Workface at 8:15 a.m. – 9 a.m. – no discernable odour Continued use of daily cover Bird Banger operational Requested Complainant notify WM as soon as Odour detected Note: employees arriving on Site did detect strong manure odour 6 a.m. Continued use of daily cover Additional Landfill Gas wells as waste grades allow
2018	Friday, September 7, 2018	Odour	noticed an odour when going through tim horton's (8-8:30 a.m.)	continued use of daily cover, requested complainant notify WM as soon as Odour detected, Manure and agricultural smells noted in area in morning, continued use of odour suppression system, additional landfill gas wells as waste grades allow
2018	Monday, October 1, 2018	Odour	Odour coming from landfill (approx. at 8:15 a.m.)	- investigation into source of odour -- Verified with scalehouse on loads arriving, verified with ooperations supervisor operational activities at that time i.e. trucks, special waste hole, odour suppression unit not operating-turned on approx 8:30 am. Operations supervisor frove off site approx 8:55 am -- at 402 on both sides of Nauvoo - Manure/pig odour. Senior project manager, environmental compliance manager-off site investigation approx. 9-10 am - manure, biosolids smell (mixed wit wet weather. continued use of daily cover, continued use of odour suppression unit
2018	Tuesday, October 2, 2018	Odour	Odour at 9 a.m.	continued use of daily cover placed on deck continued use of odour suppression system
2019	Thursday, February 7, 2019	Odour	Continued use of daily cover and follow procedure for odourous loads	No additional comment
2019	Thursday, February 7, 2019	Odour	Continued use of daily cover and follow procedure for odourous loads	No additional comment
2019	Wednesday, March 13, 2019	Odour	Continued use of daily cover	No additional comment
2019	Friday, April 5, 2019	Odour	Drive by difficult to substantiate	No callback requested
2019	Friday, April 26, 2019	Odour	Drive by difficult to substantiate	No callback requested
2019	Wednesday, May 1, 2019	Odour	Drive by difficult to substantiate	No callback requested
2019	Sunday, May 5, 2019	Odour	Wind direction not consistent with complaint	No additional comment
2019	Sunday, May 5, 2019	Odour	Wind direction not consistent with complaint	No additional comment
2019	Friday, May 10, 2019	Odour	Wind direction not consistent with complaint	No additional comment
2019	Friday, May 10, 2019	Odour	Gas collection improvements implemented	No additional comment
2019	Saturday, May 11, 2019	Odour	Minimize workface area, odours not confirmed by odour inspections	No additional comment
2019	Monday, May 13, 2019	Odour	Odour unit activiated, odours not confirmed by odour inspections	No additional comment
2019	Wednesday, May 15, 2019	Odour	Wind direction not consistent with complaint, odours not confirmed by odour inspections	No callback requested
2019	Wednesday, May 15, 2019	Odour	Drive by difficult to substantiate	No callback requested
2019	Thursday, May 16, 2019	Odour	Wind direction not consistent with complaint, odours not confirmed by odour inspections	No additional comment
2019	Saturday, May 18, 2019	Odour	Drive by difficult to substantiate	No additional comment
2019	Saturday, May 18, 2019	Odour	Potential odourous load at landfill, odours not confirmed by odour inspections	No additional comment
2019	Friday, May 24, 2019	Odour	Odours not confirmed by odour inspections	No additional comment
2019	Friday, May 24, 2019	Odour	Wind direction not consistent with complaint, odours not confirmed by odour inspections	No additional comment
2019	Friday, May 24, 2019	Odour	Drive by difficult to substantiate	No additional comment
2019	Monday, May 27, 2019	Odour	Drive by difficult to substantiate	No additional comment
2019	Friday, June 7, 2019	Odour	Odours not confirmed by odour inspections	No additional comment
2019	Friday, June 7, 2019	Odour	Odours not confirmed by odour inspections	No additional comment
2019	Friday, June 7, 2019	Odour	Odours not confirmed by odour inspections	No additional comment
2019	Tuesday, June 18, 2019	Odour	Odours not confirmed by odour inspections	No additional comment
2019	Thursday, June 20, 2019	Odour	Odours not confirmed by odour inspections	No additional comment
2019	Saturday, June 22, 2019	Odour	Odours not confirmed by odour inspections	No additional comment
2019	Wednesday, July 3, 2019	Odour	Odours not confirmed by odour inspections	No additional comment
2019	Monday, July 8, 2019	Odour	Odours not confirmed by odour inspections	No additional comment
2019	Monday, July 8, 2019	Odour	Odours not confirmed by odour inspections	No additional comment

Year	Date	Type	Investigation and Corrective Action	Response
2019	Sunday, July 14, 2019	Odour	Odours not confirmed by odour inspections	No additional comment
2019	Friday, August 2, 2019	Odour	Odour not confirmed by odour inspections	No additional comment
2019	Sunday, August 4, 2019	Odour	Odour not confirmed by odour inspections	No additional comment
2019	Wednesday, August 7, 2019	Odour	Odour not confirmed by odour inspections	No additional comment
2019	Wednesday, August 14, 2019	Odour	Odour not confirmed by odour inspections	No additional comment
2019	Friday, August 16, 2019	Odour	Odour not confirmed by odour inspections	No additional comment
2019	Monday, August 26, 2019	Odour	Mild waste mixed with another unidentifiable smell/Suppression Unit deployed	3rd Party Verfication of Odour
2019	Thursday, September 5, 2019	Odour	Odour not confirmed by odour inspections	No additional comment
2019	Monday, September 9, 2019	Odour	Odour Suppression Unit dispatched	No additional comment
2019	Tuesday, September 17, 2019	Odour	Odour Suppression Unit dispatched	No additional comment
2019	Tuesday, September 17, 2019	Odour	Odour Suppression Unit dispatched	No additional comment
2019	Monday, October 7, 2019	Odour	Odour Suppression Unit dispatched	No additional comment
2019	Saturday, October 26, 2019	Odour	Odour not confirmed	No additional comment
2019	Monday, October 28, 2019	Odour	Odour not confirmed	Possible Inversion of Air Currents
2019	Thursday, October 31, 2019	Odour	Odour not confirmed	No additional comment
2019	Monday, November 11, 2019	Odour	Continue with interim capping of Cell3/look at potential high producing wells that can be hooked up with temporary lines/continue with planned installation of replacement lines once interim capping is installed.	report to WPLC at next Meeting
2019	Monday, November 25, 2019	Odour	End Cap on Primary leachate cleanout line missing-re-installed	No additional comment
2019	Tuesday, November 26, 2019	Odour	Drive by difficult to substantiate/Landfill Gas potential source of odour minor impacts off site/Interim Capping Underway	No additional comment
2019	Tuesday, December 3, 2019	Odour	Timely Reporting	No additional comment
2019	Friday, December 6, 2019	Odour	Timely Reporting	No additional comment
2019	Saturday, December 28, 2019	Odour	Drive by difficult to substantiate	No additional comment
2020	Friday, January 3, 2020	Odour	Investigation Ops/Gas/Continue to comply with ECA	No Response at this time
2020	Friday, January 3, 2020	Odour	Investigation Ops/Gas/Continue to comply with ECA	No Response at this time
2020	Wednesday, January 15, 2020	Odour	Flare was down for Mtce/Continue with Interim Capping & planned installation of Lines/Odour Assess. Did not verify	Complainant expressed that they were one of several residents concerned about the odour.
2020	Sunday, January 19, 2020	Odour	Investigation Ops/Gas/Continue to comply with ECA	No Response at this time
2020	Monday, January 27, 2020	Debris	Continue with sweeping program and advising truck drivers to use designated check areas prior to leaving Site.	No Response at this time
2020	Monday, February 3, 2020	Odour	Investigation - odour not Landfill related/however pinched lateral collections wells identified as potential odour source.	Complainant disagreed with assessment.
2020	Monday, February 24, 2020	Odour	Continue to comply with ECA, add info of landfill gas leaking from our completed cell has been identified as a potential source of odour.	No Response at this time
2020	Tuesday, February 25, 2020	Odour	Continue to comply with ECA, add info of landfill gas leaking from our completed cell has been identified as a potential source of odour.	Complainant looking to receive response and plan of action to address odours.
2020	Wednesday, February 26, 2020	Odour	Wind speed and direction not consistent with complaint.	No Response at this time
2020	Wednesday, February 26, 2020	Odour	Continue to comply with ECA, add info of landfill gas leaking from our completed cell has been identified as a potential source of odour.	No Response at this time
2020	Wednesday, March 11, 2020	Odour	Wind direction not consistent with complaint.	No additional comment
2020	Thursday, March 19, 2020	Odour	Odour not confirmed as complaint was reported to WM one day after occurrence.	No Response at this time
2020	Tuesday, March 31, 2020	Odour	Continue to comply with ECA, add info of landfill gas leaking from our completed cell has been identified as a potential source of odour.	No Response at this time
2020	Saturday, April 4, 2020	Odour	Continue to coply with ECA, add info of landfill gas leaking from our completed cell has been identified as a potential source of odour…	No Response at this time
2020	Thursday, May 7, 2020	Odour	Will continue to operate within ECA conditions	No Response at this time
2020	Saturday, May 16, 2020	Odour	Continue to coply with ECA, add info of landfill gas leaking from our completed cell has been identified as a potential source of odour…	No Response at this time
2020	Saturday, May 16, 2020	Odour	Continue to coply with ECA, add info of landfill gas leaking from our completed cell has been identified as a potential source of odour…	No Response at this time
2020	Wednesday, June 17, 2020	Odour	Continue to coply with ECA, add info of landfill gas leaking from our completed cell has been identified as a potential source of odour…	No Response at this time

Year	Date	Type	Investigation and Corrective Action	Response
2020	Monday, June 29, 2020	Odour	Timely Reporting	No Response at this time
2020	Tuesday, June 30, 2020	Odour	Continue to coply with ECA, add info of landfill gas leaking from our completed cell has been identified as a potential source of odour…	No Response at this time
2020	Wednesday, July 1, 2020	Odour	Weather not consistent, Landfill was operational	No Response at this time
2020	Tuesday, July 21, 2020	Odour	Landfill operational, potential odourous loads recd in that timeframe, agricultural odours detected N of Landfill	No Response at this time
2020	Thursday, July 23, 2020	Odour	Investigation into possible source of odours, filed log, reviewed weather-potential for intermittent odours due to wind direction, Ops Super did not detect at that time	No Response at this time
2020	Thursday, July 30, 2020	Odour	Investigation into possible source of odours, filed log, reviewed weather, complaint not filed as per previously followed procedures	No Response at this time
2020	Friday, July 31, 2020	Odour	Odour suppression system activated at 7:20 AM	No Response at this time
2020	Friday, August 7, 2020	Odour	Investigated, filed, possible intermittent odours, deployed odour suppression unit	Clarified Special Waste
2020	Sunday, August 30, 2020	Odour	Filed Log, investigated weather, source of odours	No Response at this time
2020	Thursday, October 8, 2020	Odour	Filed Log, Investigation completed, source located not Landfill related	No Response at this time
2020	Thursday, November 12, 2020	Odour	Filed log, Investigation completed	No Contact
2020	Friday, December 11, 2020	Odour	Investigation, Operator identified odour on site, Gas tech investigation, suspected lid repair require	Thank you for the Update.
2020	Friday, December 18, 2020	Odour	Investigation with wind direction potential -gas or waste odour	Smelt a rotten compost smell
2021	Wednesday, January 6, 2021	Odour	Investigation completed, Manipulation of the intermediate cover earlier in the day in preparation of gas line installation may have disturbed a gas pocket. Vacuum across the collection system increased.	No response at this time.
2021	Friday, January 8, 2021	Odour	Investigation, weather conditions reviewed, complaint filed.	No response at this time.
2021	Monday, August 2, 2021	Odour	Investigation ongoing, reviewed weather conditions-potentially.	No response at this time.
2021	Tuesday, August 17, 2021	Odour	Investigation, potential for intermittent odours due to wind direction.	No response at this time.
2021	Tuesday, August 17, 2021	Odour	Investigation, weather conditions potentially caused a general lack of dispersion.	No response at this time.
2021	Tuesday, August 17, 2021	Odour	Investigation, weather conditions potentially caused a general lack of dispersion, if more detail could be provided on time going forward.	smell occurred at 8:30 p.m.
2021	Wednesday, August 18, 2021	Odour	Investigation, odour suppression relocated, area of odourous load promptly covered, tipper relocated to minimize potential of reoccurrence.	No response at this time.
2021	Thursday, August 19, 2021	Odour	Investigation, Odour Check-did not detect, deodorizer unit relocated due to wind shift.	No response at this time.
2021	Friday, August 20, 2021	Odour	Investigation, odour check-performed, no landfill gas odour detected.	No response at this time.
2021	Friday, August 20, 2021	Odour	Investigation, odour check performed, no odour detected at residence or front entrance.	No response at this time.
2021	Friday, August 20, 2021	Odour	Investigation, odour check-mild odour from one load which arrived prior to this notification, follow up - no odours detected, weather conditions review-potential for intermittent odours due to wind direction and inversion.	No response at this time.
2021	Tuesday, August 31, 2021	Odour	Investigation, Filed, weather conditions reviewed.	No response at this time.
2021	Wednesday, September 1, 2021	Odour	Potential for intermittent odours due to wind direction, drive by could be Hauler as opposed to Landfill odour, ops managing odourous loads for disposal.	Make it handier for people to call in-post contact information on Office Door.
2021	Wednesday, September 1, 2021	Odour	Power outage, Generator started but flare did not light, Gas Tech came to site immediately.	No response at this time.
2021	Wednesday, September 1, 2021	Odour	Power outage, Generator started but flare did not light, Gas Tech came to site immediately.	No response at this time.
2021	Friday, September 3, 2021	Odour	Power outage, Gas tech came to site to investigate, back online by 11 p.m.	No response at this time.
2021	Wednesday, September 15, 2021	Odour	Investigation, nothing abnormal to generate odour offsite, weather conditions reviewed, complaint filed.	No response at this time.
2021	Saturday, September 18, 2021	Odour	Investigation, nothing abnormal to generate odour offsite, weather conditions reviewed, complaint filed.	No response at this time.
2021	Monday, October 25, 2021	Odour	Sr. DM, DOM, OMT reviewed Logs, multiple sources of non landfill odour identified during investigation, wind direction not consistent at complainant residence throughout duration of complaint.	No response at this time.
2021	Monday, November 22, 2021	Odour	Investigation, nothing abnormal to generate odour offsite, weather conditions reviewed, complaint filed.	No response at this time.
2021	Tuesday, November 23, 2021	Odour	Investigation, nothing abnormal to generate odour offsite, weather conditions reviewed, complaint filed.	No response at this time.
2021	Monday, November 29, 2021	Odour	Investigation, well casing with a damaged seal, temp repair completed.	No response at this time.

Year	Date	Type	Investigation and Corrective Action	Response
2021	Monday, November 29, 2021	Odour	Investigation, northing abnormal to generate landfill odour offsite in vicinity of complaint, site personnel no odour on site and to the 402 5:20 p.m., wind direction not consistent with complaint, drive bys can be difficult to substantiate.	Thx. Unfortunately they need to go at the actual time that it happens like from 5 o'clock on because that is when it smells. I'm not sure how they can say it's abnormal when it semlls everywhere and comes into the actual town itself.
2021	Monday, November 29, 2021	Odour	Investigation, well casing with a damaged seal, temp repair completed.	No response at this time.
2021	Wednesday, December 1, 2021	Odour	Landfill was operational, DoM went out immediately to investigate no odour detected.	No response at this time.
2021	Tuesday, December 21, 2021	Odour	Investigation, DoM went out detected slight gas odour Nauvoo and Egermont/9:47 a.m. no odour detected at 6332 Nauvoo/OS Unit dispatched.	No response at this time.
2022	Tuesday, January 4, 2022	Odour	Investigation, continue to monitor previous casing repairs	No Response at this time
2022	Wednesday, January 19, 2022	Odour	Investigation, Wind direction not consistent with complaint, stockpiling of biosolids and spreading-strong odours on Nauvoo	No Response at this time
2022	Monday, January 24, 2022	Odour	Investigation, Site inspections indicated slight waste odour onsite-North Rd., no odour detected offsite on Zion	No Response at this time
2022	Monday, January 31, 2022	Odour	Landfill operational, Site Inspect. Waste odour identified 7:15 a.m., add. Cover applied to WF	No Response at this time
2022	Monday, January 31, 2022	Odour	Landfill operational, Site Inspect. Waste odour identified 7:15 a.m. and periodically throughout day, add. Cover applied to WF	No Response at this time
2022	Monday, January 31, 2022	Odour	Site Inspections identified waste odour at 7:15 a.m. and periodically throughout the day, additional cover applied to WF	No Response at this time
2022	Tuesday, February 1, 2022	Odour	Landfill operational, site inspections identified odours periodically throughout the day, continue to follow BMP	There is a smell there, and can smell downwind, worse earlier in the day and later at night due to inversion. Generally, that is when it is the worst.
2022	Friday, February 4, 2022	Odour	Completed Verification as required by D&O	No Response at this time
2022	Saturday, February 5, 2022	Odour	Completed Verification as required by D&O	No Response at this time
2022	Sunday, February 6, 2022	Odour	Completed Verification as required by D&O	No Response at this time
2022	Monday, February 7, 2022	Odour	Completed Verification as required by D&O, WM noted: mild odour detected, not consistent with odour modelling (no strong odour detected at Landfill), complainant location 3 km from Landfill	No Response at this time
2022	Tuesday, February 8, 2022	Odour	Completed Verification as required by D&O, WM noted: Arkona Rd. detected slight landfill odour, Donnelly, sources of agricultural odours, mixture of smells, in front of location could not detect Landfill, Note: complainant residence 8 km from Landfill	No Response at this time
2022	Wednesday, February 9, 2022	Odour	Completed Verification as required by D&O	No Response at this time
2022	Tuesday, February 15, 2022	Odour	Completed Verification as required by D&O, Flare went down at 530pm for no more than ten minutes, WM noted 5:49 p.m. -Drove Nauvoo to Cemetery and Zion to Greenhouse to a few hundred meters west of Nauvoo. Detected a very slight landfill odour at the intersection of Zion and Nauvoo, nothing detected north of Zion or West of Nauvoo. WM Notes at 7 p.m. There is still slight odour at intersection of Zion and Nauvoo but no odour west on Zion and definitely no odour east on Zion	No Response at this time
2022	Wednesday, February 16, 2022	Odour	Completed Verification as required by D&O	No Response at this time
2022	Sunday, February 20, 2022	Odour	Completed Verification as required by D&O	No Response at this time
2022	Tuesday, February 22, 2022	Odour	Completed Verification as required by D&O	No Response at this time
2022	Tuesday, February 22, 2022	Odour	Completed Verification as required by D&O	No Response at this time
2022	Wednesday, February 23, 2022	Odour	Weather - wind direction not consistent, Complaint submission after occurrence	No Response at this time
2022	Friday, February 25, 2022	Odour	Completed Verification as required by D&O	No Response at this time
2022	Saturday, February 26, 2022	Odour	Completed Verification as required by D&O	No Response at this time
2022	Friday, March 4, 2022	Odour	Completed Verification as required by D&O, Power outage-Watford. Alvinston-reported by Bluewater Power, Gas Tech came to Site	No Response at this time
2022	Saturday, March 5, 2022	Odour	Completed Verification as required by D&O	No Response at this time
2022	Sunday, March 13, 2022	Odour	Completed Verification as required by D&O	No Response at this time
2022	Tuesday, March 15, 2022	Odour	Completed Verification as required by D&O, Confirmed address to be 8290 Zion Line	No Response at this time
2022	Thursday, March 17, 2022	Odour	Completed verification as required by D&O, WM noted: strong, earthy smell on field west of Nauvoo, where biosolids had previously been spread. Weather conditions reviewed - wind direction consistent with odours detected by WM noted above. Odour potentially from another source	LOL I live on a farm and can clearly distinguish the difference between chicken manure, cow manure, pig manure, bio solids and methane, but I appreciate your response. That would be like WM coming to my house and telling me the smell chicken manure and I say no that's not what you smell, you're smelling fresh green grass
2022	Thursday, March 31, 2022	Odour	Completed Verification as required by D&O	No Response at this time
2022	Saturday, April 2, 2022	Odour	Completed Verification as required by D&O, weather conditions reviewed-wind direction not consistent with complaint	No Response at this time

Year	Date	Type	Investigation and Corrective Action	Response
2022	Friday, April 22, 2022	Odour	Completed verification as required by D&O, WM Notes: (2) employees went out to investigate-no odour detected on Nauvoo/Ontario or in vicinity. Very faint agricultural odour closer to school.	No Response at this time
2022	Tuesday, May 3, 2022	Odour	Completed verification as required by D&O	No Response at this time
2022	Thursday, May 5, 2022	Odour	Completed verification as required by D&O, weather conditions reviewed, address is 5639 Nauvoo, WM Notes: odour detected on-site to entrance gate, but not down as far as the store.	No Response at this time
2022	Thursday, May 5, 2022	Odour	Completed verification as required by D&O, WM notes: odour detected on site to entrance gate	No Response at this time
2022	Monday, May 9, 2022	Odour	Completed verification as required by D&O	Wanted to advise again that whenever there is a south wind he can smell the Landfill
2022	Saturday, May 28, 2022	Odour	Completed verification as required by D&O, WM Notes: Employee on site that evening from 7-9 p.m. no odour detected at all at the Site Entrance, at the Office, or on Nauvoo from the Site to the 402	No Response at this time
2022	Thursday, July 14, 2022	Odour	Completed verification as required by D&O	No Response at this time
2022	Friday, August 12, 2022	Odour	Completed verification as required by D&O, Weather conditions create times when landfill odours cannot dissipate effectively. These inversion periods are unavoidable, and WM will continue to follow the BMP.	No Response at this time
2022	Friday, August 12, 2022	Odour	Completed verification as required by D&O, Weather conditions create times when landfill odours cannot dissipate effectively. These inversion periods are unavoidable, and WM will continue to follow the BMP.	No Response at this time
2022	Friday, August 12, 2022	Odour	Completed verification as required by D&O, Weather conditions create times when landfill odours cannot dissipate effectively. These inversion periods are unavoidable, and WM will continue to follow the BMP.	No Response at this time
2022	8/24/2022 for 8/12	Odour	Completed verification as required by D&O, Weather conditions create times when landfill odours cannot dissipate effectively. These inversion periods are unavoidable, and WM will continue to follow the BMP.	
2022	Wednesday, August 17, 2022	Odour	Unable to complete verification as required by D&O due to late notification of complaint	No Response at this time
2022	8/24/22 for 8/17	Odour	Unable to complete verification as required by D&O due to late notification of complaint	No Response at this time
2022	Thursday, August 18, 2022	Odour	Completed verification as required by D&O, Landfill was operational at the time of complaint. Potentially odourous load received in that timeframe	Ok, thanks
2022	Tuesday, August 23, 2022	Odour	Completed verification as required by D&O, inversion potential based on weather	No Response at this time
2022	Tuesday, August 23, 2022	Odour	Completed verification as required by D&O, inversion potential based on weather	No Response at this time
2022	8/24/22 for 8/23	Odour	Unable to complete verification as required by D&O due to late notification of complaint	No Response at this time
2022	Wednesday, September 7, 2022	Odour	Completed verification as required by D&O, Skunk on Nauvoo, inversion potential based on weather	No Response at this time
2022	Wednesday, September 7, 2022	Odour	Completed verification as required by D&O, Landfill Staff notes: on site 9:30-11:30 p.m. did not detect odour, weather inversion	No Response at this time
2022	Thursday, September 8, 2022	Odour	Completed verification as required by D&O, Odour surveys completed by WM Staff, RWDI, MECP, pockets of moderate odour detected, weather inversion	No Response at this time
2022	Thursday, September 8, 2022	Odour	Completed verification as required by D&O, Odour surveys completed by WM Staff, RWDI, MECP, pockets of moderate odour detected, weather inversion	No Response at this time
2022	Thursday, September 8, 2022	Odour	Completed verification as required by D&O, Odour surveys completed by WM Staff, RWDI, MECP, pockets of moderate odour detected, weather inversion	No Response at this time
2022	Thursday, September 8, 2022	Odour	Completed verification as required by D&O, Odour surveys completed by WM Staff, RWDI, MECP, pockets of moderate odour detected, weather inversion	No Response at this time
2022	Thursday, September 8, 2022	Odour	Completed verification as required by D&O, Odour surveys completed by WM Staff, RWDI, MECP, pockets of moderate odour detected, weather inversion	No Response at this time
2022	Thursday, September 8, 2022	Odour	Completed verification as required by D&O, Odour surveys completed by WM Staff, RWDI, MECP, pockets of moderate odour detected, weather inversion	No Response at this time
2022	Thursday, September 8, 2022	Odour	Completed verification as required by D&O, Odour surveys completed by WM Staff, RWDI, MECP, pockets of moderate odour detected, weather inversion	No Response at this time
2022	Wednesday, September 14, 2022	Odour	Completed verification as required by D&O, includes: review weather, gas ops, site conditions nothing abnormal noted, higher than normal volume of odourous material received combined with weather conditions may have contributed to related concerns. Areas where odourous loads are deposited will receive additional or alternate cover application to prevent potential sources of odour.	No Response at this time

Year	Date	Type	Investigation and Corrective Action	Response
2022	Monday, October 3, 2022	Odour	Gas techs report there are six leaking wells that require attention. This is a continuation of a project to seal off penetration points in the Landfill to improve gas capture. The next step is installing gas collection headers to all casings in Cell 4. This project will take some time to complete • Reviewed weather conditions, Gas operations, and site conditions; nothing abnormal noted Connection of gas wells is a scheduled activity based on fill volumes and cell construction. The project is currently on schedule; however this is a large task that will take several months to complete.	Thank you
2022	Monday, October 3, 2022	Odour	Gas techs report there are six leaking wells that require attention. This is a continuation of a project to seal off penetration points in the Landfill to improve gas capture. The next step is installing gas collection headers to all casings in Cell 4. This project will take some time to complete • Reviewed weather conditions, Gas operations, and site conditions; nothing abnormal noted Connection of gas wells is a scheduled activity based on fill volumes and cell construction. The project is currently on schedule; however this is a large task that will take several months to complete.	No Response at this time
2022	Tuesday, October 11, 2022	Odour	WM is currently working on a continuation of a project to seal off penetration points in the Landfill to improve gas capture. The next step is installing gas collection headers to all casings in Cell 4. This project will take some time to complete	Thanked for call back.
2022	Monday, October 31, 2022	Odour	WM is currently working on a continuation of a project to seal off penetration points in the Landfill to improve gas capture. The next step is installing gas collection headers to all casings in Cell 4. This project will take some time to complete	Thx will pass this message and information along to the concerned public
2022	Monday, October 31, 2022	Odour	WM is currently working on a continuation of a project to seal off penetration points in the Landfill to improve gas capture. The next step is installing gas collection headers to all casings in Cell 4. This project will take some time to complete. Provided direct contact to address timely reporting.	Thanked for call, and glad to know there is a reason and it is being addressed
2022	Monday, November 7, 2022	Odour	WM is currently working on a continuation of a project to seal off penetration points in the Landfill to improve gas capture. The next step is installing gas collection headers to all casings in Cell 4. This project will take some time to complete.	Thx.
2022	Tuesday, November 8, 2022	Odour	WM is currently working on a continuation of a project to seal off penetration points in the Landfill to improve gas capture. The next step is installing gas collection headers to all casings in Cell 4. This project will take some time to complete.	Thanks
2022	Friday, November 11, 2022	Odour	Advised related to the Gas Well Connection previously discussed	No Response at this time
2022	Friday, November 11, 2022	Odour	WM is currently working on a continuation of a project to seal off penetration points in the Landfill to improve gas capture. The next step is installing gas collection headers to all casings in Cell 4. This project will take some time to complete.	No Response at this time
2022	Friday, November 11, 2022	Odour	WM is currently working on a continuation of a project to seal off penetration points in the Landfill to improve gas capture. The next step is installing gas collection headers to all casings in Cell 4. This project will take some time to complete.	No Response at this time
2022	Sunday, November 27, 2022	Odour	WM is currently working on a continuation of a project to seal off penetration points in the Landfill to improve gas capture. The next step is installing gas collection headers to all casings in Cell 4. This project will take some time to complete. /Litter Collectors on site reminded of closure of gates during non operating hours.	No Response at this time
2022	Tuesday, December 6, 2022	Odour	Reviewed Weather conditions, Gas and Site conditions, Ops Mgr, GOM, ECM went out did not detect any landfill odour other than on Nauvoo Rd. outside Landfill gate, mild odour detected (burning smell) not Landfill related on Nauvoo	It was the Landfill, has to travel to get to their house, on a field trip, thanks
2022	Thursday, December 8, 2022	Odour	WM is currently working on a continuation of a project to seal off penetration points in the Landfill to improve gas capture. The next step is installing gas collection headers to all casings in Cell 4. This project will take some time to complete.	No Response at this time
2023	Sunday, January 22, 2023	Odour	WM is currently working on a continuation of a project to seal off penetration points in the Landfill to improve gas capture. The next step is installing gas collection headers to all casings in Cell 4. This project will take some time to complete Connection of gas wells is a scheduled activity based on fill volumes and cell construction. The project is currently on schedule; however, this is a large task, that will take several more weeks to complete	No Response at this time
2023	Monday, January 23, 2023	Odour	WM is currently working on a continuation of a project to seal off penetration points in the Landfill to improve gas capture. The next step is installing gas collection headers to all casings in Cell 4. This project will take some time to complete Connection of gas wells is a scheduled activity based on fill volumes and cell construction. The project is currently on schedule; however, this is a large task, that will take several more weeks to complete	Thank you for your quick response
2023	Thursday, March 9, 2023	Odour	Potentially the special waste hole, odour dissipated by 8:24 a.m., covered that day	No Response at this time

Year	Date	Type	Investigation and Corrective Action	Response
2023	Friday, March 31, 2023	Odour	Odour not verified, drive bys can be difficult to substantiate, As info: cover ops were being conducted at the time of the complaint. Gas well project is in final stages- wells currently being balanced.	No Response at this time
2023	Wednesday, May 10, 2023	Odour	Wind direction verified, at time of complaint wind was shifting from NE to NNE to WNW, verified that cover was adequate as per ECA, Gas system was operational	Thanks for your response.
2023	Wednesday, May 10, 2023	Odour	Wind direction verified, at time of complaint wind was shifting from NE to NNE to WNW, verified that cover was adequate as per ECA, Gas system was operational	Thank you for your reply.
2023	Friday, May 12, 2023	Odour (Transient)	Wind direction verified, verified that cover was adequate as per ECA, Gas system was operational, Notes: WM employee was on 402 approx. 7ish-detected agricultural activities and odour in area	Thanks for your response.
2023	Monday, May 15, 2023	Odour	Investigation with Operations and Gas - nothing abnormal, landfill was operational at the time, weather conditions reviewed, Notes: WM employee detected mild garbage odour east of Nauvoo along Erie and St. Clair St.	Concerned about increase in odours if the Landfill gets bigger
2023	Monday, May 29, 2023	Odour	Investigation with Operations and Gas - nothing abnormal, weather conditions reviewed, completed and filed relevant complaint log	No Response at this time
2023	Friday, June 2, 2023	Odour	Investigation with Operations and Gas - nothing abnormal, Landfill was operational at the time, weather conditions reviewed, completed and filed relevant complaint log, Investigator Notes: WM employee went to investigate-multi odours at that time i.e. exhaust, hot air, did not detect Landfill specifically.	No Response at this time
2023	Saturday, June 24, 2023	Odour	Investigation, Landfill was operational, Weather conditions reviewed, Flare running at full capacity other than five wells offline to be repaired	No Response at this time
2023	Monday, July 10, 2023	Odour (Transient) and ASR	Investigation, Landfill was operational, Weather conditions reviewed, Sweeper was running at time of complaint	No Response at this time
2023	Tuesday, July 18, 2023	Odour	Investigation, Landfill was operational, Agricultural odours detected, weather conditions reviewed	No Response at this time
2023	Wednesday, August 9, 2023	Odour	Investigation, Landfill was operational, weather conditions reviewed.	No Response at this time
2023	Tuesday, August 15, 2023	Odour (Transient)	Investigation, Flares Running, Landfill operational at time of drive by, heavy rains created a potential for increased odours	No Response at this time
2023	Tuesday, August 22, 2023	Odour	Filed, reviewed weather conditions, reminder of proper reporting procedure	Thanked for procedure.
2023	Friday, September 8, 2023	Odour	Investigation, confirmed during morning perimeter inspection moderate odour at dog park at 8:50 am, other resident did not detect odours at school drop off.	No Response at this time
2023	Wednesday, October 4, 2023	Odour (Transient)	Investigation Notes: bulk of Watford smelt of agricultural odours at that time, wind direction inconsistent with complaint.	No Response at this time
2023	Saturday, November 4, 2023	Odour (Transient)	One flare was done, part required, repair completed on Monday	Appreciated response
2023	Saturday, November 4, 2023	Odour (Transient)	One flare was done, part required, repair completed on Monday	No Response at this time
2023	Saturday, December 2, 2023	Odour	Gas Plant went down overnight, back online Sat. morning, review of Alert system to Techs	Thanks
2023	Saturday, December 2, 2023	Odour	Gas Plant went down overnight, back online Sat. morning, review of Alert system to Techs	No Response at this time
2023	Wednesday, December 20, 2023	Odour (Transient)	One of Flares was down for a few days but is running, takes some time to rebalance the field after an outage	No Response at this time
2024	Saturday, February 3, 2024	Odour	Investigation with Ops, Gas, Residents in area did not detect	Left message
2024	Wednesday, April 10, 2024	Odour	Investigation with Gas, A power interruption caused a shutdown of the gas collection system, following restart the system returned to normal operations.	Left message
2024	Wednesday, April 10, 2024	Odour	Investigation with Gas, A power interruption caused a shutdown of the gas collection system, following restart the system returned to normal operations.	Add info requested on power availability, could smell same odour last night
2024	Tuesday, April 16, 2024	Odour	Investigation, agricultural odours, light methane odour at front gate, report as timely as possible	No response at this time
2024	Tuesday, April 30, 2024	Odour	Investigation-nothing abnormal noted	No response at this time
2024	Monday, May 6, 2024	Odour	Investigation-Ops Mgr detected at 6:15 a.m. odour to Home Hardware, went to addresses at 8:27 a.m. no odour detected	No response at this time
2024	Friday, May 24, 2024	Odour	Investigation-Ops Mgr, Gas Tech went out did not detect in Town, could smell waste by South Slope on site and did note agricultural odours in the morning	No response at this time
2024	Thursday, May 30, 2024	Odour	Flare had gone down earlier in day, back up by afternoon	No response at this time
2024	Thursday, July 25, 2024	Odour	Investigation-Gas System went offline at 8:10 a.m. back up within 30 mins.	No response at this time

Year	Date	Type	Investigation and Corrective Action	Response
2024	Friday, July 26, 2024	Odour	Investigation: Mix of agricultural and some garbage odours detected on Sunset	No response at this time
2024	Wednesday, August 7, 2024	Odour	Investigation:compounding odours of Agricultural and Landfill. Typically after a long weekend waste that has been accumulated in the Transfer Stations is shipped and this waste is known to be odourous due to the length of time sitting	No response at this time
2024	Saturday, September 14, 2024	Odour (Transient)	Wind direction does not align with complaint	Believes it was Landfill
2024	Monday, September 16, 2024	Odour (Transient)	Wind direction does not align with complaint	Agreed on Wind Direction, apologies
2024	Thursday, September 26, 2024	Odour	Ops Mgr went to location faint garbage as well as agricult.	Phone not working?
2024	Thursday, September 26, 2024	Odour (Transient)	Investigation, agricultural odours in area	No response at this time

APPENDIX 11C

Fall THC Walkover – Locations of the Landfill Cap that were repaired.

Twin Creeks Environmental Centre – Existing Landfill

October 24, 2023

Landfill Cap Repair Location #1:
42°58'11.50"N
81°51'54.70"W

@4:30pm: Started the excavation for the landfill cap repair.
@4:45pm: Completed the installation of the bentonite “blanket” patch repair. Observed that the bentonite “blanket” patch repair was saturated with water. Observed acceptable backfill and compaction, of the soil initially excavated, was completed.

(Photo taken when the repair bentonite “blanket” patch was already placed in the excavation, saturated, and partially backfilled)

Landfill Cap Repair Location #2:
42°58'19.30"N
81°51'55.40"W

@4:05pm: Started the excavation for the landfill cap repair.
@4:20pm: Completed the installation of the bentonite “blanket” patch repair. Observed that the bentonite “blanket” patch repair was saturated with water. Observed acceptable backfill and compaction, of the soil initially excavated, was completed.

(Photo taken when the repair bentonite “blanket” patch was already placed in the excavation, saturated, and partially backfilled)

Landfill Cap Repair Location #3:
42°58'19.80"N
81°51'55.10"W

@3:40pm: Started the excavation for the landfill cap repair.
@4:00pm: Completed the installation of the bentonite “blanket” patch repair. Observed that the bentonite “blanket” patch repair was saturated with water. Observed acceptable backfill and compaction, of the soil initially excavated, was completed.

(Photo taken when the repair bentonite “blanket” patch was placed in the excavation and saturated with water)

Landfill Cap Repair Location #4:
42°58'21.20"N
81°51'54.30"W

@3:10pm: Started the excavation for the landfill cap repair.
@3:35pm: Completed the installation of the bentonite “blanket” patch repair. Observed that the bentonite “blanket” patch repair was saturated with water. Observed acceptable backfill and compaction, of the soil initially excavated, was completed.

(Photo taken when the repair bentonite “blanket” patch was placed in the excavation and saturated with water)

Landfill Cap Repair Location #5:
42°58'25.50"N
81°51'54.20"W

@2:10pm: Started the excavation for the landfill cap repair.
@2:30pm: Completed the installation of the bentonite “blanket” patch repair. Observed that the bentonite “blanket” patch repair was saturated with water. Observed acceptable backfill and compaction, of the soil initially excavated, was completed.

(Photo taken when the repair bentonite “blanket” patch was placed in the excavation and saturated with water)

Landfill Cap Repair Location #6:
42°58'32.30"N
81°51'53.90"W

@1:40pm: Started the excavation for the landfill cap repair.
@2:05pm: Completed the installation of the bentonite “blanket” patch repair. Observed that the bentonite “blanket” patch repair was saturated with water. Observed acceptable backfill and compaction, of the soil initially excavated, was completed.

(Photo taken when the repair bentonite “blanket” patch was placed in the excavation and saturated with water)

Landfill Cap Repair Location #7:
42°58'36.50"N
81°51'54.10"W

@1:20pm: Started the excavation for the landfill cap repair.
@1:35pm: Completed the installation of the bentonite “blanket” patch repair. Observed that the bentonite “blanket” patch repair was saturated with water. Observed acceptable backfill and compaction, of the soil initially excavated, was completed.

(Photo taken when the repair bentonite “blanket” patch was placed in the excavation and saturated with water)

Landfill Cap Repair Location #8:
42°58'37.70"N
81°51'54.00"W

@12:55pm: Started the excavation for the landfill cap repair.
@1:15pm: Completed the installation of the bentonite “blanket” patch repair. Observed that the bentonite “blanket” patch repair was saturated with water. Observed acceptable backfill and compaction, of the soil initially excavated, was completed.

(Photo taken when the repair bentonite “blanket” patch was placed in the excavation and saturated with water)

APPENDIX 11D

Appendix 11D-a: Twin Creeks Landfill, Fugitive Odour Emission Assessment - Existing Condition (2033)

Sampling Result

Sampling Location	Odour Intensity from Sampling (OU/m^3) [1]	
	Average	Maximum
Old Landfill	546	1,030
New Landfill	23,185	299,100

Note:
[1] Average odour intensity was adopted in the modelling.

Gas Collection Efficiency

Landfill Area	Sources	Gas Collection Efficiency
Current Landfill and Proposed Landfill	Interim Cover	75%
	Final Cover	90%
Old Landfill, i.e. AREA5	Final Cover	75%

Summary of Odour Emissions for Existing Condition

Source ID	Source Description	Area (m^2)	Odour Flux Rate ($OU/s/m^2$)	Emission Rate (OU/s)	LandGEM Gas Generation (m^3/yr)	Fugitive LFG Emissions (m^3/s)	Odour Intensity (OU/m^3)
AREA5	Old Landfill - Final Cover	275,424	**4.84E-05**	1.33E+01	3.09E+06	2.45E-02	**546**
AREA1	Current Landfill - Final Cover	244,004	**1.39E-02**	3.40E+03	4.62E+07	1.46E-01	**23,185**
AREA2	Current Landfill - Final Cover	165,611	**2.30E-02**	3.82E+03	5.19E+07	1.65E-01	**23,185**
AREA3	Current Landfill - Final Cover	179,092	**2.63E-02**	4.71E+03	6.41E+07	2.03E-01	**23,185**
AREA4	Current Landfill - Interim Cover	99,012	**8.37E-02**	8.28E+03	4.51E+07	3.57E-01	**23,185**

Sample Calculation for AREA5

3.09E+06 m^3	1 yr	100 - 75	%	546 OU	1
1 yr	31,536,000 s	1		1 m^3	275,424 m^2

= 4.84E-05 $OU/s/m^2$

Appendix 11D-b: Twin Creeks Landfill, Fugitive Odour Emission Assessment End of Phase 9 (2033)

RWDI Project 2101750

Summary of Odour Emissions based on 2023 and 2025 Source Testing

Source ID	Source Description	Area (m^2)	Odour Flux Rate ($OU/s/m^2$)	Emission Rate (OU/s)
WF	Working Face/Scrape Down Area - Freshly Uncovered Waste Flux Rate (6am - 9am)	3,720	3.56E-01	1.33E+03
WF	Working Face/Scrape Down Area - Working Face Flux Rate (9am - 6am)	3,720	4.94E-02	1.84E+02
Various	Leachate Maintenance Hole	0.5	7.97E-02	3.99E-02
AREA1	Expansion Landfill Phases 1 through 3 - Final Cover	244,004	1.39E-02	3.40E+03
AREA2	Expansion Landfill Phases 4 through 5 - Final Cover	165,611	2.30E-02	3.82E+03
AREA3	Expansion Landfill Phases 6 through 7 - Final Cover	179,092	2.63E-02	4.71E+03
AREA4	Expansion Landfill Phases 8 through 9 - Interim Cover	99,012	8.37E-02	8.28E+03
AREA5	Existing Landfill - Final Cover	275,424	4.84E-05	1.33E+01
CONSOIL	Contaminated Soil Pile	20	7.65E-02	1.53E+00

Note:

[1] Odour flux rates for the working face, maintenance holes, and contaminated soil are based on the average detection odour flux from the sampling completed on June 19^{th,} June 29th, 2023. Odour flux rates for the interim cover and final cover areas are based engineering calculations using 2025 landfill gas well odour sampling data 2024 gas quality well sampling data.

Source ID	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM
WF	0.08	0.08	0.08	0.08	0.08	0.08	0.59	0.59	0.59	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08	0.08

Appendix 11D-d1: SBR Emission Rates (Per Unit)

RWDI# 2101750

WASTEWATER TREATMENT SUMMARY I 12-08-2008 14:07:30

Project I:\W085303\W085303A\Analysis\05 Water9\SBR 11/27/2008 11:11:12 AM

COMPOUND	RATE (g/s)	Fraction Air	Removal		Exit	Adsorb	error	emissions
BENZENE	4.77E-05	0.59	0.4016	0.0029	0.0003	0	(1.50E-03	Mg/yr)
CHLOROETHYLENE (vinyl chloride)	2.14E-04	0.96	0.0303	0.0019	0	0	(6.74E-03	Mg/yr)
1,4 DICHLOROBENZENE (-p)	1.34E-05	0.33	0.6609	0.0046	0.0021	0	(4.22E-04	Mg/yr)
DICHLOROETHYLENE(1,2) cis	1.89E-03	0.98	.	0.0153	0.0001	0	(5.97E-02	Mg/yr)
ETHYLBENZENE	3.40E-04	0.49	0.4969	0.0033	0.0012	0	(1.07E-02	Mg/yr)
METHYLENE CHLORIDE, dichloromethane	1.05E-02	0.79	0.2	0.0046	0.0001	0	(3.31E-01	Mg/yr)
TETRACHLOROETHENE	6.45E-05	0.8	0.1911	0.0031	0.0006	0	(2.03E-03	Mg/yr)
TOLUENE	1.78E-03	0.46	0.5354	0.0025	0.0005	0	(5.60E-02	Mg/yr)
TRICHLOROETHYLENE	1.65E-04	0.74	0.2517	0.0029	0.0004	0	(5.19E-03	Mg/yr)
XYLENE	1.42E-03	0.44	0.5495	0.0042	0.0015	0	(4.48E-02	Mg/yr)
DICHLOROETHANE(1,2)	2.67E-05	0.43	0.5564	0.0053	0.0002	0	(8.42E-04	Mg/yr)
1,1 DICHLOROETHENE vinylidene chloride	6.64E-05	0.83	0.168	0.0019	0.0002	0	(2.10E-03	Mg/yr)
AMMONIA *	1.06E-01	0.07	.	0.9238	0.0056	0	(3.34E+00	Mg/yr)
PHENOL	4.44E-08	0	0.9993	0.0007	0	0	(1.40E-06	Mg/yr)

TOTAL ALL COMPOUNDS 1.23E-01 g/s air emissions

TOTAL ALL COMPOUNDS 3.87E+00 Mg/yr air emissions

Compound	CAS	Emission Rate (g/s)	
BENZENE	71-43-2	4.77E-05	
CHLOROETHYLENE (vinyl chloride)	75-01-4	2.14E-04	
1,4 DICHLOROBENZENE (-p)	106-46-7	1.34E-05	
DICHLOROETHYLENE(1,2) cis	156-59-2	1.89E-03	
ETHYLBENZENE	100-41-4	3.40E-04	
METHYLENE CHLORIDE, dichloromethane	75-09-2	1.05E-02	
TETRACHLOROETHENE	127-18-4	6.45E-05	
TOLUENE	108-88-3	1.78E-03	
TRICHLOROETHYLENE	79-01-6	1.65E-04	
XYLENE	1330-20-7	1.42E-03	
DICHLOROETHANE(1,2)	107-06-2	2.67E-05	
1,1 DICHLOROETHENE vinylidene chloride	75-35-4	6.64E-05	
AMMONIA *	7664-41-7	1.39E-02	Calculated based on info provided by CRA (99% ammonia removal)
PHENOL	108-95-2	4.44E-08	

Appendix 11D-d2: Aeration Tank Emission Rates (1 Unit)

RWDI# 2101750

WASTEWATER TREATMENT SUMMARY I 12-08-2008 14:09:03

Project I:\W085303\W085303A\Analysis\05 Water9\Aeration 12/8/2008 2:03:20 PM

COMPOUND	RATE (g/s)	Fraction Air	Removal	Exit	Adsorb	error	emissions
BENZENE	9.51E-05	0.99 .	0.0043	0	0	(3.00E-03	Mg/yr)
CHLOROETHYLENE (vinyl chloride)	9.54E-05	0.99 .	0.0012	0	0	(3.01E-03	Mg/yr)
1,4 DICHLOROBENZENE (-p)	9.47E-05	0.99 .	0.0089	0	0	(2.98E-03	Mg/yr)
DICHLOROETHYLENE(1,2) cis	9.43E-05	0.98 .	0.0123	0	0	(2.97E-03	Mg/yr)
ETHYLBENZENE	9.52E-05	0.99 .	0.0036	0	0	(3.00E-03	Mg/yr)
METHYLENE CHLORIDE, dichloromethane	9.48E-05	0.99 .	0.0071	0	0	(2.99E-03	Mg/yr)
TETRACHLOROETHENE	9.53E-05	0.99 .	0.0022	0	0	(3.01E-03	Mg/yr)
TOLUENE	9.51E-05	0.99 .	0.004	0	0	(3.00E-03	Mg/yr)
TRICHLOROETHYLENE	9.52E-05	0.99 .	0.0027	0	0	(3.00E-03	Mg/yr)
XYLENE	2.85E-04	0.99 .	0.0055	0	0	(8.99E-03	Mg/yr)
DICHLOROETHANE(1,2)	9.38E-05	0.98 .	0.0175	0	0	(2.96E-03	Mg/yr)
1,1 DICHLOROETHENE vinylidene chloride	9.54E-05	0.99 .	0.0012	0	0	(3.01E-03	Mg/yr)
AMMONIA *	1.83E-05	0.09 .	0.9041	0	0	(5.78E-04	Mg/yr)
PHENOL	2.69E-08	0.02 .	0.9719	0	0	(8.47E-07	Mg/yr)

TOTAL ALL COMPOUNDS 1.35E-03 g/s air emissions

TOTAL ALL COMPOUNDS 4.25E-02 Mg/yr air emissions

Compound	CAS	Emission Rate (g/s)
BENZENE	71-43-2	9.51E-05
CHLOROETHYLENE (vinyl chloride)	75-01-4	9.54E-05
1,4 DICHLOROBENZENE (-p)	106-46-7	9.47E-05
DICHLOROETHYLENE(1,2) cis	156-59-2	9.43E-05
ETHYLBENZENE	100-41-4	9.52E-05
METHYLENE CHLORIDE, dichloromethane	75-09-2	9.48E-05
TETRACHLOROETHENE	127-18-4	9.53E-05
TOLUENE	108-88-3	9.51E-05
TRICHLOROETHYLENE	79-01-6	9.52E-05
XYLENE	1330-20-7	2.85E-04
DICHLOROETHANE(1,2)	107-06-2	9.38E-05
1,1 DICHLOROETHENE vinylidene chloride	75-35-4	9.54E-05
AMMONIA *	7664-41-7	1.83E-05
PHENOL	108-95-2	2.69E-08

Appendix 11D-d3: RO System Emission Rates (One Unit)

RWDI# 2101750

WASTEWATER TREATMENT SUMMARY I 12-08-2008 14:06:08

Project I:\W085303\W085303A\Analysis\05 Water9\RO 11/20/2008 4:34:27 PM

COMPOUND	RATE (g/s)	Fraction Air	Removal	Exit	Adsorb	error	emissions
BENZENE	2.55E-04	0.97 .	0.0224	0	0	(8.03E-03	Mg/yr)
CHLOROETHYLENE (vinyl chloride)	2.59E-04	0.99 .	0.0069	0	0	(8.16E-03	Mg/yr)
1,4 DICHLOROBENZENE (-p)	2.48E-04	0.95 .	0.0464	0	0	(7.83E-03	Mg/yr)
DICHLOROETHYLENE(1,2) cis	2.11E-04	0.8 .	0.1919	0	0	(6.64E-03	Mg/yr)
ETHYLBENZENE	2.55E-04	0.98 .	0.0197	0	0	(8.05E-03	Mg/yr)
METHYLENE CHLORIDE, dichloromethane	2.51E-04	0.96 .	0.0351	0	0	(7.93E-03	Mg/yr)
TETRACHLOROETHENE	2.57E-04	0.98 .	0.0125	0	0	(8.11E-03	Mg/yr)
TOLUENE	2.55E-04	0.97 .	0.0209	0	0	(8.04E-03	Mg/yr)
TRICHLOROETHYLENE	2.57E-04	0.98 .	0.0149	0	0	(8.09E-03	Mg/yr)
XYLENE	7.07E-04	0.9 .	0.0956	0	0	(2.23E-02	Mg/yr)
DICHLOROETHANE(1,2)	2.39E-04	0.91 .	0.0821	0	0	(7.54E-03	Mg/yr)
1,1 DICHLOROETHENE vinylidene chloride	2.59E-04	0.99 .	0.0071	0	0	(8.16E-03	Mg/yr)
AMMONIA *	9.49E-06	0.01 .	0.9818	0	0	(2.99E-04	Mg/yr)
PHENOL	1.20E-08	0 .	0.9954	0	0	(3.78E-07	Mg/yr)

TOTAL ALL COMPOUNDS 3.46E-03 g/s air emissions

TOTAL ALL COMPOUNDS 1.09E-01 Mg/yr air emissions

Compound	CAS	Emission Rate (g/s)
BENZENE	71-43-2	2.55E-04
CHLOROETHYLENE (vinyl chloride)	75-01-4	2.59E-04
1,4 DICHLOROBENZENE (-p)	106-46-7	2.48E-04
DICHLOROETHYLENE(1,2) cis	156-59-2	2.11E-04
ETHYLBENZENE	100-41-4	2.55E-04
METHYLENE CHLORIDE, dichloromethane	75-09-2	2.51E-04
TETRACHLOROETHENE	127-18-4	2.57E-04
TOLUENE	108-88-3	2.55E-04
TRICHLOROETHYLENE	79-01-6	2.57E-04
XYLENE	1330-20-7	7.07E-04
DICHLOROETHANE(1,2)	107-06-2	2.39E-04
1,1 DICHLOROETHENE vinylidene chloride	75-35-4	2.59E-04
AMMONIA *	7664-41-7	9.49E-06
PHENOL	108-95-2	1.20E-08

Appendix 11D-d4: Slurry Dryer Emission Rates

RWDI# 2101750

WASTEWATER TREATMENT SUMMARY I 11-20-2008 16:46:45

Project I:\W085303\W085303A\Analysis\05 Water9\Slurry

COMPOUND	RATE (g/s) Air	Removal	tion Exit	Adsorb	error	emissions		
BENZENE	6.40E-04	0.99	.	0.0001	0	0	(2.02E-02	Mg/yr)
CHLOROETHYLENE (vinyl chloride)	6.40E-04	0.99	.	0.0001	0	0	(2.02E-02	Mg/yr)
1,4 DICHLOROBENZENE (-p)	6.40E-04	0.99	.	0.0001	0	0	(2.02E-02	Mg/yr)
DICHLOROETHYLENE(1,2) cis	6.40E-04	0.99	.	0.0015	0	0	(2.02E-02	Mg/yr)
ETHYLBENZENE	6.40E-04	0.99	.	.	0	0	(2.02E-02	Mg/yr)
METHYLENE CHLORIDE (dichloromethane)	6.40E-04	0.99	.	0.0002	0	0	(2.02E-02	Mg/yr)
TETRACHLOROETHENE	6.40E-04	0.99	.	.	0	0	(2.02E-02	Mg/yr)
TOLUENE	6.40E-04	0.99	.	0.0001	0	0	(2.02E-02	Mg/yr)
TRICHLOROETHYLENE	6.40E-04	0.99	.	0.0001	0	0	(2.02E-02	Mg/yr)
XYLENE	1.89E-03	0.98	.	0.0154	0	0	(5.96E-02	Mg/yr)
DICHLOROETHANE(1,2)	6.40E-04	0.99	.	0.0003	0	0	(2.02E-02	Mg/yr)
1,1 DICHLOROETHENE (vinylidene chloride)	6.40E-04	0.99	.	.	0	0	(2.02E-02	Mg/yr)
AMMONIA	4.40E-04	0.34	.	0.6556	0	0	(1.39E-02	Mg/yr)
PHENOL	6.62E-06	0.94	.	0.0544	0	0	(2.09E-04	Mg/yr)

TOTAL ALL COMPOUNDS 9.38E-03 g/s air emissions
TOTAL ALL COMPOUNDS 2.96E-01 Mg/yr air emissions

Compound	CAS	Emission Rate (g/s)
BENZENE	71-43-2	6.40E-04
CHLOROETHYLENE (vinyl chloride)	75-01-4	6.40E-04
1,4 DICHLOROBENZENE (-p)	106-46-7	6.40E-04
DICHLOROETHYLENE(1,2) cis	156-59-2	6.40E-04
ETHYLBENZENE	100-41-4	6.40E-04
METHYLENE CHLORIDE, dichloromethane	75-09-2	6.40E-04
TETRACHLOROETHENE	127-18-4	6.40E-04
TOLUENE	108-88-3	6.40E-04
TRICHLOROETHYLENE	79-01-6	6.40E-04
XYLENE	1330-20-7	1.89E-03
DICHLOROETHANE(1,2)	107-06-2	6.40E-04
1,1 DICHLOROETHENE vinylidene chloride	75-35-4	6.40E-04
AMMONIA *	7664-41-7	4.40E-04
PHENOL	108-95-2	6.62E-06

Appendix 11D-e: Twin Creeks Landfill, Leachate Plant Odour Thresholds

RWDI Project 2101750

Contaminant Name	CAS Number	Molecular Weight	Odour Threshold (ppm)	Odour Threshold (mg/m^3)	Odour Threshold Reference
Benzene	71-43-2	78.11	34	108.62	[1]
Vinyl Chloride (Chloroethylene)	75-01-4	62.50	10	25.56	[2]
1,4 Dichlorobenzene (-p)	106-46-7	147.01	15	90.19	[2]
1,2-Dichloroethylene (cis)	156-59-2	96.95	N/A	N/A	- -
Ethyl Benzene	100-41-4	106.16	0.092	0.40	[2]
Dichloromethane (Methylene Chloride)	75-09-2	84.94	1.2	4.17	[2]
Tetrachloroethene	127-18-4	165.84	2	13.57	[2]
Toluene	108-88-3	92.13	0.16	0.60	[1]
Trichloroethylene	79-01-6	131.40	0.50	2.69	[2]
Xylene	1330-20-7	106.16	0.081	0.35	[2]
1,2-Dichloroethane	107-06-2	98.96	6.00	24.28	[1]
1,1 Dichloroethene (Vinylidene Chloride)	75-35-4	96.94	n/a	0.00	- -
Ammonia	7664-41-7	17.03	0.043	0.03	[2]
Phenol	108-95-2	94.11	0.0045	0.02	[2]

Conversion from ppm to mg/m^3

$$\frac{\text{(gram molecular weight of substance) x (TLV in ppm)}}{24.45}$$

These formulas can be used when measurements are taken at 25°C and the air pressure is 760 torr (= 1 atmosphere or 760 mm Hg).

Notes:

[1] Minimum odour threshold value from range of "Acceptable Values" from AIHA, 1989. *Odour Thresholds for Chemicals with Established Occupational Health Standards* . Akron, Ohio.

[2] Minimum odour threshold value from range of "All Referenced Values" from AIHA, 1989. *Odour Thresholds for Chemicals with Established Occupational Health Standards* . Akron, Ohio.

Appendix 11D-f: Twin Creeks Landfill, Leachate Plant Odour Thresholds

RWDI Project 2101750

Source ID	Source Type	Source Description	Source Data								Emission Data							
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter [1] (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate (g/s)	In-Stack Concentration (mg/m^3)	Odour Thresholds (mg/m^3)	In-Stack Odour Concentration (OU/m^3)	Maximum Odour Emission Rate (OU/s)	Total Odour Emission Rate [1] (OU/S)
L4	Point	Passive Exhaust Louvre Serving SBR and Aeration Tanks	1.96	25	1.38	1.31	2.13	n/a	0	0	Benzene	71-43-2	1.43E-04	7.29E-02	1.09E+02	6.71E-04	1.31E-03	**476**
											Vinyl Chloride (Chloroethylene)	75-01-4	3.09E-04	1.58E-01	2.56E+01	6.18E-03	1.21E-02	
											1,4 Dichlorobenzene (-p)	106-46-7	1.08E-04	5.52E-02	9.02E+01	6.12E-04	1.20E-03	
											1,2-Dichloroethylene (cis)	156-59-2	1.98E-03	1.01E+00	N/A	N/A	N/A	
											Ethylbenzene	100-41-4	4.35E-04	2.22E-01	3.99E-01	5.56E-01	1.09E+00	
											Dichloromethane (Methylene Chloride)	75-09-2	1.06E-02	5.41E+00	4.17E+00	1.30E+00	2.54E+00	
											Tetrachloroethene	127-18-4	1.60E-04	8.15E-02	1.36E+01	6.01E-03	1.18E-02	
											Toluene	108-88-3	1.88E-03	9.57E-01	6.03E-01	1.59E+00	3.11E+00	
											Trichloroethylene	79-01-6	2.60E-04	1.33E-01	2.69E+00	4.94E-02	9.68E-02	
											Xylene	1330-20-7	1.71E-03	8.70E-01	3.52E-01	2.47E+00	4.85E+00	
											1,2-Dichloroethane	107-06-2	1.21E-04	6.15E-02	2.43E+01	2.53E-03	4.96E-03	
											1,1 Dichloroethene (Vinylidene Chloride)	75-35-4	1.62E-04	8.26E-02	0.00E+00	N/A	N/A	
											Ammonia	7664-41-7	1.39E-02	7.10E+00	3.00E-02	2.37E+02	4.65E+02	
											Phenol	108-95-2	7.13E-08	3.64E-05	1.73E-02	2.10E-03	4.12E-03	
L3	Point	Passive Exhaust Louvre Serving SBR and Aeration Tanks	1.96	25	1.38	1.31	2.13	n/a	0	0	Benzene	71-43-2	1.43E-04	7.29E-02	1.09E+02	6.71E-04	1.31E-03	**476**
											Vinyl Chloride (Chloroethylene)	75-01-4	3.09E-04	1.58E-01	2.56E+01	6.18E-03	1.21E-02	
											1,4 Dichlorobenzene (-p)	106-46-7	1.08E-04	5.52E-02	9.02E+01	6.12E-04	1.20E-03	
											1,2-Dichloroethylene (cis)	156-59-2	1.98E-03	1.01E+00	N/A	N/A	N/A	
											Ethylbenzene	100-41-4	4.35E-04	2.22E-01	3.99E-01	5.56E-01	1.09E+00	
											Dichloromethane (Methylene Chloride)	75-09-2	1.06E-02	5.41E+00	4.17E+00	1.30E+00	2.54E+00	
											Tetrachloroethene	127-18-4	1.60E-04	8.15E-02	1.36E+01	6.01E-03	1.18E-02	
											Toluene	108-88-3	1.88E-03	9.57E-01	6.03E-01	1.59E+00	3.11E+00	
											Trichloroethylene	79-01-6	2.60E-04	1.33E-01	2.69E+00	4.94E-02	9.68E-02	
											Xylene	1330-20-7	1.71E-03	8.70E-01	3.52E-01	2.47E+00	4.85E+00	
											1,2-Dichloroethane	107-06-2	1.21E-04	6.15E-02	2.43E+01	2.53E-03	4.96E-03	
											1,1 Dichloroethene (vinylidene chloride)	75-35-4	1.62E-04	8.26E-02	0.00E+00	N/A	N/A	
											Ammonia	7664-41-7	1.39E-02	7.10E+00	3.00E-02	2.37E+02	4.65E+02	
											Phenol	108-95-2	7.13E-08	3.64E-05	1.73E-02	2.10E-03	4.12E-03	
EF-2	Point	Process Exhaust Fan Serving RO System Area	1.71	25	0.51	8.37	3.96	n/a	0	0	Benzene	71-43-2	2.55E-04	1.49E-01	1.09E+02	1.37E-03	2.35E-03	**4**
											Vinyl Chloride (Chloroethylene)	75-01-4	2.59E-04	1.51E-01	2.56E+01	5.93E-03	1.01E-02	
											1,4 Dichlorobenzene (-p)	106-46-7	2.48E-04	1.45E-01	9.02E+01	1.61E-03	2.75E-03	
											1,2-Dichloroethylene (cis)	156-59-2	2.11E-04	1.23E-01	N/A	N/A	N/A	
											Ethylbenzene	100-41-4	2.55E-04	1.49E-01	3.99E-01	3.73E-01	6.38E-01	
											Dichloromethane (Methylene Chloride)	75-09-2	2.51E-04	1.47E-01	4.17E+00	3.52E-02	6.02E-02	
											Tetrachloroethene	127-18-4	2.57E-04	1.50E-01	1.36E+01	1.11E-02	1.89E-02	
											Toluene	108-88-3	2.55E-04	1.49E-01	6.03E-01	2.47E-01	4.23E-01	
											Trichloroethylene	79-01-6	2.57E-04	1.50E-01	2.69E+00	5.59E-02	9.56E-02	
											Xylene	1330-20-7	7.07E-04	4.13E-01	3.52E-01	1.18E+00	2.01E+00	
											1,2-Dichloroethane	107-06-2	2.39E-04	1.40E-01	2.43E+01	5.76E-03	9.84E-03	
											1,1 Dichloroethene (vinylidene chloride)	75-35-4	2.59E-04	1.51E-01	0.00E+00	N/A	N/A	
											Ammonia	7664-41-7	9.49E-06	5.55E-03	3.00E-02	1.85E-01	3.17E-01	
											Phenol	108-95-2	1.20E-08	7.02E-06	1.73E-02	4.05E-04	6.93E-04	
SD-1	Point	Slurry Dryer Exhaust	0.24	25	0.3	3.34	5.00	n/a	0	0	Benzene	71-43-2	6.40E-04	2.71E+00	1.09E+02	2.50E-02	5.89E-03	**24**
											Vinyl Chloride (Chloroethylene)	75-01-4	6.40E-04	2.71E+00	2.56E+01	1.06E-01	2.50E-02	
											1,4 Dichlorobenzene (-p)	106-46-7	6.40E-04	2.71E+00	9.02E+01	3.01E-02	7.10E-03	
											1,2-Dichloroethylene (cis)	156-59-2	6.40E-04	2.71E+00	N/A	N/A	N/A	
											Ethylbenzene	100-41-4	6.40E-04	2.71E+00	3.99E-01	6.79E+00	1.60E+00	
											Dichloromethane (Methylene Chloride)	75-09-2	6.40E-04	2.71E+00	4.17E+00	6.51E-01	1.54E-01	
											Tetrachloroethene	127-18-4	6.40E-04	2.71E+00	1.36E+01	2.00E-01	4.72E-02	
											Toluene	108-88-3	6.40E-04	2.71E+00	6.03E-01	4.50E+00	1.06E+00	
											Trichloroethylene	79-01-6	6.40E-04	2.71E+00	2.69E+00	1.01E+00	2.38E-01	
											Xylene	1330-20-7	1.89E-03	8.01E+00	3.52E-01	2.28E+01	5.37E+00	
											1,2-Dichloroethane	107-06-2	6.40E-04	2.71E+00	2.43E+01	1.12E-01	2.64E-02	
											1,1 Dichloroethene (vinylidene chloride)	75-35-4	6.40E-04	2.71E+00	0.00E+00	N/A	N/A	
											Ammonia	7664-41-7	4.40E-04	1.86E+00	3.00E-02	6.22E+01	1.47E+01	
											Phenol	108-95-2	6.62E-06	2.81E-02	1.73E-02	1.62E+00	3.82E-01	

Notes:

[1] The Total Odour Emission is the sum of the Maximum Odour Emission Rate for each compound.

Sample Calculations:

Benzene from Source L4

A In-Stack Conc. (mg/m^3) = Maximum Emission Rate (g/s) / Stack Volumetric Flow Rate (m^3
In-Stack Concentration (mg/m^3) = (1.43×10^{-4}) / 1.96 * 1000
In-Stack Concentration (mg/m^3) = 0.07

B In-Stack Odour Conc. (OU/m^3) = In-Stack Concentration (mg/m^3) / Odour Threshold (mg/m^3)
In-Stack Odour Concentration (OU/m^3) = 0.07 / 108.62
In-Stack Odour Concentration (OU/m^3) = 0.0007

C Odour Emission Rate (OU/s) = In-Stack Odour Conc. (OU/m^3) * Stack Volumetric Flow (m^3/s)
Odour Emission Rate (OU/s) = 0.0007 X 1.96
Odour Emission Rate (OU/s) = 0.0013

Appendix 11D-g: Odour Source Summary

RWDI Project 2101750

Source ID [1]	Source Type [1]	Source Description	Source Data								Emission Data							
			Stack Volumetric Flow Rate (Am^3/s)	Stack Exit Gas Temp. (°C)	Stack Inner Diameter (m)	Stack Exit Velocity (m/s)	Stack Height Above Grade (m)	Stack Height Above Roof (m)	Source Coordinates X (m)	Source Coordinates Y (m)	Contaminant	CAS Number	Maximum Emission Rate (g/s)	Maximum Flux Rate ($g/m^2/s$)	Averaging Period (hours)	Emission Estimating Technique [2]	Emissions Data Quality [3]	% of Overall Emissions (%)
L4	Point	Passive Exhaust Louvre Serving SBR and Aeration Tanks	1.96	25	1.38	1.31	2.13	n/a			Odour	OU	4.76E+02	N/A	10-minute	EF	Average	2%
L3	Point	Passive Exhaust Louvre Serving SBR and Aeration Tanks	1.96	25	1.38	1.31	2.13	n/a			Odour	OU	4.76E+02	N/A	10-minute	EF	Average	2%
EF_2	Point	Process Exhaust Fan Serving RO System Area	1.71	25	0.51	8.37	4.0	n/a			Odour	OU	3.59E+00	N/A	10-minute	EF	Average	<1%
SD_1	Point	Slurry Dryer Exhaust	0.24	25	0.3	3.34	5.0	n/a			Odour	OU	2.36E+01	N/A	10-minute	EF	Average	<1%
AREA1	Area	Expansion Landfill Phases 1 through 3 Approximate Area = 244,004 m^2 (Emissions Based on Year 2030) - Final Cover	--	--	--	--	--	--			Odour	OU	3.40E+03	1.39E-02	10-minute	ST	Average	16%
AREA2	Area	Expansion Landfill Phases 4 through 5 Approximate Area = 165,611 m^2 (Emissions Based on Year 2030) - Final Cover	--	--	--	--	--	--			Odour	OU	3.82E+03	2.30E-02	10-minute	ST	Average	18%
AREA3	Area	Expansion Landfill Phases 6 through 7 Approximate Area = 179,092 m^2 (Emissions Based on Year 2030) - Final Cover	--	--	--	--	--	--			Odour	OU	4.71E+03	2.63E-02	10-minute	ST	Average	22%
AREA4	Area	Expansion Landfill Phases 8 through 9 Approximate Area = 99,012 m^2 (Emissions Based on Year 2030) - Interim Cover	--	--	--	--	--	--			Odour	OU	8.28E+03	8.37E-02	10-minute	ST	Average	39%
AREA5	Area	Existing Landfill Approximate Area = 208,263 m^2 (Emissions Based on Year 2030) - Final Cover	--	--	--	--	--	--			Odour	OU	1.33E+01	4.84E-05	10-minute	ST	Average	<1%
WF	Area	Working Face/Scrape Down Area, Approximately 3,720 m^2	--	--	--	--	--	--			Odour	OU	Variable	Variable [4]	10-minute	ST	Average	
LMAN01	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
LMAN02	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
LMAN03	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
LMAN04	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
LMAN05	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
LMAN06	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
LMAN07	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
LMAN08	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH5AB	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH4A	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH3SA	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH16	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH6AB	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
SUMP	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH3SF	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH18	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH17	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH3SB	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH3SD	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH3SC	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH3SE	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH4B	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH8AB	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH10	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH12AB	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH7AB	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH9AB	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
MH11AB	Area	Leachate Manhole, Approximately 0.5 m^2	--	--	--	--	--	--			Odour	OU	3.99E-02	7.97E-02	10-minute	ST	Average	<1%
CONSOIL	Area	Contaminated Soil Pile, Approximately 20 m^2	--	--	--	--	--	--			Odour	OU	1.53E+00	7.65E-02	10-minute	ST	Average	<1%
Total		Total of all listed sources									Odour	OU	2.12E+04	--	--	--	--	100%

Notes:

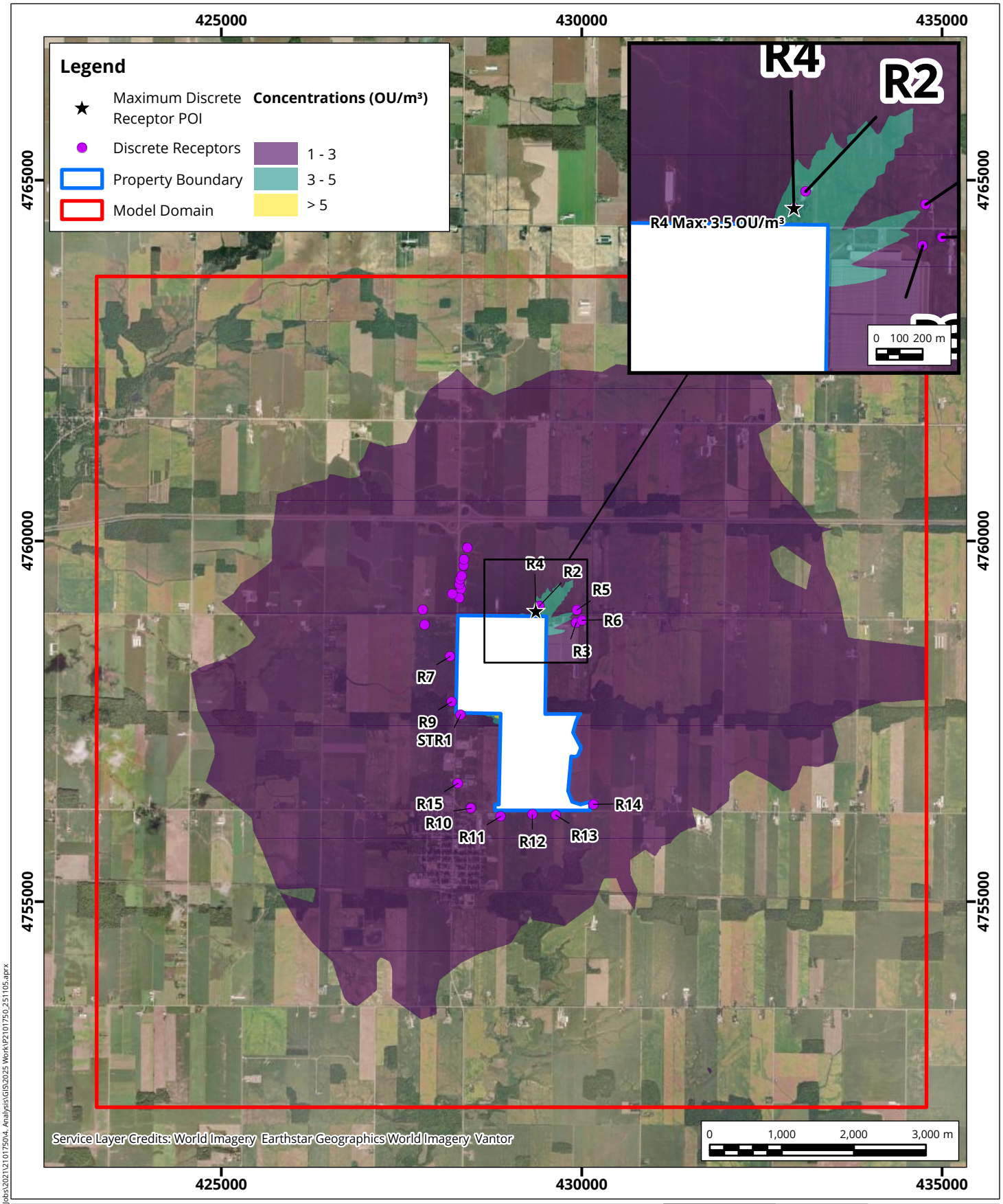
[1] Source ID, Source Type: should provide information on the modelling source type (e.g., Point, Area or Volume Source); the process source or sources within the modelling source (e.g., Process Line #1); and the stack or stacks within each process source.

[2] Emission Estimating Technique Short-Forms are V-ST (Validated Source Test), "ST" (Source Test), EF (Emission Factor), MB (Mass Balance), and EC (Engineering Calculation).

[3] Data Quality Categories: Highest; Above-Average; Average; and Marginal.

[4] Odour emissions from the working face vary depending on the time of day. From 6am - 9am the working face is freshly uncovered waste as they strip the daily cover and begin to deposite waste. By 9am the entire working face has been covered by at least 1 foot - 1 metre of waste. After 9am the emission factor for the working face is applied.

APPENDIX 11E



Predicted 10-Minute Odour Concentration (in OU/m³)

True North

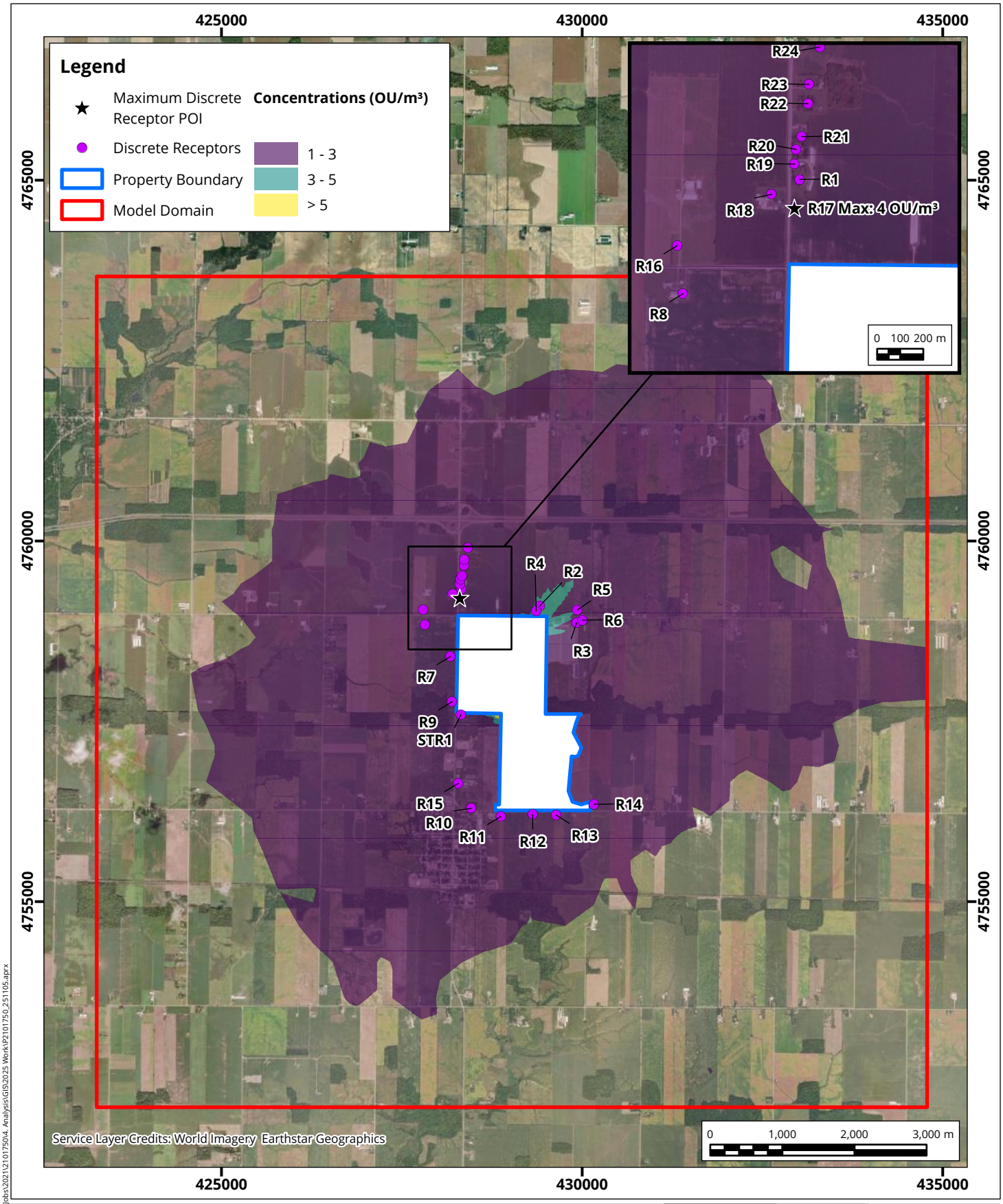
Drawn by: PIP	Figure 1E-1
Approx. Scale:	1:72,000
Date Revised:	Nov 12, 2025

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre - Watford, Ontario

Project #: 2101750

Map Document: \\rwdlgroup\rwdl\AM_Jobs\2021\2101750\4. Analysis\GIS\2025 Work\P2101750_251105.aprx



Predicted 10-Minute Odour Concentration (in OU/m³)

Scenario 1: 2034

Map Projection: NAD 1983 UTM Zone 17N

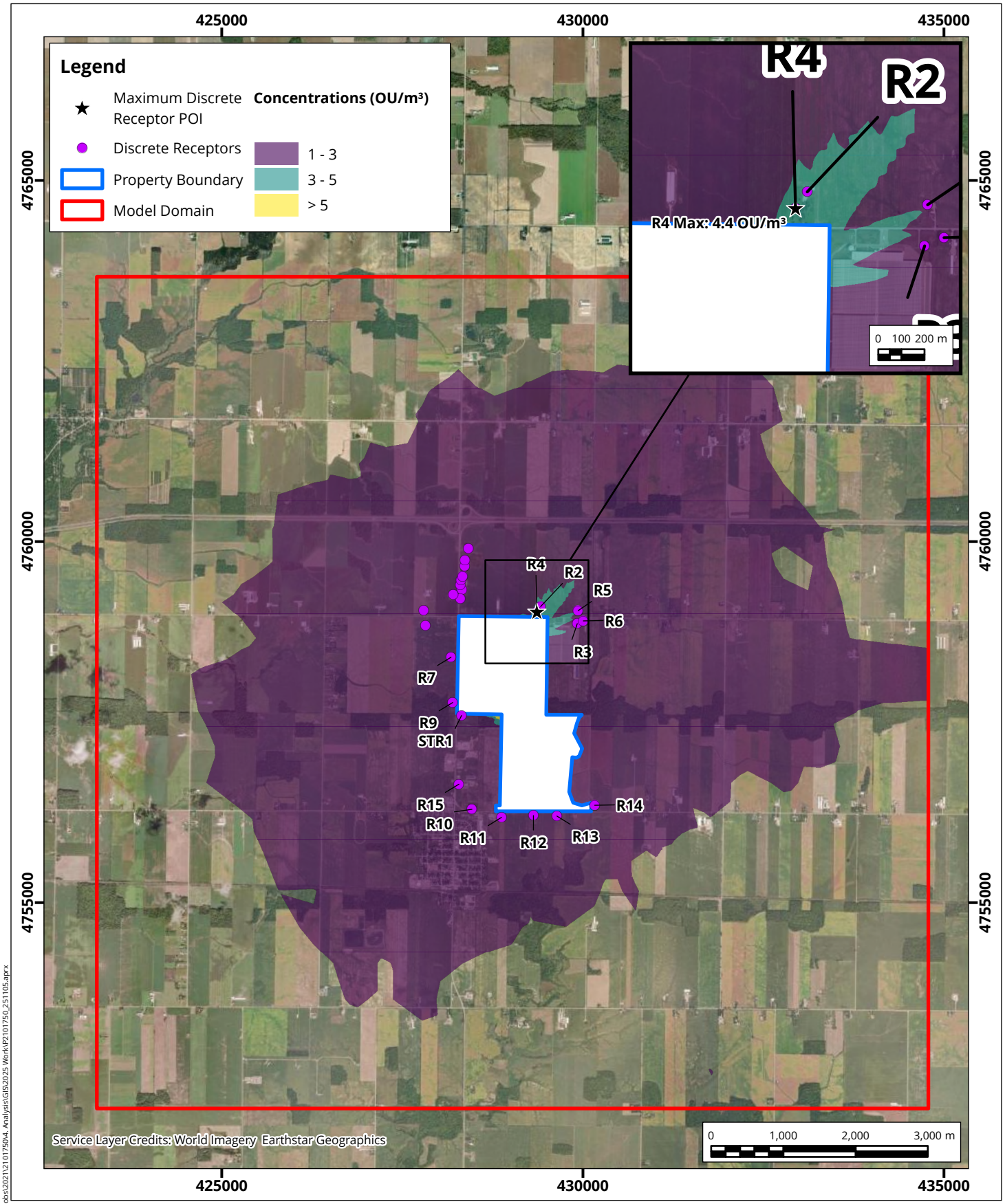
Twin Creeks Environmental Centre - Watford, Ontario

Project #: 2101750

True North

Drawn by: PIP	Figure: 1
Approx. Scale:	1:72,000
Date Revised: Nov 12, 2025	

Map Document: \\rwdlgroup\rwdl\AM_Jobs\2021\2101750\4. Analysis\GIS\2025 Work\P2101750_251105.aprx



Predicted 10-Minute Odour Concentration (in OU/m³)

Scenario 2: 2037

Map Projection: NAD 1983 UTM Zone 17N

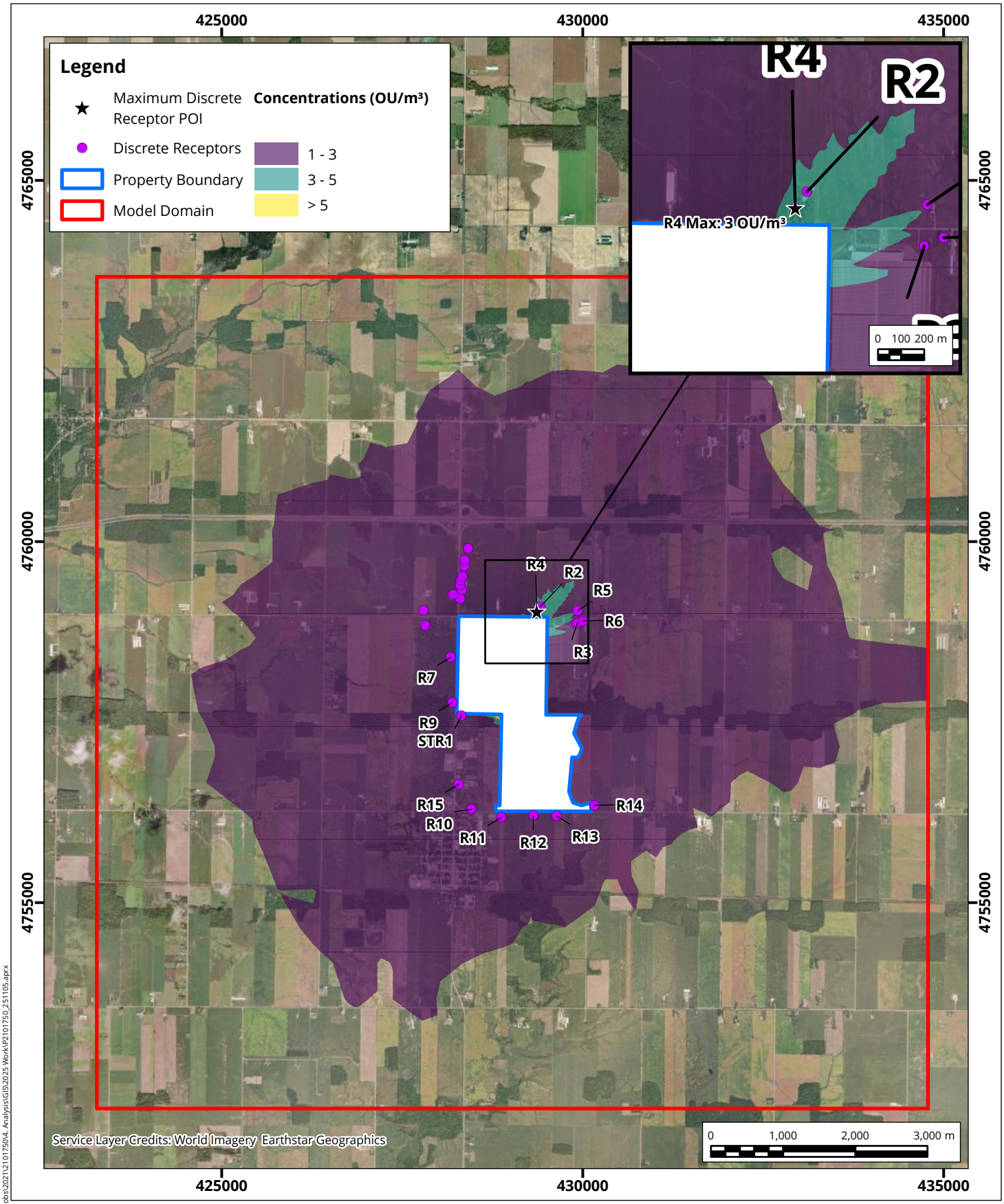
Twin Creeks Environmental Centre - Watford, Ontario

True North

Project #: 2101750

Drawn by: PIP	Figure: 1
Approx. Scale:	1:72,000
Date Revised:	Nov 12, 2025

Map Document: \\rwdlgroup\rwdl\AM_Jobs\2021\2101750\4. Analysis\GIS\2025 Work\P2101750_251105.aprx



Predicted 10-Minute Odour Concentration (in OU/m³)

Scenario 3: 2042

Map Projection: NAD 1983 UTM Zone 17N

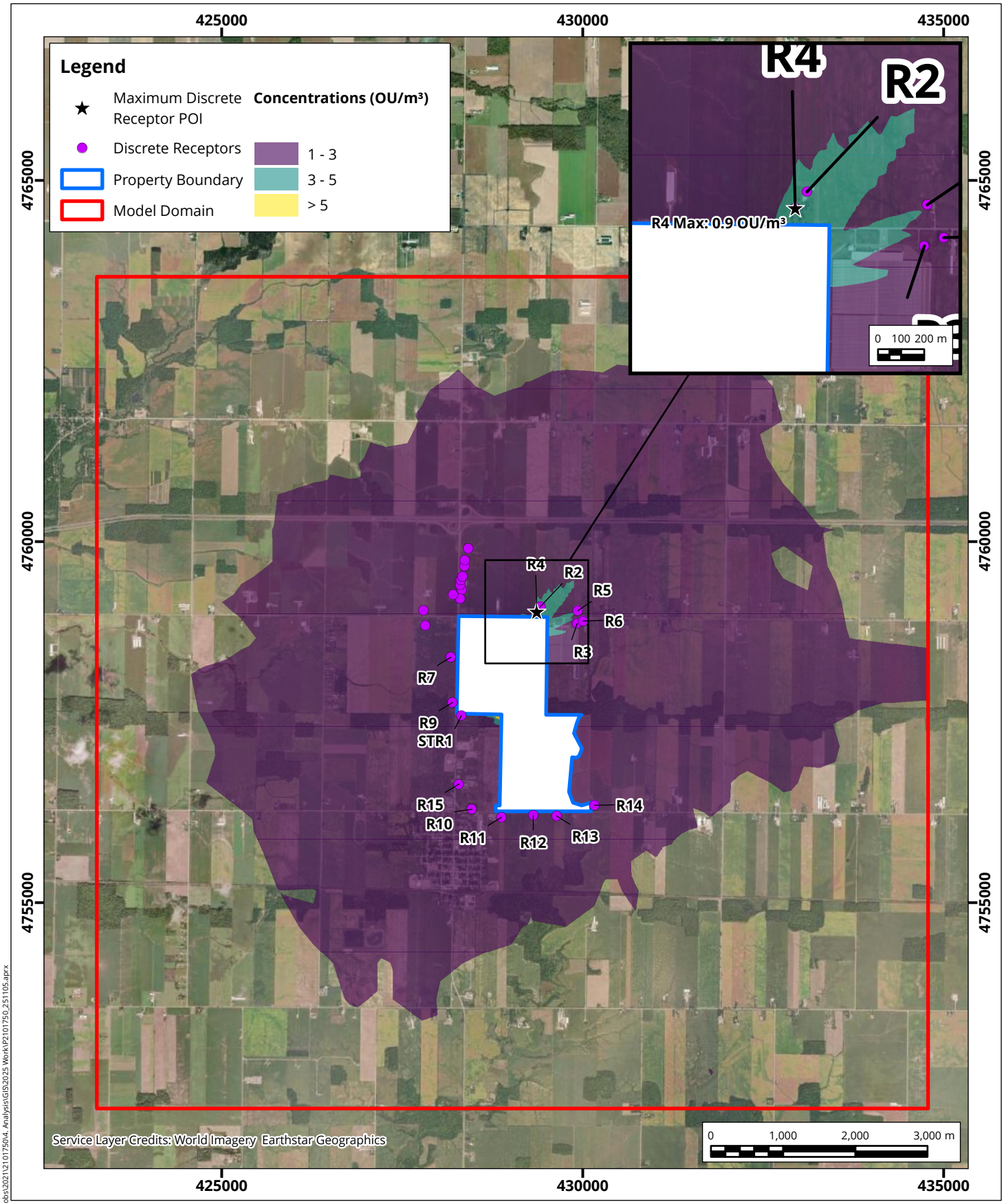
Twin Creeks Environmental Centre - Watford, Ontario

Project #: 2101750

True North

Drawn by: PIP	Figure: 1
Approx. Scale:	1:72,000
Date Revised:	Nov 12, 2025

Map Document: \\rwdlgroup\rwdl\AM_Jobs\2021\2101750\4. Analysis\GIS\2025 Work\P2101750_251105.aprx



Predicted 10-Minute Odour Concentration (in OU/m³)

Scenario 4: No-Build

Map Projection: NAD 1983 UTM Zone 17N

Twin Creeks Environmental Centre - Watford, Ontario

Project #: 2101750

True North

Drawn by: PIP	Figure: 1
Approx. Scale:	1:72,000
Date Revised:	Nov 12, 2025

Map Document: \\rwdlgroup\rwdl\AM_Jobs\2021\2101750\4. Analysis\GIS\2025 Work\P2101750_251105.aprx

APPENDIX 12A

RWDI Air Inc

Bureau Veritas Job Number: C3J2480
Report Date: 2023/07/13

Client Project #: 2101750.11
Site Location: TWIN CREEKS EA
Your P.O. #: 2101750.11

COMPRESSED GAS PARAMETERS (TEDLAR BAG)

Bureau Veritas ID		WGI894	WGI895	WGI896		
Sampling Date		2023/06/29	2023/06/29	2023/06/29		
COC Number		n/a	n/a	n/a		
	UNITS	**LFG-1**	**LFG-2**	**LFG-3**	**RDL**	**QC Batch**
Oxygen	% v/v	8.3	3.5	5.0	0.1	8773160
Nitrogen	% v/v	31.4	17.5	22.0	0.1	8773160
Carbon Monoxide	% v/v	ND	ND	ND	0.1	8773160
Methane	% v/v	33.3	44.0	40.7	0.1	8773160
Carbon Dioxide	% v/v	27.0	34.9	32.3	0.1	8773160
Total Reduced Sulfur as H2S	ppmv	290	340	370	50	8763224
Carbonyl sulfide	ppmv	ND	ND	ND	18	8766502
Hydrogen sulfide	ppmv	290	340	370	35	8766502
Carbon Disulfide	ppmv	ND	ND	ND	8.2	8766502
Sulphur dioxide	ppmv	ND	ND	ND	27	8766502
Methyl mercaptan	ppmv	ND	ND	ND	33	8766502
Ethyl Mercaptan	ppmv	ND	ND	ND	18	8766502
Dimethyl sulfide	ppmv	ND	ND	ND	34	8766502
1- Propyl mercaptan	ppmv	ND	ND	ND	19	8766502
Methyl ethyl sulfide	ppmv	ND	ND	ND	20	8766502
Dimethyl disulfide	ppmv	ND	ND	ND	4.3	8766502

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

Results relate only to the items tested.

Bureau Veritas Job Number: C3J2480
Report Date: 2023/07/13

RWDI Air Inc
Client Project #: 2101750.11
Site Location: TWIN CREEKS EA
Your P.O. #: 2101750.11

VOLATILE ORGANICS BY GC/MS (TEDLAR BAG)

Bureau Veritas ID		WGI894		
Sampling Date		2023/06/29		
COC Number		n/a		
	UNITS	**LFG-1**	**RDL**	**QC Batch**
Dichlorodifluoromethane (FREON 12)	ppbv	763	46	8763161
1,2-Dichlorotetrafluoroethane	ppbv	ND	39	8763161
Chloromethane	ppbv	ND	95	8763161
Vinyl Chloride	ppbv	453	23	8763161
Chloroethane	ppbv	131	70	8763161
1,3-Butadiene	ppbv	ND	120	8763161
Trichlorofluoromethane (FREON 11)	ppbv	577	46	8763161
Ethanol (ethyl alcohol)	ppbv	28700	460	8763161
Trichlorotrifluoroethane	ppbv	ND	35	8763161
2-propanol	ppbv	ND	6200	8763161
2-Propanone	ppbv	14100	140	8763161
Methyl Ethyl Ketone (2-Butanone)	ppbv	18900	46	8763161
Methyl Isobutyl Ketone	ppbv	511	46	8763161
Methyl Butyl Ketone (2-Hexanone)	ppbv	ND	230	8763161
Methyl t-butyl ether (MTBE)	ppbv	ND	46	8763161
Ethyl Acetate	ppbv	1730	230	8763161
1,1-Dichloroethylene	ppbv	ND	23	8763161
cis-1,2-Dichloroethylene	ppbv	589	23	8763161
trans-1,2-Dichloroethylene	ppbv	ND	300	8763161
Methylene Chloride(Dichloromethane)	ppbv	514	140	8763161
Chloroform	ppbv	ND	23	8763161
Carbon Tetrachloride	ppbv	ND	23	8763161
1,1-Dichloroethane	ppbv	31	23	8763161
1,2-Dichloroethane	ppbv	237	23	8763161
Ethylene Dibromide	ppbv	ND	23	8763161
1,1,1-Trichloroethane	ppbv	ND	23	8763161
1,1,2-Trichloroethane	ppbv	ND	23	8763161
1,1,2,2-Tetrachloroethane	ppbv	ND	23	8763161
cis-1,3-Dichloropropene	ppbv	ND	23	8763161
trans-1,3-Dichloropropene	ppbv	ND	23	8763161
1,2-Dichloropropane	ppbv	68	23	8763161
Bromomethane	ppbv	ND	23	8763161
Bromoform	ppbv	ND	46	8763161
Bromodichloromethane	ppbv	ND	46	8763161
Dibromochloromethane	ppbv	ND	46	8763161
Trichloroethylene	ppbv	188	23	8763161

Tetrachloroethylene	ppbv	285	23	8763161
Benzene	ppbv	934	23	8763161
Toluene	ppbv	13400	23	8763161
Ethylbenzene	ppbv	3010	23	8763161
p+m-Xylene	ppbv	7240	46	8763161
o-Xylene	ppbv	1990	23	8763161
Styrene	ppbv	320	23	8763161
4-ethyltoluene	ppbv	166	120	8763161
1,3,5-Trimethylbenzene	ppbv	207	120	8763161
1,2,4-Trimethylbenzene	ppbv	474	120	8763161
Chlorobenzene	ppbv	33	23	8763161
Benzyl chloride	ppbv	ND	120	8763161
1,3-Dichlorobenzene	ppbv	ND	93	8763161
1,4-Dichlorobenzene	ppbv	56	23	8763161
1,2-Dichlorobenzene	ppbv	ND	23	8763161
1,2,4-Trichlorobenzene	ppbv	ND	120	8763161
Hexachlorobutadiene	ppbv	ND	120	8763161
Hexane	ppbv	1680	46	8763161
Heptane	ppbv	2980	70	8763161
Cyclohexane	ppbv	1230	46	8763161
Tetrahydrofuran	ppbv	3400	93	8763161
1,4-Dioxane	ppbv	ND	230	8763161
Naphthalene	ppbv	ND	46	8763161
Total Xylenes	ppbv	9230	70	8763161
1,1,1,2-Tetrachloroethane	ppbv	ND	23	8763161
Vinyl Bromide	ppbv	ND	46	8763161
Propene	ppbv	16100	120	8763161
2,2,4-Trimethylpentane	ppbv	507	46	8763161
Carbon Disulfide	ppbv	464	120	8763161
Vinyl Acetate	ppbv	ND	46	8763161
Surrogate Recovery (%)				
Bromochloromethane	%	98		8763161
D5-Chlorobenzene	%	97		8763161
Difluorobenzene	%	98		8763161

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
ND = Not Detected at a concentration equal or greater than the indicated Detection Limit.

Results relate only to the items tested.

APPENDIX 12B

Waste Acceptance Rates, TCEC

Year of Waste Acceptance	2016 Increased Tonnage Study - Current (Mg/year)	2016 Increased Tonnage Study - Increased (Mg/year) [1]	Revised Tonnage (Mg/year) [2][3]
1972	9,979	9,979	9,979
1973	9,979	9,979	9,979
1974	9,979	9,979	9,979
1975	9,979	9,979	9,979
1976	9,979	9,979	9,979
1977	9,979	9,979	9,979
1978	9,979	9,979	9,979
1979	9,979	9,979	9,979
1980	9,979	9,979	9,979
1981	9,979	9,979	9,979
1982	9,979	9,979	9,979
1983	9,979	9,979	9,979
1984	9,979	9,979	9,979
1985	9,979	9,979	9,979
1986	9,979	9,979	9,979
1987	9,979	9,979	9,979
1988	9,979	9,979	9,979
1989	9,979	9,979	9,979
1990	9,979	9,979	9,979
1991	9,979	9,979	9,979
1992	9,979	9,979	9,979
1993	9,979	9,979	9,979
1994	69,605	69,605	69,605
1995	55,074	55,074	55,074
1996	43,328	43,328	43,328
1997	57,497	57,497	57,497
1998	57,903	57,903	57,903
1999	58,599	58,599	58,599
2000	53,819	53,819	53,819
2001	191,426	191,426	191,426
2002	108,441	108,441	108,441
2003	86,909	86,909	86,909
2004	98,516	98,516	98,516
2005	218,455	218,455	218,455
2006	298,090	298,090	298,090
2007	304,043	304,043	304,043
2008	283,591	283,591	283,591
2009	169,803	169,803	169,803
2010	311,006	311,006	311,006
2011	429,041	429,041	429,041
2012	528,571	528,571	528,571

Year of Waste Acceptance	2016 Increased Tonnage Study - Current (Mg/year)	2016 Increased Tonnage Study - Increased (Mg/year) [1]	Revised Tonnage (Mg/year) [2][3]
2013	452,641	452,641	452,641
2014	470,377	470,377	470,377
2015	533,326	533,326	533,326
2016	620,000	620,000	678,031
2017	750,000	750,000	820,360
2018	750,000	880,000	1,324,830
2019	750,000	1,010,000	1,417,281
2020	750,000	1,140,000	1,330,444
2021	750,000	1,270,000	1,399,849
2022	750,000	1,400,000	1,391,172
2023	750,000	1,400,000	1,400,000
2024	750,000	1,400,000	1,400,000
2025	750,000	1,400,000	1,400,000
2026	750,000	1,400,000	1,400,000
2027	750,000	1,400,000	1,400,000
2028	750,000	1,400,000	1,400,000
2029	750,000	1,400,000	1,400,000
2030	750,000	1,400,000	1,400,000
2031	750,000	1,400,000	1,400,000
2032	750,000	1,400,000	1,400,000
2033	750,000	1,400,000	1,007,103
2034	750,000	899,070	0
2035	750,000	0	0
2036	750,000	0	0
2037	750,000	0	0
2038	750,000	0	0
2039	750,000	0	0
2040	750,000	0	0
2041	750,000	0	0
2042	750,000	0	0
2043	750,000	0	0
2044	750,000	0	0
2045	750,000	0	0
2046	750,000	0	0
2047	750,000	0	0

Notes:

[1] Total landfill tonnage over lifetime: 28,468,669 tonnes

[2] Tonnage 2016 - 2022 based on NPRI reporting

[3] Tonnage 2023 - 2033 estimated based on maximum allowable acceptance rate

APPENDIX 12C

USER INPUTS

Landfill Name or Identifier: Twin Creeks Environmental Centre

Clear ALL Non-Parameter Inputs/Selections

1: PROVIDE LANDFILL CHARACTERISTICS

Landfill Open Year	1972	
Landfill Closure Year	2005	
Have Model Calculate Closure Year?	○ Yes ◉ No	
Waste Design Capacity		megagrams

Restore Default Model Parameters

2: DETERMINE MODEL PARAMETERS

Methane Generation Rate, k (*year*$^{-1}$)
User-specified
User-specified value: 0.040
User-specified k value should be based on site-specific data and determined by EPA Method 2E.

Potential Methane Generation Capacity, L_o (*m*^{3}/*Mg*)
User-specified
User-specified value: 125
User-specified Lo value should be based on site-specific data and determined by waste type and composition.

NMOC Concentration (*ppmv as hexane*)
User-specified
User-specified value: 595

Methane Content (*% by volume*)
User-specified
User-specified value: 44

3: SELECT GASES/POLLUTANTS

Gas / Pollutant #1 #REF!
Total landfill gas

Gas / Pollutant #2
Methane

Gas / Pollutant #3
Carbon dioxide

Gas / Pollutant #4
NMOC

Edit Existing or Add New Pollutant Parameters

Restore Default Pollutant Parameters

Description/Comments:

Modelling of existing landfill Area 5. Values based on MECP Interim Guide.

4: ENTER WASTE ACCEPTANCE RATES

Input Units: *Mg/year*

Year	Input Units *(Mg/year)*	Calculated Units *(short tons/year)*
1972	9,979	10,977
1973	9,979	10,977
1974	9,979	10,977
1975	9,979	10,977
1976	9,979	10,977
1977	9,979	10,977
1978	9,979	10,977
1979	9,979	10,977
1980	9,979	10,977
1981	9,979	10,977
1982	9,979	10,977
1983	9,979	10,977
1984	9,979	10,977
1985	9,979	10,977
1986	9,979	10,977
1987	9,979	10,977
1988	9,979	10,977
1989	9,979	10,977
1990	9,979	10,977
1991	9,979	10,977
1992	9,979	10,977
1993	9,979	10,977
1994	69,605	76,566
1995	55,074	60,581
1996	43,328	47,661
1997	57,497	63,247
1998	57,903	63,693
1999	58,599	64,459
2000	53,819	59,201
2001	191,426	210,569
2002	108,441	119,285
2003	86,909	95,600
2004	98,516	108,368
2005		
2006		
2007		
2008		
2009		
2010		
2011		

4: ENTER WASTE ACCEPTANCE RATES

Input Units: *Mg/year*

Year	Input Units *(Mg/year)*	Calculated Units *(short tons/year)*
2012		
2013		
2014		
2015		
2016		
2017		
2018		
2019		
2020		
2021		
2022		
2023		
2024		
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		
2034		
2035		
2036		
2037		
2038		
2039		
2040		
2041		
2042		
2043		
2044		
2045		
2046		
2047		
2048		
2049		
2050		
2051		

INVENTORY

Landfill Name or Identifier: Twin Creeks Environmental Centre

Enter year of emissions inventory: 2033

Gas / Pollutant	Emission Rate				
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(ft^3/year)*	*(short tons/year)*
Total landfill gas	3.730E+03	3.085E+06	2.073E+02	1.090E+08	4.103E+03
Methane	9.057E+02	1.358E+06	9.121E+01	4.794E+07	9.963E+02
Carbon dioxide	3.163E+03	1.728E+06	1.161E+02	6.102E+07	3.479E+03
NMOC	6.580E+00	1.836E+03	1.233E-01	6.483E+04	7.238E+00
1,1,1-Trichloroethane (methyl chloroform) - HAP	3.937E-04	7.096E-02	4.768E-06	2.506E+00	4.331E-04
1,1,2,2-Tetrachloroethane - HAP/VOC	4.954E-04	7.096E-02	4.768E-06	2.506E+00	5.450E-04
1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	2.921E-04	7.096E-02	4.768E-06	2.506E+00	3.213E-04
1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	2.488E-04	6.171E-02	4.146E-06	2.179E+00	2.737E-04
1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	3.010E-03	7.312E-01	4.913E-05	2.582E+01	3.311E-03
1,2-Dichloropropane (propylene dichloride) - HAP/VOC	9.860E-04	2.098E-01	1.410E-05	7.409E+00	1.085E-03
2-Propanol (isopropyl alcohol) - VOC	4.783E-02	1.913E+01	1.285E-03	6.756E+02	5.261E-02
Acetone	5.217E-02	2.160E+01	1.451E-03	7.627E+02	5.739E-02
Acrylonitrile - HAP/VOC	4.290E-02	1.944E+01	1.306E-03	6.864E+02	4.719E-02
Benzene - No or Unknown Co-disposal - HAP/VOC	9.365E-03	2.882E+00	1.936E-04	1.018E+02	1.030E-02
Benzene - Co-disposal - HAP/VOC	1.103E-01	3.394E+01	2.280E-03	1.199E+03	1.213E-01
Bromodichloromethane - VOC	9.671E-04	1.419E-01	9.536E-06	5.012E+00	1.064E-03
Butane - VOC	3.729E-02	1.543E+01	1.037E-03	5.448E+02	4.102E-02
Carbon disulfide - HAP/VOC	8.011E-02	2.530E+01	1.700E-03	8.935E+02	8.812E-02
Carbon monoxide	5.032E-01	4.320E+02	2.902E-02	1.525E+04	5.536E-01
Carbon tetrachloride - HAP/VOC	4.540E-04	7.096E-02	4.768E-06	2.506E+00	4.994E-04
Carbonyl sulfide - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chlorobenzene - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chlorodifluoromethane	#REF!	#REF!	#REF!	#REF!	#REF!
Chloroethane (ethyl chloride) - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chloroform - HAP/VOC	3.524E-04	7.096E-02	4.768E-06	2.506E+00	3.876E-04
Chloromethane - VOC	6.155E-04	2.931E-01	1.969E-05	1.035E+01	6.771E-04
Dichlorobenzene - (HAP for para isomer/VOC)	#REF!	#REF!	#REF!	#REF!	#REF!
Dichlorodifluoromethane	8.689E-04	1.728E-01	1.161E-05	6.102E+00	9.558E-04
Dichlorofluoromethane - VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Dichloromethane (methylene chloride) - HAP	#REF!	#REF!	#REF!	#REF!	#REF!
Dimethyl sulfide (methyl sulfide) - VOC	2.711E-01	1.049E+02	7.048E-03	3.705E+03	2.982E-01
Ethane	3.434E+00	2.746E+03	1.845E-01	9.697E+04	3.778E+00
Ethanol - VOC	1.697E-01	8.855E+01	5.950E-03	3.127E+03	1.867E-01
Ethyl mercaptan (ethanethiol) - VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Ethylbenzene - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Ethylene dibromide - HAP/VOC	5.545E-04	7.096E-02	4.768E-06	2.506E+00	6.100E-04
Fluorotrichloromethane - VOC	1.340E-02	2.345E+00	1.576E-04	8.281E+01	1.474E-02
Hexane - HAP/VOC	1.858E-02	5.183E+00	3.483E-04	1.831E+02	2.044E-02
Hydrogen sulfide	1.618E+00	1.142E+03	7.670E-02	4.032E+04	1.780E+00
Mercury (total) - HAP	7.466E-06	8.948E-04	6.012E-08	3.160E-02	8.212E-06
Methyl ethyl ketone - HAP/VOC	1.749E-01	5.831E+01	3.918E-03	2.059E+03	1.924E-01
Methyl isobutyl ketone - HAP/VOC	6.568E-03	1.577E+00	1.059E-04	5.568E+01	7.225E-03
Methyl mercaptan - VOC	2.037E-01	1.018E+02	6.841E-03	3.596E+03	2.241E-01
Pentane - VOC	3.055E-02	1.018E+01	6.841E-04	3.596E+02	3.361E-02
Perchloroethylene (tetrachloroethylene) - HAP	1.490E-02	2.160E+00	1.451E-04	7.627E+01	1.639E-02
Propane - VOC	6.224E-02	3.394E+01	2.280E-03	1.199E+03	6.846E-02
t-1,2-Dichloroethene - VOC	3.483E-02	8.639E+00	5.805E-04	3.051E+02	3.832E-02
Toluene - No or Unknown Co-disposal - HAP/VOC	1.584E-01	4.134E+01	2.778E-03	1.460E+03	1.743E-01
Toluene - Co-disposal - HAP/VOC	2.010E+00	5.245E+02	3.524E-02	1.852E+04	2.211E+00
Trichloroethylene (trichloroethene) - HAP/VOC	3.170E-03	5.801E-01	3.897E-05	2.048E+01	3.487E-03
Vinyl chloride - HAP/VOC	3.633E-03	1.398E+00	9.391E-05	4.936E+01	3.997E-03
Xylenes - HAP/VOC	1.257E-01	2.848E+01	1.913E-03	1.006E+03	1.383E-01
1,2-Dichloroethene cis	2.090E-02	5.183E+00	3.483E-04	1.831E+02	2.299E-02
1,2-Dichloroethylene	9.082E-03	2.252E+00	1.513E-04	7.954E+01	9.991E-03
2-Butanol	5.488E-02	1.780E+01	1.196E-03	6.287E+02	6.037E-02
Octane	2.565E-02	5.399E+00	3.628E-04	1.907E+02	2.822E-02
1,1,2-Trichloroethane	8.046E-03	1.450E+00	9.743E-05	5.121E+01	8.851E-03
1,2-Dibromoethane	2.411E-04	3.085E-02	2.073E-06	1.090E+00	2.652E-04
1,2-Dichloroethene trans	9.081E-03	2.252E+00	1.513E-04	7.954E+01	9.990E-03

USER INPUTS

Landfill Name or Identifier: Twin Creeks Environmental Centre

Clear ALL Non-Parameter Inputs/Selections

1: PROVIDE LANDFILL CHARACTERISTICS

Landfill Open Year	1972	
Landfill Closure Year	2020	
Have Model Calculate Closure Year?	○ Yes ◉ No	
Waste Design Capacity		megagrams

Restore Default Model Parameters

2: DETERMINE MODEL PARAMETERS

Methane Generation Rate, k (*year*$^{-1}$)
User-specified
User-specified value: 0.040
User-specified k value should be based on site-specific data and determined by EPA Method 2E.

Potential Methane Generation Capacity, L_o (*m*^{3}/*Mg*)
User-specified
User-specified value: 125
User-specified Lo value should be based on site-specific data and determined by waste type and composition.

NMOC Concentration (*ppmv as hexane*)
User-specified
User-specified value: 595

Methane Content (*% by volume*)
User-specified
User-specified value: 44

3: SELECT GASES/POLLUTANTS

Gas / Pollutant #1 #REF!
Total landfill gas

Gas / Pollutant #2
Methane

Gas / Pollutant #3
Carbon dioxide

Gas / Pollutant #4
NMOC

Edit Existing or Add New Pollutant Parameters

Restore Default Pollutant Parameters

Description/Comments:

Modelling of existing landfill Area 1. Values based on MECP Interim Guide.

4: ENTER WASTE ACCEPTANCE RATES

Input Units: *Mg/year*

Year	Input Units *(Mg/year)*	Calculated Units *(short tons/year)*
1972		0
1973		0
1974		0
1975		0
1976		0
1977		0
1978		0
1979		0
1980		0
1981		0
1982		0
1983		0
1984		0
1985		0
1986		0
1987		0
1988		0
1989		0
1990		0
1991		0
1992		0
1993		0
1994		0
1995		0
1996		0
1997		0
1998		0
1999		0
2000		0
2001		0
2002		0
2003		0
2004		0
2005	218,455	240,301
2006	298,090	327,899
2007	304,043	334,447
2008	283,591	311,950
2009	169,803	186,783
2010	311,006	342,107
2011	429,041	471,945

4: ENTER WASTE ACCEPTANCE RATES

Input Units: *Mg/year*

Year	Input Units *(Mg/year)*	Calculated Units *(short tons/year)*
2012	528,571	581,428
2013	452,641	497,905
2014	470,377	517,415
2015	533,326	586,659
2016	678,031	745,834
2017	820,360	902,396
2018	1,324,830	1,457,313
2019	1,417,281	1,559,009
2020		
2021		
2022		
2023		
2024		
2025		
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2049		
2050		
2051		

INVENTORY

Landfill Name or Identifier: Twin Creeks Environmental Centre

Enter year of emissions inventory: 2033

Gas / Pollutant	Emission Rate				
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(ft^3/year)*	*(short tons/year)*
Total landfill gas	5.582E+04	4.618E+07	3.103E+03	1.631E+09	6.140E+04
Methane	1.356E+04	2.032E+07	1.365E+03	7.176E+08	1.491E+04
Carbon dioxide	4.734E+04	2.586E+07	1.738E+03	9.133E+08	5.207E+04
NMOC	9.849E+01	2.748E+04	1.846E+00	9.703E+05	1.083E+02
1,1,1-Trichloroethane (methyl chloroform) - HAP	5.893E-03	1.062E+00	7.136E-05	3.751E+01	6.482E-03
1,1,2,2-Tetrachloroethane - HAP/VOC	7.415E-03	1.062E+00	7.136E-05	3.751E+01	8.157E-03
1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	4.372E-03	1.062E+00	7.136E-05	3.751E+01	4.809E-03
1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	3.724E-03	9.236E-01	6.206E-05	3.262E+01	4.096E-03
1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	4.505E-02	1.094E+01	7.354E-04	3.865E+02	4.955E-02
1,2-Dichloropropane (propylene dichloride) - HAP/VOC	1.476E-02	3.140E+00	2.110E-04	1.109E+02	1.623E-02
2-Propanol (isopropyl alcohol) - VOC	7.158E-01	2.863E+02	1.924E-02	1.011E+04	7.874E-01
Acetone	7.809E-01	3.233E+02	2.172E-02	1.142E+04	8.590E-01
Acrylonitrile - HAP/VOC	6.421E-01	2.909E+02	1.955E-02	1.027E+04	7.063E-01
Benzene - No or Unknown Co-disposal - HAP/VOC	1.402E-01	4.313E+01	2.898E-03	1.523E+03	1.542E-01
Benzene - Co-disposal - HAP/VOC	1.650E+00	5.080E+02	3.413E-02	1.794E+04	1.815E+00
Bromodichloromethane - VOC	1.447E-02	2.124E+00	1.427E-04	7.502E+01	1.592E-02
Butane - VOC	5.582E-01	2.309E+02	1.551E-02	8.154E+03	6.140E-01
Carbon disulfide - HAP/VOC	1.199E+00	3.787E+02	2.544E-02	1.337E+04	1.319E+00
Carbon monoxide	7.532E+00	6.465E+03	4.344E-01	2.283E+05	8.285E+00
Carbon tetrachloride - HAP/VOC	6.795E-03	1.062E+00	7.136E-05	3.751E+01	7.475E-03
Carbonyl sulfide - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chlorobenzene - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chlorodifluoromethane	#REF!	#REF!	#REF!	#REF!	#REF!
Chloroethane (ethyl chloride) - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chloroform - HAP/VOC	5.274E-03	1.062E+00	7.136E-05	3.751E+01	5.801E-03
Chloromethane - VOC	9.213E-03	4.387E+00	2.948E-04	1.549E+02	1.013E-02
Dichlorobenzene - (HAP for para isomer/VOC)	#REF!	#REF!	#REF!	#REF!	#REF!
Dichlorodifluoromethane	1.301E-02	2.586E+00	1.738E-04	9.133E+01	1.431E-02
Dichlorofluoromethane - VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Dichloromethane (methylene chloride) - HAP	#REF!	#REF!	#REF!	#REF!	#REF!
Dimethyl sulfide (methyl sulfide) - VOC	4.057E+00	1.570E+03	1.055E-01	5.545E+04	4.463E+00
Ethane	5.140E+01	4.110E+04	2.761E+00	1.451E+06	5.654E+01
Ethanol - VOC	2.540E+00	1.325E+03	8.905E-02	4.680E+04	2.794E+00
Ethyl mercaptan (ethanethiol) - VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Ethylbenzene - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Ethylene dibromide - HAP/VOC	8.300E-03	1.062E+00	7.136E-05	3.751E+01	9.130E-03
Fluorotrichloromethane - VOC	2.005E-01	3.510E+01	2.358E-03	1.239E+03	2.206E-01
Hexane - HAP/VOC	2.781E-01	7.758E+01	5.213E-03	2.740E+03	3.059E-01
Hydrogen sulfide	2.422E+01	1.709E+04	1.148E+00	6.034E+05	2.664E+01
Mercury (total) - HAP	1.117E-04	1.339E-02	8.998E-07	4.729E-01	1.229E-04
Methyl ethyl ketone - HAP/VOC	2.618E+00	8.728E+02	5.864E-02	3.082E+04	2.879E+00
Methyl isobutyl ketone - HAP/VOC	9.831E-02	2.360E+01	1.586E-03	8.333E+02	1.081E-01
Methyl mercaptan - VOC	3.049E+00	1.524E+03	1.024E-01	5.382E+04	3.354E+00
Pentane - VOC	4.573E-01	1.524E+02	1.024E-02	5.382E+03	5.030E-01
Perchloroethylene (tetrachloroethylene) - HAP	2.230E-01	3.233E+01	2.172E-03	1.142E+03	2.453E-01
Propane - VOC	9.315E-01	5.080E+02	3.413E-02	1.794E+04	1.025E+00
t-1,2-Dichloroethene - VOC	5.213E-01	1.293E+02	8.688E-03	4.566E+03	5.735E-01
Toluene - No or Unknown Co-disposal - HAP/VOC	2.371E+00	6.188E+02	4.158E-02	2.185E+04	2.608E+00
Toluene - Co-disposal - HAP/VOC	3.008E+01	7.850E+03	5.275E-01	2.772E+05	3.309E+01
Trichloroethylene (trichloroethene) - HAP/VOC	4.744E-02	8.682E+00	5.833E-04	3.066E+02	5.219E-02
Vinyl chloride - HAP/VOC	5.438E-02	2.092E+01	1.406E-03	7.388E+02	5.982E-02
Xylenes - HAP/VOC	1.882E+00	4.262E+02	2.864E-02	1.505E+04	2.070E+00
1,2-Dichloroethene cis	3.128E-01	7.758E+01	5.213E-03	2.740E+03	3.441E-01
1,2-Dichloroethylene	1.359E-01	3.371E+01	2.265E-03	1.190E+03	1.495E-01
2-Butanol	8.215E-01	2.665E+02	1.790E-02	9.410E+03	9.036E-01
Octane	3.840E-01	8.081E+01	5.430E-03	2.854E+03	4.224E-01
1,1,2-Trichloroethane	1.204E-01	2.170E+01	1.458E-03	7.665E+02	1.325E-01
1,2-Dibromoethane	3.608E-03	4.618E-01	3.103E-05	1.631E+01	3.969E-03
1,2-Dichloroethene trans	1.359E-01	3.371E+01	2.265E-03	1.190E+03	1.495E-01

USER INPUTS

Landfill Name or Identifier: Twin Creeks Environmental Centre

Clear ALL Non-Parameter Inputs/Selections

1: PROVIDE LANDFILL CHARACTERISTICS

Landfill Open Year	1972	
Landfill Closure Year	2025	
Have Model Calculate Closure Year?	○ Yes ◉ No	
Waste Design Capacity		megagrams

Restore Default Model Parameters

2: DETERMINE MODEL PARAMETERS

Methane Generation Rate, k (*year*$^{-1}$)
User-specified
User-specified value: 0.040
User-specified k value should be based on site-specific data and determined by EPA Method 2E.

Potential Methane Generation Capacity, L_o (*m*^{3}/*Mg*)
User-specified
User-specified value: 125
User-specified Lo value should be based on site-specific data and determined by waste type and composition.

NMOC Concentration (*ppmv as hexane*)
User-specified
User-specified value: 595

Methane Content (*% by volume*)
User-specified
User-specified value: 44

3: SELECT GASES/POLLUTANTS

Gas / Pollutant #1 #REF!
Total landfill gas

Gas / Pollutant #2
Methane

Gas / Pollutant #3
Carbon dioxide

Gas / Pollutant #4
NMOC

Edit Existing or Add New Pollutant Parameters

Restore Default Pollutant Parameters

Description/Comments:

Modelling of existing landfill Area 2. Values based on MECP Interim Guide.

4: ENTER WASTE ACCEPTANCE RATES

Input Units: *Mg/year*

Year	Input Units *(Mg/year)*	Calculated Units *(short tons/year)*
1972		0
1973		0
1974		0
1975		0
1976		0
1977		0
1978		0
1979		0
1980		0
1981		0
1982		0
1983		0
1984		0
1985		0
1986		0
1987		0
1988		0
1989		0
1990		0
1991		0
1992		0
1993		0
1994		0
1995		0
1996		0
1997		0
1998		0
1999		0
2000		0
2001		0
2002		0
2003		0
2004		0
2005		0
2006		0
2007		0
2008		0
2009		0
2010		0
2011		0

4: ENTER WASTE ACCEPTANCE RATES

Input Units: *Mg/year*

Year	Input Units *(Mg/year)*	Calculated Units *(short tons/year)*
2012		0
2013		0
2014		0
2015		0
2016		0
2017		0
2018		0
2019		0
2020	1,330,444	1,463,488
2021	1,399,849	1,539,834
2022	1,391,172	1,530,290
2023	1,400,000	1,540,000
2024	1,400,000	1,540,000
2025		
2026		
2027		
2028		
2029		
2030		
2031		
2032		
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2050		
2051		

INVENTORY

Landfill Name or Identifier: Twin Creeks Environmental Centre

Enter year of emissions inventory: 2033

Gas / Pollutant	Emission Rate				
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(ft^3/year)*	*(short tons/year)*
Total landfill gas	6.275E+04	5.191E+07	3.488E+03	1.833E+09	6.902E+04
Methane	1.524E+04	2.284E+07	1.535E+03	8.066E+08	1.676E+04
Carbon dioxide	5.321E+04	2.907E+07	1.953E+03	1.027E+09	5.853E+04
NMOC	1.107E+02	3.089E+04	2.075E+00	1.091E+06	1.218E+02
1,1,1-Trichloroethane (methyl chloroform) - HAP	6.624E-03	1.194E+00	8.022E-05	4.216E+01	7.287E-03
1,1,2,2-Tetrachloroethane - HAP/VOC	8.335E-03	1.194E+00	8.022E-05	4.216E+01	9.169E-03
1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	4.915E-03	1.194E+00	8.022E-05	4.216E+01	5.406E-03
1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	4.186E-03	1.038E+00	6.976E-05	3.666E+01	4.605E-03
1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	5.064E-02	1.230E+01	8.266E-04	4.345E+02	5.570E-02
1,2-Dichloropropane (propylene dichloride) - HAP/VOC	1.659E-02	3.530E+00	2.372E-04	1.247E+02	1.825E-02
2-Propanol (isopropyl alcohol) - VOC	8.046E-01	3.218E+02	2.162E-02	1.137E+04	8.851E-01
Acetone	8.778E-01	3.634E+02	2.441E-02	1.283E+04	9.656E-01
Acrylonitrile - HAP/VOC	7.217E-01	3.270E+02	2.197E-02	1.155E+04	7.939E-01
Benzene - No or Unknown Co-disposal - HAP/VOC	1.576E-01	4.848E+01	3.258E-03	1.712E+03	1.733E-01
Benzene - Co-disposal - HAP/VOC	1.855E+00	5.710E+02	3.837E-02	2.017E+04	2.041E+00
Bromodichloromethane - VOC	1.627E-02	2.388E+00	1.604E-04	8.433E+01	1.790E-02
Butane - VOC	6.274E-01	2.595E+02	1.744E-02	9.166E+03	6.902E-01
Carbon disulfide - HAP/VOC	1.348E+00	4.257E+02	2.860E-02	1.503E+04	1.483E+00
Carbon monoxide	8.467E+00	7.267E+03	4.883E-01	2.566E+05	9.313E+00
Carbon tetrachloride - HAP/VOC	7.638E-03	1.194E+00	8.022E-05	4.216E+01	8.402E-03
Carbonyl sulfide - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chlorobenzene - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chlorodifluoromethane	#REF!	#REF!	#REF!	#REF!	#REF!
Chloroethane (ethyl chloride) - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chloroform - HAP/VOC	5.928E-03	1.194E+00	8.022E-05	4.216E+01	6.521E-03
Chloromethane - VOC	1.036E-02	4.931E+00	3.313E-04	1.742E+02	1.139E-02
Dichlorobenzene - (HAP for para isomer/VOC)	#REF!	#REF!	#REF!	#REF!	#REF!
Dichlorodifluoromethane	1.462E-02	2.907E+00	1.953E-04	1.027E+02	1.608E-02
Dichlorofluoromethane - VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Dichloromethane (methylene chloride) - HAP	#REF!	#REF!	#REF!	#REF!	#REF!
Dimethyl sulfide (methyl sulfide) - VOC	4.561E+00	1.765E+03	1.186E-01	6.233E+04	5.017E+00
Ethane	5.778E+01	4.620E+04	3.104E+00	1.632E+06	6.356E+01
Ethanol - VOC	2.855E+00	1.490E+03	1.001E-01	5.261E+04	3.141E+00
Ethyl mercaptan (ethanethiol) - VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Ethylbenzene - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Ethylene dibromide - HAP/VOC	9.330E-03	1.194E+00	8.022E-05	4.216E+01	1.026E-02
Fluorotrichloromethane - VOC	2.254E-01	3.945E+01	2.651E-03	1.393E+03	2.480E-01
Hexane - HAP/VOC	3.126E-01	8.721E+01	5.859E-03	3.080E+03	3.439E-01
Hydrogen sulfide	2.722E+01	1.921E+04	1.290E+00	6.783E+05	2.995E+01
Mercury (total) - HAP	1.256E-04	1.505E-02	1.011E-06	5.316E-01	1.382E-04
Methyl ethyl ketone - HAP/VOC	2.943E+00	9.811E+02	6.592E-02	3.465E+04	3.237E+00
Methyl isobutyl ketone - HAP/VOC	1.105E-01	2.653E+01	1.782E-03	9.368E+02	1.216E-01
Methyl mercaptan - VOC	3.427E+00	1.713E+03	1.151E-01	6.050E+04	3.770E+00
Pentane - VOC	5.141E-01	1.713E+02	1.151E-02	6.050E+03	5.655E-01
Perchloroethylene (tetrachloroethylene) - HAP	2.506E-01	3.634E+01	2.441E-03	1.283E+03	2.757E-01
Propane - VOC	1.047E+00	5.710E+02	3.837E-02	2.017E+04	1.152E+00
t-1,2-Dichloroethene - VOC	5.860E-01	1.453E+02	9.766E-03	5.133E+03	6.446E-01
Toluene - No or Unknown Co-disposal - HAP/VOC	2.665E+00	6.956E+02	4.674E-02	2.456E+04	2.932E+00
Toluene - Co-disposal - HAP/VOC	3.382E+01	8.825E+03	5.929E-01	3.116E+05	3.720E+01
Trichloroethylene (trichloroethene) - HAP/VOC	5.333E-02	9.759E+00	6.557E-04	3.446E+02	5.866E-02
Vinyl chloride - HAP/VOC	6.113E-02	2.351E+01	1.580E-03	8.304E+02	6.724E-02
Xylenes - HAP/VOC	2.116E+00	4.791E+02	3.219E-02	1.692E+04	2.327E+00
1,2-Dichloroethene cis	3.516E-01	8.721E+01	5.859E-03	3.080E+03	3.868E-01
1,2-Dichloroethylene	1.528E-01	3.789E+01	2.546E-03	1.338E+03	1.681E-01
2-Butanol	9.234E-01	2.995E+02	2.012E-02	1.058E+04	1.016E+00
Octane	4.316E-01	9.084E+01	6.104E-03	3.208E+03	4.748E-01
1,1,2-Trichloroethane	1.354E-01	2.440E+01	1.639E-03	8.616E+02	1.489E-01
1,2-Dibromoethane	4.056E-03	5.191E-01	3.488E-05	1.833E+01	4.462E-03
1,2-Dichloroethene trans	1.528E-01	3.789E+01	2.546E-03	1.338E+03	1.681E-01

USER INPUTS

Landfill Name or Identifier: Twin Creeks Environmental Centre

Clear ALL Non-Parameter Inputs/Selections

1: PROVIDE LANDFILL CHARACTERISTICS

Landfill Open Year	1972	
Landfill Closure Year	2030	
Have Model Calculate Closure Year?	○ Yes ◉ No	
Waste Design Capacity		megagrams

Restore Default Model Parameters

2: DETERMINE MODEL PARAMETERS

Methane Generation Rate, k (*year*$^{-1}$)
User-specified
User-specified k value should be based on site-specific data and determined by EPA Method 2E.
User-specified value: 0.040

Potential Methane Generation Capacity, L_o (*m*^{3}/*Mg*)
User-specified
User-specified Lo value should be based on site-specific data and determined by waste type and composition.
User-specified value: 125

NMOC Concentration (*ppmv as hexane*)
User-specified
User-specified value: 595

Methane Content (*% by volume*)
User-specified
User-specified value: 44

3: SELECT GASES/POLLUTANTS

Gas / Pollutant #1 #REF!
Total landfill gas

Gas / Pollutant #2
Methane

Gas / Pollutant #3
Carbon dioxide

Gas / Pollutant #4
NMOC

Edit Existing or Add New Pollutant Parameters

Restore Default Pollutant Parameters

Description/Comments:

Modelling of existing landfill Area 3. Values based on MECP Interim Guide.

4: ENTER WASTE ACCEPTANCE RATES

Input Units: *Mg/year*

Year	Input Units *(Mg/year)*	Calculated Units *(short tons/year)*
1972		0
1973		0
1974		0
1975		0
1976		0
1977		0
1978		0
1979		0
1980		0
1981		0
1982		0
1983		0
1984		0
1985		0
1986		0
1987		0
1988		0
1989		0
1990		0
1991		0
1992		0
1993		0
1994		0
1995		0
1996		0
1997		0
1998		0
1999		0
2000		0
2001		0
2002		0
2003		0
2004		0
2005		0
2006		0
2007		0
2008		0
2009		0
2010		0
2011		0

4: ENTER WASTE ACCEPTANCE RATES

Input Units: *Mg/year*

Year	Input Units *(Mg/year)*	Calculated Units *(short tons/year)*
2012		0
2013		0
2014		0
2015		0
2016		0
2017		0
2018		0
2019		0
2020		0
2021		0
2022		0
2023		0
2024		0
2025	1,400,000	1,540,000
2026	1,400,000	1,540,000
2027	1,400,000	1,540,000
2028	1,400,000	1,540,000
2029	1,400,000	1,540,000
2030		
2031		
2032		
2033		
2034		
2035		
2036		
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2048		
2049		
2050		
2051		

INVENTORY

Landfill Name or Identifier: Twin Creeks Environmental Centre

Enter year of emissions inventory: 2033

Gas / Pollutant	Emission Rate				
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(ft^3/year)*	*(short tons/year)*
Total landfill gas	7.745E+04	6.407E+07	4.305E+03	2.263E+09	8.519E+04
Methane	1.881E+04	2.819E+07	1.894E+03	9.956E+08	2.069E+04
Carbon dioxide	6.568E+04	3.588E+07	2.411E+03	1.267E+09	7.225E+04
NMOC	1.366E+02	3.812E+04	2.561E+00	1.346E+06	1.503E+02
1,1,1-Trichloroethane (methyl chloroform) - HAP	8.176E-03	1.474E+00	9.901E-05	5.204E+01	8.994E-03
1,1,2,2-Tetrachloroethane - HAP/VOC	1.029E-02	1.474E+00	9.901E-05	5.204E+01	1.132E-02
1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	6.066E-03	1.474E+00	9.901E-05	5.204E+01	6.673E-03
1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	5.167E-03	1.281E+00	8.610E-05	4.525E+01	5.683E-03
1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	6.250E-02	1.518E+01	1.020E-03	5.363E+02	6.875E-02
1,2-Dichloropropane (propylene dichloride) - HAP/VOC	2.048E-02	4.357E+00	2.927E-04	1.539E+02	2.252E-02
2-Propanol (isopropyl alcohol) - VOC	9.932E-01	3.972E+02	2.669E-02	1.403E+04	1.092E+00
Acetone	1.083E+00	4.485E+02	3.013E-02	1.584E+04	1.192E+00
Acrylonitrile - HAP/VOC	8.908E-01	4.036E+02	2.712E-02	1.425E+04	9.799E-01
Benzene - No or Unknown Co-disposal - HAP/VOC	1.945E-01	5.984E+01	4.021E-03	2.113E+03	2.139E-01
Benzene - Co-disposal - HAP/VOC	2.290E+00	7.048E+02	4.735E-02	2.489E+04	2.519E+00
Bromodichloromethane - VOC	2.008E-02	2.947E+00	1.980E-04	1.041E+02	2.209E-02
Butane - VOC	7.744E-01	3.204E+02	2.152E-02	1.131E+04	8.519E-01
Carbon disulfide - HAP/VOC	1.664E+00	5.254E+02	3.530E-02	1.855E+04	1.830E+00
Carbon monoxide	1.045E+01	8.970E+03	6.027E-01	3.168E+05	1.150E+01
Carbon tetrachloride - HAP/VOC	9.428E-03	1.474E+00	9.901E-05	5.204E+01	1.037E-02
Carbonyl sulfide - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chlorobenzene - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chlorodifluoromethane	#REF!	#REF!	#REF!	#REF!	#REF!
Chloroethane (ethyl chloride) - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chloroform - HAP/VOC	7.317E-03	1.474E+00	9.901E-05	5.204E+01	8.049E-03
Chloromethane - VOC	1.278E-02	6.087E+00	4.090E-04	2.150E+02	1.406E-02
Dichlorobenzene - (HAP for para isomer/VOC)	#REF!	#REF!	#REF!	#REF!	#REF!
Dichlorodifluoromethane	1.804E-02	3.588E+00	2.411E-04	1.267E+02	1.985E-02
Dichlorofluoromethane - VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Dichloromethane (methylene chloride) - HAP	#REF!	#REF!	#REF!	#REF!	#REF!
Dimethyl sulfide (methyl sulfide) - VOC	5.629E+00	2.178E+03	1.464E-01	7.693E+04	6.192E+00
Ethane	7.132E+01	5.702E+04	3.831E+00	2.014E+06	7.845E+01
Ethanol - VOC	3.524E+00	1.839E+03	1.236E-01	6.494E+04	3.877E+00
Ethyl mercaptan (ethanethiol) - VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Ethylbenzene - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Ethylene dibromide - HAP/VOC	1.152E-02	1.474E+00	9.901E-05	5.204E+01	1.267E-02
Fluorotrichloromethane - VOC	2.782E-01	4.869E+01	3.272E-03	1.720E+03	3.061E-01
Hexane - HAP/VOC	3.858E-01	1.076E+02	7.232E-03	3.801E+03	4.244E-01
Hydrogen sulfide	3.360E+01	2.371E+04	1.593E+00	8.372E+05	3.696E+01
Mercury (total) - HAP	1.550E-04	1.858E-02	1.248E-06	6.562E-01	1.705E-04
Methyl ethyl ketone - HAP/VOC	3.632E+00	1.211E+03	8.136E-02	4.276E+04	3.995E+00
Methyl isobutyl ketone - HAP/VOC	1.364E-01	3.274E+01	2.200E-03	1.156E+03	1.500E-01
Methyl mercaptan - VOC	4.230E+00	2.114E+03	1.421E-01	7.467E+04	4.653E+00
Pentane - VOC	6.345E-01	2.114E+02	1.421E-02	7.467E+03	6.979E-01
Perchloroethylene (tetrachloroethylene) - HAP	3.093E-01	4.485E+01	3.013E-03	1.584E+03	3.403E-01
Propane - VOC	1.292E+00	7.048E+02	4.735E-02	2.489E+04	1.422E+00
t-1,2-Dichloroethene - VOC	7.233E-01	1.794E+02	1.205E-02	6.335E+03	7.957E-01
Toluene - No or Unknown Co-disposal - HAP/VOC	3.290E+00	8.586E+02	5.769E-02	3.032E+04	3.619E+00
Toluene - Co-disposal - HAP/VOC	4.174E+01	1.089E+04	7.318E-01	3.847E+05	4.591E+01
Trichloroethylene (trichloroethene) - HAP/VOC	6.583E-02	1.205E+01	8.093E-04	4.254E+02	7.241E-02
Vinyl chloride - HAP/VOC	7.545E-02	2.902E+01	1.950E-03	1.025E+03	8.299E-02
Xylenes - HAP/VOC	2.611E+00	5.914E+02	3.973E-02	2.088E+04	2.872E+00
1,2-Dichloroethene cis	4.340E-01	1.076E+02	7.232E-03	3.801E+03	4.774E-01
1,2-Dichloroethylene	1.886E-01	4.677E+01	3.143E-03	1.652E+03	2.075E-01
2-Butanol	1.140E+00	3.697E+02	2.484E-02	1.306E+04	1.254E+00
Octane	5.327E-01	1.121E+02	7.534E-03	3.960E+03	5.860E-01
1,1,2-Trichloroethane	1.671E-01	3.011E+01	2.023E-03	1.063E+03	1.838E-01
1,2-Dibromoethane	5.006E-03	6.407E-01	4.305E-05	2.263E+01	5.507E-03
1,2-Dichloroethene trans	1.886E-01	4.677E+01	3.143E-03	1.652E+03	2.074E-01

USER INPUTS

Landfill Name or Identifier: Twin Creeks Environmental Centre

Clear ALL Non-Parameter Inputs/Selections

1: PROVIDE LANDFILL CHARACTERISTICS

Landfill Open Year	1972	
Landfill Closure Year	2034	
Have Model Calculate Closure Year?	○ Yes ◉ No	
Waste Design Capacity		megagrams

Restore Default Model Parameters

2: DETERMINE MODEL PARAMETERS

Methane Generation Rate, k (*year*$^{-1}$)
User-specified
User-specified value: 0.040
User-specified k value should be based on site-specific data and determined by EPA Method 2E.

Potential Methane Generation Capacity, L_o (*m*^{3}/*Mg*)
User-specified
User-specified value: 125
User-specified Lo value should be based on site-specific data and determined by waste type and composition.

NMOC Concentration (*ppmv as hexane*)
User-specified
User-specified value: 595

Methane Content (*% by volume*)
User-specified
User-specified value: 44

3: SELECT GASES/POLLUTANTS

Gas / Pollutant #1 #REF!
Total landfill gas

Gas / Pollutant #2
Methane

Gas / Pollutant #3
Carbon dioxide

Gas / Pollutant #4
NMOC

Edit Existing or Add New Pollutant Parameters

Restore Default Pollutant Parameters

Description/Comments:

Modelling of existing landfill Area 4. Values based on MECP Interim Guide.

4: ENTER WASTE ACCEPTANCE RATES

Input Units: *Mg/year*

Year	Input Units *(Mg/year)*	Calculated Units *(short tons/year)*
1972		0
1973		0
1974		0
1975		0
1976		0
1977		0
1978		0
1979		0
1980		0
1981		0
1982		0
1983		0
1984		0
1985		0
1986		0
1987		0
1988		0
1989		0
1990		0
1991		0
1992		0
1993		0
1994		0
1995		0
1996		0
1997		0
1998		0
1999		0
2000		0
2001		0
2002		0
2003		0
2004		0
2005		0
2006		0
2007		0
2008		0
2009		0
2010		0
2011		0

4: ENTER WASTE ACCEPTANCE RATES

Input Units: *Mg/year*

Year	Input Units *(Mg/year)*	Calculated Units *(short tons/year)*
2012		0
2013		0
2014		0
2015		0
2016		0
2017		0
2018		0
2019		0
2020		0
2021		0
2022		0
2023		0
2024		0
2025		0
2026		0
2027		0
2028		0
2029		0
2030	1,400,000	1,540,000
2031	1,400,000	1,540,000
2032	1,400,000	1,540,000
2033	1,007,103	1,107,813
2034		
2035		
2036		
2037		
2038		
2039		
2040		
2041		
2042		
2043		
2044		
2045		
2046		
2047		
2048		
2049		
2050		
2051		

INVENTORY

Landfill Name or Identifier: Twin Creeks Environmental Centre

Enter year of emissions inventory: 2033

Gas / Pollutant	Emission Rate				
	(Mg/year)	*(m^3/year)*	*(av ft^3/min)*	*(ft^3/year)*	*(short tons/year)*
Total landfill gas	5.447E+04	4.506E+07	3.028E+03	1.591E+09	5.992E+04
Methane	1.323E+04	1.983E+07	1.332E+03	7.002E+08	1.455E+04
Carbon dioxide	4.620E+04	2.524E+07	1.696E+03	8.912E+08	5.081E+04
NMOC	9.611E+01	2.681E+04	1.802E+00	9.469E+05	1.057E+02
1,1,1-Trichloroethane (methyl chloroform) - HAP	5.751E-03	1.036E+00	6.964E-05	3.660E+01	6.326E-03
1,1,2,2-Tetrachloroethane - HAP/VOC	7.236E-03	1.036E+00	6.964E-05	3.660E+01	7.960E-03
1,1-Dichloroethane (ethylidene dichloride) - HAP/VOC	4.267E-03	1.036E+00	6.964E-05	3.660E+01	4.693E-03
1,1-Dichloroethene (vinylidene chloride) - HAP/VOC	3.634E-03	9.013E-01	6.056E-05	3.183E+01	3.997E-03
1,2-Dichloroethane (ethylene dichloride) - HAP/VOC	4.396E-02	1.068E+01	7.176E-04	3.772E+02	4.836E-02
1,2-Dichloropropane (propylene dichloride) - HAP/VOC	1.440E-02	3.064E+00	2.059E-04	1.082E+02	1.584E-02
2-Propanol (isopropyl alcohol) - VOC	6.985E-01	2.794E+02	1.877E-02	9.867E+03	7.684E-01
Acetone	7.620E-01	3.155E+02	2.120E-02	1.114E+04	8.382E-01
Acrylonitrile - HAP/VOC	6.266E-01	2.839E+02	1.908E-02	1.003E+04	6.892E-01
Benzene - No or Unknown Co-disposal - HAP/VOC	1.368E-01	4.209E+01	2.828E-03	1.486E+03	1.505E-01
Benzene - Co-disposal - HAP/VOC	1.610E+00	4.957E+02	3.331E-02	1.751E+04	1.772E+00
Bromodichloromethane - VOC	1.413E-02	2.073E+00	1.393E-04	7.321E+01	1.554E-02
Butane - VOC	5.447E-01	2.253E+02	1.514E-02	7.957E+03	5.992E-01
Carbon disulfide - HAP/VOC	1.170E+00	3.695E+02	2.483E-02	1.305E+04	1.287E+00
Carbon monoxide	7.350E+00	6.309E+03	4.239E-01	2.228E+05	8.085E+00
Carbon tetrachloride - HAP/VOC	6.631E-03	1.036E+00	6.964E-05	3.660E+01	7.294E-03
Carbonyl sulfide - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chlorobenzene - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chlorodifluoromethane	#REF!	#REF!	#REF!	#REF!	#REF!
Chloroethane (ethyl chloride) - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Chloroform - HAP/VOC	5.147E-03	1.036E+00	6.964E-05	3.660E+01	5.661E-03
Chloromethane - VOC	8.991E-03	4.281E+00	2.877E-04	1.512E+02	9.890E-03
Dichlorobenzene - (HAP for para isomer/VOC)	#REF!	#REF!	#REF!	#REF!	#REF!
Dichlorodifluoromethane	1.269E-02	2.524E+00	1.696E-04	8.912E+01	1.396E-02
Dichlorofluoromethane - VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Dichloromethane (methylene chloride) - HAP	#REF!	#REF!	#REF!	#REF!	#REF!
Dimethyl sulfide (methyl sulfide) - VOC	3.959E+00	1.532E+03	1.029E-01	5.411E+04	4.355E+00
Ethane	5.016E+01	4.011E+04	2.695E+00	1.416E+06	5.518E+01
Ethanol - VOC	2.479E+00	1.293E+03	8.690E-02	4.568E+04	2.727E+00
Ethyl mercaptan (ethanethiol) - VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Ethylbenzene - HAP/VOC	#REF!	#REF!	#REF!	#REF!	#REF!
Ethylene dibromide - HAP/VOC	8.100E-03	1.036E+00	6.964E-05	3.660E+01	8.910E-03
Fluorotrichloromethane - VOC	1.957E-01	3.425E+01	2.301E-03	1.210E+03	2.153E-01
Hexane - HAP/VOC	2.714E-01	7.571E+01	5.087E-03	2.674E+03	2.985E-01
Hydrogen sulfide	2.364E+01	1.667E+04	1.120E+00	5.888E+05	2.600E+01
Mercury (total) - HAP	1.090E-04	1.307E-02	8.781E-07	4.615E-01	1.199E-04
Methyl ethyl ketone - HAP/VOC	2.555E+00	8.517E+02	5.723E-02	3.008E+04	2.810E+00
Methyl isobutyl ketone - HAP/VOC	9.593E-02	2.303E+01	1.547E-03	8.132E+02	1.055E-01
Methyl mercaptan - VOC	2.975E+00	1.487E+03	9.992E-02	5.252E+04	3.273E+00
Pentane - VOC	4.463E-01	1.487E+02	9.992E-03	5.252E+03	4.909E-01
Perchloroethylene (tetrachloroethylene) - HAP	2.176E-01	3.155E+01	2.120E-03	1.114E+03	2.393E-01
Propane - VOC	9.091E-01	4.957E+02	3.331E-02	1.751E+04	1.000E+00
t-1,2-Dichloroethene - VOC	5.088E-01	1.262E+02	8.478E-03	4.456E+03	5.596E-01
Toluene - No or Unknown Co-disposal - HAP/VOC	2.314E+00	6.039E+02	4.057E-02	2.133E+04	2.545E+00
Toluene - Co-disposal - HAP/VOC	2.936E+01	7.661E+03	5.147E-01	2.705E+05	3.229E+01
Trichloroethylene (trichloroethene) - HAP/VOC	4.630E-02	8.472E+00	5.692E-04	2.992E+02	5.093E-02
Vinyl chloride - HAP/VOC	5.307E-02	2.041E+01	1.372E-03	7.209E+02	5.837E-02
Xylenes - HAP/VOC	1.837E+00	4.159E+02	2.795E-02	1.469E+04	2.020E+00
1,2-Dichloroethene cis	3.053E-01	7.571E+01	5.087E-03	2.674E+03	3.358E-01
1,2-Dichloroethylene	1.327E-01	3.290E+01	2.210E-03	1.162E+03	1.459E-01
2-Butanol	8.016E-01	2.600E+02	1.747E-02	9.183E+03	8.818E-01
Octane	3.747E-01	7.886E+01	5.299E-03	2.785E+03	4.122E-01
1,1,2-Trichloroethane	1.175E-01	2.118E+01	1.423E-03	7.480E+02	1.293E-01
1,2-Dibromoethane	3.521E-03	4.506E-01	3.028E-05	1.591E+01	3.873E-03
1,2-Dichloroethene trans	1.326E-01	3.290E+01	2.210E-03	1.162E+03	1.459E-01

APPENDIX 12D

Existing Conditions Landfill - Default Vinyl Chloride Concentration (Year 2033)

Year	Waste Acceptance Years (Inclusive)	LANDGEM Emission Rate (Mg/yr)	Biodegradable Portion	Corrected Concentration for Biodegradable Portion (Mg/year)	Emission Rate (g/s)	Assumed Landfill Area (m^2)	Emission Rate ($g/m^2/s$)	Gas Collection Coverage (%)	Gas Collection Efficiency (%)	Flare Destruction Efficiency (%)	Mound Emission Rate (Controlled) (g/m2/s)	Flare Emission (g/s)
2035	1972-2004	3.63E-03	100%	3.63E-03	1.15E-04	208,263	5.53E-10	100%	70%	98%	1.66E-10	1.61E-06

Sample Calculations

Calculation of g/s Emission Rate = LANDGEM Emission Rate * 1,000,000 (g/Mg) / 365 (days/yr) / 24 (hr/day) / 3,600 (s/hr)
= 0.004 Mg/yr * 1,000,000 / 365 / 24 / 3,600
= 1.15E-04 g/s

Calculation of $g/m^2/s$ Emission Flux Rate = Emission Rate / Landfill Area
= 1.15E-04 g/s/ 208263 m2
= 5.53E-10 g/m2/s

Calculation of Mound Emission Rate (Controlled) ($g/m^2/s$) = Emission Flux Rate * (1 - Gas Collection Efficiency)
= 5.53E-10 g/m2/s * (1 - 0.7)
= 1.66E-10 g/m2/s

Calculation of Total Flare Emission Rate (g/s) = Emission Rate * Gas Collection Efficiency * (1 - Flare Destruction Efficiency)
= 1.15E-04 g/s * 0.7 * (1-0.98)
= 1.61E-06 g/s

Appendix 12D: NMOC Emissions from the Existing Landfill (Year 2033) RWDI# 2101750

Twin Creeks Environmental Centre

Modelled Source: AREA5

Emissions rates calculated relative to the Vinyl Chloride emission rate.

Compound	CAS Number	Molecular Weight (g/mol)	Average Concentration In Raw LFG (ppm)	Note	Total AREA5 Flux Rate ($g/m^2/s$)	Total AREA5 Emission Rate [1] (g/s)
Vinyl Chloride	75-01-4	62.5	0.45	[2]	1.66E-10	3.46E-05
1,2-Dichloroethane	107-06-2	99.0	0.24	[2]	1.37E-10	2.86E-05
Benzene	71-43-2	78.1	0.93	[2]	4.28E-10	8.91E-05

Notes:

[1] Based on a source area of 208,263 m^2

[2] Concentrations based on the landfill gas sampling report dated July 13, 2023.

[3] Concentrations from the US EPA *User's Manual - Landfill Gas Emissions Model Version 2.0*, 1998.

Sample Calculation

$$\text{Calculation of Benzene Emission Flux Rate} = \frac{\text{Vinyl Chloride Emission Flux Rate} * \text{Benzene Concentration in LFG} * \text{Molecular Weight of Benzene}}{\text{Vinyl Chloride Concentration in LFG} * \text{Molecular Weight of Vinyl Chloride}}$$

$$= \frac{1.66\text{E-}10\ g/m^2/s * 0.93\ ppm * 78.1\ g/mol}{0.45\ ppm * 62.5\ g/mol}$$

$$= 4.28\text{E-}10\ g/m^2/s$$

Appendix 12D: Vinyl Chloride Emissions

RWDI# 2101750

Twin Creeks Environmental Centre

Expansion Landfill Phases 1 Through 9 - (Year 2033)

Year	Waste Acceptance Years (Inclusive)	Scenario	LANDGEM Emission Rate (Mg/yr)	Emission Rate (g/s)	Approximate Landfill Area (m^2)	Emission Flux Rate ($g/m^2/s$)	Gas Collection Coverage (%)	Gas Collection Efficiency (%)	Flare Destruction Efficiency (%)	Mound Emission Rate (Controlled) ($g/m^2/s$)
2033	2005-2019	Phases 1 to 3	5.44E-02	1.72E-03	244,004	7.07E-09	100%	70%	98%	2.12E-09
2033	2020-2024	Phases 4 to 5	6.11E-02	1.94E-03	165,611	1.17E-08	100%	70%	98%	3.51E-09
2033	2025-2029	Phases 6 to 7	7.54E-02	2.39E-03	179,092	1.34E-08	100%	70%	98%	4.01E-09
2033	2030-2034	Phases 8 to 9	5.31E-02	1.68E-03	99,012	1.70E-08	100%	50%	98%	8.50E-09
2033	2005-2034	Total Emissions	2.44E-01	7.74E-03	687,719	4.91E-08	100%	70%	98%	1.81E-08

Sample Calculations

Calculation of Emission Rate (Phases 1 to 3) = LANDGEM Emission Rate * 1,000,000 (g/Mg) / 365 (days/yr) / 24 (hr/day) / 3,600 (s/hr)
= 5.44E-02 Mg/yr * 1,000,000 / 365 / 24 / 3,600
= 1.72E-03 g/s

Calculation of Emission Flux Rate (Phases 1 to 3) = Emission Rate / Landfill Area
= 1.72E-03 g/s/ 244,004 m^2
= 7.07E-09 $g/m^2/s$

Calculation of Mound Emission Rate (Controlled) (Phases 1 to 3) = Emission Flux Rate * (1 - Gas Collection Efficiency)
= 7.07E-09 $g/m^2/s$ * (1 - 0.70)
= 2.12E-09 $g/m^2/s$

Calculation of Total Flare Emission Rate (Phases 1 to 3) = Emission Rate * Gas Collection Efficiency * (1 - Flare Destruction Efficiency)
= 1.72E-03 g/s * 0.70 * (1 - 0.98)
= 2.41E-05 g/s

Appendix 12D: NMOC Emissions from the Expansion Landfill Phases 1 Through 3 (Year 2033) RWDI# 2101750

Twin Creeks Environmental Centre

Modelled Source: AREA1

Emissions rates calculated relative to the Vinyl Chloride emission rate.

Compound	CAS Number	Molecular Weight (g/mol)	Average Concentration In Raw LFG (ppm)	Note	Total AREA1 Flux Rate ($g/m^2/s$)	Total AREA1 Emission Rate [1] (g/s)
Vinyl Chloride	75-01-4	62.50	0.45	[2]	2.12E-09	5.17E-04
1,2-Dichloroethane	107-06-2	98.96	0.24	[2]	1.76E-09	4.29E-04
Benzene	71-43-2	78.13	0.93	[2]	5.46E-09	1.33E-03

Notes:

[1] Based on a source area of 244,004 m^2

[2] Concentrations based on the landfill gas sampling report dated July 13, 2023.

[3] Concentrations from the US EPA *User's Manual - Landfill Gas Emissions Model Version 2.0*, 1998.

Sample Calculation

Calculation of Benzene Emission Flux Rate = $\frac{\text{Vinyl Chloride Emission Flux Rate} * \text{Benzene Concentration in LFG} * \text{Molecular Weight of Benzene}}{\text{Vinyl Chloride Concentration in LFG} * \text{Molecular Weight of Vinyl Chloride}}$

= $\frac{2.12\text{E-}9\ g/m^2/s * 0.93\ ppm * 78.13\ g/mol}{0.45\ ppm * 62.50\ g/mol}$

= 5.46E-09 $g/m^2/s$

Appendix 12D: NMOC Emissions from the Expansion Landfill Phases 4 Through 5 (Year 2033)

RWDI# 2101750

Twin Creeks Environmental Centre

Modelled Source: AREA2
Emissions rates calculated relative to the Vinyl Chloride emission rate.

Compound	CAS Number	Molecular Weight (g/mol)	Average Concentration In Raw LFG (ppm)	Note	Total AREA2 Flux Rate ($g/m^2/s$)	Total AREA2 Emission Rate [1] (g/s)
Vinyl Chloride	75-01-4	62.50	0.45	[2]	3.51E-09	5.82E-04
1,2-Dichloroethane	107-06-2	98.96	0.24	[2]	2.91E-09	4.82E-04
Benzene	71-43-2	78.13	0.93	[2]	9.05E-09	1.50E-03

Notes:

[1] Based on a source area of 165,611 m^2

[2] Concentrations based on the landfill gas sampling report dated July 13, 2023.

[3] Concentrations from the US EPA *User's Manual - Landfill Gas Emissions Model Version 2.0*, 1998.

Sample Calculation

$$\text{Calculation of Benzene Emission Flux Rate} = \frac{\text{Vinyl Chloride Emission Flux Rate} * \text{Benzene Concentration in LFG} * \text{Molecular Weight of Benzene}}{\text{Vinyl Chloride Concentration in LFG} * \text{Molecular Weight of Vinyl Chloride}}$$

$$= \frac{3.51\text{E-}09\ g/m^2/s * 0.93\ ppm * 78.13\ g/mol}{0.45\ ppm * 62.50\ g/mol}$$

$$= 9.05\text{E-}09\ g/m^2/s$$

Appendix 12D: NMOC Emissions from the Expansion Landfill Phases 6 Through 7 (Year 2033) RWDI# 2101750

Twin Creeks Environmental Centre

Modelled Source: AREA3

Emissions rates calculated relative to the Vinyl Chloride emission rate.

Compound	CAS Number	Molecular Weight (g/mol)	Average Concentration In Raw LFG (ppm)	Note	Total AREA3 Flux Rate ($g/m^2/s$)	Total AREA3 Emission Rate [1] (g/s)
Vinyl Chloride	75-01-4	62.50	0.45	[2]	4.01E-09	7.18E-04
1,2-Dichloroethane	107-06-2	98.96	0.24	[2]	3.32E-09	5.95E-04
Benzene	71-43-2	78.13	0.93	[2]	1.03E-08	1.85E-03

Notes:

[1] Based on a source area of 179,092 m^2

[2] Concentrations based on the landfill gas sampling report dated July 13, 2023.

[3] Concentrations from the US EPA *User's Manual - Landfill Gas Emissions Model Version 2.0*, 1998.

Sample Calculation

Calculation of Benzene Emission Flux Rate = $\frac{\text{Vinyl Chloride Emission Flux Rate} * \text{Benzene Concentration in LFG} * \text{Molecular Weight of Benzene}}{\text{Vinyl Chloride Concentration in LFG} * \text{Molecular Weight of Vinyl Chloride}}$

$= \frac{4.01\text{E-}09\ g/m^2/s * 0.93\ ppm * 78.13\ g/mol}{0.45\ ppm * 62.50\ g/mol}$

$= 1.03\text{E-}08\ g/m^2/s$

Appendix 12D: NMOC Emissions from the Expansion Landfill Phases 8 Through 9 (Year 2033)

RWDI# 2101750

Twin Creeks Environmental Centre

Modelled Source: AREA4
Emissions rates calculated relative to the Vinyl Chloride emission rate.

Compound	CAS Number	Molecular Weight (g/mol)	Average Concentration In Raw LFG (ppm)	Note	Total AREA4 Flux Rate ($g/m^2/s$)	Total AREA4 Emission Rate [1] (g/s)
Vinyl Chloride	75-01-4	62.50	0.45	[2]	8.50E-09	8.41E-04
1,2-Dichloroethane	107-06-2	98.96	0.24	[2]	7.04E-09	6.97E-04
Benzene	71-43-2	78.13	0.93	[2]	2.19E-08	2.17E-03

Notes:
[1] Based on a source area of 99,012 m^2
[2] Concentrations based on the landfill gas sampling report dated July 13, 2023.
[3] Concentrations from the US EPA *User's Manual - Landfill Gas Emissions Model Version 2.0*, 1998.

Sample Calculation

Calculation of Benzene Emission Flux Rate = $\frac{\text{Vinyl Chloride Emission Flux Rate} * \text{Benzene Concentration in LFG} * \text{Molecular Weight of Benzene}}{\text{Vinyl Chloride Concentration in LFG} * \text{Molecular Weight of Vinyl Chloride}}$

$= \frac{8.50\text{E-}09\ g/m^2/s * 0.93\ ppm * 78.13\ g/mol}{0.45\ ppm * 62.50\ g/mol}$

$= 2.19\text{E-}08\ g/m^2/s$

Appendix 12D: Hydrogen Sulphide (H_2S) and Total Reduced Sulphur (TRS) Emissions from Interim and Final Cover

RWDI# 2101750

Twin Creeks Environmental Centre

			New Interim Cover 01		New Interim Cover 02		New Interim Cover 03		New Interim Cover 04		New Interim Cover 05		Result Units
Compound		D.L.	Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	
Carbon Disulfide		6.2	<6.2	3.99E-09	<6.2	3.99E-09	<6.5	4.19E-09	<6.2	3.99E-09	<6.2	3.99E-09	µg/m³
Carbon Disulfide		2.0	<2.0		<2.0		<2.1		<2.0		<2.0		ppb (V)
Carbonyl Sulfide		10.0	<10	6.30E-09	<10	6.30E-09	<10	6.61E-09	<10	6.30E-09	<10	6.30E-09	µg/m³
Carbonyl Sulfide		4.0	<4.0		<4.0		<4.2		<4.0		<4.0		ppb (V)
Dimethyl Sulfide		10.0	<10	6.51E-09	<10	6.51E-09	<11	6.84E-09	<10	6.51E-09	<10	6.51E-09	µg/m³
Dimethyl Sulfide		4.0	<4.0		<4.0		<4.2		<4.0		<4.0		ppb (V)
Dimethyl Disulfide		7.7	<7.7	3.26E-09	<7.7	3.26E-09	<8.1	3.42E-09	<7.7	3.26E-09	<7.7	3.26E-09	µg/m³
Dimethyl Disulfide		2.0	<2.0		<2.0		<2.1		<2.0		<2.0		ppb (V)
Hydrogen Sulfide		5.6	<5.6	3.57E-09	<5.6	3.57E-09	**7.2**	4.64E-09	<5.6	3.57E-09	<5.6	3.57E-09	µg/m³
Hydrogen Sulfide		4.0	<4.0		<4.0		**5.2**		<4.0		<4.0		ppb (V)
Methly Mercaptan		7.9	<7.9	5.04E-09	<7.9	5.04E-09	<8.3	5.30E-09	<7.9	5.04E-09	<7.9	5.04E-09	µg/m³
Methyl Mercaptan		4.0	<4.0		<4.0		<4.2		<4.0		<4.0		ppb (V)
Total Reduced Sulfur as H2S (NPRI-6)													
Total Reduced Sulfur		12.0	<12.0	1.07E-08	<12.0	1.07E-08	<12.0	1.07E-08	<12.0	1.07E-08	<12.0	1.07E-08	µg/m³

			New Interim Cover 06		New Interim Cover 07		New Interim Cover 08		New Interim Cover 09		BLANK-DAJH		Result Units
Compound		D.L.	Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	
Carbon Disulfide		6.2	<6.2	3.99E-09	<6.2	3.99E-09	<6.2	3.99E-09	<6.2	3.99E-09	<6.5	4.19E-09	µg/m³
Carbon Disulfide		2.0	<2.0		<2.0		<2.0		<2.0		<2.1		ppb (V)
Carbonyl Sulfide		10.0	<10	6.30E-09	<10	6.30E-09	<10	6.30E-09	<10	6.30E-09	<10	6.61E-09	µg/m³
Carbonyl Sulfide		4.0	<4.0		<4.0		<4.0		<4.0		<4.2		ppb (V)
Dimethyl Sulfide		10.0	<10	6.51E-09	<10	6.51E-09	<10	6.51E-09	<10	6.51E-09	<11	6.84E-09	µg/m³
Dimethyl Sulfide		4.0	<4.0		<4.0		<4.0		<4.0		<4.2		ppb (V)
Dimethyl Disulfide		7.7	<7.7	3.26E-09	<7.7	3.26E-09	<7.7	3.26E-09	<7.7	3.26E-09	<8.1	3.42E-09	µg/m³
Dimethyl Disulfide		2.0	<2.0		<2.0		<2.0		<2.0		<2.1		ppb (V)
Hydrogen Sulfide		5.6	<5.6	3.57E-09	<5.6	3.57E-09	<5.6	3.57E-09	<5.6	3.57E-09	<5.8	3.75E-09	µg/m³
Hydrogen Sulfide		4.0	<4.0		<4.0		<4.0		<4.0		<4.2		ppb (V)
Methly Mercaptan		7.9	<7.9	5.04E-09	<7.9	5.04E-09	<7.9	5.04E-09	<7.9	5.04E-09	<8.3	5.30E-09	µg/m³
Methyl Mercaptan		4.0	<4.0		<4.0		<4.0		<4.0		<4.2		ppb (V)
Total Reduced Sulfur as H2S (NPRI-6)													
Total Reduced Sulfur		8.5		1.07E-08		1.07E-08		1.07E-08		1.07E-08		1.07E-08	ppb (V)
Total Reduced Sulfur		12.0	<12.0		<12.0		<12.0		<12.0		<12.0		µg/m³

Compound		D.L.	New Final Cover 01		New Final Cover 02		New Final Cover 03		New Final Cover 04		New Final Cover 05		Result Units
			Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	
Carbon Disulfide		6.2	<6.2	3.99E-09	<6.2	3.99E-09	<6.2	3.99E-09	<6.2	3.99E-09	<6.2	3.99E-09	$\mu g/m^3$
Carbon Disulfide		2.0	<2.0		<2.0		<2.0		<2.0		<2.0		ppb (V)
Carbonyl Sulfide		10.0	<10	6.30E-09	<10	6.30E-09	<10	6.46E-09	<10	6.46E-09	<10	6.46E-09	$\mu g/m^3$
Carbonyl Sulfide		4.0	<4.0		<4.0		<4.0		<4.1		<4.1		ppb (V)
Dimethyl Sulfide		10.0	<10	6.51E-09	<10	6.51E-09	<10	6.68E-09	<10	6.68E-09	<10	6.68E-09	$\mu g/m^3$
Dimethyl Sulfide		4.0	<4.0		<4.0		<4.0		<4.1		<4.1		ppb (V)
Dimethyl Disulfide		7.7	<7.7	3.26E-09	<7.7	3.26E-09	<7.7	3.26E-09	<7.7	3.26E-09	<7.7	3.26E-09	$\mu g/m^3$
Dimethyl Disulfide		2.0	<2.0		<2.0		<2.0		<2.0		<2.0		ppb (V)
Hydrogen Sulfide		5.6	<5.6	3.57E-09	<5.6	3.57E-09	<5.6	3.66E-09	<5.7	3.66E-09	<5.7	3.66E-09	$\mu g/m^3$
Hydrogen Sulfide		4.0	<4.0		<4.0		<4.0		<4.1		<4.1		ppb (V)
Methly Mercaptan		7.9	<7.9	5.04E-09	<7.9	5.04E-09	<7.9	5.17E-09	<8.1	5.17E-09	<8.1	5.17E-09	$\mu g/m^3$
Methyl Mercaptan		4.0	<4.0		<4.0		<4.0		<4.1		<4.1		ppb (V)
Total Reduced Sulfur as H2S (NPRI-6)													
Total Reduced Sulfur		12.0	<12	1.07E-08	<12	1.07E-08	<12	1.07E-08	<12	1.07E-08	<12	1.07E-08	$\mu g/m^3$

Compound		D.L.	New Final Cover 06		New Final Cover 07		New Final Cover 08		New Final Cover 09		BLANK-EZH		Result Units
			Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	Result	Average Flux ($g/m^2/s$)	
Carbon Disulfide		6.2	<6.2	3.99E-09	<6.2	3.99E-09	<6.2	3.99E-09	<6.2	3.99E-09	<6.2	3.45E-07	$\mu g/m^3$
Carbon Disulfide		2.0	<2.0		<2.0		<2.0		<2.0		<2.0		ppb (V)
Carbonyl Sulfide		10.0	<10	6.30E-09	<10	6.30E-09	<10	6.30E-09	<10	6.46E-09	<10	5.44E-07	$\mu g/m^3$
Carbonyl Sulfide		4.0	<4.0		<4.0		<4.0		<4.1		<4.0		ppb (V)
Dimethyl Sulfide		10.0	<10	6.51E-09	<10	6.51E-09	<10	6.51E-09	<10	6.68E-09	<10	5.63E-07	$\mu g/m^3$
Dimethyl Sulfide		4.0	<4.0		<4.0		<4.0		<4.1		<4.0		ppb (V)
Dimethyl Disulfide		7.7	<7.7	3.26E-09	<7.7	3.26E-09	<7.7	3.26E-09	<7.7	3.26E-09	<7.7	2.81E-07	$\mu g/m^3$
Dimethyl Disulfide		2.0	<2.0		<2.0		<2.0		<2.0		<2.0		ppb (V)
Hydrogen Sulfide		5.6	<5.6	3.57E-09	<5.6	3.57E-09	<5.6	3.57E-09	<5.7	3.66E-09	<5.6	3.09E-07	$\mu g/m^3$
Hydrogen Sulfide		4.0	<4.0		<4.0		<4.0		<4.1		<4.0		ppb (V)
Methly Mercaptan		7.9	<7.9	5.04E-09	<7.9	5.04E-09	<7.9	5.04E-09	<8.1	5.17E-09	<7.9	4.36E-07	$\mu g/m^3$
Methyl Mercaptan		4.0	<4.0		<4.0		<4.0		<4.1		<4.0		ppb (V)
Total Reduced Sulfur as H2S (NPRI-6)													
Total Reduced Sulfur		12.0	<12	1.07E-08	<12	1.07E-08	<12	1.07E-08	<12	1.07E-08	<12	1.07E-08	$\mu g/m^3$

Contaminant	CAS	Interim Cover	Final Cover
Hydrogen Sulfide	7783-06-4	3.69E-09	3.61E-09
Total Reduced Sulfur	TRS	1.07E-08	1.07E-08

Notes:

[1] Areas 1-3, and 5 are under final cover, Area 4 is under interim cover.

APPENDIX 12E

Appendix 12E: NMOC Emissions from the Existing Landfill (Year 2033)

RWDI# 2101750

Twin Creeks Environmental Centre

Modelled Sources: FLARE1-FLARE6
Emissions rates calculated relative each flares individual maximum capacity

As a conservative assumption all flares were assumed to operation at their individual maximum capacities. US EPA AP-42 Chapter 2.4 Municipal Solid Waste Landfills suggests 99.2% destruction of NMOC compounds. As a conservative assumption a destruction efficiency of 98% was applied to all landfill gas flares.

Flare ID	Maximum Landfill Gas Flow Rate (m^3/s)
FLARE1	2.08
FLARE2	2.08
FLARE3	2.08
FLARE4	0.94
FLARE5	1.89
FLARE6	1.89

Flare Destruction Efficiency	98%

Compound	CAS Number	Molecular Weight (g/mol)	Average Concentration In Raw LFG (ppm)	Note	Flare 1 -3 Emission Rate (g/s)	Emission Rate FLARE4 (g/s)	Emission Rate FLARE5 (g/s)	Emission Rate FLARE6 (g/s)
Vinyl Chloride	75-01-4	62.5	0.45	[1]	4.91E-05	2.22E-05	4.45E-05	4.45E-05
1,2-Dichloroethane	107-06-2	99.0	0.24	[1]	4.06E-05	1.84E-05	3.68E-05	3.68E-05
Benzene	71-43-2	78.1	0.93	[1]	1.26E-04	5.73E-05	1.15E-04	1.15E-04
Hydrogen Sulfide	7783-06-4	34.1	333	[1]	1.97E-02	8.92E-03	1.78E-02	1.78E-02
Total Reduced Sulphur (TRS) [2]	TRS	- -	333	[1]	1.97E-02	8.92E-03	1.78E-02	1.78E-02

Notes:
[1] Concentrations based on the landfill gas sampling report dated July 13, 2023.
[2] Emissions of Total Reduced Sulphurs (TRS) are based on the total of all sulphur compounds.

Sample Calculation

Vinyl Chloride Emission Rate from Flare 1

$$\text{Molar Flow of Vinyl Chloride} = \frac{101325\ \text{Pa}}{} \left| \frac{0.45\ \text{m}^3}{1{,}000{,}000\ \text{m}^3} \right| \frac{1}{8.314\ \text{Pa m}^3/\text{mol-K}} \left| \frac{1}{293\ \text{K}} \right.$$

$$\text{Molar Flow of Vinyl Chloride} = \frac{1.9\text{E-}05\ \text{mol}}{\text{m}^3}$$

$$\text{Emission Rate of Vinyl Chloride} = \frac{1.9\text{E-}05\ \text{mol}}{\text{m}^3} \left| \frac{62.5\ \text{g}}{\text{mol}} \right| \frac{2.08\ \text{m}^3}{\text{s}} \quad (1\text{-}0.98) \quad \text{destruction efficiency}$$

$$\text{Emission Rate of Vinyl Chloride} = \frac{4.9\text{E-}05\ \text{g}}{\text{s}}$$

APPENDIX 12F

Appendix 12F: Landfill Gas Flare Combustion Emissions

RWDI# 2101750

Emission Factors and Emission Rate Development for Combustion By-Products from Landfill Gas Flares

Source ID	Source Description	Contaminant	CAS	Emission Factor	Units	Note	Data Quality	Estimation Technique	Landfill Gas Emission Rate (g/s)	Bypass Scenario Emission Rate (g/s) [3]
Flare1	Waste Gas Burner (Flare A)	Oxides of Nitrogen	10102-44-0	631	kg/10^6 dscm Methane	[1]	C	EF	6.57E-01	--
		Carbon Monoxide	630-08-0	737	kg/10^6 dscm Methane	[1]	C	EF	7.68E-01	--
		Sulphur Dioxide	7446-09-5	187	mg/m^3	[2]	D	EC	3.89E-01	--
		Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	2.48E-01	--
		Dioxins and Furans	DF	11	pg TEQ/m^3	[7]	E	EF	2.29E-11	--
Flare2	Waste Gas Burner (Flare B)	Oxides of Nitrogen	10102-44-0	631	kg/10^6 dscm Methane	[1]	C	EF	6.57E-01	--
		Carbon Monoxide	630-08-0	737	kg/10^6 dscm Methane	[1]	C	EF	7.68E-01	--
		Sulphur Dioxide	7446-09-5	187	mg/m^3	[2]	D	EC	3.89E-01	--
		Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	2.48E-01	--
		Dioxins and Furans	DF	11	pg TEQ/m^3	[7]	E	EF	2.29E-11	--
Flare3	Waste Gas Burner (Flare C)	Oxides of Nitrogen	10102-44-0	631	kg/10^6 dscm Methane	[1]	C	EF	6.57E-01	--
		Carbon Monoxide	630-08-0	737	kg/10^6 dscm Methane	[1]	C	EF	7.68E-01	--
		Sulphur Dioxide	7446-09-5	187	mg/m^3	[2]	D	EC	3.89E-01	--
		Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	2.48E-01	--
		Dioxins and Furans	DF	11	pg TEQ/m^3	[7]	E	EF	2.29E-11	--
Flare4	Waste Gas Burner (Flare D)	Oxides of Nitrogen	10102-44-0	631	kg/10^6 dscm Methane	[1]	C	EF	2.98E-01	--
		Carbon Monoxide	630-08-0	737	kg/10^6 dscm Methane	[1]	C	EF	3.48E-01	--
		Sulphur Dioxide	7446-09-5	187	mg/m^3	[2]	D	EC	1.76E-01	--
		Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	1.12E-01	--
		Dioxins and Furans	DF	11	pg TEQ/m^3	[7]	E	EF	1.04E-11	--
Flare5	Waste Gas Burner (Flare E)	Oxides of Nitrogen	10102-44-0	631	kg/10^6 dscm Methane	[1]	C	EF	5.96E-01	5.78E-01
		Carbon Monoxide	630-08-0	737	kg/10^6 dscm Methane	[1]	C	EF	6.96E-01	6.75E-01
		Sulphur Dioxide [3]	7446-09-5	187	mg/m^3	[2]	D	EC	3.53E-01	2.65E-01
		Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	2.25E-01	2.18E-01
		Dioxins and Furans	DF	11	pg TEQ/m^3	[7]	E	EF	2.08E-11	1.04E-11
Flare6	Waste Gas Burner (Flare F)	Oxides of Nitrogen	10102-44-0	631	kg/10^6 dscm Methane	[1]	C	EF	5.96E-01	5.78E-01
		Carbon Monoxide	630-08-0	737	kg/10^6 dscm Methane	[1]	C	EF	6.96E-01	6.75E-01
		Sulphur Dioxide [3]	7446-09-5	187	mg/m^3	[2]	D	EC	3.53E-01	1.26E-02
		Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	2.25E-01	2.18E-01
		Dioxins and Furans	DF	11	pg TEQ/m^3	[7]	E	EF	2.08E-11	1.04E-11
RNG_TO1	Off-Spec RNG Gas	Oxides of Nitrogen	10102-44-0	0.11	kg/MMBTU	[4]	B	EF	1.30E-01	--
		Carbon Monoxide	630-08-0	0.11	kg/MMBTU	[4]	B	EF	1.30E-01	--
		Sulphur Dioxide	7446-09-5	280	mg/m^3	[6]	D	EC	9.13E-02	--
		Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	4.65E-03	--
		Dioxins and Furans	DF	11	pg TEQ/m^3	[7]	E	EF	3.58E-12	--
RNG_TO2	Off-Spec RNG Gas	Oxides of Nitrogen	10102-44-0	0.11	kg/MMBTU	[5]	B	EF	1.20E+00	--
		Carbon Monoxide	630-08-0	0.11	kg/MMBTU	[5]	B	EF	1.20E+00	--
		Sulphur Dioxide	7446-09-5	13.3	mg/m^3	[6]	D	EC	3.08E-02	--
		Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	7.71E-02	--
		Dioxins and Furans	DF	11	pg TEQ/m^3	[7]	E	EF	2.54E-11	--

Notes:

[1] Emission factors for NO_x (expressed as NO_2), CO, and PM are from US EPA AP-42 Table 2.4-4 (Emission Factors for Secondary Compounds Exiting Control Devices).

[2] Units of SO_2 emission factor are mg/m^3. This emission factor was calculated by assuming that all sulphur compounds in the LFG are converted to SO_2 upon combustion. (The default concentration LFG values from US EPA AP-42 Table 2.4-1 "Default Concentrations for LFG Constituents" of all sulphur compounds were summed - see below.)

[3] Flare 5 and flare 6 are used to combust off-spec landfill gas when the thermal oxidizers are not operational. For the bypass scenario emissions of sulphur dioxide are calculated in Appendix C9. All sulphur compounds were calculated using the emissions data provided by Morrow Energy.

[4] Emission factors for nitrogen oxides and carbon monoxide for the pre-treatment thermal oxidizer (RNG_TO1), were provided by MRW in the proposal dated August 23rd, 2022. Emission factors are based on the maximium thermal input rating provided:

Maximum Thermal Input Rating = 4.14 MMBTU/hr

[5] Emission factors for nitrogen oxides and carbon monoxide for the direct fired thermal oxidizer (RNG_TO2), were provided by MRW in the proposal dated August 23rd, 2022. Emission factors are based on the maximium thermal input rating provided:

Maximum Thermal Input Rating = 38.2 MMBTU/hr

[6] Emissions of SO_2 for the thermal oxidizers were calculated using the sum of the sulphur compounds found in Appendix C9.

Data provided by Comcor for Flare1-Flare3

Flare Flow Rate per Flare=	2.08	(m^3/s)
Flare Flow Rate per Flare=	125	(m^3/min)
Flare Methane Concentration per Flare=	50%	
Flare Methane Flow Rate per Flare=	62.5	(m^3/min)
Flare Methane Flow Rate per Flare=	**1.04**	(m^3/s)

Data provided by TCLF for Flare4

Flare Flow Rate =	0.94	(m^3/s)
Flare Flow Rate =	57	(m^3/min)
Flare Methane Concentration =	50%	
Flare Methane Flow Rate =	28.3	(m^3/min)
Flare Methane Flow Rate =	**0.47**	(m^3/s)

Data Provided in John Zinkhamworthy quote for Flares 5 and 6 - per flare

Startup Operations

Flare Flow Rate =	1.89	(m^3/s)
Flare Flow Rate =	113	(m^3/min)
Flare Methane Concentration =	50%	
Flare Methane Flow Rate =	56.6	(m^3/min)
Flare Methane Flow Rate =	**0.94**	(m^3/s)

Data provided by Comcor for Flare1-Flare3

Flare A Methane Flow Rate =	1.04	(m^3/s)
Flare B Methane Flow Rate =	1.04	(m^3/s)
Flare C Methane Flow Rate =	1.04	(m^3/s)

Data provided by TCLF for Flare4

Flare D Methane Flow Rate =	0.47	(m^3/s)

Bypass Scenario

Flare Flow Rate =	0.94	(m^3/s)
Flare Flow Rate =	57	(m^3/min)
Flare Methane Concentration Bypass Scenario=	97%	
Bypass Scenario Flare Methane Flow Rate =	54.9	(m^3/min)
Bypass Scenario Flare Methane Flow Rate =	**0.92**	(m^3/s)

Data Provided in MRW pre-treatment thermal oxidizer quote

Thermal Oxidizer Flow Rate =	0.33	(m^3/s)
Thermal Oxidizer Flow Rate =	20	(m^3/min)
Thermal Oxidizer Methane Concentration =	6%	
Thermal Oxidizer Methane Flow Rate =	1.2	(m^3/min)
Thermal Oxidizer Methane Flow Rate =	**0.02**	(m^3/s)

Data Provided in MRW direct fired thermal oxidizer quote

Thermal Oxidizer Flow Rate =	2.31	(m^3/s)
Thermal Oxidizer Flow Rate =	139	(m^3/min)
Thermal Oxidizer Methane Concentration =	14%	
Thermal Oxidizer Methane Flow Rate =	19.4	(m^3/min)
Thermal Oxidizer Methane Flow Rate =	**0.32**	(m^3/s)

Total (for 6 flares) =	**5.48**	(m^3/s)
Total (for 2 thermal oxidizers) =	**0.34**	(m^3/s)

Assuming all sulphur compounds in LFG are converted to SO_2:

US EPA AP-42 Table 2.4-1 Default Concentrations for LFG Constituents

Compound	Molecular Weight	Default Concentration (ppm)	Measured Concentrations (ppm)						Average Concentration of Measured Values (ppm)
			Well 1	Well 2	Well 3	Well 4	Well 5	Well 6	
Carbon disulfide	76.13	0.58	0	0	0	0	0	0	0
Carbonyl sulfide	60.07	0.49	-	-	-	-	-	-	-
Dimethyl sulfide (methyl sulfide)	62.13	7.82	0	0	0	0	0	0	0
Ethyl mercaptan (ethanethiol)	62.13	2.28	5.5	0	1.1	0	0	0	1.1
Hydrogen sulfide	34.08	52.6	2.8	140	2.3	0	170	0.68	52.6
Methyl mercaptan	48.11	15.7	1.6	88	2.3	0	1.2	1.2	15.7
$SO_{2\ (ppm)}$	57.11	80.05	9.9	228	5.7	0	171.2	1.88	69.4
$SO_{2\ (mg/m3)}$	**57.11**	**186.86**							

[7] Emissions of Dioxins and Furans were estimated based on the measured concentration for a landfill gas flare at a similar landfill site in Ontario.

APPENDIX 12G

Appendix 12G: NMOC Emissions from the Thermal Oxidizers and Flares 5 &6 Bypass Scenario

RWDI# 2101750

Twin Creeks Environmental Centre

Pre-Treatment and Direct Fired Thermal Oxidizers and Flare Bypass

Emissions from the thermal oxidizers (TO) were based on VOC data provided by Morrow Energy. Emissions for each TO were calculated based on the flow rate of off-spec RNG gas to each flare and the concentration of each contaminant in the gas stream. A destruction efficiency of 99% was provide by Morrow Energy and was applied to the emission calculations.

Pre-Treatment Thermal Oxidizer (RNG_TO1) Design Basis (August 20th, 2022)

Gas Flow	0.33 m^3/s
Methane %	6.0%
VOC Destruction Efficiency %	99%

Flares 5 & 6 Design Basis (August 10th, 2022) - Per Flare

Gas Flow	0.94 m^3/s
Methane %	97%
VOC Destruction Efficiency %	98%

Direct Fired Thermal Oxidizer (RNG_TO2) Design Basis (August 23rd, 2022)

Gas Flow	2.31 m^3/s
Methane %	14%
VOC Destruction Efficiency %	99%

Total Heat Release	12 MMBTU/hr

Stack Parameters

Gas Flow	0.944 m^3/s
Stack Diameter	? m
Stack Height	? m
Exit Temperature	1000 °F

Compound	CAS Number	Molecular Weight (g/mol)	Morrow Energy Pre-Treatment Thermal Oxidizer Concentrations (ppm)	Morrow Energy Main Thermal Oxidizer Concentrations (ppm)	Concentration in Pre-Treatment Thermal Oxidizer (g/m^3)	Concentration in Main Thermal Oxidizer (g/m^3)	RNG_TO1 Emission Rate (g/s)	RNG_TO2 Emission Rate (g/s)	FLARE5BP Emission Rate (g/s)	FLARE6BP Emission Rate (g/s)
Maximum LFG Volumetric Flow (m^3/s)	- -	- -	- -		- -	- -	0.33	2.31	0.94	0.94
Destruction Efficiency [1]	- -	- -	- -		- -	- -	99%	99%	98%	98%
VOC										
Benzene	71-43-2	78.11	3.87E+00	1.59E-01	1.30E-02	5.36E-04	4.24E-05	1.24E-05	2.46E-04	1.01E-05
1,2-Dichloroethane	107-06-2	98.96	4.43E-01	4.10E-01	1.89E-03	1.75E-03	6.14E-06	4.04E-05	3.56E-05	3.30E-05
Vinyl Chloride	75-01-4	62.50	2.03E+00	1.50E+00	5.47E-03	4.05E-03	1.78E-05	9.36E-05	1.03E-04	7.64E-05
Total Reduced Sulphur (TRS) [2]	TRS	--	--	--	2.80E-01	1.33E-02	9.13E-04	3.08E-04	5.29E-03	2.51E-04

Notes

[1] Destruction efficiency for the bypass stacks is based on AP-42 Chapter 2.4 Municipal Solid Waste Landfills, Table 2.4-3. Morrow Energy provided a destruction efficiency of 99% for the thermal oxidizers.

[2] Emissions of Total Reduced Sulphurs (TRS) are based on the total of all sulphur compounds.

Sample Calculation

Calculation of 1,1-Dichloroethane Emission Rate (Pre-Treatmet Thermal Oxidizer) = Maximum LFG Flow (m^3/s) * Concentration in Raw LFG (g/m^3) * (1 - Detruction Efficiency)

$$= \frac{0.33\ m^3}{s} \left| \frac{2.87E\text{-}02\ g}{m^3} \right| (1 - 0.99)$$

$$= 9.34E\text{-}05\ g/s$$

NOx Emissions from Natural Gas Burner in Thermal Oxidizers

Gas sent to the thermal oxidizers have low methane concentrations which can make combustion difficult. In order to achieve combustion assist gas is used to increase the methane concentration of the gas. Although the lower methane gas streams are the ones that require more assist gas it was conservatively assumed that the maximum assist gas was sent to the thermal oxidizer under all conditions. The assist gas was assumed to be natural gas

Source	Burner Thermal Input Rating	
RNG_TO1	2.3125 MMBTU/hr	2,384 scf/hr
RNG_TO2	19.5 MMBTU/hr	20,103 scf/hr

Contaminants	Emission Factor (lb/10^6scf)	RNG_TO1 Emission Rate (g/s)	RNG_TO2 Emission Rate (g/s)	RNG_TO1 Emissions from Waste Gas [1] (g/s)	RNG_TO2 Emissions from Waste Gas [1] (g/s)	RNG_TO1 Total Emissions (g/s)	RNG_TO2 Total Emissions (g/s)
Nitrogen Oxides	100	2.95E-02	2.49E-01	1.30E-01	1.20E+00	1.60E-01	1.45E+00
Carbon Monoxide	84	2.48E-02	2.09E-01	1.30E-01	1.20E+00	1.55E-01	1.41E+00
Particulate Matter	7.6	2.25E-03	1.89E-02	4.65E-03	7.71E-02	6.90E-03	9.60E-02

Notes:
[1] Emissions from waste gas are calculated in Appendix C8.

Sample Calculation

Nitrogen Oxides Emission Rate = (1961 scf/h) x (100 lb/10^6 scf) x (453.6 g/lb) / (3660 s/h)
= 2.95E-02 g/s

Notes:
[1] Average concentration for Thermal Oxidizer based on manufacturer outlet concentration of NMOC scaled by Landgem NMOC concentration for contaminants of interest.
[2] Concentration for each contaminant calculated using raw LFG concentration ratios
[3] Conversion Formula: Concentration (ppm) = 24.45 x concentration (mg/m3) ÷ molecular weight
[4] Combustion emissions calculated by sumation of Natural gas combustion and waste stream combustion rates.
[5] Refer to Appendix D1 for waste stream analysis
[6] H2S emissions were calculated using the manufacturer guarenteed outlet concentration.

APPENDIX 12H

Appendix 12H: Emissions Rate Calculations for Waste Soil Storage Pile (WSOIL)

RWDI# 2101750

Emissions from waste soil were based on flux chamber sampling completed at similar facilities in Ontario. Of the two samples available the highest recorded flux rate was used.

Contaminant Name	CAS Number	Facility 1: Emission Flux Rate (g m^{-2} s^{-1})	Facility 2: Emission Flux Rate (g m^{-2} s^{-1})	Overall Maximum Maximum Emission Flux Rate (g m^{-2} s^{-1})
Vinyl Chloride	75-01-4	3.67E-08	0.00E+00	3.67E-08
1,2-Dichloroethane	107-06-2	4.91E-08	7.97E-07	7.97E-07
Benzene	71-43-2	8.76E-08	3.38E-05	3.38E-05

APPENDIX 12I

Appendix 12I: Emissions Rate Calculations for the Generator Associated with the Leachate Pumps (GEN2)

RWDI# 2101750

Contaminant	CAS	Emission Factor (lb/BHP-hr)	Emission Factor (kg/kW-hr)	Emission Rate (g/s)	Data Quality Rating
Oxides of Nitrogen	630-08-0	3.10E-02	1.88E-02	3.27E-01	D
Carbon Monoxide	10102-44-0	6.68E-03	4.06E-03	7.05E-02	D
Particulate Matter	PM	2.20E-03	1.34E-03	2.32E-02	D
Sulphur Dioxide	7446-09-5	2.05E-03	1.25E-03	2.16E-02	D

Note: Emission Factors from the U.S. EPA's AP-42 Document, Chapter 3.3 Gasoline and Diesel Industrial Engines

Generator Size =	50	kW
Engine Size =	62.5	kW (assuming 80% efficiency)
	84	bhp
Conversion Factor	1.341	bhp = 1 kW

APPENDIX 12J

Appendix 12J-1: 24-Hour Benzene Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%) [1]	Maximum Modelled Concentration With Background (µg/m³) [2]	Percentage of Criteria With Background (%) [1]
Max GLC	0.33	14%	0.88	38%
R1	0.08	3%	0.63	28%
R2	0.15	7%	0.71	31%
R3	0.13	6%	0.69	30%
R4	0.18	8%	0.73	32%
R5	0.09	4%	0.65	28%
R6	0.11	5%	0.67	29%
R7	0.13	5%	0.68	30%
R8	0.09	4%	0.65	28%
R9	0.10	4%	0.66	29%
R10	0.05	2%	0.61	27%
R11	0.05	2%	0.61	27%
R12	0.06	3%	0.62	27%
R13	0.06	3%	0.62	27%
R14	0.05	2%	0.61	27%
R15	0.05	2%	0.61	27%
R16	0.08	3%	0.64	28%
R17	0.09	4%	0.65	28%
R19	0.07	3%	0.63	27%
R20	0.06	3%	0.62	27%
R21	0.06	2%	0.61	27%
R22	0.04	2%	0.60	26%
R23	0.04	2%	0.60	26%
R24	0.04	2%	0.60	26%
STR1	N/A	N/A	N/A	N/A

Notes:
[1] Criteria = 2.3 µg/m³
[2] 90th Percentile Background Concentration = 0.56 µg/m³

Table 12J-2: Annual Benzene Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%) [1]	Maximum Modelled Concentration With Background (µg/m³) [2]	Percentage of Criteria With Background (%) [1]
Max GLC	0.05	10%	0.44	99%
R1	0.01	1%	0.41	90%
R2	0.02	3%	0.41	92%
R3	0.01	3%	0.41	91%
R4	0.02	5%	0.42	93%
R5	0.01	2%	0.41	91%
R6	0.01	2%	0.41	91%
R7	0.01	3%	0.41	92%
R8	0.01	2%	0.41	90%
R9	0.01	2%	0.41	91%
R10	0.003	1%	0.40	89%
R11	0.004	1%	0.40	89%
R12	0.00	1%	0.40	90%
R13	0.00	1%	0.40	90%
R14	0.003	1%	0.40	89%
R15	0.003	1%	0.40	89%
R16	0.01	1%	0.41	90%
R17	0.01	2%	0.41	90%
R18	0.01	1%	0.41	90%
R19	0.01	1%	0.40	90%
R20	0.01	1%	0.40	90%
R21	0.01	1%	0.40	90%
R22	0.004	1%	0.40	90%
R23	0.004	1%	0.40	90%
R24	0.004	1%	0.40	90%
STR1	N/A	N/A	N/A	N/A

Notes:
[1] Criteria = 0.45 µg/m³
[2] Average Background Concentration = 0.40 µg/m³

Table 12J-3: 24-Hour Vinyl Chloride Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%) [1]	Maximum Modelled Concentration With Background (µg/m³) [2]	Percentage of Criteria With Background (%) [1]
Max GLC	0.41	41%	0.46	46%
R1	0.03	3%	0.08	8%
R2	0.05	5%	0.10	10%
R3	0.03	3%	0.08	8%
R4	0.06	6%	0.11	11%
R5	0.03	3%	0.08	8%
R6	0.03	3%	0.08	8%
R7	0.04	4%	0.09	9%
R8	0.03	3%	0.08	8%
R9	0.04	4%	0.10	10%
R10	0.03	3%	0.08	8%
R11	0.03	3%	0.08	8%
R12	0.04	4%	0.09	9%
R13	0.03	3%	0.08	8%
R14	0.03	3%	0.08	8%
R15	0.03	3%	0.08	8%
R16	0.03	3%	0.08	8%
R17	0.03	3%	0.08	8%
R18	0.03	3%	0.08	8%
R19	0.02	2%	0.08	8%
R20	0.02	2%	0.07	7%
R21	0.02	2%	0.07	7%
R22	0.02	2%	0.07	7%
R23	0.02	2%	0.07	7%
R24	0.02	2%	0.07	7%
STR1	N/A	N/A	N/A	N/A

Notes:
[1] Criteria = 1 µg/m³
[2] Average Background Concentration = 0.05 µg/m³

Table 12J-4: Annual Vinyl Chloride Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%) [1]	Maximum Modelled Concentration With Background (µg/m³) [2]	Percentage of Criteria With Background (%) [1]
Max GLC	0.05	24%	0.10	49%
R1	0.002	1%	0.05	27%
R2	0.005	2%	0.06	28%
R3	0.004	2%	0.06	28%
R4	0.006	3%	0.06	29%
R5	0.003	2%	0.05	27%
R6	0.004	2%	0.05	27%
R7	0.006	3%	0.06	28%
R8	0.003	1%	0.05	27%
R9	0.006	3%	0.06	28%
R10	0.002	1%	0.05	26%
R11	0.002	1%	0.05	27%
R12	0.003	1%	0.05	27%
R13	0.002	1%	0.05	27%
R14	0.002	1%	0.05	26%
R15	0.002	1%	0.05	27%
R16	0.002	1%	0.05	27%
R17	0.003	1%	0.05	27%
R18	0.002	1%	0.05	27%
R19	0.002	1%	0.05	27%
R20	0.002	1%	0.05	27%
R21	0.002	1%	0.05	27%
R22	0.002	1%	0.05	26%
R23	0.002	1%	0.05	26%
R24	0.001	1%	0.05	26%
STR1	N/A	N/A	N/A	N/A

Notes:
[1] Criteria = 0.2 µg/m³
[2] Average Background Concentration = 0.05 µg/m³

Table 12J-5: 24-Hour 1,2-Dichloroethane Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%) [1]	Maximum Modelled Concentration With Background (µg/m³) [2]	Percentage of Criteria With Background (%) [1]
Max GLC	0.3	15%	0.4	20%
R1	0.02	1%	0.1	6%
R2	0.04	2%	0.1	7%
R3	0.03	1%	0.1	6%
R4	0.05	2%	0.1	7%
R5	0.02	1%	0.1	6%
R6	0.02	1%	0.1	6%
R7	0.04	2%	0.1	7%
R8	0.03	1%	0.1	6%
R9	0.03	2%	0.1	6%
R10	0.02	1%	0.1	6%
R11	0.02	1%	0.1	6%
R12	0.03	2%	0.1	6%
R13	0.02	1%	0.1	6%
R14	0.02	1%	0.1	6%
R15	0.02	1%	0.1	6%
R16	0.02	1%	0.1	6%
R17	0.03	1%	0.1	6%
R18	0.03	1%	0.1	6%
R19	0.02	1%	0.1	6%
R20	0.02	1%	0.1	6%
R21	0.02	1%	0.1	6%
R22	0.01	1%	0.1	5%
R23	0.01	1%	0.1	5%
R24	0.01	1%	0.1	5%
STR1	N/A	N/A	N/A	N/A

Notes:
[1] Criteria = 2 µg/m³
[2] Average Background Concentration = 0.10 µg/m³

Table 12J-6: Annual 1,2-Dichloroethane Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%) [1]	Maximum Modelled Concentration With Background (µg/m³) [2]	Percentage of Criteria With Background (%) [1]
Max GLC	0.03	8.6%	0.1	24%
R1	0.002	0.5%	0.06	15%
R2	0.004	1.0%	0.06	16%
R3	0.003	0.9%	0.06	16%
R4	0.005	1.2%	0.06	16%
R5	0.003	0.7%	0.06	16%
R6	0.003	0.8%	0.06	16%
R7	0.005	1.2%	0.06	16%
R8	0.002	0.6%	0.06	16%
R9	0.004	1.1%	0.06	16%
R10	0.001	0.3%	0.06	15%
R11	0.002	0.4%	0.06	15%
R12	0.002	0.5%	0.06	16%
R13	0.002	0.5%	0.06	15%
R14	0.001	0.4%	0.06	15%
R15	0.002	0.4%	0.06	15%
R16	0.002	0.5%	0.06	15%
R17	0.002	0.6%	0.06	16%
R18	0.002	0.5%	0.06	15%
R19	0.002	0.4%	0.06	15%
R20	0.002	0.4%	0.06	15%
R21	0.002	0.4%	0.06	15%
R22	0.001	0.4%	0.06	15%
R23	0.001	0.3%	0.06	15%
R24	0.001	0.3%	0.06	15%
STR1	N/A	N/A	N/A	N/A

Notes:
[1] Criteria = 0.4 µg/m³
[2] Average Background Concentration = 0.06 µg/m³

Table 12J-7: 24-Hour Ammonia Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%) [1]	Maximum Modelled Concentration With Background (µg/m³) [2]	Percentage of Criteria With Background (%) [1]
Max GLC	8.5	9%	12	12%
R1	0.2	0.2%	3.3	3%
R2	0.2	0.2%	3.3	3%
R3	0.4	0.4%	3.5	3%
R4	0.2	0.2%	3.3	3%
R5	0.3	0.3%	3.4	3%
R6	0.4	0.4%	3.5	3%
R7	0.4	0.4%	3.5	4%
R8	0.2	0.2%	3.3	3%
R9	0.9	0.9%	4.0	4%
R10	0.3	0.3%	3.4	3%
R11	0.3	0.3%	3.4	3%
R12	0.5	0.5%	3.6	4%
R13	0.3	0.3%	3.4	3%
R14	0.3	0.3%	3.4	3%
R15	0.4	0.4%	3.5	4%
R16	0.2	0.2%	3.3	3%
R17	0.2	0.2%	3.3	3%
R18	0.2	0.2%	3.3	3%
R19	0.2	0.2%	3.3	3%
R20	0.2	0.2%	3.3	3%
R21	0.1	0.1%	3.3	3%
R22	0.1	0.1%	3.2	3%
R23	0.1	0.1%	3.2	3%
R24	0.1	0.1%	3.2	3%
STR1	N/A	N/A	N/A	N/A

Notes:
[1] Criteria = 100 µg/m³
[2] Average Background Concentration = 3.11 µg/m³

Table 12J-8: 1-Hour Sulphur Dioxide Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%) [1]	Maximum Modelled Concentration With Background (µg/m³) [2]	Percentage of Criteria With Background (%) [1]
Max GLC	75	75%	77	77%
R1	8	8%	10	10%
R2	10	10%	12	12%
R3	12	12%	14	14%
R4	11	11%	14	14%
R5	9	9%	12	12%
R6	14	14%	16	16%
R7	21	21%	24	24%
R8	10	10%	12	12%
R9	26	26%	28	28%
R10	19	19%	22	22%
R11	18	18%	21	21%
R12	22	22%	25	25%
R13	20	20%	23	23%
R14	13	13%	15	15%
R15	23	23%	25	25%
R16	9	9%	12	12%
R17	10	10%	12	12%
R18	9	9%	11	11%
R19	8	8%	10	10%
R20	8	8%	10	10%
R21	7	7%	10	10%
R22	7	7%	9	9%
R23	6	6%	9	9%
R24	6	6%	8	8%
STR1	28	28%	31	0

Notes:
[1] Criteria = 100 µg/m³
[2] Average Background Concentration = 2.4 µg/m³

Table 12J-9: Annual Sulphur Dioxide Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%) [1]	Maximum Modelled Concentration With Background (µg/m³) [2]	Percentage of Criteria With Background (%) [1]
Max GLC	2.0	20%	3.4	34%
R1	0.2	2%	1.6	16%
R2	0.2	2%	1.6	16%
R3	0.2	2%	1.6	16%
R4	0.2	2%	1.6	16%
R5	0.2	2%	1.6	16%
R6	0.2	2%	1.6	16%
R7	0.3	3%	1.7	17%
R8	0.2	2%	1.6	16%
R9	0.3	3%	1.7	17%
R10	0.1	1%	1.5	15%
R11	0.2	2%	1.6	16%
R12	0.3	3%	1.7	17%
R13	0.2	2%	1.6	16%
R14	0.2	2%	1.6	16%
R15	0.2	2%	1.6	16%
R16	0.2	2%	1.6	16%
R17	0.2	2%	1.6	16%
R18	0.2	2%	1.6	16%
R19	0.2	2%	1.6	16%
R20	0.2	2%	1.6	16%
R21	0.1	1%	1.5	15%
R22	0.1	1%	1.5	15%
R23	0.1	1%	1.5	15%
R24	0.1	1%	1.5	15%
STR1	N/A	N/A	N/A	N/A

Notes:
[1] Criteria = 10 µg/m³
[2] Average Background Concentration = 1.4 µg/m³

Table 12J-10: 1-Hour Nitrogen Oxides Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%) [1]	Maximum Modelled Concentration With Background (µg/m³) [2]	Percentage of Criteria With Background (%) [1]
Max GLC	278	70%	299	75%
R1	54	14%	75	19%
R2	49	12%	70	17%
R3	48	12%	69	17%
R4	64	16%	85	21%
R5	41	10%	62	16%
R6	38	10%	59	15%
R7	108	27%	129	32%
R8	65	16%	86	22%
R9	70	18%	91	23%
R10	33	8%	54	13%
R11	29	7%	50	12%
R12	37	9%	58	15%
R13	55	14%	76	19%
R14	54	13%	75	19%
R15	33	8%	54	13%
R16	62	15%	83	21%
R17	65	16%	86	21%
R18	67	17%	88	22%
R19	52	13%	73	18%
R20	47	12%	68	17%
R21	45	11%	66	17%
R22	45	11%	66	16%
R23	42	11%	63	16%
R24	39	10%	60	15%
STR1	72	18%	93	23%

Notes:
[1] Criteria = 400 µg/m³
[2] Average Background Concentration = 21.0 µg/m³

Table 12J-11: 24-Hour Nitrogen Oxides Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (µg/m³)	Percentage of Criteria Without Background (%) [1]	Maximum Modelled Concentration With Background (µg/m³) [2]	Percentage of Criteria With Background (%) [1]
Max GLC	38	19%	57	28%
R1	3	2%	22	11%
R2	7	3%	26	13%
R3	6	3%	25	13%
R4	8	4%	27	14%
R5	4	2%	23	12%
R6	5	2%	24	12%
R7	12	6%	31	16%
R8	4	2%	23	12%
R9	8	4%	27	13%
R10	3	2%	22	11%
R11	3	1%	22	11%
R12	4	2%	23	12%
R13	5	3%	24	12%
R14	4	2%	23	12%
R15	3	2%	22	11%
R16	3	2%	23	11%
R17	4	2%	23	11%
R18	3	2%	23	11%
R19	3	2%	22	11%
R20	3	1%	22	11%
R21	3	1%	22	11%
R22	2	1%	21	11%
R23	2	1%	21	11%
R24	2	1%	21	11%
STR1	N/A	N/A	N/A	N/A

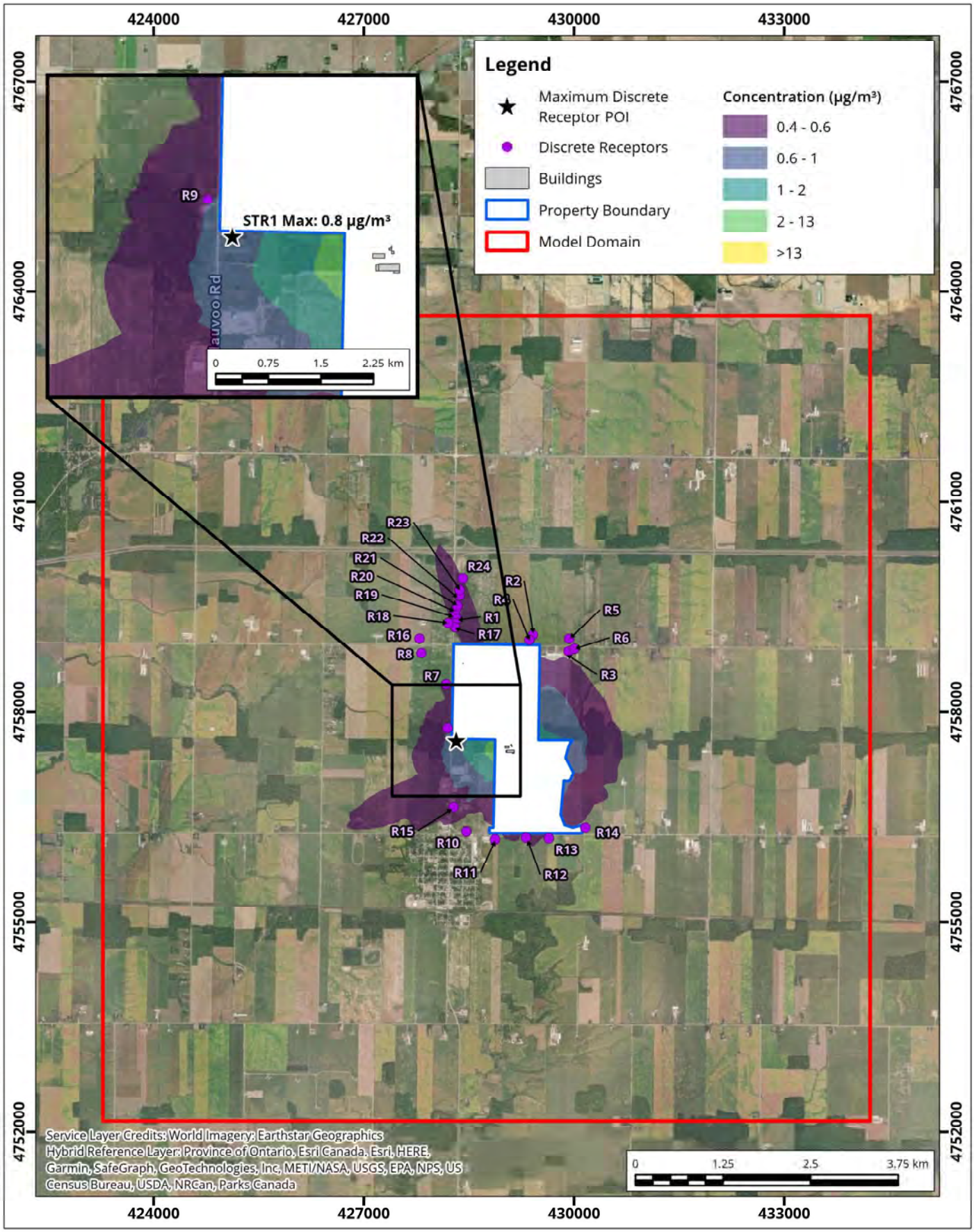
Notes:
[1] Criteria = 200 µg/m³
[2] Average Background Concentration = 19.1 µg/m³

Table 12J-12: 24-Hour Dioxins and Furans Predicted Concentrations

Receptor ID	Existing Conditions			
	Maximum Modelled Concentration Without Background (pg TEQ/m³)	Percentage of Criteria Without Background (%) [1]	Maximum Modelled Concentration With Background (pg TEQ/m³) [2]	Percentage of Criteria With Background (%) [1]
Max GLC	0.001	0.000%	0.02	21%
R1	0.00004	0.00002%	0.02	20%
R2	0.00007	0.00004%	0.02	20%
R3	0.00008	0.00004%	0.02	20%
R4	0.00007	0.00004%	0.02	20%
R5	0.00007	0.00004%	0.02	20%
R6	0.00008	0.00004%	0.02	20%
R7	0.00008	0.00004%	0.02	20%
R8	0.00005	0.00003%	0.02	20%
R9	0.00011	0.00006%	0.02	20%
R10	0.00004	0.00002%	0.02	20%
R11	0.00007	0.00004%	0.02	20%
R12	0.00011	0.00006%	0.02	20%
R13	0.00009	0.00005%	0.02	20%
R14	0.00007	0.00004%	0.02	20%
R15	0.00009	0.00005%	0.02	20%
R16	0.00005	0.00003%	0.02	20%
R17	0.00005	0.00003%	0.02	20%
R18	0.00005	0.00003%	0.02	20%
R19	0.00004	0.00002%	0.02	20%
R20	0.00004	0.00002%	0.02	20%
R21	0.00004	0.00002%	0.02	20%
R22	0.00004	0.00002%	0.02	20%
R23	0.00003	0.00002%	0.02	20%
R24	0.00003	0.00002%	0.02	20%
STR1	N/A	N/A	N/A	N/A

Notes:
[1] Criteria = 0.1 pg TEQ/m³
[2] Average Background Concentration = 0.02 pg TEQ/m³

APPENDIX 12K



Predicted 10-Minute Hydrogen Sulphide Concentrations (in µg/m³)

True North

10-Minute Hydrogen Sulphide Criteria = 13 µg/m³

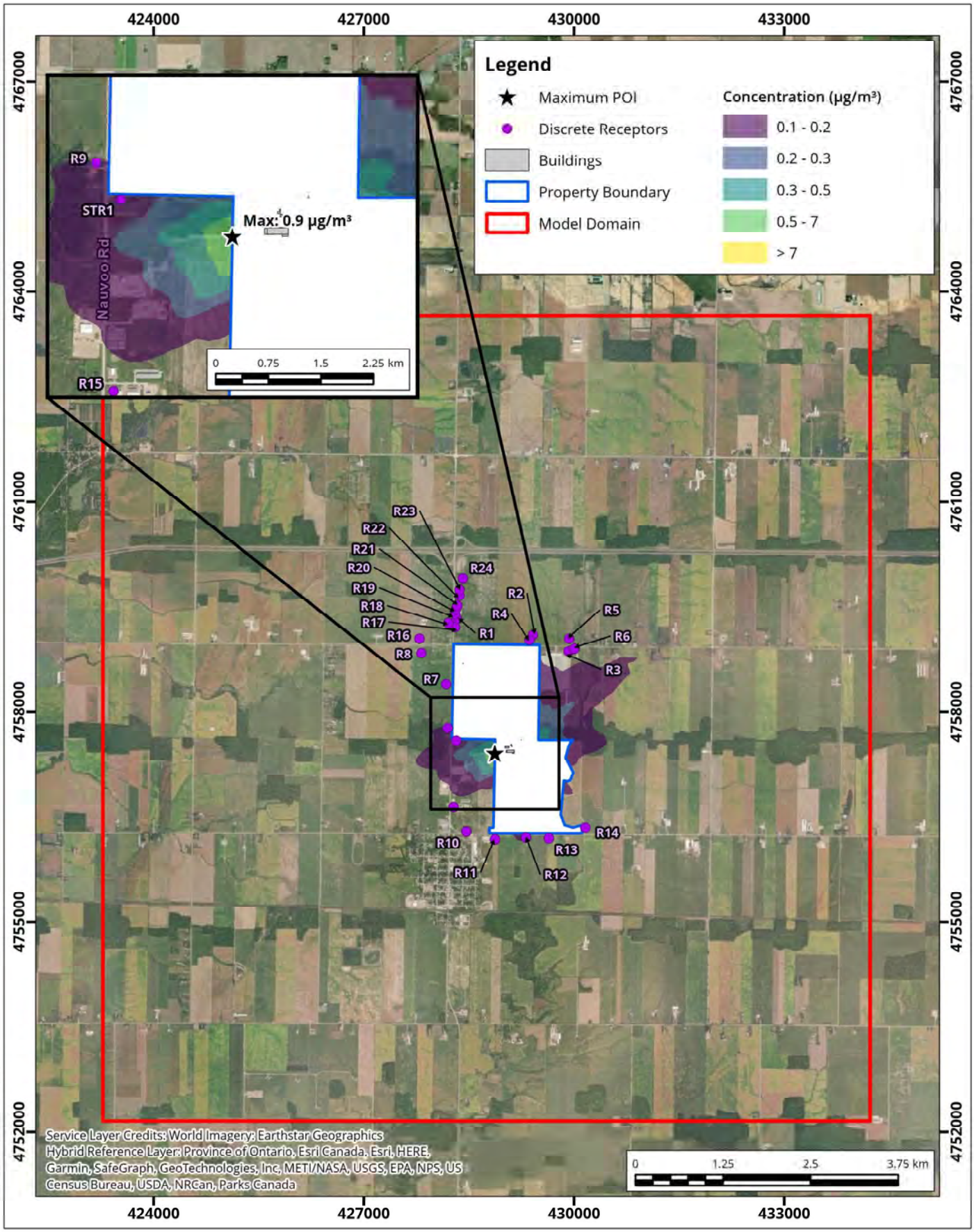
Map Projection: NAD 1983 UTM Zone 17N

Twin Creek Environmental Centre - Watford, ON

Project #: 2101750

Drawn by: RCL	Figure: 12K-1
Approx. Scale:	1:75,000
Date Revised:	Oct 16, 2023

Map Document: C:\GIS\2101750_TwinCreeksEA\12x Figures\P2101750_TCEC_Fig12Kaprx



Predicted 24-Hour Hydrogen Sulphide Concentrations (in µg/m³)

True North

24-Hour Hydrogen Sulphide Criteria = 7 µg/m³

Map Projection: NAD 1983 UTM Zone 17N

Twin Creek Environmental Centre - Watford, ON

Project #: 2101750

Drawn by: RCL	Figure: 12K-2
Approx. Scale:	1:75,000
Date Revised:	Oct 16, 2023

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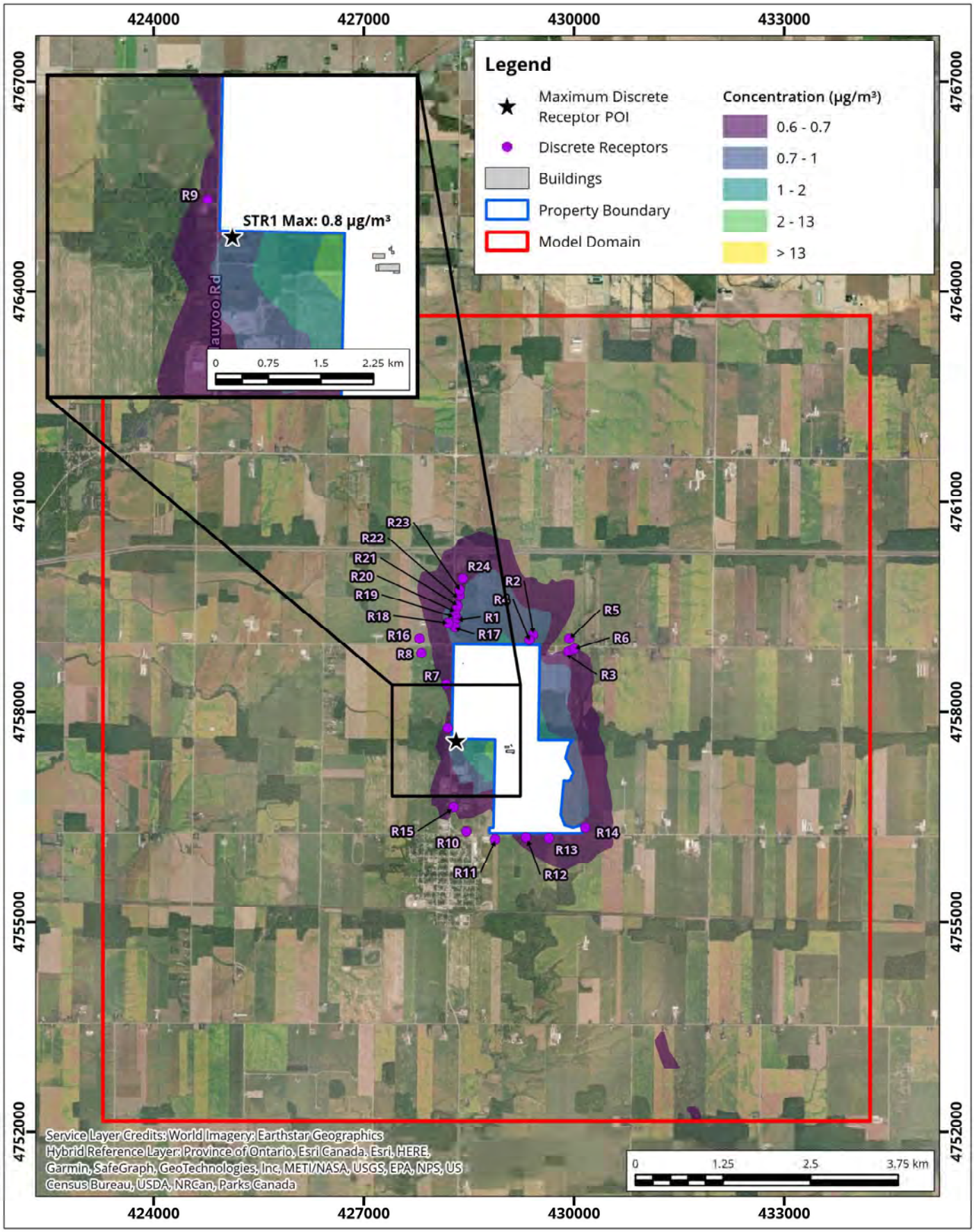

Predicted 10-Minute Total Reduced Sulphurs Concentrations (in µg/m³)

True North

10-Minute Total Reduced Sulphurs Criteria = 13 µg/m³

Map Projection: NAD 1983 UTM Zone 17N

Twin Creek Environmental Centre - Watford, ON

Project #: 2101750

Drawn by: RCL	Figure: 12K-3
Approx. Scale:	1:75,000
Date Revised:	Oct 16, 2023

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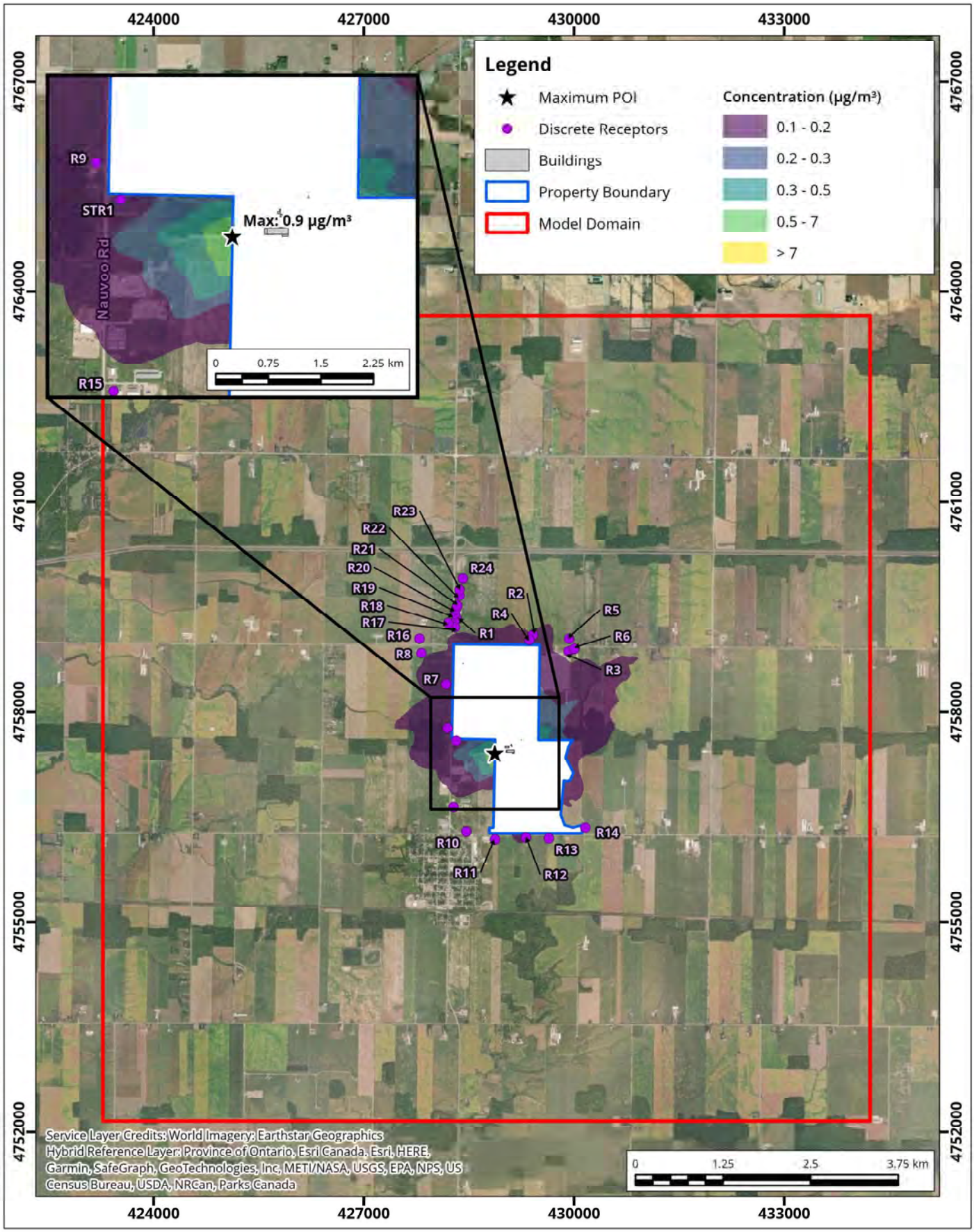


Predicted 24-Hour Total Reduced Suphurs Concentrations (in µg/m³)

True North

24-Hour Total Reduced Sulphurs Criteria = 7 µg/m³

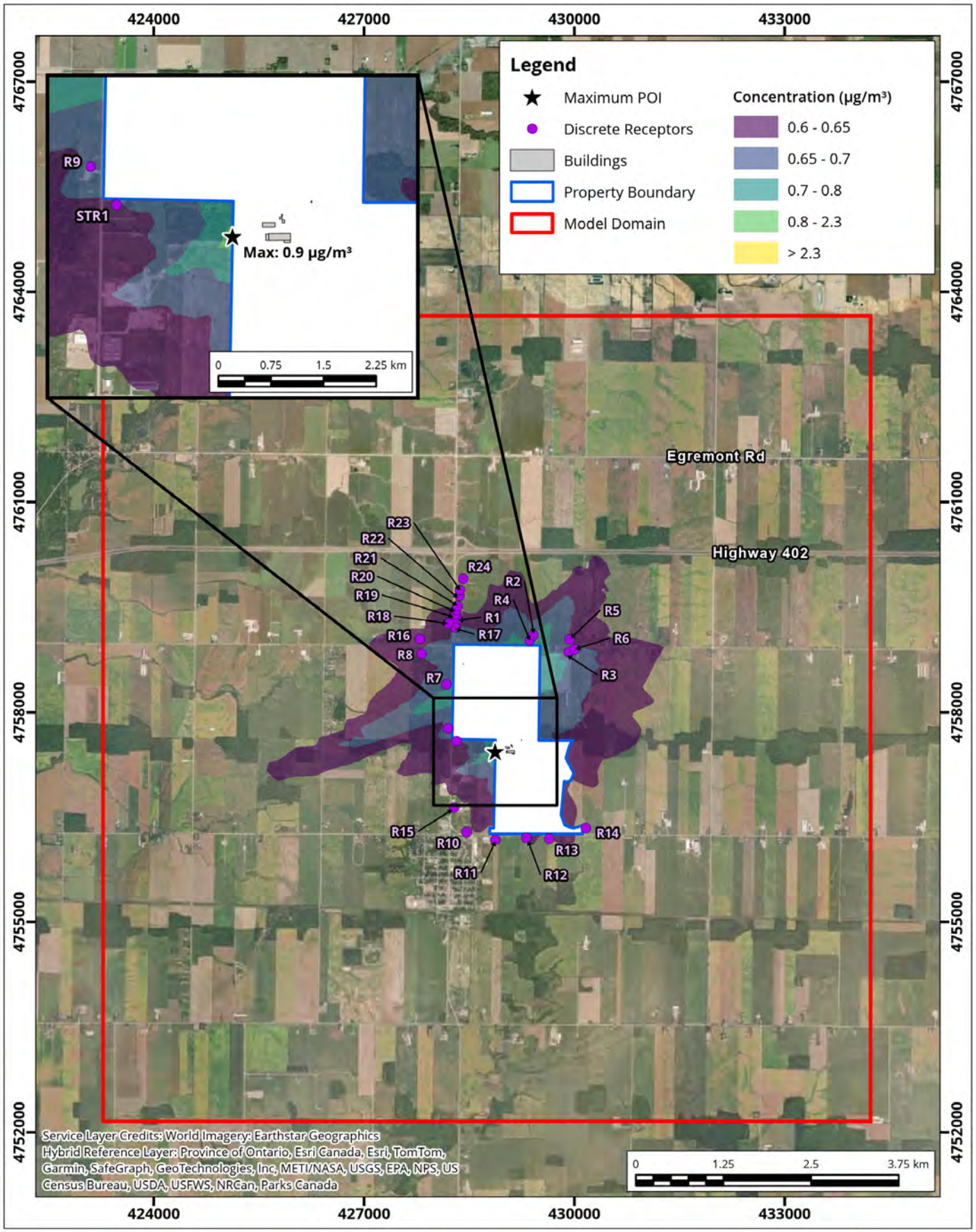
Map Projection: NAD 1983 UTM Zone 17N

Twin Creek Environmental Centre - Watford, ON

Project #: 2101750

Drawn by: RCL	Figure: 12K-4
Approx. Scale:	1:75,000
Date Revised:	Oct 16, 2023

Map Document: C:\GIS\2101750_TwinCreeksEA\12x Figures\P2101750_TCEC_Fig12K.aprx



Predicted 24-Hour Benzene Concentrations (in µg/m³)

True North

24-Hour Benzene Criteria = 2.3 µg/m³
Background = 0.56 µg/m³

Map Projection: NAD 1983 UTM Zone 17N
Twin Creek Environmental Centre - Watford, ON

Project #: 2101750

Drawn by: RCL	Figure: 12K-5
Approx. Scale:	1:75,000
Date Revised:	Jun 26, 2024

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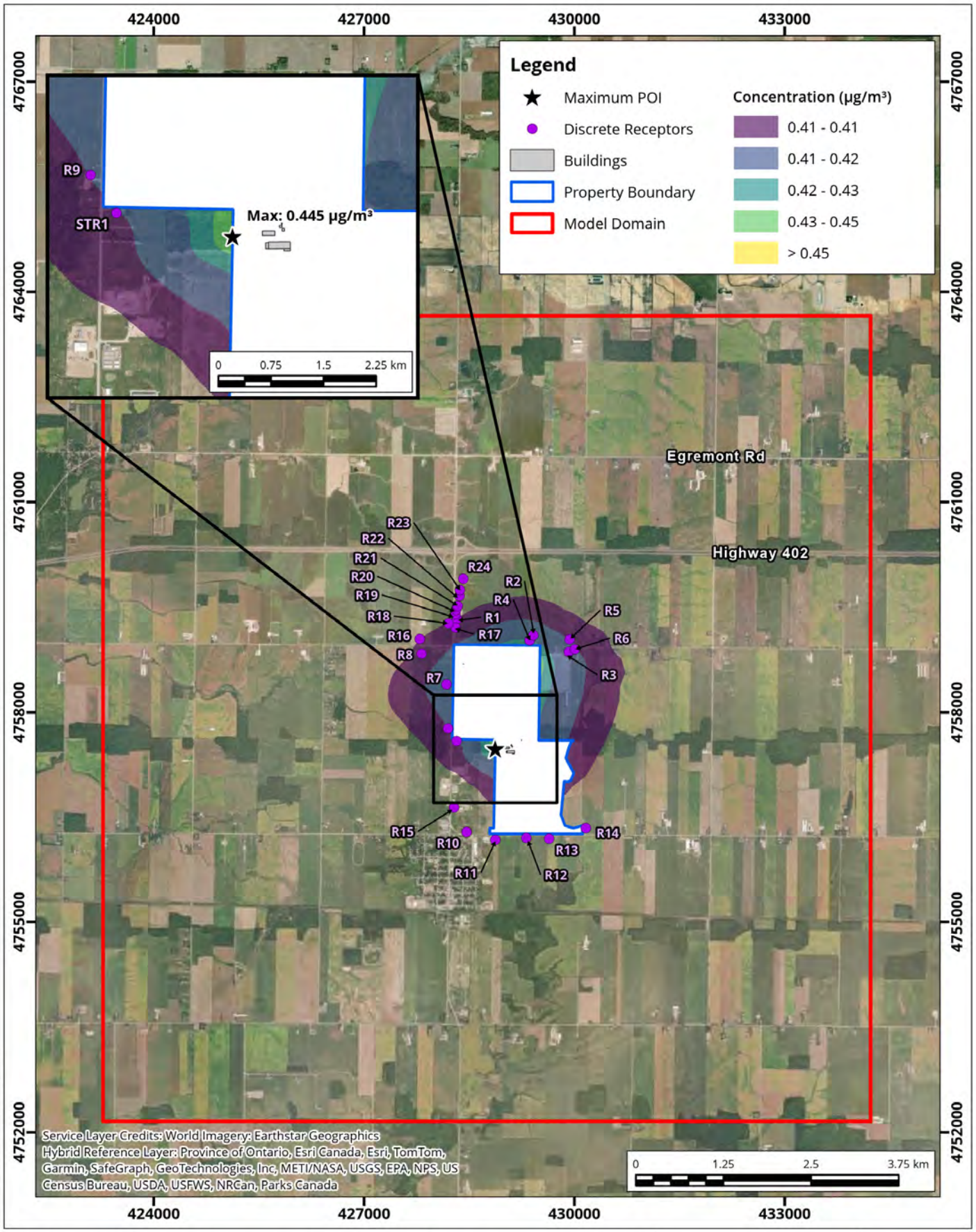

Predicted Annual Benzene Concentrations (in µg/m³)

Map Projection: NAD 1983 UTM Zone 17N
Twin Creek Environmental Centre - Watford, ON

True North

Annual Benzene Criteria = 0.45 µg/m³
Background = 0.4 µg/m³
Project #: 2101750

Drawn by: RCL	Figure: 12K-6
Approx. Scale:	1:75,000
Date Revised:	Jun 26, 2024

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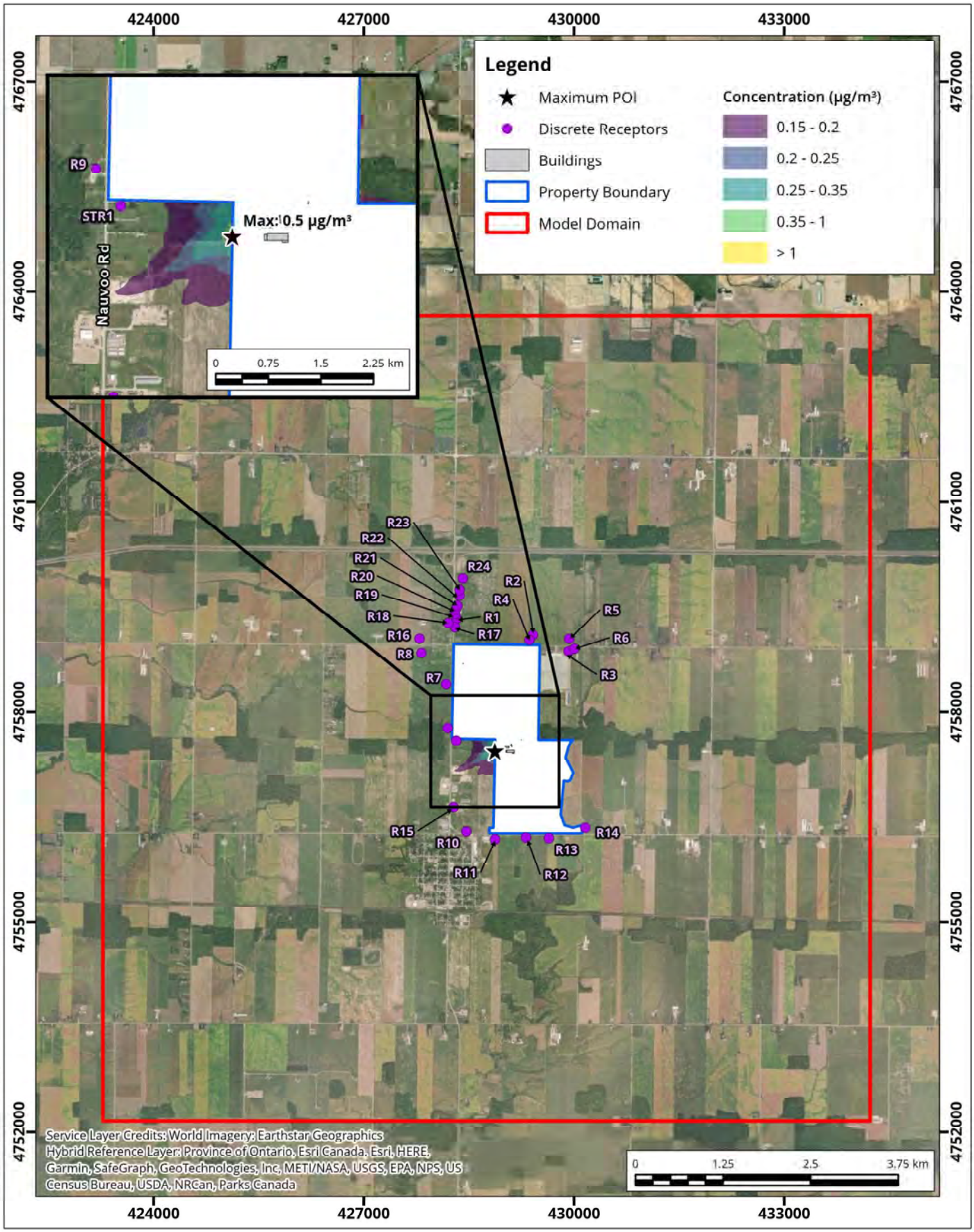

Predicted 24-Hour Vinyl Chloride Concentrations (in µg/m³)

True North

24-Hour Vinyl Chloride Criteria = 1 µg/m³
Background = 0.05 µg/m³

Map Projection: NAD 1983 UTM Zone 17N
Twin Creek Environmental Centre - Watford, ON

Project #: 2101750

Drawn by: RCL	Figure: 12K-7
Approx. Scale:	1:75,000
Date Revised:	Oct 12, 2023

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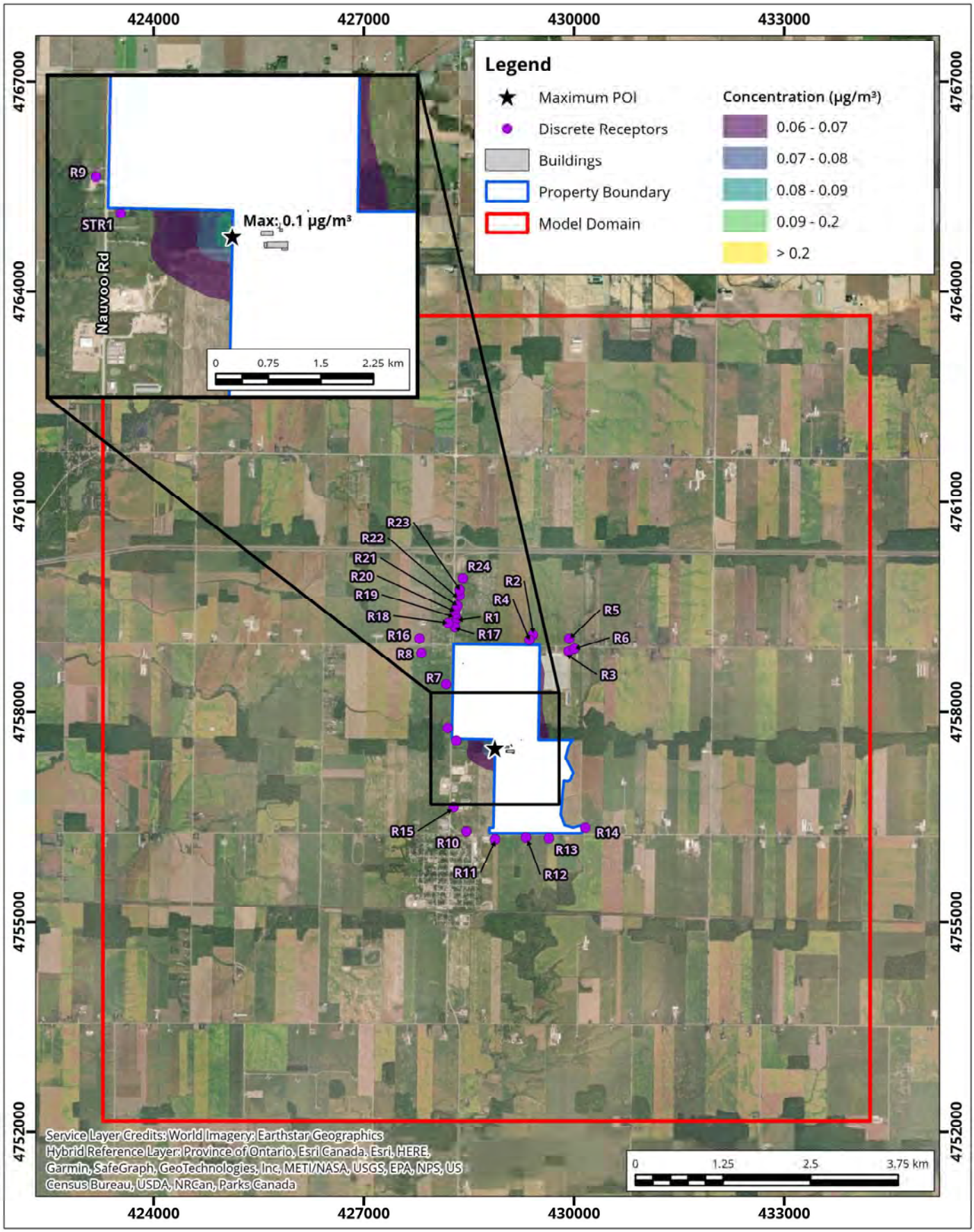

Predicted Annual Vinyl Chloride Concentrations (in µg/m³)

True North

Annual Vinyl Chloride Criteria = 0.2 µg/m³
Background = 0.05 µg/m³

Map Projection: NAD 1983 UTM Zone 17N
Twin Creek Environmental Centre - Watford, ON

Project #: 2101750

Drawn by: RCL	Figure: 12K-8
Approx. Scale:	1:75,000
Date Revised:	Oct 12, 2023

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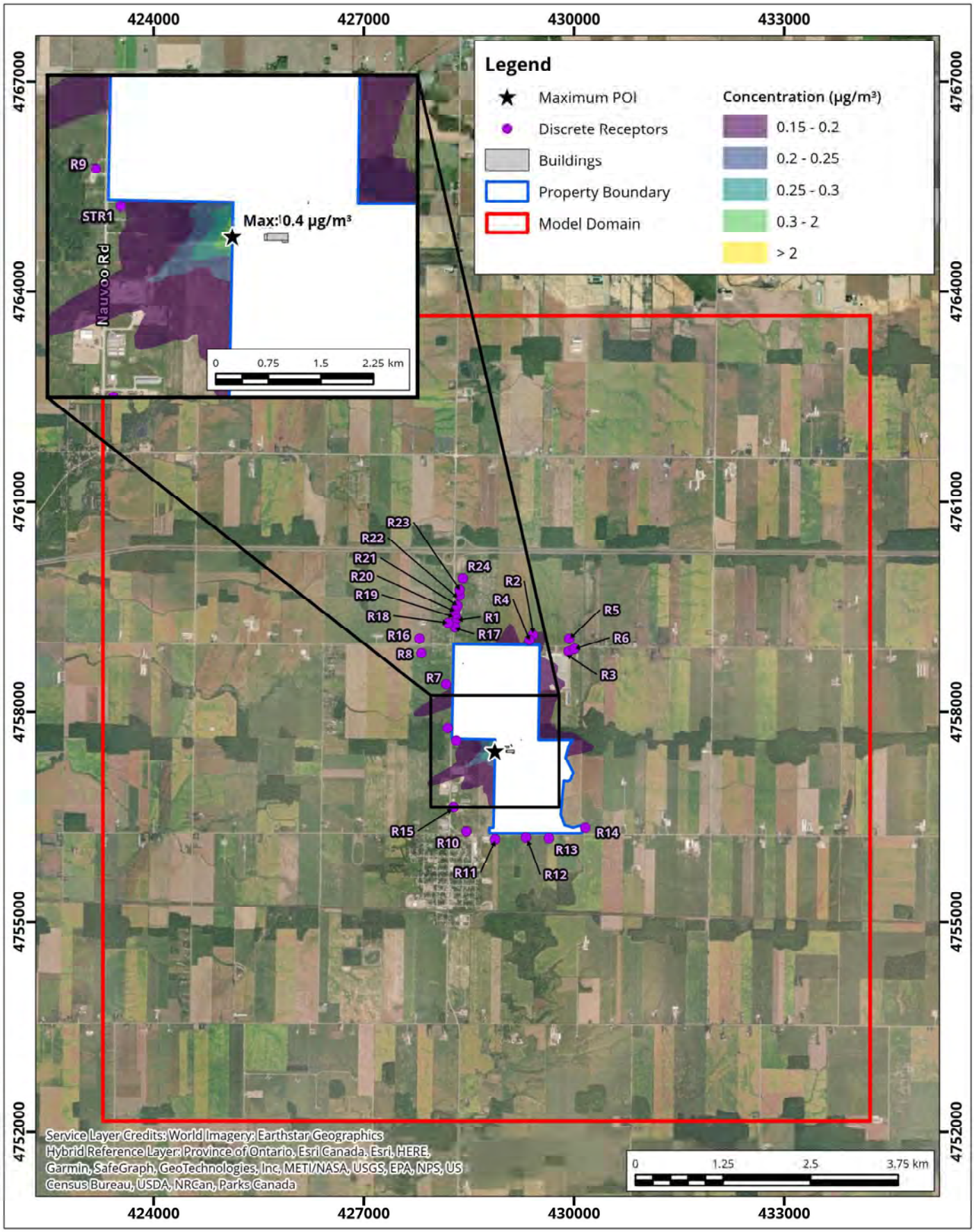

Predicted 24-Hour 1,2-Dichloroethane Concentrations (in µg/m³)

True North

24-Hour 1,2-Dichloroethane Criteria = 2 µg/m³
Background = 0.1 µg/m³

Map Projection: NAD 1983 UTM Zone 17N
Twin Creek Environmental Centre - Watford, ON

Project #: 2101750

Drawn by: RCL	Figure: 12K-9
Approx. Scale:	1:75,000
Date Revised:	Oct 12, 2023

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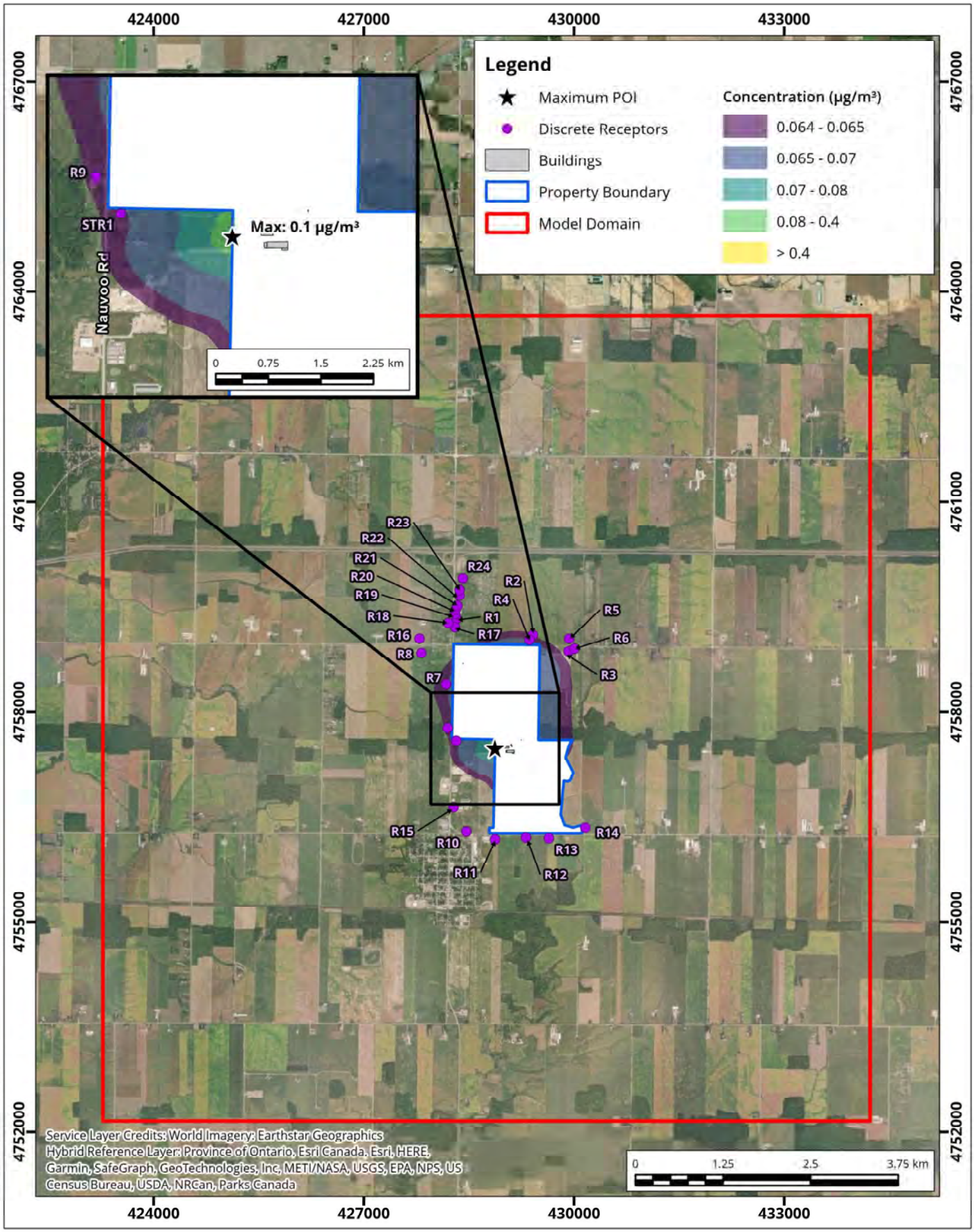


Predicted Annual 1,2-Dichloroethane Concentrations (in µg/m³)

Map Projection: NAD 1983 UTM Zone 17N

Twin Creek Environmental Centre - Watford, ON

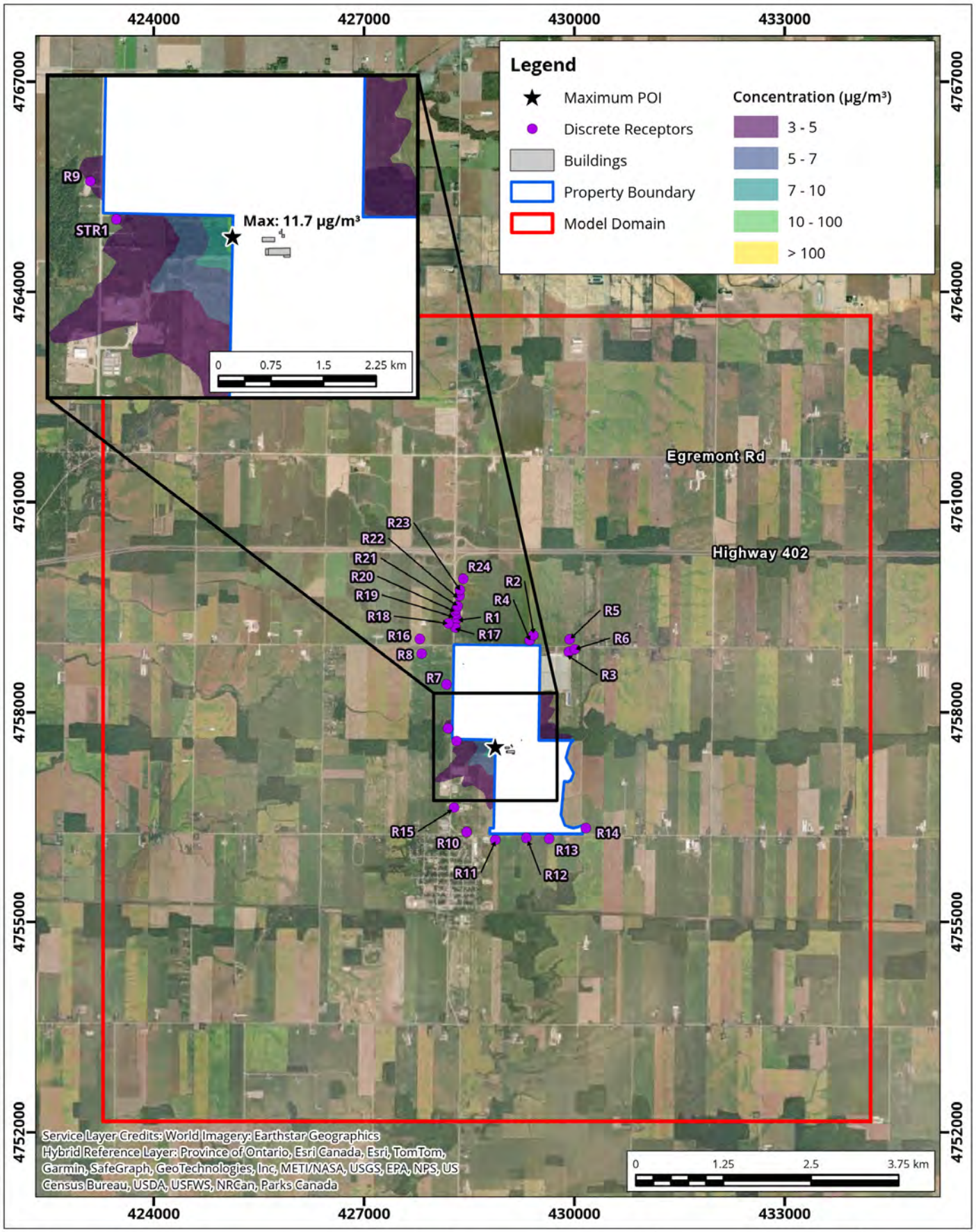
True North

Annual 1,2-Dichloroethane Criteria = 0.4 µg/m³
Background = 0.06 µg/m³

Project #: 2101750

Drawn by: RCL	Figure: 12K-10
Approx. Scale:	1:75,000
Date Revised:	Oct 13, 2023

Map Document: C:\GIS\2101750_TwinCreeksEA\12x Figures\P2101750_TCEC_Fig12K.aprx



Predicted 24-Hour Ammonia Concentration (in µg/m³)

True North

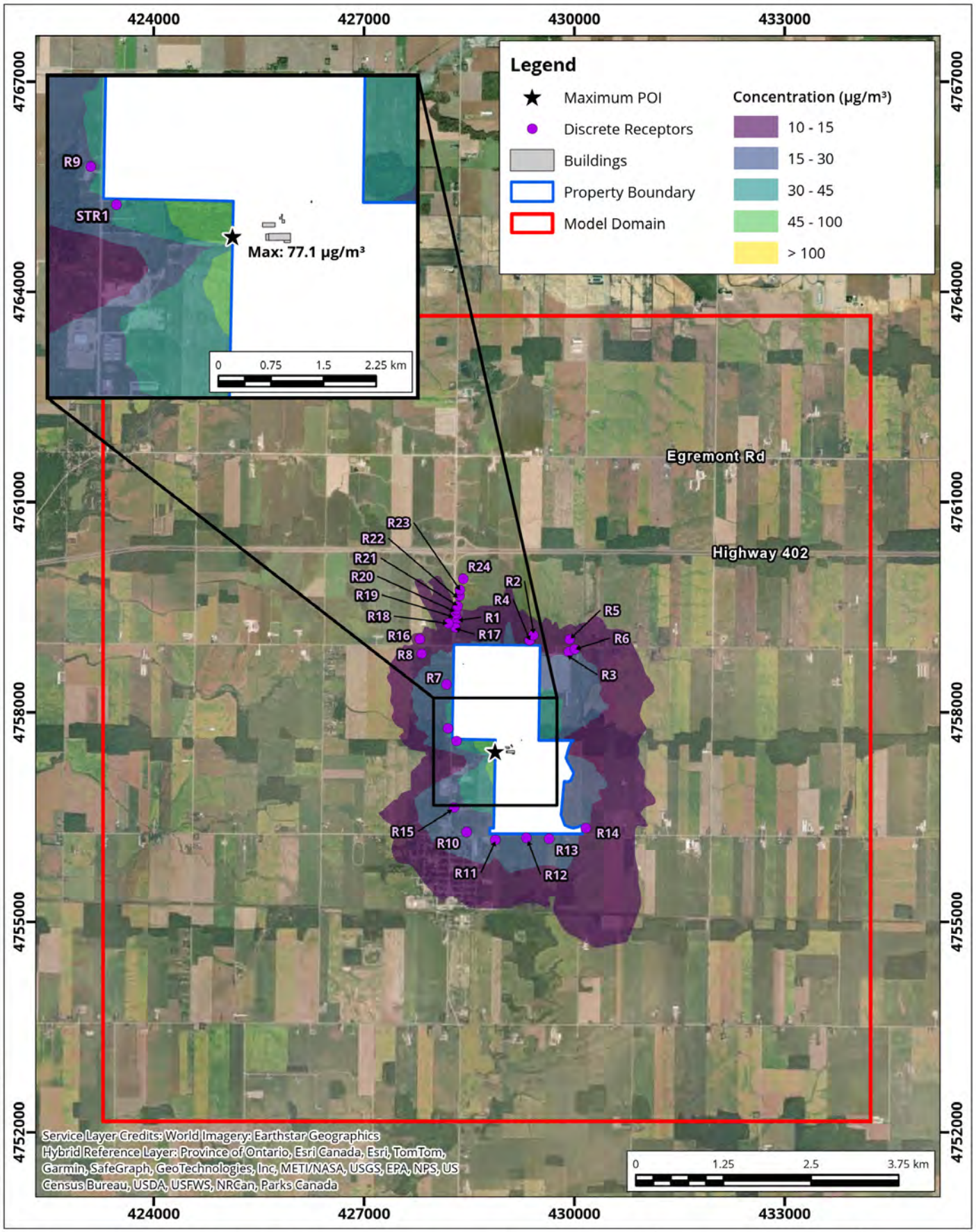
24-Hour Ammonia Criteria = 100 µg/m³
Background = 3.1 µg/m³

Map Projection: NAD 1983 UTM Zone 17N
Twin Creek Environmental Centre - Watford, ON

Project #: 2101750

Drawn by: RCL	Figure:12K-11
Approx. Scale:	1:75,000
Date Revised:	Jun 26, 2024

Map Document: C:\GIS\2101750_TwinCreeksEA\P2101750_TCEC_Figures12_2024.aprx



Predicted 1-Hour Sulphur Dioxide Concentrations (in µg/m³)

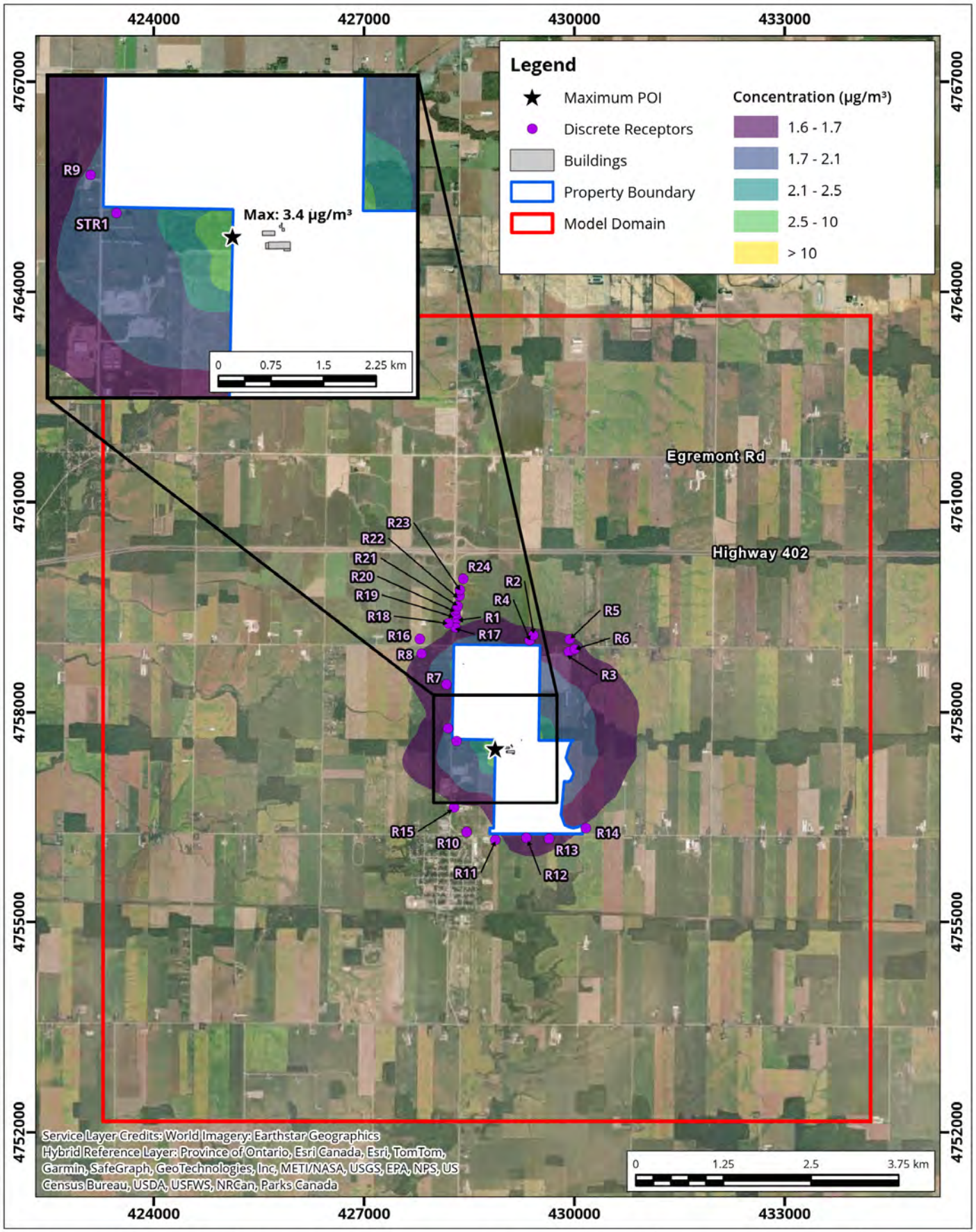
True North

1-Hour Sulphur Dioxide Criteria = 100 µg/m³
Background = 2.4 µg/m³

Map Projection: NAD 1983 UTM Zone 17N
Twin Creek Environmental Centre - Watford, ON
Project #: 2101750

Drawn by: RCL	Figure:12K-12
Approx. Scale:	1:75,000
Date Revised:	Jun 26, 2024

Map Document: C:\GIS\2101750_TwinCreeksEA\P2101750_TCEC_Figures12_2024.aprx



Predicted Annual Sulphur Dioxide Concentrations (in µg/m³)

True North

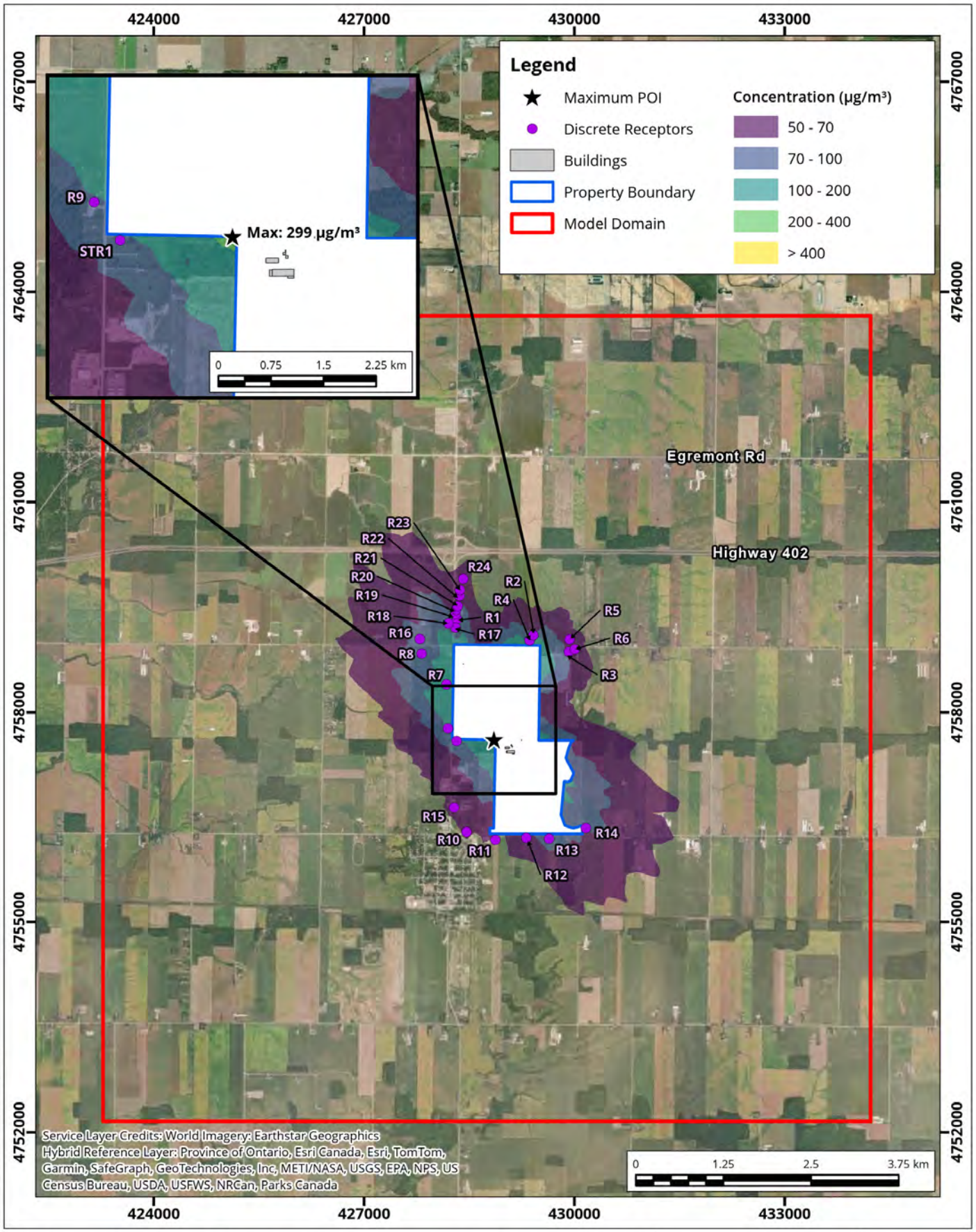
Annual Suphur Dioxide Criteria = 10 µg/m³
Background = 1.4 µg/m³

Map Projection: NAD 1983 UTM Zone 17N
Twin Creek Environmental Centre - Watford, ON

Project #: 2101750

Drawn by: RCL	Figure:12K-13
Approx. Scale:	1:75,000
Date Revised:	Jun 26, 2024

Map Document: C:\GIS\2101750_TwinCreeksEA\P2101750_TCEC_Figures12_2024.aprx



Predicted 1-Hour Nitrogen Oxide Concentrations (in µg/m³)

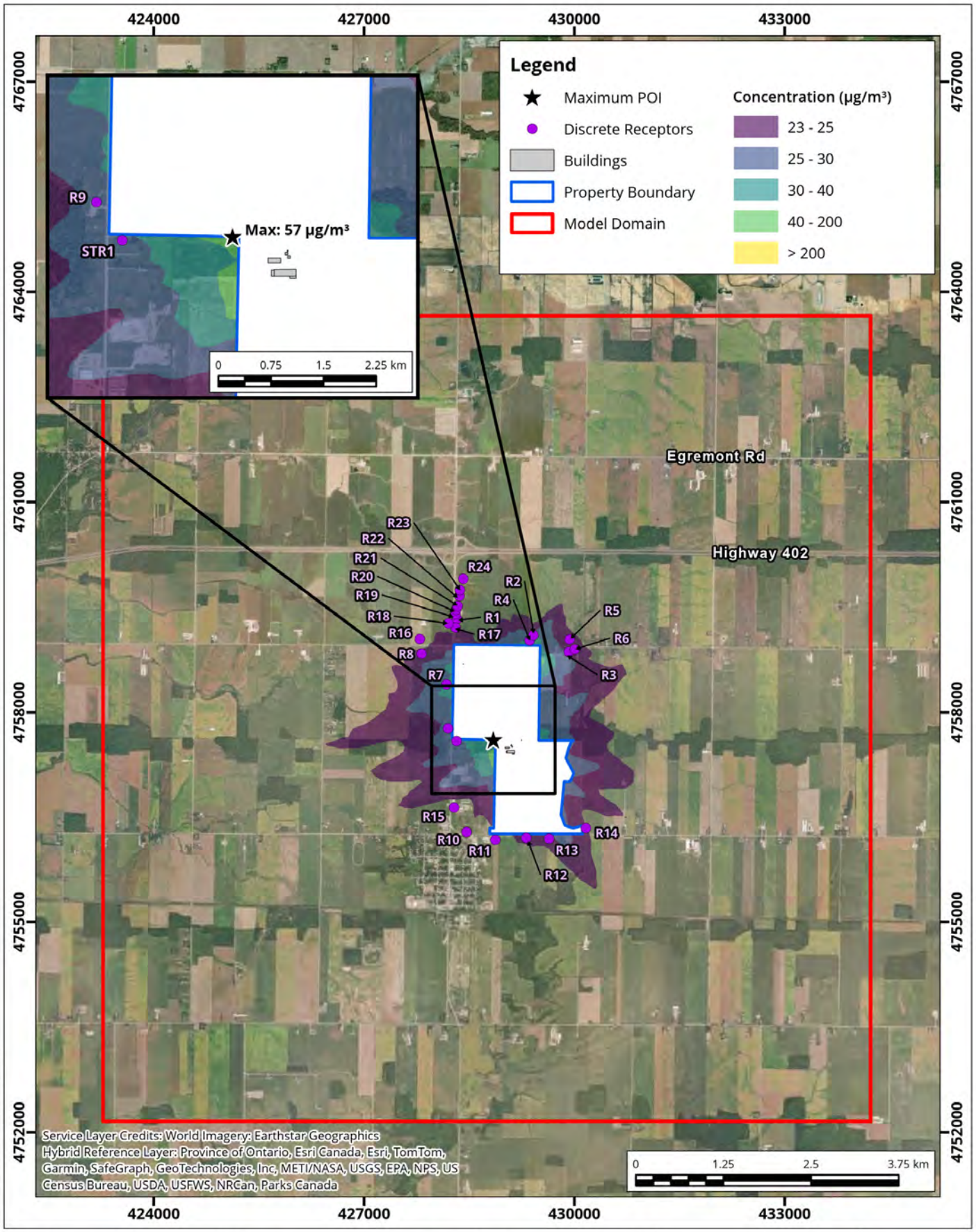
True North

1-Hour Nitrogen Oxide Criteria = 400 µg/m³
Background = 21 µg/m³

Map Projection: NAD 1983 UTM Zone 17N
Twin Creek Environmental Centre - Watford, ON
Project #: 2101750

Drawn by: RCL	Figure:12K-14
Approx. Scale:	1:75,000
Date Revised:	Jun 27, 2024

Map Document: C:\GIS\2101750_TwinCreeksEA\P2101750_TCEC_Figures12_2024.aprx



Predicted 24-Hour Nitrogen Oxide Concentrations (in µg/m³)

True North

24-Hour Nitrogen Oxide Criteria = 200 µg/m³
Background = 19.1 µg/m³

Map Projection: NAD 1983 UTM Zone 17N
Twin Creek Environmental Centre - Watford, ON

Project #: 2101750

Drawn by: RCL	Figure:12K-15
Approx. Scale:	1:75,000
Date Revised:	Jun 27, 2024

Map Document: C:\GIS\2101750_TwinCreeksEA\P2101750_TCEC_Figures12_2024.aprx

APPENDIX 13A

Appendix 13A - Complaints History Summary

Year	Date	Type	Investigation and Corrective Action	Response
2015	Friday, March 20, 2015	Mud	dirt on road	deployed sweeper -continue to do this.
2018	Thursday, December 20, 2018	Road Debris	debris on road (around 11:30 a.m.)	continue to inspect road throughout the day continue to sweep daily
2020	Monday, January 27, 2020	Debris	Continue with sweeping program and advising truck drivers to use designated check areas prior to leaving Site.	No Response at this time
2021	Tuesday, April 20, 2021	Track Out	Equipment dispatched, Haulers complete on site route, additional Operator for Saturday to ensure track out is dealt with at end of day.	Acknowledged.
2021	Friday, June 11, 2021	Merge Lane/Tire Debris	Investigation to identify Hauler and address concerns, continue to advise Haulers of site procedures including importance of North Rd. circle before exiting site, tire check in designated area on site.	Thank you for the response that I don't find satisfactory. The exit from the landfill still remains poorly designed for trucks merging onto Nauvoo Rd and continues to be a hazard for our community safety…
2021	Saturday, August 21, 2021	Track Out	Sweeper Operations dispatched Monday morning at 7 a.m.	Thank you for the update, but should have been cleaned up Saturday not left all weekend. Your company needs to be much more attentive to this matter. It is really growing tiresome for our community. We travelled 16 hours on highways this week and did not see a merge lane or road shoulder that look like the one in front of the landfill with all the debris littered about. Better problem solving needs to be done. It should not be formal complaints that make you attentive for a short period of time.
2021	Wednesday, September 1, 2021	Track Out	Investigation, minimal fluff observed, Sweeper dispatched, corner cleaned.	Make it handier for people to call in-post contact information on Office Door.
2021	Sunday, September 26, 2021	Track Out	Crew dispatched to pick up items, complaint filed.	Was complaint sent to PLC for their information (advised as per 11.3 "Complaints shall be reported to the WPLC at the next WPLC Meeting").
2021	Saturday, October 30, 2021	Track Out	DOM investigated, Sweeper dispatched.	No response at this time.
2022	Wednesday, March 16, 2022	Track Out	Completed Verification as required by D&O, continue to follow Dust BMP	No Response at this time.

APPENDIX 13B

REPORT

WASTE MANAGEMENT OF CANADA CORPORATION

WATFORD, ONTARIO

TWIN CREEKS LANDFILL SITE: BEST MANAGMENET PRACTICES PLAN (DUST) – VERSION 5

RWDI #1600984

April 3, 2017

SUBMITTED TO

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LIST OF ATTACHMENTS

Attachment A: Example Of WM Dust Training Form
Attachment B: Example Of WM Dust Inspection And Dispatch Form
Attachment C: Example Of WM Dust Complaint Form

1 PURPOSE

In an effort to minimize the potential for off-site dust events for the existing and future operations of the Twin Creeks Landfill site, Waste Management of Canada Corporation (WM) has developed this Best Management Practices Plan that outlines measure that will be taken throughout the life of the landfill. Dusts from solid waste landfills can sometimes be difficult to manage, due to various fugitive sources on site. The most effective method of minimizing the potential is to develop this plan identifying the main sources at the site, outlining the intended target and listing the control methods, implementation times and record keeping procedures. The following sections outline the procedure that WM will implement to control the potential for dust emissions from the site.

2 RESPONSIBILITIES

WM is responsible for ensuring the requirements of this plan. To accomplish this, employees will be trained in this plan, including the deployment, maintenance, monitoring and inspections of equipment and operations are carried out and employee's responsibilities will be designated.

The Site Superintendent is responsible for:

- Providing training to staff
- Providing guidance on dust control measures
- Maintaining this plan
- Maintaining a Dust Control log

3 GENERAL INFORMATION

Potential dust sources were grouped into three general categories:

1) Travelled surfaces (dust generated by vehicles travelling on paved and unpaved haul routes located both on-site and off-site). The dust emissions from vehicles travelling on paved and unpaved surfaces includes emissions from tailpipes, brake wear, and tire wear as well as re-suspension of loose material on the road surfaces;
2) Material handling (dust generated during bulldozing, excavation of soil stockpiles and turning of compost, etc.)
3) Fugitive emissions from dusty loads/trucks entering and exiting the site; and
4) Exposed areas (dust generated by wind erosion of stockpiles, unvegetated areas, etc.).

A number of factors are critical to influencing the amount of dust that is generated from the site. Factors affecting dust emissions include:

- Silt loading on roadways – this refers to the amount of loose material on top of paved and unpaved surfaces
- Traffic volume and speed
- Soil characteristics
- Climatic conditions (wind and precipitation)
- Control measures in place (wind screen, stabilization, wet suppression)
- Frequency of mechanical disturbance

Further details are provided in the Design and Operations Plan for the site. [2]

4 TRAINING

The site superintendent will be responsible for identifying a list of personnel who are trained in dust suppression and control. These individuals will have the responsibility to evaluate dust conditions and implement control actions on an on-going basis. The control actions will include road sweeping, road watering, application of stabilizers to exposed surfaces and directing operations to the extreme weather area. The list of individuals identified will be listed in the Dust log as well as the date when they were trained. The list will be updated at annual intervals. **Attachment A** includes an example of the WM Dust Training Log.

As noted in the Design and Operations Plan, an inclement weather area should be defined and utilized under high and sustained moderate wind events. In general winds gusting to or exceeding 47 kilometres per hour (short term events) indicating a high litter event or sustained (hourly or daily) moderate litter events (33 to 47 kilometres per hour) should be considered as trigger for landfilling in the inclement weather area. WM employees will be trained in the procedure for reviewing and documenting the predicted weather (wind) forecast. At a minimum the Environment Canada Weather Office under the current website of www.weatheroffice.gc.ca. will be checked. If the wind events of heavy or sustained moderate levels are forecasted landfilling for the following day will be planned within the inclement weather area (air space permitting). If heavy wind events occur that are not forecasted the operations will be moved to the inclement weather area (air space permitting). The procedure and training may be updated based on actual working conditions as required.

WM representatives will be trained in determining the appropriate speeds for vehicles travelling within the site. Drivers not obeying the speed limit requirements will be warned. If following one warning, the driver continues non-compliance with speed limits, the driver's employer shall be advised and warned in writing. If the non-compliance continues, the driver shall be barred from the site.

WM representatives will also be trained in the recordkeeping and reporting procedures as required.

5 INSPECTION AND MAINTENANCE PROCEDURES

The site superintendent or individuals that have been identified by the site superintendent will be responsible for monitoring site dust conditions. An inspection log will be completed and entered into the dust log. The following items will be inspected and noted twice daily:

- Evaluating the cleanliness of internal and external paved roads. During particularly adverse conditions, wet sweeping and flushing should be dispatched as outlined in the Design and Operations Plan. [2] Under these conditions, wet sweeping is to be done on all internal paved roads and external main access routes. The external haul route sweeping will be limited to off-peak traffic hours for the safety of the operator. The times of sweeping and the operator should be noted in the log. An individual log can be filled out by the sweeper operator and transferred to the dust log on a weekly basis.
- Monitoring of wind conditions from the on-site weather station to see if a move to the heavy weather area is required.
- Ensure that heavy trucks respect the internal speed limits of 20 km/hr for paved roads, 15 km/hr for surface treated roads and 10 km/hr for on-site haul routes and gravel roads. Corrective action will be taken with drivers that disregard this limit including warnings, informing driver's employers and if necessary barring noncomplying driver's from the site.
- Evaluate dust plumes from passing vehicles. The visible plumes behind vehicles should not be greater than ¼ the vehicle length on any surface area on-site. Watering and/or sweeping of roadways should be ordered when this occurs and should continue until the condition abates. The amount of watering and the time of watering should be noted in the log. The inspections are to be completed twice daily and more frequently during dry periods or if plumes from the truck movements are becoming visible.
- General road maintenance inspections will occur on a weekly basis. These inspections will include the physical conditions of the roads and identify corrective actions where required.

The site superintendent and other identified individuals will routinely monitor the condition of stockpiles and exposed areas to ensure that excessive wind erosion is not taking place. If wind erosion from these sources is noted, additional cover treatment should be applied and noted in the log.

Monitoring for Total Suspended Particulate (TSP) will be done on an on-going basis at three locations around the landfill footprint. Total Suspended Particulate samples will be taken on a six-day interval during the months of October through May and samples will be taken on a three-day interval during the months of June through September. The sampling will be in concurrence with the North American-wide particulate monitoring schedule. The sampling will include the entire year (sampling during 12 months per year).

The monitoring method would comply with the methods specified by USEPA Method IO-2. The 24-hour samples would be collected on standard hi-volume air samplers.

The results will be presented in quarterly summary letters and an annual report. The report will include the data in tabular format with a description of the program, quality assurance documentation, details regarding data recovery, abnormal site conditions, etc. As well, any days when the ambient air quality criterion for TSP was exceeded would be reported to the District MOECC office within two (2) weeks of receiving results, as per the terms defined in Regulation 419. In order to enhance the notification of elevated TSP Levels, WM will copy the Township of Warwick on any future elevated TSP level reporting provided to the MOECC.

In addition, the analysis for airborne metals will be completed for 11 of the collected TSP samples per station (total of 33 metal samples per year). The list of metals that will be examined are Lead, Manganese, Chromium, Cadmium, Nickel.

Attachment B includes an example of the WM Dust Inspection and Dispatch Form.

6 CONTROL METHODS FOR IDENTIDIED SOURCES

For areas frequently disturbed or erodible surfaces (e.g., daily cover area, areas on the mound without vegetation and soil stockpiles), water or an encrusting agent should be applied in order to reduce the amount of fugitive dust emissions. If water is used, the exposed areas should only be moistened. Over watering will increase the leachate production on-site.

If visible plumes behind vehicles are greater than ¼ the vehicle length on any surface area on-site. Watering and/or sweeping of roadways should be ordered when this occurs and should continue until the condition abates. The amount of watering and the time of watering should be noted in the log. This can also be applied to the on-site construction haul routes, however, implemented land visible dust plume not greater than one vehicle length.

Constructing additional berms along the haul route. Placing a berm along the west side of the north/south internal haul route should act to block the wind and thus reduce the effects of the wind on vehicles travelling along the internal haul routes. These berms should be vegetated with trees and shrubs as defined in the Design and Operations plan. Additional uses of other berms and windscreens could prove useful and should be considered where problematic dust conditions persist.

The inclement weather area should be utilized under high and sustained moderate wind events. In general winds gusting to or exceeding 47 kilometres per hour (short term events) indicating a high litter event or sustained (hourly or daily) moderate litter events (33 to 47 kilometres per hour) should be considered as trigger for landfilling in the inclement weather area. At a minimum the Environment Canada Weather Office under the current website of www.weatheroffice.gc.ca. will be checked. If the wind events of heavy or sustained moderate levels are forecasted landfilling for the following day will be planned within the inclement weather area (air space permitting). If heavy wind events occur that are not forecasted the operations will be moved to the inclement weather area (air space permitting). Any grading and levelling activities should be minimized when sustained (hourly or daily) wind speeds are greater than 25 km/h.

Muddy areas identified at the active face will be minimized utilizing the application of "shredded fluff" or other appropriate material. This material minimizes the amount of mud that would normally adhere to the truck upon leaving and being tracked out of the site.

7 SCHEDULE OF IMPLEMENTATION

The following table provides the proposed schedule for implementation of the plan:

Table 7.1: Schedule for Control Methods

Task	Implementation Time Lines
Construction of roadway berms	During construction of the first cell excavation
Implementation of activities defined in Section 5	During Construction of First Cell and On-going until site completion
TSP ambient monitoring	During Construction of First Cell and On-going until site completion

8 RECORD KEEPING

Throughout this document there is reference to a Dust log that will be maintained on site. This log will include notation of the items listed previously as well as any other notes relevant to dust at the site. The log will be kept with the landfill annual report that will contain portioned sections for training, inspection, watering activities, road sweeping log, remediation activities, general notes and the complaint logs. The log will contain notations going back no less than 2 years – once implemented.

From time to time there may be complaints regarding dust from the local residents. There will be individual logs with standard forms for dust complaints (**Attachment C**). Sampling logs will include the following at a minimum:

- Name of complainant
- Time of complaint
- Time that the incident occurred
- Nature of complaint
- Operational details at the time of the complaint
- Wind conditions at the time of the complaint
- Details of any investigation

All complaints will be included in the dust log. On an annual basis, the logs will be reviewed and any unfavourable trends will be examined further to identify corrective actions. These corrective actions will be included in the site annual report.

9 ADDITIONAL DUST MONITORING PROVISIONS

As discussed with stakeholders during the consultation for the annual fill rate increase for the site, the following provisions were made for additional monitoring to be completed under specific conditions. The following notes the agreed to provisions for the additional monitoring. In the event that the provision is triggered, WM will prepare an updated Air Quality Monitoring Plan to layout the specific agreed to monitoring approach at the time the additional monitoring provision is required.

As agreed to with stakeholders, in the event that 2 measured exceedances (trigger), that can be attributed to WM operations, in any quarter (excluding periods when on-site cell construction is occurring) occurs, WM is committing to reviewing the data with the Township. Upon confirmation that the exceedances can be attributed to WM operations, and are not related to cell construction, WM will complete the installation of continuous dust monitors.

If continuous dust monitors are to be installed, WM will work with the Township to update the following documents:

- Air Quality Monitoring Plan – updated for equipment change as well as trigger for shorter duration alerts to be issued to WM as warnings for higher dust levels.
- Best Management Practices Plan (Dust) – to be updated to link dust alerts to dust control initiatives.

10REFERENCES

[1] Ontario Ministry of the Environment: Interim Guide to Estimate and Assess Landfill Air Impacts. Air Resources Branch, October 1992.

[2] Henderson Paddon & Associates Limited: Development and Operations Report Warwick Landfill Expansion Waste Management of Canada Corporation Project #105716. March, 2008.

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ATTACHMENT A

Warwick Landfill Best Management Plan
Dust Control Training Log

Trained Employee Name	Date of Training	Supervisor Signature

ATTACHMENT B

Warwick Landfill Best Management Plan
Dust Inspection and Dispatch Log

Inspected By: _____ **Inspection Date:** _____

Areas to inspect include: Travelled Surfaces, Material Handling Areas & Exposed Stockpiles

Area Inspected/Date and Time	Visual Observations/Identified Area/Corrective Actions Required	Corrective Action Completed/Date & Time	Additional Control Action Required	Notes
Example: *Site Entrance Roads to Scale House 11/29/2007 @ 10:00am*	*Dirt build-up on roads, visual plume of dust approaching watering criteria* *Initiate road flushing and sweeping* *Include all paved on-site roads*	*Started 11/29/2007 @ 11:00 am with sweeper* *Stopped 11/29/2007 @ 330pm* *Sweeper traveled 200 metre commencing at site entrance*	*No further action at this time*	*none*

ATTACHMENT C

Warwick Landfill Best Management Plan
Dust Complaint Form

WM Personnel:	

Date of Call		Time of Call	
Complainant Name		Complainant Contact Number	
Complainant Address			

Date of Dust Incident		Time of Dust Incident	
Description of Event			

Operations at Time of Incident	
Winds at Time of Incident	
Investigation Results and Corrective Action	

APPENDIX 13C

Appendix 13C: On-Site Mobile Equipment Emissions Spreadsheet - Fugitive Dust (AM)

Project #2101750

Twin Creeks Environmental Centre - Existing Conditions

UNPAVED ROAD SECTIONS - AP-42 Section 13.2.2
PAVED ROAD SECTIONS - AP-42 Section 13.2.1

Paved Roads: $E = k\,(sL)^{0.91}\,(W)^{1.02}$
Unpaved Roads - Industrial: $E = 281.9\,k\,(s/12)^{a}\,(W/3)^{b}$
Unpaved Roads - Public: $E = 281.9\,k\,(s/12)^{a}\,(S/30)^{d}\,/\,(M/0.5)^{c} - C$

E particulate emission factor (g/VKT)
k particle size multiplier (see below)
sL road surface silt loading (g/m^2)
W average weight of the vehicles traveling the road (US short tons)
s surface material silt content (%)
C emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear
M surface material moisture content (%)
S mean vehicle speed (mph)
a,b,c,d constants (see below)

Route ID [1]	Route Description	Traffic Passes			Segment Length [2]	Road Surface [3]	Roadway Type [4]	Mean Vehicle Speed		Average Vehicle Weight [5]	Surface Material Moisture Content [6]	Surface Silt Content [7]	Road Surface Silt Loading [8]	Base AP-42 Emission Factor			Base Emission Rate			Additional Control Efficiency Applied	Final Controlled Emission Rate					
		Hourly	Daily	Annual										TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$		TSP	Data Quality Rating	PM_{10}	Data Quality Rating	$PM_{2.5}$	Data Quality Rating
		(#/h)	(#/d)	(#/a)	(m)			(km/h)	(mph)	(tons)	(%)	(%)	(g/m^2)	(g/VKT)	(g/VKT)	(g/VKT)	(g/s)	(g/s)	(g/s)	(%)	(g/s)		(g/s)		(g/s)	
PR01	Main Entrance Road	1	1	1	206	Paved	Industrial	10	6	34.6			0.63	1.2E+02	1.5E+01	3.6E+00	6.7E-03	8.6E-04	2.1E-04	90%	6.7E-04		8.6E-05		2.1E-05	
PR01Z	Main Entrance Road, onsite equipment	1	1	1	206	Paved	Industrial	10	6	34.6			0.63	1.2E+02	1.5E+01	3.6E+00	6.7E-03	8.6E-04	2.1E-04	90%	6.7E-04		8.6E-05		2.1E-05	
PR04A	Entrance to Scale House	1	1	1	487	Paved	Industrial	10	6	38.7			0.63	1.3E+02	1.7E+01	4.1E+00	1.8E-02	2.3E-03	5.5E-04	90%	1.8E-03		2.3E-04		5.5E-05	
PR04AZ	Entrance to Scale House, onsite equipment	1	1	1	487	Paved	Industrial	10	6	38.7			0.63	1.3E+02	1.7E+01	4.1E+00	1.8E-02	2.3E-03	5.5E-04	90%	1.8E-03		2.3E-04		5.5E-05	
UR06	Across WF	1	1	1	1366	Unpaved	Industrial	10	6	43.8		16.8%		8.4E+03	1.9E+03	1.9E+02	3.2E+00	7.3E-01	7.3E-02	90%	3.2E-01		7.3E-02		7.3E-03	
UR06Z	Across WF, onsite equipment	1	1	1	1366	Unpaved	Industrial	10	6	43.8		16.8%		8.4E+03	1.9E+03	1.9E+02	3.2E+00	7.3E-01	7.3E-02	90%	3.2E-01		7.3E-02		7.3E-03	
PR08Z	WF to SS/LTF	1	1	1	469	Paved	Industrial	10	6	53.3			3.53	8.7E+02	1.1E+02	2.7E+01	1.1E-01	1.5E-02	3.6E-03	90%	1.1E-02		1.5E-03		3.6E-04	
UR09Z	WF to SS	1	1	1	394	Unpaved	Industrial	10	6	36.4		43.1%		1.4E+04	4.1E+03	4.1E+02	1.5E+00	4.5E-01	4.5E-02	90%	1.5E-01		4.5E-02		4.5E-03	
UR11Z	Across SS	1	1	1	749	Unpaved	Industrial	10	6	50.9		43.1%		1.6E+04	4.8E+03	4.8E+02	3.3E+00	9.9E-01	9.9E-02	90%	3.3E-01		9.9E-02		9.9E-03	
PR13Z	WF to LTF	1	1	1	165	Paved	Industrial	10	6	39.1			3.53	6.3E+02	8.2E+01	2.0E+01	2.9E-02	3.8E-03	9.1E-04	90%	2.9E-03		3.8E-04		9.1E-05	
PR14Z	WF to LTF	1	1	1	61	Paved	Industrial	10	6	44.3			3.53	7.2E+02	9.3E+01	2.3E+01	1.2E-02	1.6E-03	3.8E-04	90%	1.2E-03		1.6E-04		3.8E-05	
UR18Z	Across WF, onsite equipment	1	1	1	45	Unpaved	Industrial	10	6	36.4		44.7%		1.4E+04	4.2E+03	4.2E+02	1.7E-01	5.3E-02	5.3E-03	90%	1.7E-02		5.3E-03		5.3E-04	
PR04B	Scale House to WF	1	1	1	524	Paved	Industrial	10	6	38.7			0.75	1.5E+02	2.0E+01	4.8E+00	2.2E-02	2.9E-03	7.0E-04	90%	2.2E-03		2.9E-04		7.0E-05	
PR04BZ	Scale House to WF, onsite equipment	1	1	1	524	Paved	Industrial	10	6	38.7			0.75	1.5E+02	2.0E+01	4.8E+00	2.2E-02	2.9E-03	7.0E-04	90%	2.2E-03		2.9E-04		7.0E-05	
PR04C	Exit Road from WF	1	1	1	420	Paved	Industrial	10	6	38.7			0.75	1.5E+02	2.0E+01	4.8E+00	1.8E-02	2.3E-03	5.6E-04	90%	1.8E-03		2.3E-04		5.6E-05	
PR04CZ	Exit Road from WF, onsite equipment	1	1	1	420	Paved	Industrial	10	6	38.7			0.75	1.5E+02	2.0E+01	4.8E+00	1.8E-02	2.3E-03	5.6E-04	90%	1.8E-03		2.3E-04		5.6E-05	

Constants for Mobile Emission Equations

Roadway Type	Contaminant	k	a	b	c	d	Quality
Paved Roads:	**$PM_{2.5}$**	0.15	-	-	-	-	-
	PM_{10}	0.62	-	-	-	-	-
	TSP	4.79	-	-	-	-	-
Unpaved Roads - Industrial:	**$PM_{2.5}$**	0.15	0.9	0.45	-	-	C
	PM_{10}	1.5	0.9	0.45	-	-	B
	TSP	7.32	0.6	0.45	-	-	B
Unpaved Roads - Public:	**$PM_{2.5}$**	0.18	1	-	0.2	0.5	C
	PM_{10}	1.8	1	-	0.2	0.5	B
	TSP	8.96	1	-	0.49	0.2	B

[1] Route ID numbers provided on site plan.
[2] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.
[3] Paved surfaces include asphalt, concrete, and recycled asphalt (if it forms a relatively consistent surface).
[4] Publicly accessible and dominated by light vehicles, or industrial, and dominated by heavy vehicles.
[5] The average vehicle weight reflects the average of the empty and loaded vehicle weight, for travel in both directions.
[6] Required only for publicly accessible unpaved roads.
[7] Required only for unpaved roads (public and industrial).
[8] Required only for industrial paved roads.

Sample calculation for uncontrolled TSP emission factor for Source PR01: Main Entrance Road

EF = 281.9 x (4.9) x [(0% / 12)]^(0.7) x [(36.6087628865979 tons) / 3]^(0.45) = 116 g TSP / vehicle kilometer travelled (vkt)

Sample calculation for TSP emission rate for Source PR01: Main Entrance Road

$$\frac{1 \text{ vehicles}}{1 \text{ h}} \left| \frac{206 \text{ m}}{} \right| \frac{1 \text{ km}}{1000 \text{ m}} \left| \frac{116 \text{ } g_{TSP}}{1 \text{ vehicle km}} \right| \frac{1 \text{ h}}{3600 \text{ s}} \left| \frac{0.1 \text{ } g_{TSP\ uncontrolled}}{1 \text{ } g_{TSP}} \right. = 6.7E\text{-}04 \text{ } g_{TSP} / \text{ s}$$

Comments

Appendix 13C: On-Site Mobile Equipment Emissions Spreadsheet - Fugitive Dust (MD)

Project #2101750

Twin Creeks Environmental Centre - Existing Conditions

UNPAVED ROAD SECTIONS - AP-42 Section 13.2.2
PAVED ROAD SECTIONS - AP-42 Section 13.2.1

Paved Roads: $E = k\,(sL)^{0.91}\,(W)^{1.02}$
Unpaved Roads - Industrial: $E = 281.9\,k\,(s/12)^{a}\,(W/3)^{b}$
Unpaved Roads - Public: $E = 281.9\,k\,(s/12)^{a}\,(S/30)^{d}\,/\,(M/0.5)^{c} - C$

E particulate emission factor (g/VKT)
k particle size multiplier (see below)
sL road surface silt loading (g/m^2)
W average weight of the vehicles traveling the road (US short tons)
s surface material silt content (%)
C emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear
M surface material moisture content (%)
S mean vehicle speed (mph)
a,b,c,d constants (see below)

Route ID [1]	Route Description	Traffic Passes [2]			Segment Length [2]	Road Surface [3]	Roadway Type [4]	Mean Vehicle Speed		Average Vehicle Weight [5]	Surface Material Moisture Content [6]	Surface Silt Content [7]	Road Surface Silt Loading [8]	Base AP-42 Emission Factor			Base Emission Rate			Additional Control Efficiency Applied	Final Controlled Emission Rate					
		Hourly	Daily	Annual										TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$		TSP	Data Quality Rating	PM_{10}	Data Quality Rating	$PM_{2.5}$	Data Quality Rating
		(#/h)	(#/d)	(#/a)	(m)			(km/h)	(mph)	(tons)	(%)	(%)	(g/m^2)	(g/VKT)	(g/VKT)	(g/VKT)	(g/s)	(g/s)	(g/s)	(%)	(g/s)		(g/s)		(g/s)	
PR01	Main Entrance Road	1	1	1	206	Paved	Industrial	10	6	34.6			0.63	1.2E+02	1.5E+01	3.6E+00	6.7E-03	8.6E-04	2.1E-04	90%	6.7E-04		8.6E-05		2.1E-05	
PR01Z	Main Entrance Road, onsite equipment	1	1	1	206	Paved	Industrial	10	6	34.6			0.63	1.2E+02	1.5E+01	3.6E+00	6.7E-03	8.6E-04	2.1E-04	90%	6.7E-04		8.6E-05		2.1E-05	
PR04A	Entrance to Scale House	1	1	1	487	Paved	Industrial	10	6	38.7			0.63	1.3E+02	1.7E+01	4.1E+00	1.8E-02	2.3E-03	5.5E-04	90%	1.8E-03		2.3E-04		5.5E-05	
PR04AZ	Entrance to Scale House, onsite equipment	1	1	1	487	Paved	Industrial	10	6	38.7			0.63	1.3E+02	1.7E+01	4.1E+00	1.8E-02	2.3E-03	5.5E-04	90%	1.8E-03		2.3E-04		5.5E-05	
UR06	Across WF	1	1	1	1366	Unpaved	Industrial	10	6	43.8		16.8%		8.4E+03	1.9E+03	1.9E+02	3.2E+00	7.3E-01	7.3E-02	90%	3.2E-01		7.3E-02		7.3E-03	
UR06Z	Across WF, onsite equipment	1	1	1	1366	Unpaved	Industrial	10	6	43.8		16.8%		8.4E+03	1.9E+03	1.9E+02	3.2E+00	7.3E-01	7.3E-02	90%	3.2E-01		7.3E-02		7.3E-03	
PR08Z	WF to SS/LTF	1	1	1	469	Paved	Industrial	10	6	53.3			3.53	8.7E+02	1.1E+02	2.7E+01	1.1E-01	1.5E-02	3.6E-03	90%	1.1E-02		1.5E-03		3.6E-04	
UR09Z	WF to SS	1	1	1	394	Unpaved	Industrial	10	6	36.4		43.1%		1.4E+04	4.1E+03	4.1E+02	1.5E+00	4.5E-01	4.5E-02	90%	1.5E-01		4.5E-02		4.5E-03	
UR11Z	Across SS	1	1	1	749	Unpaved	Industrial	10	6	50.9		43.1%		1.6E+04	4.8E+03	4.8E+02	3.3E+00	9.9E-01	9.9E-02	90%	3.3E-01		9.9E-02		9.9E-03	
PR13Z	WF to LTF	1	1	1	165	Paved	Industrial	10	6	39.1			3.53	6.3E+02	8.2E+01	2.0E+01	2.9E-02	3.8E-03	9.1E-04	90%	2.9E-03		3.8E-04		9.1E-05	
PR14Z	WF to LTF	1	1	1	61	Paved	Industrial	10	6	44.3			3.53	7.2E+02	9.3E+01	2.3E+01	1.2E-02	1.6E-03	3.8E-04	90%	1.2E-03		1.6E-04		3.8E-05	
UR18Z	Across WF, onsite equipment	1	1	1	45	Unpaved	Industrial	10	6	36.4		44.7%		1.4E+04	4.2E+03	4.2E+02	1.7E-01	5.3E-02	5.3E-03	90%	1.7E-02		5.3E-03		5.3E-04	
PR04B	Scale House to WF	1	1	1	524	Paved	Industrial	10	6	38.7			0.75	1.5E+02	2.0E+01	4.8E+00	2.2E-02	2.9E-03	7.0E-04	90%	2.2E-03		2.9E-04		7.0E-05	
PR04BZ	Scale House to WF, onsite equipment	1	1	1	524	Paved	Industrial	10	6	38.7			0.75	1.5E+02	2.0E+01	4.8E+00	2.2E-02	2.9E-03	7.0E-04	90%	2.2E-03		2.9E-04		7.0E-05	
PR04C	Exit Road from WF	1	1	1	420	Paved	Industrial	10	6	38.7			0.75	1.5E+02	2.0E+01	4.8E+00	1.8E-02	2.3E-03	5.6E-04	90%	1.8E-03		2.3E-04		5.6E-05	
PR04CZ	Exit Road from WF, onsite equipment	1	1	1	420	Paved	Industrial	10	6	38.7			0.75	1.5E+02	2.0E+01	4.8E+00	1.8E-02	2.3E-03	5.6E-04	90%	1.8E-03		2.3E-04		5.6E-05	

Constants for Mobile Emission Equations

Roadway Type	Contaminant	k	a	b	c	d	Quality
Paved Roads:	**$PM_{2.5}$**	0.15	-	-	-	-	-
	PM_{10}	0.62	-	-	-	-	-
	TSP	4.79	-	-	-	-	-
Unpaved Roads - Industrial:	**$PM_{2.5}$**	0.15	0.9	0.45	-	-	C
	PM_{10}	1.5	0.9	0.45	-	-	B
	TSP	7.32	0.6	0.45	-	-	B
Unpaved Roads - Public:	**$PM_{2.5}$**	0.18	1	-	0.2	0.5	C
	PM_{10}	1.8	1	-	0.2	0.5	B
	TSP	8.96	1	-	0.49	0.2	B

[1] Route ID numbers provided on site plan.
[2] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.
[3] Paved surfaces include asphalt, concrete, and recycled asphalt (if it forms a relatively consistent surface).
[4] Publicly accessible and dominated by light vehicles, or industrial, and dominated by heavy vehicles.
[5] The average vehicle weight reflects the average of the empty and loaded vehicle weight, for travel in both directions.
[6] Required only for publicly accessible unpaved roads.
[7] Required only for unpaved roads (public and industrial).
[8] Required only for industrial paved roads.

Sample calculation for uncontrolled TSP emission factor for Source PR01: Main Entrance Road

EF = 281.9 x (4.9) x [(0% / 12)]^(0.7) x [(36.6087628865979 tons) / 3]^(0.45) = 116 g TSP / vehicle kilometer travelled (vkt)

Sample calculation for TSP emission rate for Source PR01: Main Entrance Road

$$\frac{1 \text{ vehicles}}{1 \text{ h}} \left| \frac{206 \text{ m}}{} \right| \frac{1 \text{ km}}{1000 \text{ m}} \left| \frac{116 \text{ } g_{TSP}}{1 \text{ vehicle km}} \right| \frac{1 \text{ h}}{3600 \text{ s}} \left| \frac{0.1 \text{ } g_{TSP\ uncontrolled}}{1 \text{ } g_{TSP}} \right. = 6.7E\text{-}04 \text{ } g_{TSP} / \text{ s}$$

Comments

Appendix 13C: On-Site Mobile Equipment Emissions Spreadsheet - Fugitive Dust (PM)

Project #2101750

Twin Creeks Environmental Centre - Existing Conditions

UNPAVED ROAD SECTIONS - AP-42 Section 13.2.2
PAVED ROAD SECTIONS - AP-42 Section 13.2.1

Paved Roads: $E = k\ (sL)^{0.91}\ (W)^{1.02}$
Unpaved Roads - Industrial: $E = 281.9\ k\ (s / 12)^{a}\ (W / 3)^{b}$
Unpaved Roads - Public: $E = 281.9\ k\ (s / 12)^{a}\ (S / 30)^{d} / (M / 0.5)^{c} - C$

E particulate emission factor (g/VKT)
k particle size multiplier (see below)
sL road surface silt loading (g/m^2)
W average weight of the vehicles traveling the road (US short tons)
s surface material silt content (%)
C emission factor for 1980's vehicle fleet exhaust, brake wear and tire wear
M surface material moisture content (%)
S mean vehicle speed (mph)
a,b,c,d constants (see below)

Route ID [1]	Route Description	Traffic Passes [2]			Segment Length [2]	Road Surface [3]	Roadway Type [4]	Mean Vehicle Speed		Average Vehicle Weight [5]	Surface Material Moisture Content [6]	Surface Silt Content [7]	Road Surface Silt Loading [8]	Base AP-42 Emission Factor			Base Emission Rate			Additional Control Efficiency Applied	Final Controlled Emission Rate					
		Hourly	Daily	Annual										TSP	PM_{10}	$PM_{2.5}$	TSP	PM_{10}	$PM_{2.5}$		TSP	Data Quality Rating	PM_{10}	Data Quality Rating	$PM_{2.5}$	Data Quality Rating
		(#/h)	(#/d)	(#/a)	(m)			(km/h)	(mph)	(tons)	(%)	(%)	(g/m^2)	(g/VKT)	(g/VKT)	(g/VKT)	(g/s)	(g/s)	(g/s)	(%)	(g/s)		(g/s)		(g/s)	
PR01	Main Entrance Road	1	1	1	206	Paved	Industrial	10	6	34.6			0.63	1.2E+02	1.5E+01	3.6E+00	6.7E-03	8.6E-04	2.1E-04	90%	6.7E-04		8.6E-05		2.1E-05	
PR01Z	Main Entrance Road, onsite equipment	1	1	1	206	Paved	Industrial	10	6	34.6			0.63	1.2E+02	1.5E+01	3.6E+00	6.7E-03	8.6E-04	2.1E-04	90%	6.7E-04		8.6E-05		2.1E-05	
PR04A	Entrance to Scale House	1	1	1	487	Paved	Industrial	10	6	38.7			0.63	1.3E+02	1.7E+01	4.1E+00	1.8E-02	2.3E-03	5.5E-04	90%	1.8E-03		2.3E-04		5.5E-05	
PR04AZ	Entrance to Scale House, onsite equipment	1	1	1	487	Paved	Industrial	10	6	38.7			0.63	1.3E+02	1.7E+01	4.1E+00	1.8E-02	2.3E-03	5.5E-04	90%	1.8E-03		2.3E-04		5.5E-05	
UR06	Across WF	1	1	1	1366	Unpaved	Industrial	10	6	43.8		16.8%		8.4E+03	1.9E+03	1.9E+02	3.2E+00	7.3E-01	7.3E-02	90%	3.2E-01		7.3E-02		7.3E-03	
UR06Z	Across WF, onsite equipment	1	1	1	1366	Unpaved	Industrial	10	6	43.8		16.8%		8.4E+03	1.9E+03	1.9E+02	3.2E+00	7.3E-01	7.3E-02	90%	3.2E-01		7.3E-02		7.3E-03	
PR08Z	WF to SS/LTF	1	1	1	469	Paved	Industrial	10	6	53.3			3.53	8.7E+02	1.1E+02	2.7E+01	1.1E-01	1.5E-02	3.6E-03	90%	1.1E-02		1.5E-03		3.6E-04	
UR09Z	WF to SS	1	1	1	394	Unpaved	Industrial	10	6	36.4		43.1%		1.4E+04	4.1E+03	4.1E+02	1.5E+00	4.5E-01	4.5E-02	90%	1.5E-01		4.5E-02		4.5E-03	
UR11Z	Across SS	1	1	1	749	Unpaved	Industrial	10	6	50.9		43.1%		1.6E+04	4.8E+03	4.8E+02	3.3E+00	9.9E-01	9.9E-02	90%	3.3E-01		9.9E-02		9.9E-03	
PR13Z	WF to LTF	1	1	1	165	Paved	Industrial	10	6	39.1			3.53	6.3E+02	8.2E+01	2.0E+01	2.9E-02	3.8E-03	9.1E-04	90%	2.9E-03		3.8E-04		9.1E-05	
PR14Z	WF to LTF	1	1	1	61	Paved	Industrial	10	6	44.3			3.53	7.2E+02	9.3E+01	2.3E+01	1.2E-02	1.6E-03	3.8E-04	90%	1.2E-03		1.6E-04		3.8E-05	
UR18Z	Across WF, onsite equipment	1	1	1	45	Unpaved	Industrial	10	6	36.4		44.7%		1.4E+04	4.2E+03	4.2E+02	1.7E-01	5.3E-02	5.3E-03	90%	1.7E-02		5.3E-03		5.3E-04	
PR04B	Scale House to WF	1	1	1	524	Paved	Industrial	10	6	38.7			0.75	1.5E+02	2.0E+01	4.8E+00	2.2E-02	2.9E-03	7.0E-04	90%	2.2E-03		2.9E-04		7.0E-05	
PR04BZ	Scale House to WF, onsite equipment	1	1	1	524	Paved	Industrial	10	6	38.7			0.75	1.5E+02	2.0E+01	4.8E+00	2.2E-02	2.9E-03	7.0E-04	90%	2.2E-03		2.9E-04		7.0E-05	
PR04C	Exit Road from WF	1	1	1	420	Paved	Industrial	10	6	38.7			0.75	1.5E+02	2.0E+01	4.8E+00	1.8E-02	2.3E-03	5.6E-04	90%	1.8E-03		2.3E-04		5.6E-05	
PR04CZ	Exit Road from WF, onsite equipment	1	1	1	420	Paved	Industrial	10	6	38.7			0.75	1.5E+02	2.0E+01	4.8E+00	1.8E-02	2.3E-03	5.6E-04	90%	1.8E-03		2.3E-04		5.6E-05	

Constants for Mobile Emission Equations

Roadway Type	Contaminant	k	a	b	c	d	Quality
Paved Roads:	**$PM_{2.5}$**	0.15	-	-	-	-	-
	PM_{10}	0.62	-	-	-	-	-
	TSP	4.79	-	-	-	-	-
Unpaved Roads - Industrial:	**$PM_{2.5}$**	0.15	0.9	0.45	-	-	C
	PM_{10}	1.5	0.9	0.45	-	-	B
	TSP	7.32	0.6	0.45	-	-	B
Unpaved Roads - Public:	**$PM_{2.5}$**	0.18	1	-	0.2	0.5	C
	PM_{10}	1.8	1	-	0.2	0.5	B
	TSP	8.96	1	-	0.49	0.2	B

[1] Route ID numbers provided on site plan.
[2] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.
[3] Paved surfaces include asphalt, concrete, and recycled asphalt (if it forms a relatively consistent surface).
[4] Publicly accessible and dominated by light vehicles, or industrial, and dominated by heavy vehicles.
[5] The average vehicle weight reflects the average of the empty and loaded vehicle weight, for travel in both directions.
[6] Required only for publicly accessible unpaved roads.
[7] Required only for unpaved roads (public and industrial).
[8] Required only for industrial paved roads.

Sample calculation for uncontrolled TSP emission factor for Source PR01: Main Entrance Road

EF = 281.9 x (4.9) x [(0% / 12)]^(0.7) x [(36.6087628865979 tons) / 3]^(0.45) = 116 g TSP / vehicle kilometer travelled (vkt)

Sample calculation for TSP emission rate for Source PR01: Main Entrance Road

$$\frac{1 \text{ vehicles}}{1 \text{ h}} \left| \frac{206 \text{ m}}{} \right| \frac{1 \text{ km}}{1000 \text{ m}} \left| \frac{116 \text{ } g_{TSP}}{1 \text{ vehicle km}} \right| \frac{1 \text{ h}}{3600 \text{ s}} \left| \frac{0.1 \text{ } g_{TSP\ uncontrolled}}{1 \text{ } g_{TSP}} \right. = 6.7E\text{-}04 \text{ } g_{TSP} / \text{ s}$$

Comments

Appendix 13C: Silt Loading - Paved Roads

Project #2101750

Twin Creeks Environmental Centre - Existing Conditions

Sample ID	Sampled Area Dimensions		Area	Combined Area	Lab ID	Lab Measured Dry Weight of Sample (g)	Weight of Sample per m^2 (g/m^2)	Silt %	Silt loading (g/m2)
	length (m)	width (m)	m^2	m^2					
PR1	7.0	12.7	89.0	89.0	WT2217491-001	81.90	0.92	0.50	0.46
PR2	3.3	3.6	11.9	41.7	WT2217491-002	81.10	1.94	0.41	0.80
	6.7	4.4	29.8						
PR3	5.3	3.7	19.5	28.8	WT2217491-003	115.50	4.01	0.19	0.75
	3.5	2.6	9.3						
PR4	1.1	6.6	7.3	7.3	WT2217491-004	100.20	13.80	0.26	3.53
								Average Silt Loading:	1.38

APPENDIX 13D

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, AM

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Tailpipe Emission Factor [5] TSP PM (g/vkt)	TSP PM (g/h)	PM10 PM10 (g/vkt)	PM10 PM10 (g/h)	PM2.5 PM25 (g/vkt)	PM2.5 PM25 (g/h)	Benzene 71-43-2 (g/vkt)	Benzene 71-43-2 (g/h)	Ammonia 7664-41-7 (g/vkt)	Ammonia 7664-41-7 (g/h)	Nitrogen Dioxide NO2 (g/vkt)	Nitrogen Dioxide NO2 (g/h)	Nitrogen Oxides 10102-44-0 (g/vkt)	Nitrogen Oxides 10102-44-0 (g/h)
Mobile Equipment																				
PR01	Main Entrance Road	1	1	206	10	100%	6.65E+00	0.00E+00	6.65E+00	0.00E+00	9.24E-01	0.00E+00	2.09E-03	0.00E+00	4.13E-02	0.00E+00	3.58E+00	0.00E+00	9.80E+00	0.00E+00
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	0.00E+00	3.00E+00	0.00E+00	3.00E+00	0.00E+00	4.15E-01	0.00E+00	4.82E-04	0.00E+00	1.67E-02	0.00E+00	1.62E+00	0.00E+00	4.42E+00
PR04A	Entrance to Scale House	1	1	487	10	100%	6.65E+00	0.00E+00	6.65E+00	0.00E+00	9.24E-01	0.00E+00	2.09E-03	0.00E+00	4.13E-02	0.00E+00	3.58E+00	0.00E+00	9.80E+00	0.00E+00
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	0.00E+00	3.65E+00	0.00E+00	3.65E+00	0.00E+00	5.05E-01	0.00E+00	9.00E-04	0.00E+00	2.16E-02	0.00E+00	1.97E+00	0.00E+00	5.37E+00
UR06	Across WF	1	1	1366	10	100%	6.65E+00	0.00E+00	6.65E+00	0.00E+00	9.24E-01	0.00E+00	2.09E-03	0.00E+00	4.13E-02	0.00E+00	3.58E+00	0.00E+00	9.80E+00	0.00E+00
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	0.00E+00	1.96E+00	0.00E+00	1.96E+00	0.00E+00	1.46E+00	0.00E+00	9.39E-02	0.00E+00	1.03E+00	0.00E+00	2.55E-01	0.00E+00	3.24E+01
PR08Z	WF to SS/LTF	1	1	469	10	100%	0.00E+00	7.34E+00	0.00E+00	7.34E+00	0.00E+00	1.42E+00	0.00E+00	3.27E-02	0.00E+00	3.87E-01	0.00E+00	3.70E+00	0.00E+00	2.09E+01
UR09Z	WF to SS	1	1	394	10	100%	0.00E+00	4.09E-01	0.00E+00	4.09E-01	0.00E+00	3.97E-01	0.00E+00	2.65E-02	0.00E+00	2.93E-01	0.00E+00	0.00E+00	0.00E+00	9.10E+00
UR11Z	Across SS	1	1	749	10	100%	0.00E+00	7.78E-01	0.00E+00	7.78E-01	0.00E+00	7.55E-01	0.00E+00	5.05E-02	0.00E+00	5.57E-01	0.00E+00	0.00E+00	0.00E+00	1.73E+01
PR13Z	WF to LTF	1	1	165	10	100%	0.00E+00	2.57E+00	0.00E+00	2.57E+00	0.00E+00	4.97E-01	0.00E+00	1.15E-02	0.00E+00	1.36E-01	0.00E+00	1.30E+00	0.00E+00	7.33E+00
PR14Z	WF to LTF	1	1	61	10	100%	0.00E+00	8.83E-01	0.00E+00	8.83E-01	0.00E+00	1.22E-01	0.00E+00	1.42E-04	0.00E+00	4.90E-03	0.00E+00	4.78E-01	0.00E+00	1.30E+00
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	0.00E+00	6.43E-02	0.00E+00	6.43E-02	0.00E+00	4.78E-02	0.00E+00	3.07E-03	0.00E+00	3.36E-02	0.00E+00	8.35E-03	0.00E+00	1.06E+00
PR04B	Scale House to WF	1	1	524	10	100%	6.65E+00	0.00E+00	6.65E+00	0.00E+00	9.24E-01	0.00E+00	2.09E-03	0.00E+00	4.13E-02	0.00E+00	3.58E+00	0.00E+00	9.80E+00	0.00E+00
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	0.00E+00	7.90E+00	0.00E+00	7.90E+00	0.00E+00	1.09E+00	0.00E+00	2.08E-03	0.00E+00	4.73E-02	0.00E+00	4.25E+00	0.00E+00	1.16E+01
PR04C	Exit Road from WF	1	1	420	10	100%	6.65E+00	0.00E+00	6.65E+00	0.00E+00	9.24E-01	0.00E+00	2.09E-03	0.00E+00	4.13E-02	0.00E+00	3.58E+00	0.00E+00	9.80E+00	0.00E+00
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	0.00E+00	3.15E+00	0.00E+00	3.15E+00	0.00E+00	4.36E-01	0.00E+00	7.77E-04	0.00E+00	1.87E-02	0.00E+00	1.70E+00	0.00E+00	4.64E+00
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	--	--	--	--	--	--	--	--	--	--	--	--	--	--
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	0.00E+00	1.02E+01	0.00E+00	1.02E+01	0.00E+00	9.90E+00	0.00E+00	6.51E-01	0.00E+00	3.01E+00	0.00E+00	0.00E+00	0.00E+00	1.67E+02
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	0.00E+00	1.96E+00	0.00E+00	1.96E+00	0.00E+00	1.90E+00	0.00E+00	1.37E-01	0.00E+00	8.13E-01	0.00E+00	0.00E+00	0.00E+00	3.38E+01
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	0.00E+00	2.88E+00	0.00E+00	2.88E+00	0.00E+00	2.80E+00	0.00E+00	2.13E-01	0.00E+00	4.27E-01	0.00E+00	0.00E+00	0.00E+00	3.70E+01
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	0.00E+00	1.04E+00	0.00E+00	1.04E+00	0.00E+00	1.01E+00	0.00E+00	6.00E-02	0.00E+00	1.20E+00	0.00E+00	0.00E+00	0.00E+00	3.06E+01

[1] ID should reflect Source ID or Route ID, as appropriate.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes). For idling, this is the number of trucks idling per hour.

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Emissions are input on either a vehicle distance or operation time basis.

[5] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, AM

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Sulphur Dioxide 7446-09-5 (g/vkt)	Sulphur Dioxide 7446-09-5 (g/h)	Carbon Dioxide 124-38-9 (g/vkt)	Carbon Dioxide 124-38-9 (g/h)	Methane 74-82-8 (g/vkt)	Methane 74-82-8 (g/h)	Nitrous Oxide 10024-97-2 (g/vkt)	Nitrous Oxide 10024-97-2 (g/h)	Source ID	TSP PM (g/s)
Mobile Equipment															**Mobile Equipment**	
PR01	Main Entrance Road	1	1	206	10	100%	1.15E-02	0.00E+00	1.83E+03	0.00E+00	5.72E-02	0.00E+00	1.35E-02	0.00E+00	PR01	3.80E-04
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	0.00E+00	4.74E-03	0.00E+00	7.88E+02	0.00E+00	2.40E-02	0.00E+00	5.49E-03	PR01Z	8.34E-04
PR04A	Entrance to Scale House	1	1	487	10	100%	1.15E-02	0.00E+00	1.83E+03	0.00E+00	5.72E-02	0.00E+00	1.35E-02	0.00E+00	PR04A	8.99E-04
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	0.00E+00	6.08E-03	0.00E+00	9.82E+02	0.00E+00	3.04E-02	0.00E+00	7.08E-03	PR04AZ	1.01E-03
UR06	Across WF	1	1	1366	10	100%	1.15E-02	0.00E+00	1.83E+03	0.00E+00	5.72E-02	0.00E+00	1.35E-02	0.00E+00	UR06	2.52E-03
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	0.00E+00	3.33E-01	0.00E+00	1.26E+05	0.00E+00	1.57E-01	0.00E+00	3.28E-03	UR06Z	5.46E-04
PR08Z	WF to SS/LTF	1	1	469	10	100%	0.00E+00	1.24E-01	0.00E+00	4.48E+04	0.00E+00	1.05E-01	0.00E+00	1.25E-02	PR08Z	2.04E-03
UR09Z	WF to SS	1	1	394	10	100%	0.00E+00	9.53E-02	0.00E+00	3.61E+04	0.00E+00	4.18E-02	0.00E+00	0.00E+00	UR09Z	1.14E-04
UR11Z	Across SS	1	1	749	10	100%	0.00E+00	1.81E-01	0.00E+00	6.87E+04	0.00E+00	7.96E-02	0.00E+00	0.00E+00	UR11Z	2.16E-04
PR13Z	WF to LTF	1	1	165	10	100%	0.00E+00	4.36E-02	0.00E+00	1.57E+04	0.00E+00	3.66E-02	0.00E+00	4.39E-03	PR13Z	7.14E-04
PR14Z	WF to LTF	1	1	61	10	100%	0.00E+00	1.39E-03	0.00E+00	2.32E+02	0.00E+00	7.04E-03	0.00E+00	1.61E-03	PR14Z	2.45E-04
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	0.00E+00	1.09E-02	0.00E+00	4.11E+03	0.00E+00	5.13E-03	0.00E+00	1.07E-04	UR18Z	1.79E-05
PR04B	Scale House to WF	1	1	524	10	100%	1.15E-02	0.00E+00	1.83E+03	0.00E+00	5.72E-02	0.00E+00	1.35E-02	0.00E+00	PR04B	9.68E-04
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	0.00E+00	1.33E-02	0.00E+00	2.14E+03	0.00E+00	6.63E-02	0.00E+00	1.55E-02	PR04BZ	2.19E-03
PR04C	Exit Road from WF	1	1	420	10	100%	1.15E-02	0.00E+00	1.83E+03	0.00E+00	5.72E-02	0.00E+00	1.35E-02	0.00E+00	PR04C	7.77E-04
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	0.00E+00	5.25E-03	0.00E+00	8.49E+02	0.00E+00	2.62E-02	0.00E+00	6.11E-03	PR04CZ	8.75E-04
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	--	--	--	--	--	--	--	--	IDLE01	1.92E-04
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	--	--	--	--	--	--	--	--	IDLE02	1.92E-04
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	0.00E+00	9.92E-01	0.00E+00	3.72E+05	0.00E+00	1.01E+00	0.00E+00	0.00E+00	DOZE2	2.84E-03
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	0.00E+00	2.66E-01	0.00E+00	1.00E+05	0.00E+00	2.09E-01	0.00E+00	0.00E+00	DOZE4	5.45E-04
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	0.00E+00	1.42E-01	0.00E+00	5.26E+04	0.00E+00	3.19E-01	0.00E+00	0.00E+00	DOZE2CAP	8.01E-04
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	0.00E+00	3.89E-01	0.00E+00	1.48E+05	0.00E+00	9.95E-02	0.00E+00	0.00E+00	DOZE2SS	2.89E-04

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[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Emissions are input on either a vehicle distance or operation time basis.

[5] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, AM

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Tailpipe Emission Rate PM10 PM10 (g/s)	PM2.5 PM25 (g/s)	Benzene 71-43-2 (g/s)	Ammonia 7664-41-7 (g/s)	Nitrogen Dioxide NO2 (g/s)	Nitrogen Oxides 10102-44-0 (g/s)
Mobile Equipment												
PR01	Main Entrance Road	1	1	206	10	100%	3.80E-04	5.28E-05	1.19E-07	2.36E-06	2.04E-04	5.60E-04
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	8.34E-04	1.15E-04	1.34E-07	4.63E-06	4.51E-04	1.23E-03
PR04A	Entrance to Scale House	1	1	487	10	100%	8.99E-04	1.25E-04	2.82E-07	5.58E-06	4.83E-04	1.32E-03
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	1.01E-03	1.40E-04	2.50E-07	6.00E-06	5.46E-04	1.49E-03
UR06	Across WF	1	1	1366	10	100%	2.52E-03	3.50E-04	7.91E-07	1.57E-05	1.36E-03	3.72E-03
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	5.46E-04	4.06E-04	2.61E-05	2.85E-04	7.08E-05	8.99E-03
PR08Z	WF to SS/LTF	1	1	469	10	100%	2.04E-03	3.94E-04	9.09E-06	1.08E-04	1.03E-03	5.81E-03
UR09Z	WF to SS	1	1	394	10	100%	1.14E-04	1.10E-04	7.37E-06	8.13E-05	0.00E+00	2.53E-03
UR11Z	Across SS	1	1	749	10	100%	2.16E-04	2.10E-04	1.40E-05	1.55E-04	0.00E+00	4.81E-03
PR13Z	WF to LTF	1	1	165	10	100%	7.14E-04	1.38E-04	3.19E-06	3.77E-05	3.61E-04	2.04E-03
PR14Z	WF to LTF	1	1	61	10	100%	2.45E-04	3.39E-05	3.94E-08	1.36E-06	1.33E-04	3.61E-04
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	1.79E-05	1.33E-05	8.53E-07	9.33E-06	2.32E-06	2.94E-04
PR04B	Scale House to WF	1	1	524	10	100%	9.68E-04	1.34E-04	3.04E-07	6.01E-06	5.20E-04	1.43E-03
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	2.19E-03	3.04E-04	5.78E-07	1.31E-05	1.18E-03	3.23E-03
PR04C	Exit Road from WF	1	1	420	10	100%	7.77E-04	1.08E-04	2.43E-07	4.82E-06	4.17E-04	1.14E-03
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	8.75E-04	1.21E-04	2.16E-07	5.18E-06	4.72E-04	1.29E-03
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	1.92E-04	1.77E-04	2.19E-06	1.07E-04	5.14E-03	1.37E-02
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	1.92E-04	1.77E-04	2.19E-06	1.07E-04	5.14E-03	1.37E-02
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	2.84E-03	2.75E-03	1.81E-04	8.37E-04	0.00E+00	4.65E-02
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	5.45E-04	5.28E-04	3.80E-05	2.26E-04	0.00E+00	9.40E-03
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	8.01E-04	7.77E-04	5.93E-05	1.19E-04	0.00E+00	1.03E-02
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	2.89E-04	2.80E-04	1.67E-05	3.33E-04	0.00E+00	8.51E-03

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[4] Emissions are input on either a vehicle distance or operation time basis.

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Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, AM

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Sulphur Dioxide 7446-09-5 (g/s)	Carbon Dioxide 124-38-9 (g/s)	Methane 74-82-8 (g/s)	Nitrous Oxide 10024-97-2 (g/s)	Tailpipe + Fugitive Emission Rate [6] TSP PM (g/s)	PM10 PM10 (g/s)	PM2.5 PM2.5 (g/s)	Ratio Tail TSP PM (g/s)
Mobile Equipment														
PR01	Main Entrance Road	1	1	206	10	100%	6.60E-07	1.05E-01	3.27E-06	7.71E-07	1.05E-03	4.67E-04	7.36E-05	3.64E-01
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	1.32E-06	2.19E-01	6.65E-06	1.53E-06	1.50E-03	9.20E-04	1.36E-04	5.56E-01
PR04A	Entrance to Scale House	1	1	487	10	100%	1.56E-06	2.47E-01	7.73E-06	1.82E-06	2.67E-03	1.13E-03	1.80E-04	3.37E-01
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	1.69E-06	2.73E-01	8.43E-06	1.97E-06	2.78E-03	1.24E-03	1.96E-04	3.64E-01
UR06	Across WF	1	1	1366	10	100%	4.38E-06	6.94E-01	2.17E-05	5.11E-06	3.23E-01	7.51E-02	7.61E-03	7.82E-03
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	9.26E-05	3.49E+01	4.35E-05	9.10E-07	3.21E-01	7.32E-02	7.67E-03	1.70E-03
PR08Z	WF to SS/LTF	1	1	469	10	100%	3.46E-05	1.25E+01	2.90E-05	3.48E-06	1.34E-02	3.51E-03	7.50E-04	1.52E-01
UR09Z	WF to SS	1	1	394	10	100%	2.65E-05	1.00E+01	1.16E-05	0.00E+00	1.50E-01	4.51E-02	4.61E-03	7.60E-04
UR11Z	Across SS	1	1	749	10	100%	5.04E-05	1.91E+01	2.21E-05	0.00E+00	3.31E-01	9.97E-02	1.02E-02	6.53E-04
PR13Z	WF to LTF	1	1	165	10	100%	1.21E-05	4.37E+00	1.02E-05	1.22E-06	3.61E-03	1.09E-03	2.29E-04	1.98E-01
PR14Z	WF to LTF	1	1	61	10	100%	3.87E-07	6.43E-02	1.96E-06	4.48E-07	1.46E-03	4.02E-04	7.18E-05	1.68E-01
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	3.03E-06	1.14E+00	1.42E-06	2.98E-08	1.74E-02	5.29E-03	5.41E-04	1.03E-03
PR04B	Scale House to WF	1	1	524	10	100%	1.68E-06	2.66E-01	8.32E-06	1.96E-06	3.21E-03	1.26E-03	2.04E-04	3.02E-01
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	3.69E-06	5.94E-01	1.84E-05	4.30E-06	4.43E-03	2.48E-03	3.74E-04	4.95E-01
PR04C	Exit Road from WF	1	1	420	10	100%	1.35E-06	2.13E-01	6.68E-06	1.57E-06	2.57E-03	1.01E-03	1.64E-04	3.02E-01
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	1.46E-06	2.36E-01	7.28E-06	1.70E-06	2.67E-03	1.11E-03	1.77E-04	3.28E-01
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	1.21E-05	1.89E+00	9.16E-05	3.72E-05	1.92E-04	1.92E-04	1.77E-04	n/a
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	1.21E-05	1.89E+00	9.16E-05	3.72E-05	1.92E-04	1.92E-04	1.77E-04	n/a
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	2.76E-04	1.03E+02	2.80E-04	0.00E+00	2.84E-03	2.84E-03	2.75E-03	1.00E+00
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	7.38E-05	2.78E+01	5.82E-05	0.00E+00	5.45E-04	5.45E-04	5.28E-04	1.00E+00
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	3.95E-05	1.46E+01	8.87E-05	0.00E+00	8.01E-04	8.01E-04	7.77E-04	1.00E+00
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	1.08E-04	4.10E+01	2.76E-05	0.00E+00	2.89E-04	2.89E-04	2.80E-04	1.00E+00

[1] ID should reflect Source ID or Route ID, as appropriate.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes). For idling, this is the number of trucks idling per hour.

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Emissions are input on either a vehicle distance or operation time basis.

[5] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, AM

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	ipe : Total Emission Rate PM10 PM10 (g/s)	PM2.5 PM2.5 (g/s)	Source ID	# of Volume Sources g/hr	# of Volume Sources g/vkt	TSP PM	PM10 PM10	PM2.5 PM25
Mobile Equipment									**Mobile Equipment**					
PR01	Main Entrance Road	1	1	206	10	100%	8.15E-01	7.17E-01	PR01	11	11	9.51E-05	4.24E-05	6.70E-06
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	9.06E-01	8.47E-01	PR01Z	11	11	1.36E-04	8.37E-05	1.24E-05
PR04A	Entrance to Scale House	1	1	487	10	100%	7.97E-01	6.93E-01	PR04A	57	57	4.68E-05	1.98E-05	3.16E-06
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	8.16E-01	7.17E-01	PR04AZ	57	57	4.88E-05	2.18E-05	3.43E-06
UR06	Across WF	1	1	1366	10	100%	3.36E-02	4.60E-02	UR06	159	159	2.03E-03	4.73E-04	4.79E-05
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	7.46E-03	5.29E-02	UR06Z	159	159	2.02E-03	4.60E-04	4.82E-05
PR08Z	WF to SS/LTF	1	1	469	10	100%	5.81E-01	5.25E-01	PR08Z	55	55	2.44E-04	6.38E-05	1.36E-05
UR09Z	WF to SS	1	1	394	10	100%	2.52E-03	2.39E-02	UR09Z	46	46	3.25E-03	9.80E-04	1.00E-04
UR11Z	Across SS	1	1	749	10	100%	2.17E-03	2.07E-02	UR11Z	87	87	3.80E-03	1.15E-03	1.17E-04
PR13Z	WF to LTF	1	1	165	10	100%	6.56E-01	6.03E-01	PR13Z	19	19	1.90E-04	5.73E-05	1.20E-05
PR14Z	WF to LTF	1	1	61	10	100%	6.10E-01	4.71E-01	PR14Z	7	7	2.08E-04	5.75E-05	1.03E-05
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	3.38E-03	2.46E-02	UR18Z	5	5	3.47E-03	1.06E-03	1.08E-04
PR04B	Scale House to WF	1	1	524	10	100%	7.70E-01	6.57E-01	PR04B	61	61	5.26E-05	2.06E-05	3.35E-06
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	8.83E-01	8.13E-01	PR04BZ	61	61	7.26E-05	4.07E-05	6.13E-06
PR04C	Exit Road from WF	1	1	420	10	100%	7.70E-01	6.57E-01	PR04C	49	49	5.25E-05	2.06E-05	3.35E-06
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	7.90E-01	6.83E-01	PR04CZ	49	49	5.45E-05	2.26E-05	3.62E-06
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	n/a	n/a	IDLE01	1	1	3.84E-04	3.84E-04	3.53E-04
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	n/a	n/a	IDLE02	1	1	3.84E-04	3.84E-04	3.53E-04
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	1.00E+00	1.00E+00	DOZE2	1	1	2.84E-03	2.84E-03	2.75E-03
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	1.00E+00	1.00E+00	DOZE4	1	1	5.45E-04	5.45E-04	5.28E-04
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	1.00E+00	1.00E+00	DOZE4	1	1	8.01E-04	8.01E-04	7.77E-04
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	1.00E+00	1.00E+00	DOZE4	1	1	2.89E-04	2.89E-04	2.80E-04

[1] ID should reflect Source ID or Route ID, as appropriate.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes). For idling, this is the number of trucks idling per hour.

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Emissions are input on either a vehicle distance or operation time basis.

[5] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, AM

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Emission rate per volume source (g/s) Benzene 71-43-2	Ammonia 7664-41-7	Nitrogen Dioxide NO2	Nitrogen Oxides 10102-44-0	Sulphur Dioxide 7446-09-5	Carbon Dioxide 124-38-9	Methane 74-82-8	Nitrous Oxide 10024-97-2
Mobile Equipment														
PR01	Main Entrance Road	1	1	206	10	100%	1.08E-08	2.15E-07	1.86E-05	5.09E-05	6.00E-08	9.50E-03	2.97E-07	7.01E-08
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	1.22E-08	4.21E-07	4.10E-05	1.12E-04	1.20E-07	1.99E-02	6.05E-07	1.39E-07
PR04A	Entrance to Scale House	1	1	487	10	100%	4.95E-09	9.80E-08	8.48E-06	2.32E-05	2.74E-08	4.34E-03	1.36E-07	3.20E-08
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	4.39E-09	1.05E-07	9.58E-06	2.62E-05	2.96E-08	4.79E-03	1.48E-07	3.45E-08
UR06	Across WF	1	1	1366	10	100%	4.98E-09	9.86E-08	8.53E-06	2.34E-05	2.75E-08	4.36E-03	1.36E-07	3.22E-08
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	1.64E-07	1.79E-06	4.46E-07	5.66E-05	5.82E-07	2.19E-01	2.74E-07	5.72E-09
PR08Z	WF to SS/LTF	1	1	469	10	100%	1.65E-07	1.95E-06	1.87E-05	1.06E-04	6.28E-07	2.26E-01	5.28E-07	6.33E-08
UR09Z	WF to SS	1	1	394	10	100%	1.60E-07	1.77E-06	0.00E+00	5.50E-05	5.76E-07	2.18E-01	2.53E-07	0.00E+00
UR11Z	Across SS	1	1	749	10	100%	1.61E-07	1.78E-06	0.00E+00	5.53E-05	5.79E-07	2.19E-01	2.54E-07	0.00E+00
PR13Z	WF to LTF	1	1	165	10	100%	1.68E-07	1.98E-06	1.90E-05	1.07E-04	6.38E-07	2.30E-01	5.36E-07	6.42E-08
PR14Z	WF to LTF	1	1	61	10	100%	5.62E-09	1.94E-07	1.90E-05	5.16E-05	5.53E-08	9.19E-03	2.79E-07	6.41E-08
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	1.71E-07	1.87E-06	4.64E-07	5.89E-05	6.06E-07	2.28E-01	2.85E-07	5.96E-09
PR04B	Scale House to WF	1	1	524	10	100%	4.98E-09	9.86E-08	8.53E-06	2.34E-05	2.75E-08	4.36E-03	1.36E-07	3.22E-08
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	9.47E-09	2.16E-07	1.94E-05	5.29E-05	6.05E-08	9.74E-03	3.02E-07	7.05E-08
PR04C	Exit Road from WF	1	1	420	10	100%	4.97E-09	9.84E-08	8.52E-06	2.33E-05	2.75E-08	4.36E-03	1.36E-07	3.21E-08
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	4.41E-09	1.06E-07	9.62E-06	2.63E-05	2.98E-08	4.81E-03	1.49E-07	3.46E-08
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	4.39E-06	2.13E-04	1.03E-02	2.75E-02	2.41E-05	3.78E+00	1.83E-04	7.45E-05
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	4.39E-06	2.13E-04	1.03E-02	2.75E-02	2.41E-05	3.78E+00	1.83E-04	7.45E-05
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	1.81E-04	8.37E-04	0.00E+00	4.65E-02	2.76E-04	1.03E+02	2.80E-04	0.00E+00
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	3.80E-05	2.26E-04	0.00E+00	9.40E-03	7.38E-05	2.78E+01	5.82E-05	0.00E+00
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	5.93E-05	1.19E-04	0.00E+00	1.03E-02	3.95E-05	1.46E+01	8.87E-05	0.00E+00
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	1.67E-05	3.33E-04	0.00E+00	8.51E-03	1.08E-04	4.10E+01	2.76E-05	0.00E+00

[1] ID should reflect Source ID or Route ID, as appropriate.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes). For idling, this is the number of trucks idling per hour.

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Emissions are input on either a vehicle distance or operation time basis.

[5] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, MD

Source ID	Description	Traffic Passes [2] Hourly	Traffic Passes [2] Daily	Segment Length [3]	Mean Vehicle Speed	Load Factor [4]	Tailpipe Emission Factor [5], [7]													
							TSP PM		PM10 PM10		PM2.5 PM25		Benzene 71-43-2		Ammonia 7664-41-7		Nitrogen Dioxide NO2		Nitrogen Oxides 10102-44-0	
		(#/h)	(#/d)	(m)	(km/h)	(%)	(g/vkt)	(g/h)	(g/vkt)	(g/h)	(g/vkt)	(g/h)	(g/vkt)	(g/h)	(g/vkt)	(g/h)	(g/vkt)	(g/h)	(g/vkt)	(g/h)
Mobile Equipment																				
PR01	Main Entrance Road	1	1	206	10	100%	4.31E+00	0.00E+00	4.31E+00	0.00E+00	6.10E-01	0.00E+00	4.06E-03	0.00E+00	4.16E-02	0.00E+00	2.26E+00	0.00E+00	6.34E+00	0.00E+00
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	0.00E+00	3.00E+00	0.00E+00	3.00E+00	0.00E+00	4.15E-01	0.00E+00	4.82E-04	0.00E+00	1.67E-02	0.00E+00	1.62E+00	0.00E+00	4.42E+00
PR04A	Entrance to Scale House	1	1	487	10	100%	4.31E+00	0.00E+00	4.31E+00	0.00E+00	6.10E-01	0.00E+00	4.06E-03	0.00E+00	4.16E-02	0.00E+00	2.26E+00	0.00E+00	6.34E+00	0.00E+00
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	0.00E+00	3.65E+00	0.00E+00	3.65E+00	0.00E+00	5.05E-01	0.00E+00	9.00E-04	0.00E+00	2.16E-02	0.00E+00	1.97E+00	0.00E+00	5.37E+00
UR06	Across WF	1	1	1366	10	100%	4.31E+00	0.00E+00	4.31E+00	0.00E+00	6.10E-01	0.00E+00	4.06E-03	0.00E+00	4.16E-02	0.00E+00	2.26E+00	0.00E+00	6.34E+00	0.00E+00
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	0.00E+00	1.96E+00	0.00E+00	1.96E+00	0.00E+00	1.46E+00	0.00E+00	9.39E-02	0.00E+00	1.03E+00	0.00E+00	2.55E-01	0.00E+00	3.24E+01
PR08Z	WF to SS/LTF	1	1	469	10	100%	0.00E+00	7.34E+00	0.00E+00	7.34E+00	0.00E+00	1.42E+00	0.00E+00	3.27E-02	0.00E+00	3.87E-01	0.00E+00	3.70E+00	0.00E+00	2.09E+01
UR09Z	WF to SS	1	1	394	10	100%	0.00E+00	4.09E-01	0.00E+00	4.09E-01	0.00E+00	3.97E-01	0.00E+00	2.65E-02	0.00E+00	2.93E-01	0.00E+00	0.00E+00	0.00E+00	9.10E+00
UR11Z	Across SS	1	1	749	10	100%	0.00E+00	7.78E-01	0.00E+00	7.78E-01	0.00E+00	7.55E-01	0.00E+00	5.05E-02	0.00E+00	5.57E-01	0.00E+00	0.00E+00	0.00E+00	1.73E+01
PR13Z	WF to LTF	1	1	165	10	100%	0.00E+00	2.57E+00	0.00E+00	2.57E+00	0.00E+00	4.97E-01	0.00E+00	1.15E-02	0.00E+00	1.36E-01	0.00E+00	1.30E+00	0.00E+00	7.33E+00
PR14Z	WF to LTF	1	1	61	10	100%	0.00E+00	8.83E-01	0.00E+00	8.83E-01	0.00E+00	1.22E-01	0.00E+00	1.42E-04	0.00E+00	4.90E-03	0.00E+00	4.78E-01	0.00E+00	1.30E+00
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	0.00E+00	6.43E-02	0.00E+00	6.43E-02	0.00E+00	4.78E-02	0.00E+00	3.07E-03	0.00E+00	3.36E-02	0.00E+00	8.35E-03	0.00E+00	1.06E+00
PR04B	Scale House to WF	1	1	524	10	100%	4.31E+00	0.00E+00	4.31E+00	0.00E+00	6.10E-01	0.00E+00	4.06E-03	0.00E+00	4.16E-02	0.00E+00	2.26E+00	0.00E+00	6.34E+00	0.00E+00
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	0.00E+00	7.90E+00	0.00E+00	7.90E+00	0.00E+00	1.09E+00	0.00E+00	2.08E-03	0.00E+00	4.73E-02	0.00E+00	4.25E+00	0.00E+00	1.16E+01
PR04C	Exit Road from WF	1	1	420	10	100%	4.31E+00	0.00E+00	4.31E+00	0.00E+00	6.10E-01	0.00E+00	4.06E-03	0.00E+00	4.16E-02	0.00E+00	2.26E+00	0.00E+00	6.34E+00	0.00E+00
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	0.00E+00	3.15E+00	0.00E+00	3.15E+00	0.00E+00	4.36E-01	0.00E+00	7.77E-04	0.00E+00	1.87E-02	0.00E+00	1.70E+00	0.00E+00	4.64E+00
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	--	--	--	--	--	--	--	--	--	--	--	--	--	--
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	0.00E+00	1.02E+01	0.00E+00	1.02E+01	0.00E+00	9.90E+00	0.00E+00	6.51E-01	0.00E+00	3.01E+00	0.00E+00	0.00E+00	0.00E+00	1.67E+02
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	0.00E+00	1.96E+00	0.00E+00	1.96E+00	0.00E+00	1.90E+00	0.00E+00	1.37E-01	0.00E+00	8.13E-01	0.00E+00	0.00E+00	0.00E+00	3.38E+01
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	0.00E+00	2.88E+00	0.00E+00	2.88E+00	0.00E+00	2.80E+00	0.00E+00	2.13E-01	0.00E+00	4.27E-01	0.00E+00	0.00E+00	0.00E+00	3.70E+01
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	0.00E+00	1.04E+00	0.00E+00	1.04E+00	0.00E+00	1.01E+00	0.00E+00	6.00E-02	0.00E+00	1.20E+00	0.00E+00	0.00E+00	0.00E+00	3.06E+01

[1] ID should reflect Source ID or Route ID, as appropriate.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010

[5] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on power ratings.

[6] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, MD

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Sulphur Dioxide 7446-09-5 (g/vkt)	Sulphur Dioxide 7446-09-5 (g/h)	Carbon Dioxide 124-38-9 (g/vkt)	Carbon Dioxide 124-38-9 (g/h)	Methane 74-82-8 (g/vkt)	Methane 74-82-8 (g/h)	Nitrous Oxide 10024-97-2 (g/vkt)	Nitrous Oxide 10024-97-2 (g/h)
Mobile Equipment														
PR01	Main Entrance Road	1	1	206	10	100%	1.14E-02	0.00E+00	1.46E+03	0.00E+00	4.90E-02	0.00E+00	1.25E-02	0.00E+00
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	0.00E+00	4.74E-03	0.00E+00	7.88E+02	0.00E+00	2.40E-02	0.00E+00	5.49E-03
PR04A	Entrance to Scale House	1	1	487	10	100%	1.14E-02	0.00E+00	1.46E+03	0.00E+00	4.90E-02	0.00E+00	1.25E-02	0.00E+00
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	0.00E+00	6.08E-03	0.00E+00	9.82E+02	0.00E+00	3.04E-02	0.00E+00	7.08E-03
UR06	Across WF	1	1	1366	10	100%	1.14E-02	0.00E+00	1.46E+03	0.00E+00	4.90E-02	0.00E+00	1.25E-02	0.00E+00
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	0.00E+00	3.33E-01	0.00E+00	1.26E+05	0.00E+00	1.57E-01	0.00E+00	3.28E-03
PR08Z	WF to SS/LTF	1	1	469	10	100%	0.00E+00	1.24E-01	0.00E+00	4.48E+04	0.00E+00	1.05E-01	0.00E+00	1.25E-02
UR09Z	WF to SS	1	1	394	10	100%	0.00E+00	9.53E-02	0.00E+00	3.61E+04	0.00E+00	4.18E-02	0.00E+00	0.00E+00
UR11Z	Across SS	1	1	749	10	100%	0.00E+00	1.81E-01	0.00E+00	6.87E+04	0.00E+00	7.96E-02	0.00E+00	0.00E+00
PR13Z	WF to LTF	1	1	165	10	100%	0.00E+00	4.36E-02	0.00E+00	1.57E+04	0.00E+00	3.66E-02	0.00E+00	4.39E-03
PR14Z	WF to LTF	1	1	61	10	100%	0.00E+00	1.39E-03	0.00E+00	2.32E+02	0.00E+00	7.04E-03	0.00E+00	1.61E-03
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	0.00E+00	1.09E-02	0.00E+00	4.11E+03	0.00E+00	5.13E-03	0.00E+00	1.07E-04
PR04B	Scale House to WF	1	1	524	10	100%	1.14E-02	0.00E+00	1.46E+03	0.00E+00	4.90E-02	0.00E+00	1.25E-02	0.00E+00
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	0.00E+00	1.33E-02	0.00E+00	2.14E+03	0.00E+00	6.63E-02	0.00E+00	1.55E-02
PR04C	Exit Road from WF	1	1	420	10	100%	1.14E-02	0.00E+00	1.46E+03	0.00E+00	4.90E-02	0.00E+00	1.25E-02	0.00E+00
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	0.00E+00	5.25E-03	0.00E+00	8.49E+02	0.00E+00	2.62E-02	0.00E+00	6.11E-03
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	--	--	--	--	--	--	--	--
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	--	--	--	--	--	--	--	--
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	0.00E+00	9.92E-01	0.00E+00	3.72E+05	0.00E+00	1.01E+00	0.00E+00	0.00E+00
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	0.00E+00	2.66E-01	0.00E+00	1.00E+05	0.00E+00	2.09E-01	0.00E+00	0.00E+00
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	0.00E+00	1.42E-01	0.00E+00	5.26E+04	0.00E+00	3.19E-01	0.00E+00	0.00E+00
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	0.00E+00	3.89E-01	0.00E+00	1.48E+05	0.00E+00	9.95E-02	0.00E+00	0.00E+00

Source ID	Tailpipe Emission Rate TSP PM (g/s)	PM10 PM10 (g/s)	PM2.5 PM25 (g/s)	Benzene 71-43-2 (g/s)	Ammonia 7664-41-7 (g/s)	Nitrogen Dioxide NO2 (g/s)	Nitrogen Oxides 10102-44-0 (g/s)
Mobile Equipment							
PR01	2.5E-04	2.5E-04	3.5E-05	2.3E-07	2.4E-06	1.3E-04	3.6E-04
PR01Z	8.3E-04	8.3E-04	1.2E-04	1.3E-07	4.6E-06	4.5E-04	1.2E-03
PR04A	5.8E-04	5.8E-04	8.2E-05	5.5E-07	5.6E-06	3.0E-04	8.6E-04
PR04AZ	1.0E-03	1.0E-03	1.4E-04	2.5E-07	6.0E-06	5.5E-04	1.5E-03
UR06	1.6E-03	1.6E-03	2.3E-04	1.5E-06	1.6E-05	8.6E-04	2.4E-03
UR06Z	5.5E-04	5.5E-04	4.1E-04	2.6E-05	2.9E-04	7.1E-05	9.0E-03
PR08Z	2.0E-03	2.0E-03	3.9E-04	9.1E-06	1.1E-04	1.0E-03	5.8E-03
UR09Z	1.1E-04	1.1E-04	1.1E-04	7.4E-06	8.1E-05	0.0E+00	2.5E-03
UR11Z	2.2E-04	2.2E-04	2.1E-04	1.4E-05	1.5E-04	0.0E+00	4.8E-03
PR13Z	7.1E-04	7.1E-04	1.4E-04	3.2E-06	3.8E-05	3.6E-04	2.0E-03
PR14Z	2.5E-04	2.5E-04	3.4E-05	3.9E-08	1.4E-06	1.3E-04	3.6E-04
UR18Z	1.8E-05	1.8E-05	1.3E-05	8.5E-07	9.3E-06	2.3E-06	2.9E-04
PR04B	6.3E-04	6.3E-04	8.9E-05	5.9E-07	6.1E-06	3.3E-04	9.2E-04
PR04BZ	2.2E-03	2.2E-03	3.0E-04	5.8E-07	1.3E-05	1.2E-03	3.2E-03
PR04C	5.0E-04	5.0E-04	7.1E-05	4.7E-07	4.9E-06	2.6E-04	7.4E-04
PR04CZ	8.7E-04	8.7E-04	1.2E-04	2.2E-07	5.2E-06	4.7E-04	1.3E-03
IDLE01	1.71E-04	1.71E-04	1.57E-04	3.89E-06	1.05E-04	3.29E-03	8.96E-03
IDLE02	1.71E-04	1.71E-04	1.57E-04	3.89E-06	1.05E-04	3.29E-03	8.96E-03
DOZE2	2.8E-03	2.8E-03	2.8E-03	1.8E-04	8.4E-04	0.0E+00	4.7E-02
DOZE4	5.4E-04	5.4E-04	5.3E-04	3.8E-05	2.3E-04	0.0E+00	9.4E-03
DOZE2CAP	8.0E-04	8.0E-04	7.8E-04	5.9E-05	1.2E-04	0.0E+00	1.0E-02
DOZE2SS	2.9E-04	2.9E-04	2.8E-04	1.7E-05	3.3E-04	0.0E+00	8.5E-03

[1] ID should reflect Source ID or Route ID, as appropriate.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010

[5] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on p

[6] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, MD

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Sulphur Dioxide 7446-09-5 (g/s)	Carbon Dioxide 124-38-9 (g/s)	Methane 74-82-8 (g/s)	Nitrous Oxide 10024-97-2 (g/s)	Tailpipe + Fugitive Emission Rate [6] TSP PM (g/s)	PM10 PM10 (g/s)	PM2.5 PM2.5 (g/s)	Ratio Tailpipe : Total Emission Rate TSP PM (g/s)	PM10 PM10 (g/s)	PM2.5 PM2.5 (g/s)	Source ID	# of Volume Sources g/hr	# of Volume Sources g/vkt	TSP PM	PM10 PM10
Mobile Equipment																	**Mobile Equipment**				
PR01	Main Entrance Road	1	1	206	10	100%	6.5E-07	8.3E-02	2.8E-06	7.2E-07	9.1E-04	3.3E-04	5.6E-05	2.70E-01	7.41E-01	6.26E-01	PR01	11	11	8.3E-05	3.0E-05
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	1.3E-06	2.2E-01	6.7E-06	1.5E-06	1.5E-03	9.2E-04	1.4E-04	5.56E-01	9.06E-01	8.47E-01	PR01Z	11	11	1.4E-04	8.4E-05
PR04A	Entrance to Scale House	1	1	487	10	100%	1.5E-06	2.0E-01	6.6E-06	1.7E-06	2.4E-03	8.1E-04	1.4E-04	2.48E-01	7.18E-01	5.98E-01	PR04A	57	57	4.1E-05	1.4E-05
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	1.7E-06	2.7E-01	8.4E-06	2.0E-06	2.8E-03	1.2E-03	2.0E-04	3.64E-01	8.16E-01	7.17E-01	PR04AZ	57	57	4.9E-05	2.2E-05
UR06	Across WF	1	1	1366	10	100%	4.3E-06	5.5E-01	1.9E-05	4.8E-06	3.2E-01	7.4E-02	7.5E-03	5.08E-03	2.20E-02	3.09E-02	UR06	159	159	2.0E-03	4.7E-04
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	9.3E-05	3.5E+01	4.4E-05	9.1E-07	3.2E-01	7.3E-02	7.7E-03	1.70E-03	7.46E-03	5.29E-02	UR06Z	159	159	2.0E-03	4.6E-04
PR08Z	WF to SS/LTF	1	1	469	10	100%	3.5E-05	1.2E+01	2.9E-05	3.5E-06	1.3E-02	3.5E-03	7.5E-04	1.52E-01	5.81E-01	5.25E-01	PR08Z	55	55	2.4E-04	6.4E-05
UR09Z	WF to SS	1	1	394	10	100%	2.6E-05	1.0E+01	1.2E-05	0.0E+00	1.5E-01	4.5E-02	4.6E-03	7.60E-04	2.52E-03	2.39E-02	UR09Z	46	46	3.3E-03	9.8E-04
UR11Z	Across SS	1	1	749	10	100%	5.0E-05	1.9E+01	2.2E-05	0.0E+00	3.3E-01	1.0E-01	1.0E-02	6.53E-04	2.17E-03	2.07E-02	UR11Z	87	87	3.8E-03	1.1E-03
PR13Z	WF to LTF	1	1	165	10	100%	1.2E-05	4.4E+00	1.0E-05	1.2E-06	3.6E-03	1.1E-03	2.3E-04	1.98E-01	6.56E-01	6.03E-01	PR13Z	19	19	1.9E-04	5.7E-05
PR14Z	WF to LTF	1	1	61	10	100%	3.9E-07	6.4E-02	2.0E-06	4.5E-07	1.5E-03	4.0E-04	7.2E-05	1.68E-01	6.10E-01	4.71E-01	PR14Z	7	7	2.1E-04	5.7E-05
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	3.0E-06	1.1E+00	1.4E-06	3.0E-08	1.7E-02	5.3E-03	5.4E-04	1.03E-03	3.38E-03	2.46E-02	UR18Z	5	5	3.5E-03	1.1E-03
PR04B	Scale House to WF	1	1	524	10	100%	1.7E-06	2.1E-01	7.1E-06	1.8E-06	2.9E-03	9.2E-04	1.6E-04	2.19E-01	6.84E-01	5.59E-01	PR04B	61	61	4.7E-05	1.5E-05
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	3.7E-06	5.9E-01	1.8E-05	4.3E-06	4.4E-03	2.5E-03	3.7E-04	4.95E-01	8.83E-01	8.13E-01	PR04BZ	61	61	7.3E-05	4.1E-05
PR04C	Exit Road from WF	1	1	420	10	100%	1.3E-06	1.7E-01	5.7E-06	1.5E-06	2.3E-03	7.4E-04	1.3E-04	2.19E-01	6.84E-01	5.59E-01	PR04C	49	49	4.7E-05	1.5E-05
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	1.5E-06	2.4E-01	7.3E-06	1.7E-06	2.7E-03	1.1E-03	1.8E-04	3.28E-01	7.90E-01	6.83E-01	PR04CZ	49	49	5.4E-05	2.3E-05
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	1.35E-05	1.62E+00	7.41E-05	3.46E-05	1.71E-04	1.71E-04	1.57E-04	n/a	n/a	n/a	IDLE01	1	1	3.41E-04	3.41E-04
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	1.35E-05	1.62E+00	7.41E-05	3.46E-05	1.71E-04	1.71E-04	1.57E-04	n/a	n/a	n/a	IDLE02	1	1	3.41E-04	3.41E-04
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	2.8E-04	1.0E+02	2.8E-04	0.0E+00	2.8E-03	2.8E-03	2.8E-03	1.00E+00	1.00E+00	1.00E+00	DOZE2	1	1	2.8E-03	2.8E-03
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	7.4E-05	2.8E+01	5.8E-05	0.0E+00	5.4E-04	5.4E-04	5.3E-04	1.00E+00	1.00E+00	1.00E+00	DOZE4	1	1	5.4E-04	5.4E-04
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	4.0E-05	1.5E+01	8.9E-05	0.0E+00	8.0E-04	8.0E-04	7.8E-04	1.00E+00	1.00E+00	1.00E+00	DOZE4	1	1	8.0E-04	8.0E-04
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	1.1E-04	4.1E+01	2.8E-05	0.0E+00	2.9E-04	2.9E-04	2.8E-04	1.00E+00	1.00E+00	1.00E+00	DOZE4	1	1	2.9E-04	2.9E-04

[1] ID should reflect Source ID or Route ID, as appropriate.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010

[5] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on p

[6] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, MD

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Emission rate per volume source: PM2.5 PM25	Benzene 71-43-2	Ammonia 7664-41-7	Nitrogen Dioxide NO2	Nitrogen Oxides 10102-44-0	Sulphur Dioxide 7446-09-5	Carbon Dioxide 124-38-9	Methane 74-82-8	Nitrous Oxide 10024-97-2
Mobile Equipment															
PR01	Main Entrance Road	1	1	206	10	100%	5.1E-06	2.1E-08	2.2E-07	1.2E-05	3.3E-05	5.9E-08	7.6E-03	2.5E-07	6.5E-08
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	1.2E-05	1.2E-08	4.2E-07	4.1E-05	1.1E-04	1.2E-07	2.0E-02	6.0E-07	1.4E-07
PR04A	Entrance to Scale House	1	1	487	10	100%	2.4E-06	9.6E-09	9.9E-08	5.3E-06	1.5E-05	2.7E-08	3.5E-03	1.2E-07	3.0E-08
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	3.4E-06	4.4E-09	1.1E-07	9.6E-06	2.6E-05	3.0E-08	4.8E-03	1.5E-07	3.4E-08
UR06	Across WF	1	1	1366	10	100%	4.7E-05	9.7E-09	9.9E-08	5.4E-06	1.5E-05	2.7E-08	3.5E-03	1.2E-07	3.0E-08
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	4.8E-05	1.6E-07	1.8E-06	4.5E-07	5.7E-05	5.8E-07	2.2E-01	2.7E-07	5.7E-09
PR08Z	WF to SS/LTF	1	1	469	10	100%	1.4E-05	1.7E-07	2.0E-06	1.9E-05	1.1E-04	6.3E-07	2.3E-01	5.3E-07	6.3E-08
UR09Z	WF to SS	1	1	394	10	100%	1.0E-04	1.6E-07	1.8E-06	0.0E+00	5.5E-05	5.8E-07	2.2E-01	2.5E-07	0.0E+00
UR11Z	Across SS	1	1	749	10	100%	1.2E-04	1.6E-07	1.8E-06	0.0E+00	5.5E-05	5.8E-07	2.2E-01	2.5E-07	0.0E+00
PR13Z	WF to LTF	1	1	165	10	100%	1.2E-05	1.7E-07	2.0E-06	1.9E-05	1.1E-04	6.4E-07	2.3E-01	5.4E-07	6.4E-08
PR14Z	WF to LTF	1	1	61	10	100%	1.0E-05	5.6E-09	1.9E-07	1.9E-05	5.2E-05	5.5E-08	9.2E-03	2.8E-07	6.4E-08
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	1.1E-04	1.7E-07	1.9E-06	4.6E-07	5.9E-05	6.1E-07	2.3E-01	2.8E-07	6.0E-09
PR04B	Scale House to WF	1	1	524	10	100%	2.6E-06	9.7E-09	9.9E-08	5.4E-06	1.5E-05	2.7E-08	3.5E-03	1.2E-07	3.0E-08
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	6.1E-06	9.5E-09	2.2E-07	1.9E-05	5.3E-05	6.1E-08	9.7E-03	3.0E-07	7.1E-08
PR04C	Exit Road from WF	1	1	420	10	100%	2.6E-06	9.7E-09	9.9E-08	5.4E-06	1.5E-05	2.7E-08	3.5E-03	1.2E-07	3.0E-08
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	3.6E-06	4.4E-09	1.1E-07	9.6E-06	2.6E-05	3.0E-08	4.8E-03	1.5E-07	3.5E-08
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	3.14E-04	7.78E-06	2.10E-04	6.58E-03	1.79E-02	2.69E-05	3.25E+00	1.48E-04	6.92E-05
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	3.14E-04	7.78E-06	2.10E-04	6.58E-03	1.79E-02	2.69E-05	3.25E+00	1.48E-04	6.92E-05
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	2.8E-03	1.8E-04	8.4E-04	0.0E+00	4.7E-02	2.8E-04	1.0E+02	2.8E-04	0.0E+00
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	5.3E-04	3.8E-05	2.3E-04	0.0E+00	9.4E-03	7.4E-05	2.8E+01	5.8E-05	0.0E+00
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	7.8E-04	5.9E-05	1.2E-04	0.0E+00	1.0E-02	4.0E-05	1.5E+01	8.9E-05	0.0E+00
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	2.8E-04	1.7E-05	3.3E-04	0.0E+00	8.5E-03	1.1E-04	4.1E+01	2.8E-05	0.0E+00

[1] ID should reflect Source ID or Route ID, as appropriate.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010

[5] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on p

[6] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, PM

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Tailpipe Emission Factor [5], [7] TSP PM (g/vkt)	TSP PM (g/h)	PM10 PM10 (g/vkt)	PM10 PM10 (g/h)	PM2.5 PM25 (g/vkt)	PM2.5 PM25 (g/h)	Benzene 71-43-2 (g/vkt)	Benzene 71-43-2 (g/h)	Ammonia 7664-41-7 (g/vkt)	Ammonia 7664-41-7 (g/h)	Nitrogen Dioxide NO2 (g/vkt)	Nitrogen Dioxide NO2 (g/h)	Nitrogen Oxides 10102-44-0 (g/vkt)	Nitrogen Oxides 10102-44-0 (g/h)
Mobile Equipment																				
PR01	Main Entrance Road	1	1	206	10	100%	5.23E+00	0.00E+00	5.23E+00	0.00E+00	7.24E-01	0.00E+00	1.80E-03	0.00E+00	3.86E-02	0.00E+00	2.81E+00	0.00E+00	7.68E+00	0.00E+00
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	0.00E+00	3.00E+00	0.00E+00	3.00E+00	0.00E+00	4.15E-01	0.00E+00	4.82E-04	0.00E+00	1.67E-02	0.00E+00	1.62E+00	0.00E+00	4.42E+00
PR04A	Entrance to Scale House	1	1	487	10	100%	5.23E+00	0.00E+00	5.23E+00	0.00E+00	7.24E-01	0.00E+00	1.80E-03	0.00E+00	3.86E-02	0.00E+00	2.81E+00	0.00E+00	7.68E+00	0.00E+00
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	0.00E+00	3.65E+00	0.00E+00	3.65E+00	0.00E+00	5.05E-01	0.00E+00	9.00E-04	0.00E+00	2.16E-02	0.00E+00	1.97E+00	0.00E+00	5.37E+00
UR06	Across WF	1	1	1366	10	100%	5.23E+00	0.00E+00	5.23E+00	0.00E+00	7.24E-01	0.00E+00	1.80E-03	0.00E+00	3.86E-02	0.00E+00	2.81E+00	0.00E+00	7.68E+00	0.00E+00
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	0.00E+00	1.96E+00	0.00E+00	1.96E+00	0.00E+00	1.46E+00	0.00E+00	9.39E-02	0.00E+00	1.03E+00	0.00E+00	2.55E-01	0.00E+00	3.24E+01
PR08Z	WF to SS/LTF	1	1	469	10	100%	0.00E+00	7.34E+00	0.00E+00	7.34E+00	0.00E+00	1.42E+00	0.00E+00	3.27E-02	0.00E+00	3.87E-01	0.00E+00	3.70E+00	0.00E+00	2.09E+01
UR09Z	WF to SS	1	1	394	10	100%	0.00E+00	4.09E-01	0.00E+00	4.09E-01	0.00E+00	3.97E-01	0.00E+00	2.65E-02	0.00E+00	2.93E-01	0.00E+00	0.00E+00	0.00E+00	9.10E+00
UR11Z	Across SS	1	1	749	10	100%	0.00E+00	7.78E-01	0.00E+00	7.78E-01	0.00E+00	7.55E-01	0.00E+00	5.05E-02	0.00E+00	5.57E-01	0.00E+00	0.00E+00	0.00E+00	1.73E+01
PR13Z	WF to LTF	1	1	165	10	100%	0.00E+00	2.57E+00	0.00E+00	2.57E+00	0.00E+00	4.97E-01	0.00E+00	1.15E-02	0.00E+00	1.36E-01	0.00E+00	1.30E+00	0.00E+00	7.33E+00
PR14Z	WF to LTF	1	1	61	10	100%	0.00E+00	8.83E-01	0.00E+00	8.83E-01	0.00E+00	1.22E-01	0.00E+00	1.42E-04	0.00E+00	4.90E-03	0.00E+00	4.78E-01	0.00E+00	1.30E+00
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	0.00E+00	6.43E-02	0.00E+00	6.43E-02	0.00E+00	4.78E-02	0.00E+00	3.07E-03	0.00E+00	3.36E-02	0.00E+00	8.35E-03	0.00E+00	1.06E+00
PR04B	Scale House to WF	1	1	524	10	100%	5.23E+00	0.00E+00	5.23E+00	0.00E+00	7.24E-01	0.00E+00	1.80E-03	0.00E+00	3.86E-02	0.00E+00	2.81E+00	0.00E+00	7.68E+00	0.00E+00
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	0.00E+00	7.90E+00	0.00E+00	7.90E+00	0.00E+00	1.09E+00	0.00E+00	2.08E-03	0.00E+00	4.73E-02	0.00E+00	4.25E+00	0.00E+00	1.16E+01
PR04C	Exit Road from WF	1	1	420	10	100%	5.23E+00	0.00E+00	5.23E+00	0.00E+00	7.24E-01	0.00E+00	1.80E-03	0.00E+00	3.86E-02	0.00E+00	2.81E+00	0.00E+00	7.68E+00	0.00E+00
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	0.00E+00	3.15E+00	0.00E+00	3.15E+00	0.00E+00	4.36E-01	0.00E+00	7.77E-04	0.00E+00	1.87E-02	0.00E+00	1.70E+00	0.00E+00	4.64E+00
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	--	--	--	--	--	--	--	--	--	--	--	--	--	--
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	--	--	--	--	--	--	--	--	--	--	--	--	--	--
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	0.00E+00	1.02E+01	0.00E+00	1.02E+01	0.00E+00	9.90E+00	0.00E+00	6.51E-01	0.00E+00	3.01E+00	0.00E+00	0.00E+00	0.00E+00	1.67E+02
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	0.00E+00	1.96E+00	0.00E+00	1.96E+00	0.00E+00	1.90E+00	0.00E+00	1.37E-01	0.00E+00	8.13E-01	0.00E+00	0.00E+00	0.00E+00	3.38E+01
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	0.00E+00	2.88E+00	0.00E+00	2.88E+00	0.00E+00	2.80E+00	0.00E+00	2.13E-01	0.00E+00	4.27E-01	0.00E+00	0.00E+00	0.00E+00	3.70E+01
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	0.00E+00	1.04E+00	0.00E+00	1.04E+00	0.00E+00	1.01E+00	0.00E+00	6.00E-02	0.00E+00	1.20E+00	0.00E+00	0.00E+00	0.00E+00	3.06E+01

[1] ID should reflect Source ID or Route ID, as appropriate.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010

[5] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on power ratings.

[6] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, PM

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Sulphur Dioxide 7446-09-5 (g/vkt)	Sulphur Dioxide 7446-09-5 (g/h)	Carbon Dioxide 124-38-9 (g/vkt)	Carbon Dioxide 124-38-9 (g/h)	Methane 74-82-8 (g/vkt)	Methane 74-82-8 (g/h)	Nitrous Oxide 10024-97-2 (g/vkt)	Nitrous Oxide 10024-97-2 (g/h)	Source ID
Mobile Equipment															**Mobile Equipment**
PR01	Main Entrance Road	1	1	206	10	100%	1.11E-02	0.00E+00	1.53E+03	0.00E+00	4.73E-02	0.00E+00	1.13E-02	0.00E+00	PR01
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	0.00E+00	4.74E-03	0.00E+00	7.88E+02	0.00E+00	2.40E-02	0.00E+00	5.49E-03	PR01Z
PR04A	Entrance to Scale House	1	1	487	10	100%	1.11E-02	0.00E+00	1.53E+03	0.00E+00	4.73E-02	0.00E+00	1.13E-02	0.00E+00	PR04A
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	0.00E+00	6.08E-03	0.00E+00	9.82E+02	0.00E+00	3.04E-02	0.00E+00	7.08E-03	PR04AZ
UR06	Across WF	1	1	1366	10	100%	1.11E-02	0.00E+00	1.53E+03	0.00E+00	4.73E-02	0.00E+00	1.13E-02	0.00E+00	UR06
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	0.00E+00	3.33E-01	0.00E+00	1.26E+05	0.00E+00	1.57E-01	0.00E+00	3.28E-03	UR06Z
PR08Z	WF to SS/LTF	1	1	469	10	100%	0.00E+00	1.24E-01	0.00E+00	4.48E+04	0.00E+00	1.05E-01	0.00E+00	1.25E-02	PR08Z
UR09Z	WF to SS	1	1	394	10	100%	0.00E+00	9.53E-02	0.00E+00	3.61E+04	0.00E+00	4.18E-02	0.00E+00	0.00E+00	UR09Z
UR11Z	Across SS	1	1	749	10	100%	0.00E+00	1.81E-01	0.00E+00	6.87E+04	0.00E+00	7.96E-02	0.00E+00	0.00E+00	UR11Z
PR13Z	WF to LTF	1	1	165	10	100%	0.00E+00	4.36E-02	0.00E+00	1.57E+04	0.00E+00	3.66E-02	0.00E+00	4.39E-03	PR13Z
PR14Z	WF to LTF	1	1	61	10	100%	0.00E+00	1.39E-03	0.00E+00	2.32E+02	0.00E+00	7.04E-03	0.00E+00	1.61E-03	PR14Z
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	0.00E+00	1.09E-02	0.00E+00	4.11E+03	0.00E+00	5.13E-03	0.00E+00	1.07E-04	UR18Z
PR04B	Scale House to WF	1	1	524	10	100%	1.11E-02	0.00E+00	1.53E+03	0.00E+00	4.73E-02	0.00E+00	1.13E-02	0.00E+00	PR04B
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	0.00E+00	1.33E-02	0.00E+00	2.14E+03	0.00E+00	6.63E-02	0.00E+00	1.55E-02	PR04BZ
PR04C	Exit Road from WF	1	1	420	10	100%	1.11E-02	0.00E+00	1.53E+03	0.00E+00	4.73E-02	0.00E+00	1.13E-02	0.00E+00	PR04C
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	0.00E+00	5.25E-03	0.00E+00	8.49E+02	0.00E+00	2.62E-02	0.00E+00	6.11E-03	PR04CZ
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	--	--	--	--	--	--	--	--	IDLE01
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	--	--	--	--	--	--	--	--	IDLE02
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	0.00E+00	9.92E-01	0.00E+00	3.72E+05	0.00E+00	1.01E+00	0.00E+00	0.00E+00	DOZE2
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	0.00E+00	2.66E-01	0.00E+00	1.00E+05	0.00E+00	2.09E-01	0.00E+00	0.00E+00	DOZE4
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	0.00E+00	1.42E-01	0.00E+00	5.26E+04	0.00E+00	3.19E-01	0.00E+00	0.00E+00	DOZE2CAP
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	0.00E+00	3.89E-01	0.00E+00	1.48E+05	0.00E+00	9.95E-02	0.00E+00	0.00E+00	DOZE2SS

[1] ID should reflect Source ID or Route ID, as appropriate.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010

[5] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on power ratings.

[6] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, PM

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Tailpipe Emission Rate TSP PM (g/s)	PM10 PM10 (g/s)	PM2.5 PM25 (g/s)	Benzene 71-43-2 (g/s)	Ammonia 7664-41-7 (g/s)	Nitrogen Dioxide NO2 (g/s)
Mobile Equipment												
PR01	Main Entrance Road	1	1	206	10	100%	3.0E-04	3.0E-04	4.1E-05	1.0E-07	2.2E-06	1.6E-04
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	8.3E-04	8.3E-04	1.2E-04	1.3E-07	4.6E-06	4.5E-04
PR04A	Entrance to Scale House	1	1	487	10	100%	7.1E-04	7.1E-04	9.8E-05	2.4E-07	5.2E-06	3.8E-04
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	1.0E-03	1.0E-03	1.4E-04	2.5E-07	6.0E-06	5.5E-04
UR06	Across WF	1	1	1366	10	100%	2.0E-03	2.0E-03	2.7E-04	6.8E-07	1.5E-05	1.1E-03
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	5.5E-04	5.5E-04	4.1E-04	2.6E-05	2.9E-04	7.1E-05
PR08Z	WF to SS/LTF	1	1	469	10	100%	2.0E-03	2.0E-03	3.9E-04	9.1E-06	1.1E-04	1.0E-03
UR09Z	WF to SS	1	1	394	10	100%	1.1E-04	1.1E-04	1.1E-04	7.4E-06	8.1E-05	0.0E+00
UR11Z	Across SS	1	1	749	10	100%	2.2E-04	2.2E-04	2.1E-04	1.4E-05	1.5E-04	0.0E+00
PR13Z	WF to LTF	1	1	165	10	100%	7.1E-04	7.1E-04	1.4E-04	3.2E-06	3.8E-05	3.6E-04
PR14Z	WF to LTF	1	1	61	10	100%	2.5E-04	2.5E-04	3.4E-05	3.9E-08	1.4E-06	1.3E-04
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	1.8E-05	1.8E-05	1.3E-05	8.5E-07	9.3E-06	2.3E-06
PR04B	Scale House to WF	1	1	524	10	100%	7.6E-04	7.6E-04	1.1E-04	2.6E-07	5.6E-06	4.1E-04
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	2.2E-03	2.2E-03	3.0E-04	5.8E-07	1.3E-05	1.2E-03
PR04C	Exit Road from WF	1	1	420	10	100%	6.1E-04	6.1E-04	8.5E-05	2.1E-07	4.5E-06	3.3E-04
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	8.7E-04	8.7E-04	1.2E-04	2.2E-07	5.2E-06	4.7E-04
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	1.45E-04	1.45E-04	1.34E-04	1.94E-06	9.64E-05	4.04E-03
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	1.45E-04	1.45E-04	1.34E-04	1.94E-06	9.64E-05	4.04E-03
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	2.8E-03	2.8E-03	2.8E-03	1.8E-04	8.4E-04	0.0E+00
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	5.4E-04	5.4E-04	5.3E-04	3.8E-05	2.3E-04	0.0E+00
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	8.0E-04	8.0E-04	7.8E-04	5.9E-05	1.2E-04	0.0E+00
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	2.9E-04	2.9E-04	2.8E-04	1.7E-05	3.3E-04	0.0E+00

[1] ID should reflect Source ID or Route ID, as appropriate.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010

[5] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on power ratings.

[6] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, PM

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Nitrogen Oxides 10102-44-0 (g/s)	Sulphur Dioxide 7446-09-5 (g/s)	Carbon Dioxide 124-38-9 (g/s)	Methane 74-82-8 (g/s)	Nitrous Oxide 10024-97-2 (g/s)	Tailpipe + Fugitive Emiss TSP PM (g/s)	Tailpipe + Fugitive Emiss PM10 PM10 (g/s)
Mobile Equipment													
PR01	Main Entrance Road	1	1	206	10	100%	4.4E-04	6.4E-07	8.8E-02	2.7E-06	6.5E-07	9.6E-04	3.8E-04
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	1.2E-03	1.3E-06	2.2E-01	6.7E-06	1.5E-06	1.5E-03	9.2E-04
PR04A	Entrance to Scale House	1	1	487	10	100%	1.0E-03	1.5E-06	2.1E-01	6.4E-06	1.5E-06	2.5E-03	9.4E-04
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	1.5E-03	1.7E-06	2.7E-01	8.4E-06	2.0E-06	2.8E-03	1.2E-03
UR06	Across WF	1	1	1366	10	100%	2.9E-03	4.2E-06	5.8E-01	1.8E-05	4.3E-06	3.2E-01	7.5E-02
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	9.0E-03	9.3E-05	3.5E+01	4.4E-05	9.1E-07	3.2E-01	7.3E-02
PR08Z	WF to SS/LTF	1	1	469	10	100%	5.8E-03	3.5E-05	1.2E+01	2.9E-05	3.5E-06	1.3E-02	3.5E-03
UR09Z	WF to SS	1	1	394	10	100%	2.5E-03	2.6E-05	1.0E+01	1.2E-05	0.0E+00	1.5E-01	4.5E-02
UR11Z	Across SS	1	1	749	10	100%	4.8E-03	5.0E-05	1.9E+01	2.2E-05	0.0E+00	3.3E-01	1.0E-01
PR13Z	WF to LTF	1	1	165	10	100%	2.0E-03	1.2E-05	4.4E+00	1.0E-05	1.2E-06	3.6E-03	1.1E-03
PR14Z	WF to LTF	1	1	61	10	100%	3.6E-04	3.9E-07	6.4E-02	2.0E-06	4.5E-07	1.5E-03	4.0E-04
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	2.9E-04	3.0E-06	1.1E+00	1.4E-06	3.0E-08	1.7E-02	5.3E-03
PR04B	Scale House to WF	1	1	524	10	100%	1.1E-03	1.6E-06	2.2E-01	6.9E-06	1.6E-06	3.0E-03	1.1E-03
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	3.2E-03	3.7E-06	5.9E-01	1.8E-05	4.3E-06	4.4E-03	2.5E-03
PR04C	Exit Road from WF	1	1	420	10	100%	9.0E-04	1.3E-06	1.8E-01	5.5E-06	1.3E-06	2.4E-03	8.4E-04
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	1.3E-03	1.5E-06	2.4E-01	7.3E-06	1.7E-06	2.7E-03	1.1E-03
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	1.08E-02	1.30E-05	1.66E+00	7.43E-05	3.12E-05	1.45E-04	1.45E-04
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	1.08E-02	1.30E-05	1.66E+00	7.43E-05	3.12E-05	1.45E-04	1.45E-04
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	4.7E-02	2.8E-04	1.0E+02	2.8E-04	0.0E+00	2.8E-03	2.8E-03
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	9.4E-03	7.4E-05	2.8E+01	5.8E-05	0.0E+00	5.4E-04	5.4E-04
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	1.0E-02	4.0E-05	1.5E+01	8.9E-05	0.0E+00	8.0E-04	8.0E-04
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	8.5E-03	1.1E-04	4.1E+01	2.8E-05	0.0E+00	2.9E-04	2.9E-04

[1] ID should reflect Source ID or Route ID, as appropriate.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010

[5] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on power ratings.

[6] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, PM

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	ion Rate [6] PM2.5 PM2.5 (g/s)	Ratio Tailpipe : Total Emission Rate TSP PM (g/s)	PM10 PM10 (g/s)	PM2.5 PM2.5 (g/s)	Source ID	# of Volume Sources g/hr	# of Volume Sources g/vkt	TSP PM
Mobile Equipment											**Mobile Equipment**			
PR01	Main Entrance Road	1	1	206	10	100%	6.2E-05	3.10E-01	7.76E-01	6.65E-01	PR01	11	11	8.8E-05
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	1.4E-04	5.56E-01	9.06E-01	8.47E-01	PR01Z	11	11	1.4E-04
PR04A	Entrance to Scale House	1	1	487	10	100%	1.5E-04	2.85E-01	7.55E-01	6.39E-01	PR04A	57	57	4.3E-05
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	2.0E-04	3.64E-01	8.16E-01	7.17E-01	PR04AZ	57	57	4.9E-05
UR06	Across WF	1	1	1366	10	100%	7.5E-03	6.15E-03	2.66E-02	3.64E-02	UR06	159	159	2.0E-03
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	7.7E-03	1.70E-03	7.46E-03	5.29E-02	UR06Z	159	159	2.0E-03
PR08Z	WF to SS/LTF	1	1	469	10	100%	7.5E-04	1.52E-01	5.81E-01	5.25E-01	PR08Z	55	55	2.4E-04
UR09Z	WF to SS	1	1	394	10	100%	4.6E-03	7.60E-04	2.52E-03	2.39E-02	UR09Z	46	46	3.3E-03
UR11Z	Across SS	1	1	749	10	100%	1.0E-02	6.53E-04	2.17E-03	2.07E-02	UR11Z	87	87	3.8E-03
PR13Z	WF to LTF	1	1	165	10	100%	2.3E-04	1.98E-01	6.56E-01	6.03E-01	PR13Z	19	19	1.9E-04
PR14Z	WF to LTF	1	1	61	10	100%	7.2E-05	1.68E-01	6.10E-01	4.71E-01	PR14Z	7	7	2.1E-04
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	5.4E-04	1.03E-03	3.38E-03	2.46E-02	UR18Z	5	5	3.5E-03
PR04B	Scale House to WF	1	1	524	10	100%	1.8E-04	2.54E-01	7.24E-01	6.01E-01	PR04B	61	61	4.9E-05
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	3.7E-04	4.95E-01	8.83E-01	8.13E-01	PR04BZ	61	61	7.3E-05
PR04C	Exit Road from WF	1	1	420	10	100%	1.4E-04	2.54E-01	7.24E-01	6.01E-01	PR04C	49	49	4.9E-05
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	1.8E-04	3.28E-01	7.90E-01	6.83E-01	PR04CZ	49	49	5.4E-05
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	1.34E-04	n/a	n/a	n/a	IDLE01	1	1	2.91E-04
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	1.34E-04	n/a	n/a	n/a	IDLE02	1	1	2.91E-04
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	2.8E-03	1.00E+00	1.00E+00	1.00E+00	DOZE2	1	1	2.8E-03
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	5.3E-04	1.00E+00	1.00E+00	1.00E+00	DOZE4	1	1	5.4E-04
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	7.8E-04	1.00E+00	1.00E+00	1.00E+00	DOZE4	1	1	8.0E-04
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	2.8E-04	1.00E+00	1.00E+00	1.00E+00	DOZE4	1	1	2.9E-04

[1] ID should reflect Source ID or Route ID, as appropriate.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010

[5] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on power ratings.

[6] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, PM

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Emission rate per volume source: PM10 PM10	PM2.5 PM25	Benzene 71-43-2	Ammonia 7664-41-7	Nitrogen Dioxide NO2	Nitrogen Oxides 10102-44-0	Sulphur Dioxide 7446-09-5	Carbon Dioxide 124-38-9	Methane 74-82-8
Mobile Equipment															
PR01	Main Entrance Road	1	1	206	10	100%	3.5E-05	5.7E-06	9.4E-09	2.0E-07	1.5E-05	4.0E-05	5.8E-08	8.0E-03	2.5E-07
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	8.4E-05	1.2E-05	1.2E-08	4.2E-07	4.1E-05	1.1E-04	1.2E-07	2.0E-02	6.0E-07
PR04A	Entrance to Scale House	1	1	487	10	100%	1.6E-05	2.7E-06	4.3E-09	9.2E-08	6.7E-06	1.8E-05	2.6E-08	3.6E-03	1.1E-07
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	2.2E-05	3.4E-06	4.4E-09	1.1E-07	9.6E-06	2.6E-05	3.0E-08	4.8E-03	1.5E-07
UR06	Across WF	1	1	1366	10	100%	4.7E-04	4.7E-05	4.3E-09	9.2E-08	6.7E-06	1.8E-05	2.7E-08	3.7E-03	1.1E-07
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	4.6E-04	4.8E-05	1.6E-07	1.8E-06	4.5E-07	5.7E-05	5.8E-07	2.2E-01	2.7E-07
PR08Z	WF to SS/LTF	1	1	469	10	100%	6.4E-05	1.4E-05	1.7E-07	2.0E-06	1.9E-05	1.1E-04	6.3E-07	2.3E-01	5.3E-07
UR09Z	WF to SS	1	1	394	10	100%	9.8E-04	1.0E-04	1.6E-07	1.8E-06	0.0E+00	5.5E-05	5.8E-07	2.2E-01	2.5E-07
UR11Z	Across SS	1	1	749	10	100%	1.1E-03	1.2E-04	1.6E-07	1.8E-06	0.0E+00	5.5E-05	5.8E-07	2.2E-01	2.5E-07
PR13Z	WF to LTF	1	1	165	10	100%	5.7E-05	1.2E-05	1.7E-07	2.0E-06	1.9E-05	1.1E-04	6.4E-07	2.3E-01	5.4E-07
PR14Z	WF to LTF	1	1	61	10	100%	5.7E-05	1.0E-05	5.6E-09	1.9E-07	1.9E-05	5.2E-05	5.5E-08	9.2E-03	2.8E-07
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	1.1E-03	1.1E-04	1.7E-07	1.9E-06	4.6E-07	5.9E-05	6.1E-07	2.3E-01	2.8E-07
PR04B	Scale House to WF	1	1	524	10	100%	1.7E-05	2.9E-06	4.3E-09	9.2E-08	6.7E-06	1.8E-05	2.7E-08	3.7E-03	1.1E-07
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	4.1E-05	6.1E-06	9.5E-09	2.2E-07	1.9E-05	5.3E-05	6.1E-08	9.7E-03	3.0E-07
PR04C	Exit Road from WF	1	1	420	10	100%	1.7E-05	2.9E-06	4.3E-09	9.2E-08	6.7E-06	1.8E-05	2.7E-08	3.7E-03	1.1E-07
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	2.3E-05	3.6E-06	4.4E-09	1.1E-07	9.6E-06	2.6E-05	3.0E-08	4.8E-03	1.5E-07
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	2.91E-04	2.67E-04	3.89E-06	1.93E-04	8.08E-03	2.16E-02	2.61E-05	3.32E+00	1.49E-04
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	2.91E-04	2.67E-04	3.89E-06	1.93E-04	8.08E-03	2.16E-02	2.61E-05	3.32E+00	1.49E-04
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	2.8E-03	2.8E-03	1.8E-04	8.4E-04	0.0E+00	4.7E-02	2.8E-04	1.0E+02	2.8E-04
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	5.4E-04	5.3E-04	3.8E-05	2.3E-04	0.0E+00	9.4E-03	7.4E-05	2.8E+01	5.8E-05
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	8.0E-04	7.8E-04	5.9E-05	1.2E-04	0.0E+00	1.0E-02	4.0E-05	1.5E+01	8.9E-05
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	2.9E-04	2.8E-04	1.7E-05	3.3E-04	0.0E+00	8.5E-03	1.1E-04	4.1E+01	2.8E-05

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[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010

[5] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on power ratings.

[6] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

Appendix 13D: Vehicle Emission Rates - Tailpipe Emissions, PM

Source ID	Description	Traffic Passes [2] Hourly (#/h)	Traffic Passes [2] Daily (#/d)	Segment Length [3] (m)	Mean Vehicle Speed (km/h)	Load Factor [4] (%)	Nitrous Oxide 10024-97-2
Mobile Equipment							
PR01	Main Entrance Road	1	1	206	10	100%	5.9E-08
PR01Z	Main Entrance Road, onsite equipment	1	1	206	10	100%	1.4E-07
PR04A	Entrance to Scale House	1	1	487	10	100%	2.7E-08
PR04AZ	Entrance to Scale House, onsite equipment	1	1	487	10	100%	3.4E-08
UR06	Across WF	1	1	1366	10	100%	2.7E-08
UR06Z	Across WF, onsite equipment	1	1	1366	10	100%	5.7E-09
PR08Z	WF to SS/LTF	1	1	469	10	100%	6.3E-08
UR09Z	WF to SS	1	1	394	10	100%	0.0E+00
UR11Z	Across SS	1	1	749	10	100%	0.0E+00
PR13Z	WF to LTF	1	1	165	10	100%	6.4E-08
PR14Z	WF to LTF	1	1	61	10	100%	6.4E-08
UR18Z	Across WF, onsite equipment	1	1	45	10	100%	6.0E-09
PR04B	Scale House to WF	1	1	524	10	100%	2.7E-08
PR04BZ	Scale House to WF, onsite equipment	1	1	524	10	100%	7.1E-08
PR04C	Exit Road from WF	1	1	420	10	100%	2.7E-08
PR04CZ	Exit Road from WF, onsite equipment	1	1	420	10	100%	3.5E-08
IDLE01	Trucks idling at the Scale House	2	20	1	0	100%	6.25E-05
IDLE02	Trucks idling at the Working Face	2	20	1	0	100%	6.25E-05
DOZE2	Cat Dozers at WF, tailpipe	1	1	1	--	100%	0.0E+00
DOZE4	Cat Dozer at SS, tailpipe	1	1	1	--	100%	0.0E+00
DOZE2CAP	Cat Dozer at final cap face	1	1	1	--	100%	0.0E+00
DOZE2SS	Cat Excavator at clay stockpile	1	1	1	--	100%	0.0E+00

[1] ID should reflect Source ID or Route ID, as appropriate.

[2] Where applicable, this value reflects travel in both directions (e.g., 1 round-trip = 2 passes)

[3] Length of a specific road segment. A separate segment should be used whenever one or more parameters change.

[4] Load Factors from "Median Life, Annual Activity, and Load Factor Values for Nonroad Engine Emissions Modeling", EPA-420-R-10-016, NR-005d, July 2010

[5] Emissions are input on either a vehicle distance or power rating basis. Load factor applies only to emissions based on power ratings.

[6] Applicable only for TSP, PM10 and PM2.5 emissions from mobile equipment. Emissions rates for NOx and stationary sources do not change.

APPENDIX 13E

Appendix 13E: Number of Vehicles per Road Segment per Time Period and Vehicle Weights

				AM				MD				PM			
Road Segment	Vehicle Type	Vehicle Weight (tons)	Mean Vehicle Weight (tons)	Number of Vehicles	Vehicle Passes Per Hour	Total Passes AM	Total Passes Per Hour (All Vehicles) [2]	Number of Vehicles	Vehicle Passes Per Hour	Total Passes MD	Total Passes Per Hour (All Vehicles) [2]	Number of Vehicles	Vehicle Passes Per Hour	Total Passes PM	Total Passes Per Hour (All Vehicles) [2]
PR01	Residential Packers	26.0	34.6	7.0	4.7	293	98	27.9	14.0	390	98	1.7	1.2	173	58
	Roll-offs	21.2		12.2	8.1			48.9	24.4			3.1	2.0		
	Transfer Trailers	44.3		126.4	84.3			89.1	44.5			59.6	39.8		
	Small Vehicles	2.2		0.0	0.0			28.8	14.4			21.6	14.4		
	Contaminated Soil Vehicles	44.3		0.8	0.5			0.5	0.3			0.4	0.2		
PR01Z	Leachate Tankers	44.3	34.6	3.0	2.0	6	2	4.0	2.0	8	2	3.0	2.0	6	2
PR04A	Residential Packers	26.0	38.7	3.5	2.3	147	49	14.0	7.0	167	42	0.9	0.6	65	22
	Roll-offs	21.2		6.1	4.1			24.4	12.2			1.5	1.0		
	Transfer Trailers	44.3		63.2	42.1			44.5	22.3			29.8	19.9		
	Contaminated Soil Vehicles	44.3		0.4	0.3			0.3	0.1			0.2	0.1		
	On-Site Roll Off	21.2		0.2	0.1			0.2	0.1			0.2	0.1		
PR04AZ	Leachate Tankers	44.3	38.7	1.5	1.0	3	1	2.0	1.0	4	1	1.5	1.0	3	1
PR04B	Residential Packers	26.0	38.7	7.0	4.7	293	98	27.9	14.0	333	83	1.7	1.2	130	43
	Roll-offs	21.2		12.2	8.1			48.9	24.4			3.1	2.0		
	Transfer Trailers	44.3		126.4	84.3			89.1	44.5			59.6	39.8		
	Contaminated Soil Vehicles	44.3		0.8	0.5			0.5	0.3			0.4	0.2		
	On-Site Roll Off	21.2		0.3	0.2			0.3	0.2			0.3	0.2		
PR04BZ	Leachate Tankers	44.3	38.7	3.0	2.0	6	2	4.0	2.0	8	2	3.0	2.0	6	2
PR04C	Residential Packers	26.0	38.7	3.5	2.3	147	49	14.0	7.0	167	42	0.9	0.6	65	22
	Roll-offs	21.2		6.1	4.1			24.4	12.2			1.5	1.0		
	Transfer Trailers	44.3		63.2	42.1			44.5	22.3			29.8	19.9		
	Contaminated Soil Vehicles	44.3		0.4	0.3			0.3	0.1			0.2	0.1		
	On-Site Roll Off	21.2		0.2	0.1			0.2	0.1			0.2	0.1		
PR04CZ	Leachate Tankers	44.3	38.7	1.5	1.0	3	1	2.0	1.0	4	1	1.5	1.0	3	1
UR06	Residential Packers	26.0	43.8	7.0	4.7	293	98	27.9	14.0	333	83	1.7	1.2	130	43
	Roll-offs	21.2		12.2	8.1			48.9	24.4			3.1	2.0		
	Transfer Trailers	44.3		126.4	84.3			89.1	44.5			59.6	39.8		
	Contaminated Soil Vehicles	44.3		0.8	0.5			0.5	0.3			0.4	0.2		
UR06Z	Cat D400 Articulated Truck	36.4	43.8	4.4	2.2	122	39	4.4	2.2	158	39	4.4	2.2	122	39
	On-Site Roll Off	21.2		0.3	0.2			0.3	0.2			0.3	0.2		
	Tracked Loader	36.4		2.2	1.1			2.2	1.1			2.2	1.1		
	Final Cap Construction Trucks	55.7		54.0	36.0			72.0	36.0			54.0	36.0		
PR08Z	Leachate Tankers	44.3	53.3	3.0	2.0	127	41	4.0	2.0	165	41	3.0	2.0	127	41
	Cat D400 Articulated Truck	36.4		4.4	2.2			4.4	2.2			4.4	2.2		
	Tracked Loader	36.4		2.2	1.1			2.2	1.1			2.2	1.1		
	Final Cap Construction Trucks	55.7		54.0	36.0			72.0	36.0			54.0	36.0		
UR09Z	Cat D400 Articulated Truck	36.4	36.4	4.4	2.2	13	3	4.4	2.2	13	3	4.4	2.2	13	3
	Tracked Loader	36.4		2.2	1.1			2.2	1.1			2.2	1.1		
UR11Z	Cat D400 Articulated Truck	36.4	50.9	4.4	2.2	148	46	4.4	2.2	184	46	4.4	2.2	148	46
	Tracked Loader	36.4		2.2	1.1			2.2	1.1			2.2	1.1		
	Cat 330L Excavator	36.4		13.4	6.7			13.4	6.7			13.4	6.7		
	Final Cap Construction Trucks	55.7		54.0	36.0			72.0	36.0			54.0	36.0		
PR13Z	Leachate Tankers	44.3	39.1	3.0	2.0	19	5	4.0	2.0	21	5	3.0	2.0	19	5
	Cat D400 Articulated Truck	36.4		4.4	2.2			4.4	2.2			4.4	2.2		
	Tracked Loader	36.4		2.2	1.1			2.2	1.1			2.2	1.1		
PR14Z	Leachate Tankers	44.3	44.3	3.0	2.0	6	2	4.0	2.0	8	2	3.0	2.0	6	2
UR18Z	Cat 836G Compactor	36.4	36.4	447.4	223.7	909	227	447.4	223.7	909	227	447.4	223.7	909	227
	Cat D8R Dozer	36.4		0.0	0.0			0.0	0.0			0.0	0.0		
	Cat D400 Articulated Truck	36.4		4.4	2.2			4.4	2.2			4.4	2.2		
	Cat D6R Dozer	36.4		0.0	0.0			0.0	0.0			0.0	0.0		
	Tracked Loader	36.4		2.2	1.1			2.2	1.1			2.2	1.1		
	On-Site Roll Off	21.2		0.3	0.2			0.3	0.2			0.3	0.2		

Notes:

[1] Incoming trucks along PR04A/PR0AZ, exit through PR04C/PR04CZ.

[2] The AM, MD, and PM periods are 3 hours, 4 hours, and 3 hours long respectively.

Sample Calculation:

Total Pass per Hour for PR01 AM:

PR01 Traffic Passes per Hour AM = 293 Total Passes in AM Period | 1 / 3 Hours in AM Period

PR01 Traffic Passes per Hour AM = 98 Passes per Hour

APPENDIX 13F

Appendix 13F: Industrial Wind Erosion Emissions

Twin Creeks Environmental Centre - Existing Conditions

Project #2101750

INDUSTRIAL WIND EROSION - AP-42 Section 13.2.5

Meteorological Station Anemometer height, z (m):	10
Maximum recorded hourly wind speed (m/s):	20.1
Fastest Mile Wind Speed (m/s):	23.115 **[1]**
Shear Velocity u* (m/s):	1.140 **[2]**

Prandtl-von Kármán Equation: $u^* = u_z k / \ln(z / z_o)$, $k = 0.4$

Emission factor: $E = K \Sigma P_i$ (i from 1 to N)

Erosion potential function: $P = 58 (u^* - u_t^*)^2 + 25 (u^* - u_t^*)$

$P = 0$ for $u^* \le u_t^*$

u* shear / friction velocity (m/s)
u_z wind speed at height z (m/s)
k von Kármán's contstant
K particle size multiplier (1, 0.6, 0.5 and 0.075 for TSP, PM_{15}, PM_{10} and $PM_{2.5}$, respectively)
z_o surface roughness length (m)
z anemometer height (m)

ID [3]	Pile	z_o (m)	u*	u_t* [3] (m/s)	Number of Disturbances [4] Hourly (#/h)	Daily (#/d)	Annual (#/a)	Area Disturbed [5] (m^2)	Maximum Erosion Potential	Base AP-42 Emission Factor TSP (g/m^2)	PM_{10} (g/m^2)	$PM_{2.5}$ (g/m^2)	Base Emission Rate TSP (g/s)	PM_{10} (g/s)	$PM_{2.5}$ (g/s)	Additional Control Efficiency Applied (%)	Final Controlled Emission Rate at 20.1 m/s TSP (g/s)	Data Quality Rating	PM_{10} (g/s)	Data Quality Rating	$PM_{2.5}$ (g/s)	Data Quality Rating
WIND_SS	Soil stockpile	0.003	1.14	1.02	1	2	4	20900	3.829	3.8E+00	1.9E+00	2.9E-01	2.2E+01	1.1E+01	1.7E+00	0%	2.2E+01	E	1.1E+01	E	1.7E+00	E
WIND_WF	Working face	0.003	1.14	1.02	1	2	4	5040	3.829	3.8E+00	1.9E+00	2.9E-01	5.4E+00	2.7E+00	4.0E-01	0%	5.4E+00	E	2.7E+00	E	4.0E-01	E
WIND_CAP	Final Cap Construction Wind Erosion	0.003	1.14	1.02	1	2	4	5040	3.829	3.8E+00	1.9E+00	2.9E-01	5.4E+00	2.7E+00	4.0E-01	0%	5.4E+00	E	2.7E+00	E	4.0E-01	E

[1] Speed-up factor to convert hourly mean wind speeds to fastest mile wind gust taken from Durst curve for in North America (1.15).
(Krayer, William R>, Marshall, Richard D. 1992: Gust Factors Applied to Hurrican Winds. Bulletin of the American Meteorological Society, Vol. 73, No. 5, May 1992)

[2] Used for sample calculations & factor validation

[3] Typical threshold friction veolocities can be taken from Table 13.2.5-2 of AP-42, or other suitable sources.

[4] Reflects the estimated maximum number of disturbances for each pile within the specified time period.

[5] Estimated from type of operations (e.g., loader operations, scraper activity, etc.)

Comments

Sample Calculations

Shear Velocity: = (23.115 m/s) x 0.4 / LN ((10 m) / (0.003 m)) = 1.14 m/s

Maximum Erosion Potential: 1.14 m/s > 1.02 m/s therefore = 58 x ((1.14 m/s) - (1.02 m/s))^2 + 25 x ((1.14 m/s) - (1.02 m/s))) = 3.829

TSP Emission Factor: = (1) x (3.829) x (1 disturbance per hour) = 3.829 g/m²/h

Base Emission Rate: = (20900 m²) x (3.829 g/m²/h) / (3600 s/h) = 22.227314 g/s

APPENDIX 13G

Appendix 13G: Bulk Material Handling Emissions Spreadsheet

RWDI Project# 2101750

Twin Creeks Environmental Centre - Existing Conditions

Material handling emissions: $E = 0.0016\ k\ (U / 2.2)^{1.3} / (M / 2)^{1.4}$

E emission factor
k particle size multiplier (0.8, 0.74, 0.35 and 0.053 for TSP, PM_{30}, PM_{10} and $PM_{2.5}$, respectively) [3]
U mean wind speed, meters per second (m/s)
M material moisture content (%)

AGGREGATE HANDLING AND STORAGE PILES - AP-42 Section 13.2.4

Average recorded hourly wind speed (m/s): 3.1
(used for sample calculations & factor validation)

Source ID [1]	Description	Processing Rate			Site Data				Base AP-42 Emission Factor				Base Emission Rate				Additional Control Efficiency Applied	Final Controlled Emission Rate at 3.1 m/s					
		Hourly	Daily	Annual	Site Specific Data?	Silt Content	Moisture Content	Source Conditions Valid [2]	TSP	PM_{10}	$PM_{2.5}$	Silica	TSP	PM_{10}	$PM_{2.5}$	Silica		TSP	Data Quality Rating	PM_{10}	Data Quality Rating	$PM_{2.5}$	Data Quality Rating
		(Mg/h)	(Mg/d)	(Mg/y)	(y/n)	(%)	(%)		(kg/Mg)	(kg/Mg)	(kg/Mg)	(kg/Mg)	(g/s)	(g/s)	(g/s)	(g/s)	(%)	(g/s)		(g/s)		(g/s)	
DC_WF	Daily Cover dropped at Working Face	168			n	9.0%	12.0%	moisture too high	1.6E-04	7.1E-05	1.1E-05	0.0E+00	7.6E-03	3.3E-03	5.0E-04	0.0E+00		7.6E-03	C	3.3E-03	C	5.0E-04	C
DC_SS	Daily Cover dropped at Soil Stockpile	90			n	9.0%	12.0%	moisture too high	1.6E-04	7.1E-05	1.1E-05	0.0E+00	4.1E-03	1.8E-03	2.7E-04	0.0E+00		4.1E-03	C	1.8E-03	C	2.7E-04	C
CDA1	Compost Material dropped at Compost Diversion Area 1 (North)	0			n	9.0%	12.0%	moisture too high	1.6E-04	7.1E-05	1.1E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00		0.0E+00	C	0.0E+00	C	0.0E+00	C
CDA2	Compost Material dropped at Compost Diversion Area 2 (South)	0			n	9.0%	12.0%	moisture too high	1.6E-04	7.1E-05	1.1E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00		0.0E+00	C	0.0E+00	C	0.0E+00	C
CS_WF	Contaminated Soil dropped at Working Face	3			n	9.0%	12.0%	moisture too high	1.6E-04	7.1E-05	1.1E-05	0.0E+00	1.4E-04	5.9E-05	9.0E-06	0.0E+00		1.4E-04	C	5.9E-05	C	9.0E-06	C
FC_CAP	Final cover truck unloading at final cap working face	653			n	85.2%	20.2%	silt too high	7.8E-05	3.4E-05	5.2E-06	0.0E+00	1.4E-02	6.2E-03	9.4E-04	0.0E+00		1.4E-02	C	6.2E-03	C	9.4E-04	C
FC_SS	Final cover loading of clay at stockpile	653			n	85.2%	20.2%	silt too high	7.8E-05	3.4E-05	5.2E-06	0.0E+00	1.4E-02	6.2E-03	9.4E-04	0.0E+00		1.4E-02	C	6.2E-03	C	9.4E-04	C

[1] ID corresponds to process flow diagram for facility and / or material
[2] Relates to AP-42 Section 13.2.4-4
[3] k-factor for TSP (PM44) scaled up logarithmically to 0.8 from published k-factor of 0.74 which refers to PM30.

Comments

Sample calculation for uncontrolled TSP emission factor for Source DC_WF: Daily Cover dropped at Working Face, at a sample wind speed of 5 m/s

EF = 0.0016 x (0.8) x ((3.1 m/s) / 2.2)^1.3 / ((12%) / 2)^1.4 = 1.6E-04 kg TSP / Mg handled

Sample calculation for TSP emission rate for Source DC_WF: Daily Cover dropped at Working Face, at a sample wind speed of 5 m/s

$$\frac{168\ Mg_{handled}}{1\ h} \left| \frac{1.6E\text{-}04\ kg_{TSP}}{1\ Mg_{handled}} \right| \frac{1\ h}{3600\ s} \left| \frac{1000\ g_{TSP}}{1\ kg_{TSP}} \right| \frac{1\ g_{TSP\ uncontrolled}}{1\ g_{TSP}} = 7.6E\text{-}03\ g_{TSP} / s$$

APPENDIX 13H

Appendix 13H: Bulldozer Activity Emissions

Project #2101750

Twin Creeks Environmental Centre - Existing Conditions

Western Surface Coal Mining AP -42 Section 11.9 (11.9-2, 11.9-4)

ID [1]	Process Name / Description	AP-42 Process Description	Process Code	AP-42 Chapter	Activity Rate	Units	Additional Parameters		Base AP-42 Emission Factor				Base Emission Rate			Final Controlled Emission Rate [4]					
					Hourly		Material Moisture Content [2]	Material Silt Content [3]	TSP	PM_{10}	$PM_{2.5}$	Units	TSP	PM_{10}	$PM_{2.5}$	TSP	Data Quality Rating	PM_{10}	Data Quality Rating	$PM_{2.5}$	Data Quality Rating
					(units/h)		(%)	(%)					(g/s)	(g/s)	(g/s)	(g/s)		(g/s)		(g/s)	
DOZE1	Cat Dozers at WF	Bulldozing - overburden	4	Table 11.9-2	4	hours of operation	24	44.74	4.0E+00	1.2E+00	4.2E-01	kg/hr	4.4E+00	1.3E+00	4.7E-01	4.4E+00	B	1.3E+00	D	4.7E-01	D
DOZE3	Cat Dozer at SS	Bulldozing - overburden	4	Table 11.9-2	1	hours of operation	12	44.74	9.8E+00	3.1E+00	1.0E+00	kg/hr	2.7E+00	8.7E-01	2.9E-01	2.7E+00	B	8.7E-01	D	2.9E-01	D
DOZE1CAP	CAT Dozer at FC	Bulldozing - overburden	4	Table 11.9-2	2	hours of operation	20.2	81.15	1.0E+01	3.7E+00	1.1E+00	kg/hr	5.7E+00	2.0E+00	6.0E-01	5.7E+00	B	2.0E+00	D	6.0E-01	D

[1] ID corresponds to process flow diagram for facility and / or material

[2] Applies to truck loading, bulldozing and dragline operations only

[3] Applies to bulldozing operations only

[4] Dozer emission rate for DOZE1 (working face) for the first and last hours of operation each day. Daily cover is removed and replaced during these times; for the remaining hours of operation, the working face is exposed waste which is minimal source of fugitive dust.

Soil Compaction Verification Report

Project No.:	12583607-B1	Date:	August 11, 2022
Client:	RWDI	Contractor:	Ron Murphy Contracting Co. Ltd.
Project:	Twin Creeks Landfill Expansion - Cell 6A	Site Visit Type:	☑ Full time ☐ Part time
Location:	Zion Line & Nauvoo Road, Watford, ON		

Material Type	Material Description	Maximum Dry Density (kg/m^3)	Optimum Water Content (%)
2	Native Grey Clay	1752	20.2
3	Bedding Sand	1950	12.4

Maximum dry density obtained from: ☑ STD. Test ☐ MOD. Test ☐ Estimated ☐ Control Strip

Sample(s) Secured: ☐ Yes ☑ No

If yes, specify testing to be done:
Proctor ☐ STD. ☐ MOD. ☐ Gradation

Area Tested: Gas Header & Gas Sub-Header

Test No.	Test Location	Test Elevation	Material Type	Dry Density (kg/m^3)	Moisture Content (%)	Compaction (%)	Specified (%)	Action
1	Sub-Header Pipe - Station 0+305	0.00	3	1919	6.5	98	98	C
2	Sub-Header Pipe - Station 0+325	0.00	3	1939	6.9	99	98	C
3	Sub-Header Pipe - Station 0+345	0.00	3	1933	7.8	99	98	C
4	Sub-Header Pipe - Station 0+365	0.00	3	1937	6.1	99	98	C
5	Sub-Header Pipe - Station 0+385	0.00	3	1929	6.9	99	98	C
6	Sub-Header Pipe - Station 0+320	-0.30	2	1814	12.5	100+	95	C
7	Header Pipe - Station 0+320	-0.90	2	1800	12.9	100+	95	C

Action: C = Complying to specifications NC = Not complying to specifications

Comments:
Test Elevation refers to top of pipe.

Standard Counts (OPSS 501 acceptable variation: density 2%, moisture 4%)

Gauge No. 70460	Calibration	Field Reading	Variation %
Density	2918	2900	0.6
Moisture	718	717	0.1

Site Rep.: Jeff Cleland Prepared By: Mark MacEwen

Of: RWDI Reviewed By: Mark MacEwen

For Internal Use Only Have: ☑ JSA/JSEA ☑ PPE ☑ Training ☑ Pre-Work Assessment Initials: MM

APPENDIX 13I

Appendix 13I: Landfill Gas Flare Combustion Emissions

Emission Factors and Emission Rate Development for Combustion By-Products from Landfill Gas Flares

Source ID	Source Description	Contaminant	CAS	Emission Factor	Units	Note	Data Quality	Estimation Technique	Landfill Gas Emission Rate (g/s)	Bypass Scenario Emission Rate (g/s) (g/s) [2]
Flare1	Waste Gas Burner (Flare A)	Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	2.48E-01	--
Flare2	Waste Gas Burner (Flare B)	Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	2.48E-01	--
Flare3	Waste Gas Burner (Flare C)	Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	2.48E-01	--
Flare4	Waste Gas Burner (Flare D)	Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	1.12E-01	--
FLARE5	Waste Gas Burner (Flare E)	Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	2.25E-01	2.18E-01
Flare6	Waste Gas Burner (Flare F)	Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	2.25E-01	2.18E-01
RNG_TO1	Off-Spec RNG Gas	Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	4.65E-03	--
RNG_TO2	Off-Spec RNG Gas	Particulate Matter	PM	238	kg/10^6 dscm Methane	[1]	D	EF	7.71E-02	--

Notes:

[1] Emission factors for PM are from US EPA AP-42 Table 2.4-4 (Emission Factors for Secondary Compounds Exiting Control Devices).

[2] Flare 5 and flare 6 are used to combust off-spec landfill gas when the thermal oxidizers are not operational. For the bypass scenario emissions of sulphur dioxide are calculated in Appendix C9. All sulphur compounds were calculated using the emissions data provided by Morrow Energy.

Data provided by Comcor for Flare1-Flare3

Flare Flow Rate per Flare=	2.08	(m^3/s)
Flare Flow Rate per Flare=	125	(m^3/min)
Flare Methane Concentration per Flare=	50%	
Flare Methane Flow Rate per Flare=	62.5	(m^3/min)
Flare Methane Flow Rate per Flare=	**1.04**	(m^3/s)

Data provided by TCLF for Flare4

Flare Flow Rate =	0.94	(m^3/s)
Flare Flow Rate =	57	(m^3/min)
Flare Methane Concentration =	50%	
Flare Methane Flow Rate =	28.3	(m^3/min)
Flare Methane Flow Rate =	**0.47**	(m^3/s)

Data Provided in John Zinkhamworthy quote for Flares 5 and 6 - per flare Startup Operations

Flare Flow Rate =	1.89	(m^3/s)
Flare Flow Rate =	113	(m^3/min)
Flare Methane Concentration =	50%	
Flare Methane Flow Rate =	56.6	(m^3/min)
Flare Methane Flow Rate =	**0.94**	(m^3/s)

Data provided by Comcor for Flare1-Flare3

Flare A Methane Flow Rate =	1.04	(m^3/s)
Flare B Methane Flow Rate =	1.04	(m^3/s)
Flare C Methane Flow Rate =	1.04	(m^3/s)

Data provided by TCLF for Flare4

Flare D Methane Flow Rate =	0.47	(m^3/s)

Bypass Scenario

Flare Flow Rate =	0.94	(m^3/s)
Flare Flow Rate =	57	(m^3/min)
Flare Methane Concentration Bypass Scenario=	97%	
Bypass Scenario Flare Methane Flow Rate =	54.9	(m^3/min)
Bypass Scenario Flare Methane Flow Rate =	**0.92**	(m^3/s)

Data Provided in MRW pre-treatment thermal oxidizer quote

Thermal Oxidizer Flow Rate =	0.33	(m^3/s)
Thermal Oxidizer Flow Rate =	20	(m^3/min)
Thermal Oxidizer Methane Concentration =	6%	
Thermal Oxidizer Methane Flow Rate =	1.2	(m^3/min)
Thermal Oxidizer Methane Flow Rate =	**0.02**	(m^3/s)

Data Provided in MRW direct fired thermal oxidizer quote

Thermal Oxidizer Flow Rate =	2.31	(m^3/s)
Thermal Oxidizer Flow Rate =	139	(m^3/min)
Thermal Oxidizer Methane Concentration =	14%	
Thermal Oxidizer Methane Flow Rate =	19.4	(m^3/min)
Thermal Oxidizer Methane Flow Rate =	**0.32**	(m^3/s)

Total (for 6 flares) =	**5.48**	(m^3/s)
Total (for 2 thermal oxidizers) =	**0.34**	(m^3/s)

APPENDIX 13J

Appendix 13J: Waste Management Twin Creeks Environmental Center - Particle Size Data

From Particle Size Distribution Curve for PR1 Sample

Summary Of Lab Analysis - Raw Data

	Mass Under %
Size (µm)	PR1
9500.00	100.0%
4750.00	100.0%
19000.00	100.0%
25400.00	100.0%
38100.00	100.0%
50800.00	100.0%
76200.00	100.0%
1000.00	91.5%
841.00	90.6%
500.00	86.2%
420.00	85.0%
250.00	77.7%
149.00	66.8%
125.00	61.3%
75.00	49.8%
63.00	43.0%
50.00	35.7%
31.20	23.4%
20.00	18.4%
5.00	13.6%
4.00	12.8%
2.00	11.6%

sand (2.0mm - 0.05mm)	58.3
silt (0.05mm - 0.002mm)	29.6
clay (<0.002mm)	12.1

Sorted Lab Data

	Vol Under %
Size (µm)	PR1
2.00	11.60%
4.00	12.80%
5.00	13.60%
20.00	18.40%
31.20	23.40%
50.00	35.70%
63.00	43.00%
75.00	49.80%
125.00	61.30%
149.00	66.80%
250.00	77.70%
420.00	85.00%
500.00	86.20%
841.00	90.60%
1000.00	91.50%
4750.00	100.00%
9500.00	100.00%
19000.00	100.00%
25400.00	100.00%
38100.00	100.00%
50800.00	100.00%
76200.00	100.00%

Calculating Size Fractions - PM100

		Size Fraction
Size (µm)	Midpoints	PR1
<2	1.0	11.60%
2 - 4	3.00	1.20%
4 - 5	4.50	0.80%
5 - 20	12.50	4.80%
20 - 31.2	25.60	5.00%
31.2 - 50	40.60	12.30%
50 - 63	56.50	7.30%
63 - 75	69.00	6.80%
75 - 125	100.00	11.50%
		0.613

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR1
<2	1.0	0.19
2 - 4	3.0	0.02
4 - 5	4.5	0.01
5 - 20	12.5	0.08
20 - 31.2	25.6	0.08
31.2 - 50	40.6	0.20
50 - 63	56.5	0.12
63 - 75	69.0	0.11
75 - 125	100.0	0.19
		1.00

Calculating Size Fractions - PM44

		Size Fraction
Size (µm)	Midpoints	PR1
<2	1.0	11.60%
2 - 4	3.00	1.20%
4 - 5	4.50	0.80%
5 - 20	12.50	4.80%
20 - 31.2	25.60	5.00%
31.2 - 50	40.60	12.30%
		0.357

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR1
<2	1.0	0.32
2 - 4	3.0	0.03
4 - 5	4.5	0.02
5 - 20	12.5	0.13
20 - 31.2	25.6	0.14
31.2 - 50	40.6	0.34
		1.00000

Calculating Size Fractions - PM10

		Size Fraction
Size (µm)	Midpoints	PR1
<2	1.0	11.60%
2 - 4	3.00	1.20%
4 - 5	4.50	0.80%
5 - 20	12.50	4.80%
		0.184000

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR1
<2	1.0	0.63
2 - 4	3.0	0.07
4 - 5	4.5	0.04
5 - 20	12.5	0.26
		#DIV/0!

Calculating Size Fractions - PM2.5

		Size Fraction
Size (µm)	Midpoints	PR1
<2	1.0	11.60%
2 - 4	3.00	1.20%
		0.13

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR1
<2	1.0	0.91
2 - 4	3.0	0.09
		1.00

Appendix 13J: Waste Management Twin Creeks Environmental Center - Particle Size Data

From Particle Size Distribution Curve for PR2 Sample

Summary Of Lab Analysis - Raw Data

	Mass Under %
Size (µm)	PR2
9500.00	100.0%
4750.00	95.5%
19000.00	100.0%
25400.00	100.0%
38100.00	100.0%
50800.00	100.0%
76200.00	100.0%
1000.00	78.8%
841.00	77.2%
500.00	71.0%
420.00	69.4%
250.00	63.2%
149.00	56.4%
125.00	51.4%
75.00	41.1%
63.00	39.9%
50.00	38.6%
31.20	32.8%
20.00	27.8%
5.00	20.1%
4.00	18.9%
2.00	16.6%

sand (2.0mm - 0.05mm)	51.6
silt (0.05mm - 0.002mm)	29.0
clay (<0.002mm)	19.4

Sorted Lab Data

	Vol Under %
Size (µm)	PR2
2.00	16.60%
4.00	18.90%
5.00	20.10%
20.00	27.80%
31.20	32.80%
50.00	38.60%
63.00	39.90%
75.00	41.10%
125.00	51.40%
149.00	56.40%
250.00	63.20%
420.00	69.40%
500.00	71.00%
841.00	77.20%
1000.00	78.80%
4750.00	95.50%
9500.00	100.00%
19000.00	100.00%
25400.00	100.00%
38100.00	100.00%
50800.00	100.00%
76200.00	100.00%

Calculating Size Fractions - PM100

		Size Fraction
Size (µm)	Midpoints	PR2
<2	1.0	16.60%
2 - 4	3.00	2.30%
4 - 5	4.50	1.20%
5 - 20	12.50	7.70%
20 - 31.2	25.60	5.00%
31.2 - 50	40.60	5.80%
50 - 63	56.50	1.30%
63 - 75	69.00	1.20%
75 - 125	100.00	10.30%
		0.514

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR2
<2	1.0	0.32
2 - 4	3.0	0.04
4 - 5	4.5	0.02
5 - 20	12.5	0.15
20 - 31.2	25.6	0.10
31.2 - 50	40.6	0.11
50 - 63	56.5	0.03
63 - 75	69.0	0.02
75 - 125	100.0	0.20
		1.00

Calculating Size Fractions - PM44

		Size Fraction
Size (µm)	Midpoints	PR2
<2	1.0	16.60%
2 - 4	3.00	2.30%
4 - 5	4.50	1.20%
5 - 20	12.50	7.70%
20 - 31.2	25.60	5.00%
31.2 - 50	40.60	5.80%
		0.386

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR2
<2	1.0	0.43
2 - 4	3.0	0.06
4 - 5	4.5	0.03
5 - 20	12.5	0.20
20 - 31.2	25.6	0.13
31.2 - 50	40.6	0.15
		1.00000

Calculating Size Fractions - PM10

		Size Fraction
Size (µm)	Midpoints	PR2
<2	1.0	16.60%
2 - 4	3.00	2.30%
4 - 5	4.50	1.20%
5 - 20	12.50	7.70%
		0.278000

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR2
<2	1.0	0.60
2 - 4	3.0	0.08
4 - 5	4.5	0.04
5 - 20	12.5	0.28
		1.00

Calculating Size Fractions - PM2.5

		Size Fraction
Size (µm)	Midpoints	PR2
<2	1.0	16.60%
2 - 4	3.00	2.30%
		0.19

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR2
<2	1.0	0.88
2 - 4	3.0	0.12
		1.00

Appendix 13J: Waste Management Twin Creeks Environmental Center - Particle Size Data

From Particle Size Distribution Curve for PR3 Sample

Summary Of Lab Analysis - Raw Data

	Mass Under %
Size (µm)	PR3
9500.00	100.0%
4750.00	94.3%
19000.00	100.0%
25400.00	100.0%
38100.00	100.0%
50800.00	100.0%
76200.00	100.0%
1000.00	65.8%
841.00	62.8%
500.00	49.3%
420.00	46.1%
250.00	36.1%
149.00	27.3%
125.00	24.5%
75.00	18.8%
63.00	17.2%
50.00	15.7%
31.20	14.3%
20.00	12.1%
5.00	9.8%
4.00	9.0%
2.00	8.0%

sand (2.0mm - 0.05mm)	78.1
silt (0.05mm - 0.002mm)	11.7
clay (<0.002mm)	10.2

Sorted Lab Data

	Vol Under %
Size (µm)	PR3
2.00	8.00%
4.00	9.00%
5.00	9.80%
20.00	12.10%
31.20	14.30%
50.00	15.70%
63.00	17.20%
75.00	18.80%
125.00	24.50%
149.00	27.30%
250.00	36.10%
420.00	46.10%
500.00	49.30%
841.00	62.80%
1000.00	65.80%
4750.00	94.30%
9500.00	100.00%
19000.00	100.00%
25400.00	100.00%
38100.00	100.00%
50800.00	100.00%
76200.00	100.00%

Calculating Size Fractions - PM100

		Size Fraction
Size (µm)	Midpoints	PR3
<2	1.0	8.00%
2 - 4	3.00	1.00%
4 - 5	4.50	0.80%
5 - 20	12.50	2.30%
20 - 31.2	25.60	2.20%
31.2 - 50	40.60	1.40%
50 - 63	56.50	1.50%
63 - 75	69.00	1.60%
75 - 125	100.00	5.70%
		0.245

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR3
<2	1.0	0.33
2 - 4	3.0	0.04
4 - 5	4.5	0.03
5 - 20	12.5	0.09
20 - 31.2	25.6	0.09
31.2 - 50	40.6	0.06
50 - 63	56.5	0.06
63 - 75	69.0	0.07
75 - 125	100.0	0.23
		1.00

Calculating Size Fractions - PM44

		Size Fraction
Size (µm)	Midpoints	PR3
<2	1.0	8.00%
2 - 4	3.00	1.00%
4 - 5	4.50	0.80%
5 - 20	12.50	2.30%
20 - 31.2	25.60	2.20%
31.2 - 50	40.60	1.40%
		0.157

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR3
<2	1.0	0.51
2 - 4	3.0	0.06
4 - 5	4.5	0.05
5 - 20	12.5	0.15
20 - 31.2	25.6	0.14
31.2 - 50	40.6	0.09
		1.00000

Calculating Size Fractions - PM10

		Size Fraction
Size (µm)	Midpoints	PR3
<2	1.0	8.00%
2 - 4	3.00	1.00%
4 - 5	4.50	0.80%
5 - 20	12.50	2.30%
		0.121000

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR3
<2	1.0	0.66
2 - 4	3.0	0.08
4 - 5	4.5	0.07
5 - 20	12.5	0.19
		1.00

Calculating Size Fractions - PM2.5

		Size Fraction
Size (µm)	Midpoints	PR3
<2	1.0	8.00%
2 - 4	3.00	1.00%
		0.09

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR3
<2	1.0	0.89
2 - 4	3.0	0.11
		1.00

Appendix 13J: Waste Management Twin Creeks Environmental Center - Particle Size Data

From Particle Size Distribution Curve for PR4 Sample

Summary Of Lab Analysis - Raw Data

	Mass Under %
Size (µm)	PR4
9500.00	100.0%
4750.00	95.6%
19000.00	100.0%
25400.00	100.0%
38100.00	100.0%
50800.00	100.0%
76200.00	100.0%
1000.00	78.2%
841.00	76.4%
500.00	64.3%
420.00	61.3%
250.00	48.4%
149.00	36.6%
125.00	33.0%
75.00	25.6%
63.00	23.4%
50.00	21.0%
31.20	17.5%
20.00	15.2%
5.00	11.6%
4.00	11.0%
2.00	9.1%

sand (2.0mm - 0.05mm)	73.1
silt (0.05mm - 0.002mm)	15.6
clay (<0.002mm)	11.2

Sorted Lab Data

	Vol Under %
Size (µm)	PR4
2.00	9.10%
4.00	11.00%
5.00	11.60%
20.00	15.20%
31.20	17.50%
50.00	21.00%
63.00	23.40%
75.00	25.60%
125.00	33.00%
149.00	36.60%
250.00	48.40%
420.00	61.30%
500.00	64.30%
841.00	76.40%
1000.00	78.20%
4750.00	95.60%
9500.00	100.00%
19000.00	100.00%
25400.00	100.00%
38100.00	100.00%
50800.00	100.00%
76200.00	100.00%

Calculating Size Fractions - PM100

		Size Fraction
Size (µm)	Midpoints	PR4
<2	1.0	9.10%
2 - 4	3.00	1.90%
4 - 5	4.50	0.60%
5 - 20	12.50	3.60%
20 - 31.2	25.60	2.30%
31.2 - 50	40.60	3.50%
50 - 63	56.50	2.40%
63 - 75	69.00	2.20%
75 - 125	100.00	7.40%
		0.33

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR4
<2	1.0	0.28
2 - 4	3.0	0.06
4 - 5	4.5	0.02
5 - 20	12.5	0.11
20 - 31.2	25.6	0.07
31.2 - 50	40.6	0.11
50 - 63	56.5	0.07
63 - 75	69.0	0.07
75 - 125	100.0	0.22
		1.00

Calculating Size Fractions - PM44

		Size Fraction
Size (µm)	Midpoints	PR4
<2	1.0	9.10%
2 - 4	3.00	1.90%
4 - 5	4.50	0.60%
5 - 20	12.50	3.60%
20 - 31.2	25.60	2.30%
31.2 - 50	40.60	3.50%
		0.21

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR4
<2	1.0	0.43
2 - 4	3.0	0.09
4 - 5	4.5	0.03
5 - 20	12.5	0.17
20 - 31.2	25.6	0.11
31.2 - 50	40.6	0.17
		1.00000

Calculating Size Fractions - PM10

		Size Fraction
Size (µm)	Midpoints	PR4
<2	1.0	9.10%
2 - 4	3.00	1.90%
4 - 5	4.50	0.60%
5 - 20	12.50	3.60%
		0.152000

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR4
<2	1.0	0.60
2 - 4	3.0	0.13
4 - 5	4.5	0.04
5 - 20	12.5	0.24
		1.00

Calculating Size Fractions - PM2.5

		Size Fraction
Size (µm)	Midpoints	PR4
<2	1.0	9.10%
2 - 4	3.00	1.90%
		0.11

Percentage of Total

		% of Total
Size (µm)	Midpoints	PR4
<2	1.0	0.83
2 - 4	3.0	0.17
		1.00

Appendix 13J: Waste Management Twin Creeks Environmental Center - Particle Size Data

Calculating Size Fractions - PM100

Midpoints				
PR1	PR2	PR3	PR4	Average
1.0	1.0	1.0	1.0	1.0
3.0	3.0	3.0	3.0	3.0
4.5	4.5	4.5	4.5	4.5
12.5	12.5	12.5	12.5	12.5
25.6	25.6	25.6	25.6	25.6
40.6	40.6	40.6	40.6	40.6
56.5	56.5	56.5	56.5	56.5
69.0	69.0	69.0	69.0	69.0
100.0	100.0	100.0	100.0	100.0

Calculating Size Fractions - PM100

Size Fractions				
PR1	PR2	PR3	PR4	Average
0.19	0.32	0.33	0.28	0.28
0.02	0.04	0.04	0.06	0.04
0.01	0.02	0.03	0.02	0.02
0.08	0.15	0.09	0.11	0.11
0.08	0.10	0.09	0.07	0.08
0.20	0.11	0.06	0.11	0.12
0.12	0.03	0.06	0.07	0.07
0.11	0.02	0.07	0.07	0.07
0.19	0.20	0.23	0.22	0.21

Calculating Size Fractions - PM44

Midpoints				
PR1	PR2	PR3	PR4	Average
1.0	1	1	1	1.0
3.0	3.00	3.00	3	3.0
4.5	4.50	4.50	4.5	4.5
12.5	12.50	12.50	12.5	12.5
25.6	25.60	25.60	25.6	25.6
40.6	40.60	40.60	40.6	40.6

Calculating Size Fractions - PM44

Size Fractions				
PR1	PR2	PR3	PR4	Average
0.32	0.43	0.51	0.43	0.424
0.03	0.06	0.06	0.09	0.062
0.02	0.03	0.05	0.03	0.033
0.13	0.20	0.15	0.17	0.163
0.14	0.13	0.14	0.11	0.130
0.34	0.15	0.09	0.17	0.188

Calculating Size Fractions - PM10

Midpoints				
PR1	PR2	PR3	PR4	Average
1.0	1	1	1	1.0
3.0	3.00	3.00	3	3.0
4.5	4.50	4.50	4.5	4.5
12.5	12.50	12.50	12.5	12.5

Calculating Size Fractions - PM10

Size Fractions				
PR1	PR2	PR3	PR4	Average
0.63	0.60	0.66	0.60	0.622
0.07	0.08	0.08	0.13	0.089
0.04	0.04	0.07	0.04	0.048
0.26	0.28	0.19	0.24	0.241

Calculating Size Fractions - PM2.5

Midpoints				
PR1	PR2	PR3	PR4	Average
1.0	1	1	1	1.0
3.0	3.00	3.00	3	3.0

Calculating Size Fractions - PM2.5

Size Fractions				
PR1	PR2	PR3	PR4	Average
0.91	0.88	0.89	0.83	0.875
0.09	0.12	0.11	0.17	0.125

Appendix 13J: Waste Management Twin Creeks Environmental Center - Particle Size Data

From Particle Size Distribution Curve for UP1 Sample

Summary Of Lab Analysis - Raw Data

	Mass Under %
Size (µm)	UP1
9500.00	89.6%
4750.00	74.1%
19000.00	100.0%
25400.00	100.0%
38100.00	100.0%
50800.00	100.0%
76200.00	100.0%
1000.00	50.4%
841.00	48.5%
500.00	39.2%
420.00	36.9%
250.00	29.1%
149.00	22.8%
125.00	20.9%
75.00	16.8%
63.00	15.1%
50.00	13.2%
31.20	10.4%
20.00	8.7%
5.00	5.2%
4.00	4.5%
2.00	3.4%

sand (2.0mm - 0.05mm)	74.2
silt (0.05mm - 0.002mm)	18.5
clay (<0.002mm)	7.2

Sorted Lab Data

	Vol Under %
Size (µm)	UP1
2.00	3.40%
4.00	4.50%
5.00	5.20%
20.00	8.70%
31.20	10.40%
50.00	13.20%
63.00	15.10%
75.00	16.80%
125.00	20.90%
149.00	22.80%
250.00	29.10%
420.00	36.90%
500.00	39.20%
841.00	48.50%
1000.00	50.40%
4750.00	74.10%
9500.00	89.60%
19000.00	100.00%
25400.00	100.00%
38100.00	100.00%
50800.00	100.00%
76200.00	100.00%

Calculating Size Fractions - PM100

		Size Fraction
Size (µm)	Midpoints	UP1
<2	1.0	3.40%
2 - 4	3.00	1.10%
4 - 5	4.50	0.70%
5 - 20	12.50	3.50%
20 - 31.2	25.60	1.70%
31.2 - 50	40.60	2.80%
50 - 63	56.50	1.90%
63 - 75	69.00	1.70%
75 - 125	100.00	4.10%
		0.209

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP1
<2	1.0	0.16
2 - 4	3.0	0.05
4 - 5	4.5	0.03
5 - 20	12.5	0.17
20 - 31.2	25.6	0.08
31.2 - 50	40.6	0.13
50 - 63	56.5	0.09
63 - 75	69.0	0.08
75 - 125	100.0	0.20
		1.00

Calculating Size Fractions - PM44

		Size Fraction
Size (µm)	Midpoints	UP1
<2	1.0	3.40%
2 - 4	3.00	1.10%
4 - 5	4.50	0.70%
5 - 20	12.50	3.50%
20 - 31.2	25.60	1.70%
31.2 - 50	40.60	2.80%
		0.132

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP1
<2	1.0	0.26
2 - 4	3.0	0.08
4 - 5	4.5	0.05
5 - 20	12.5	0.27
20 - 31.2	25.6	0.13
31.2 - 50	40.6	0.21
		1.00000

Calculating Size Fractions - PM10

		Size Fraction
Size (µm)	Midpoints	UP1
<2	1.0	3.40%
2 - 4	3.00	1.10%
4 - 5	4.50	0.70%
5 - 20	12.50	3.50%
		0.087000

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP1
<2	1.0	0.39
2 - 4	3.0	0.13
4 - 5	4.5	0.08
5 - 20	12.5	0.40
		1.00

Calculating Size Fractions - PM2.5

		Size Fraction
Size (µm)	Midpoints	UP1
<2	1.0	3.40%
2 - 4	3.00	1.10%
		0.05

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP1
<2	1.0	0.76
2 - 4	3.0	0.24
		1.00

Appendix 13J: Waste Management Twin Creeks Environmental Center - Particle Size Data

From Particle Size Distribution Curve for UP2 Sample

Summary Of Lab Analysis - Raw Data

	Mass Under %
Size (µm)	UP2
9500.00	100.0%
4750.00	99.4%
19000.00	100.0%
25400.00	100.0%
38100.00	100.0%
50800.00	100.0%
76200.00	100.0%
1000.00	93.5%
841.00	93.0%
500.00	91.4%
420.00	91.0%
250.00	89.5%
149.00	86.0%
125.00	84.6%
75.00	81.5%
63.00	81.0%
50.00	80.5%
31.20	76.5%
20.00	69.9%
5.00	46.6%
4.00	43.3%
2.00	34.8%

sand (2.0mm - 0.05mm)	16.7
silt (0.05mm - 0.002mm)	43.6
clay (<0.002mm)	39.7

Sorted Lab Data

	Vol Under %
Size (µm)	UP2
2.00	34.80%
4.00	43.30%
5.00	46.60%
20.00	69.90%
31.20	76.50%
50.00	80.50%
63.00	81.00%
75.00	81.50%
125.00	84.60%
149.00	86.00%
250.00	89.50%
420.00	91.00%
500.00	91.40%
841.00	93.00%
1000.00	93.50%
4750.00	99.40%
9500.00	100.00%
19000.00	100.00%
25400.00	100.00%
38100.00	100.00%
50800.00	100.00%
76200.00	100.00%

Calculating Size Fractions - PM100

		Size Fraction
Size (µm)	Midpoints	UP2
<2	1.0	34.80%
2 - 4	3.00	8.50%
4 - 5	4.50	3.30%
5 - 20	12.50	23.30%
20 - 31.2	25.60	6.60%
31.2 - 50	40.60	4.00%
50 - 63	56.50	0.50%
63 - 75	69.00	0.50%
75 - 125	100.00	3.10%
		0.846

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP2
<2	1.0	0.41
2 - 4	3.0	0.10
4 - 5	4.5	0.04
5 - 20	12.5	0.28
20 - 31.2	25.6	0.08
31.2 - 50	40.6	0.05
50 - 63	56.5	0.01
63 - 75	69.0	0.01
75 - 125	100.0	0.04
		1.00

Calculating Size Fractions - PM44

		Size Fraction
Size (µm)	Midpoints	UP2
<2	1.0	34.80%
2 - 4	3.00	8.50%
4 - 5	4.50	3.30%
5 - 20	12.50	23.30%
20 - 31.2	25.60	6.60%
31.2 - 50	40.60	4.00%
		0.805

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP2
<2	1.0	0.43
2 - 4	3.0	0.11
4 - 5	4.5	0.04
5 - 20	12.5	0.29
20 - 31.2	25.6	0.08
31.2 - 50	40.6	0.05
		1.00000

Calculating Size Fractions - PM10

		Size Fraction
Size (µm)	Midpoints	UP2
<2	1.0	34.80%
2 - 4	3.00	8.50%
4 - 5	4.50	3.30%
5 - 20	12.50	23.30%
		0.699000

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP2
<2	1.0	0.50
2 - 4	3.0	0.12
4 - 5	4.5	0.05
5 - 20	12.5	0.33
		#DIV/0!

Calculating Size Fractions - PM2.5

		Size Fraction
Size (µm)	Midpoints	UP2
<2	1.0	34.80%
2 - 4	3.00	8.50%
		0.43

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP2
<2	1.0	0.80
2 - 4	3.0	0.20
		1.00

Appendix 13J: Waste Management Twin Creeks Environmental Center - Particle Size Data

From Particle Size Distribution Curve for UP3 Sample

Summary Of Lab Analysis - Raw Data

	Mass Under %
Size (µm)	UP3
9500.00	100.0%
4750.00	97.9%
19000.00	100.0%
25400.00	100.0%
38100.00	100.0%
50800.00	100.0%
76200.00	100.0%
1000.00	89.8%
841.00	89.4%
500.00	87.5%
420.00	87.0%
250.00	84.2%
149.00	79.5%
125.00	78.1%
75.00	75.2%
63.00	72.6%
50.00	69.7%
31.20	65.1%
20.00	59.6%
5.00	38.4%
4.00	34.8%
2.00	26.2%

sand (2.0mm - 0.05mm)	20.0
silt (0.05mm - 0.002mm)	45.8
clay (<0.002mm)	34.2

Sorted Lab Data

	Vol Under %
Size (µm)	UP3
2.00	26.20%
4.00	34.80%
5.00	38.40%
20.00	59.60%
31.20	65.10%
50.00	69.70%
63.00	72.60%
75.00	75.20%
125.00	78.10%
149.00	79.50%
250.00	84.20%
420.00	87.00%
500.00	87.50%
841.00	89.40%
1000.00	89.80%
4750.00	97.90%
9500.00	100.00%
19000.00	100.00%
25400.00	100.00%
38100.00	100.00%
50800.00	100.00%
76200.00	100.00%

Calculating Size Fractions - PM100

		Size Fraction
Size (µm)	Midpoints	UP3
<2	1.0	26.20%
2 - 4	3.00	8.60%
4 - 5	4.50	3.60%
5 - 20	12.50	21.20%
20 - 31.2	25.60	5.50%
31.2 - 50	40.60	4.60%
50 - 63	56.50	2.90%
63 - 75	69.00	2.60%
75 - 125	100.00	2.90%
		0.781

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP3
<2	1.0	0.34
2 - 4	3.0	0.11
4 - 5	4.5	0.05
5 - 20	12.5	0.27
20 - 31.2	25.6	0.07
31.2 - 50	40.6	0.06
50 - 63	56.5	0.04
63 - 75	69.0	0.03
75 - 125	100.0	0.04
		1.00

Calculating Size Fractions - PM44

		Size Fraction
Size (µm)	Midpoints	UP3
<2	1.0	26.20%
2 - 4	3.00	8.60%
4 - 5	4.50	3.60%
5 - 20	12.50	21.20%
20 - 31.2	25.60	5.50%
31.2 - 50	40.60	4.60%
		0.697

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP3
<2	1.0	0.38
2 - 4	3.0	0.12
4 - 5	4.5	0.05
5 - 20	12.5	0.30
20 - 31.2	25.6	0.08
31.2 - 50	40.6	0.07
		1.00000

Calculating Size Fractions - PM10

		Size Fraction
Size (µm)	Midpoints	UP3
<2	1.0	26.20%
2 - 4	3.00	8.60%
4 - 5	4.50	3.60%
5 - 20	12.50	21.20%
		0.596000

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP3
<2	1.0	0.44
2 - 4	3.0	0.14
4 - 5	4.5	0.06
5 - 20	12.5	0.36
		#DIV/0!

Calculating Size Fractions - PM2.5

		Size Fraction
Size (µm)	Midpoints	UP3
<2	1.0	26.20%
2 - 4	3.00	8.60%
		0.35

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP3
<2	1.0	0.75
2 - 4	3.0	0.25
		1.00

Appendix 13J: Waste Management Twin Creeks Environmental Center - Particle Size Data

From Particle Size Distribution Curve for UP4 Sample

Summary Of Lab Analysis - Raw Data

	Mass Under %
Size (µm)	UP4
9500.00	98.9%
4750.00	93.6%
19000.00	100.0%
25400.00	100.0%
38100.00	100.0%
50800.00	100.0%
76200.00	100.0%
1000.00	74.5%
841.00	72.8%
500.00	66.2%
420.00	64.6%
250.00	59.7%
149.00	54.9%
125.00	53.5%
75.00	50.7%
63.00	48.3%
50.00	45.7%
31.20	42.1%
20.00	37.4%
5.00	24.4%
4.00	22.9%
2.00	18.1%

sand (2.0mm - 0.05mm)	40.8
silt (0.05mm - 0.002mm)	35.2
clay (<0.002mm)	24.0

Sorted Lab Data

	Vol Under %
Size (µm)	UP4
2.00	18.10%
4.00	22.90%
5.00	24.40%
20.00	37.40%
31.20	42.10%
50.00	45.70%
63.00	48.30%
75.00	50.70%
125.00	53.50%
149.00	54.90%
250.00	59.70%
420.00	64.60%
500.00	66.20%
841.00	72.80%
1000.00	74.50%
4750.00	93.60%
9500.00	98.90%
19000.00	100.00%
25400.00	100.00%
38100.00	100.00%
50800.00	100.00%
76200.00	100.00%

Calculating Size Fractions - PM100

		Size Fraction
Size (µm)	Midpoints	UP4
<2	1.0	18.10%
2 - 4	3.00	4.80%
4 - 5	4.50	1.50%
5 - 20	12.50	13.00%
20 - 31.2	25.60	4.70%
31.2 - 50	40.60	3.60%
50 - 63	56.50	2.60%
63 - 75	69.00	2.40%
75 - 125	100.00	2.80%
		0.535

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP4
<2	1.0	0.34
2 - 4	3.0	0.09
4 - 5	4.5	0.03
5 - 20	12.5	0.24
20 - 31.2	25.6	0.09
31.2 - 50	40.6	0.07
50 - 63	56.5	0.05
63 - 75	69.0	0.04
75 - 125	100.0	0.05
		1.00

Calculating Size Fractions - PM44

		Size Fraction
Size (µm)	Midpoints	UP4
<2	1.0	18.10%
2 - 4	3.00	4.80%
4 - 5	4.50	1.50%
5 - 20	12.50	13.00%
20 - 31.2	25.60	4.70%
31.2 - 50	40.60	3.60%
		0.457

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP4
<2	1.0	0.40
2 - 4	3.0	0.11
4 - 5	4.5	0.03
5 - 20	12.5	0.28
20 - 31.2	25.6	0.10
31.2 - 50	40.6	0.08
		1.00000

Calculating Size Fractions - PM10

		Size Fraction
Size (µm)	Midpoints	UP4
<2	1.0	18.10%
2 - 4	3.00	4.80%
4 - 5	4.50	1.50%
5 - 20	12.50	13.00%
		0.374000

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP4
<2	1.0	0.48
2 - 4	3.0	0.13
4 - 5	4.5	0.04
5 - 20	12.5	0.35
		#DIV/0!

Calculating Size Fractions - PM2.5

		Size Fraction
Size (µm)	Midpoints	UP4
<2	1.0	18.10%
2 - 4	3.00	4.80%
		0.23

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP4
<2	1.0	0.79
2 - 4	3.0	0.21
		1.00

Appendix 13J: Waste Management Twin Creeks Environmental Center - Particle Size Data

From Particle Size Distribution Curve for UP5 Sample

Summary Of Lab Analysis - Raw Data

	Mass Under %
Size (µm)	UP5
9500.00	89.3%
4750.00	79.1%
19000.00	93.9%
25400.00	100.0%
38100.00	100.0%
50800.00	100.0%
76200.00	100.0%
1000.00	47.7%
841.00	44.8%
500.00	34.8%
420.00	32.3%
250.00	25.1%
149.00	19.7%
125.00	18.3%
75.00	15.4%
63.00	13.4%
50.00	11.5%
31.20	9.8%
20.00	8.6%
5.00	6.2%
4.00	5.6%
2.00	5.0%

sand (2.0mm - 0.05mm)	76.5
silt (0.05mm - 0.002mm)	15.2
clay (<0.002mm)	8.3

Sorted Lab Data

	Vol Under %
Size (µm)	UP5
2.00	5.00%
4.00	5.60%
5.00	6.20%
20.00	8.60%
31.20	9.80%
50.00	11.50%
63.00	13.40%
75.00	15.40%
125.00	18.30%
149.00	19.70%
250.00	25.10%
420.00	32.30%
500.00	34.80%
841.00	44.80%
1000.00	47.70%
4750.00	79.10%
9500.00	89.30%
19000.00	93.90%
25400.00	100.00%
38100.00	100.00%
50800.00	100.00%
76200.00	100.00%

Calculating Size Fractions - PM100

		Size Fraction
Size (µm)	Midpoints	UP5
<2	1.0	5.00%
2 - 4	3.00	0.60%
4 - 5	4.50	0.60%
5 - 20	12.50	2.40%
20 - 31.2	25.60	1.20%
31.2 - 50	40.60	1.70%
50 - 63	56.50	1.90%
63 - 75	69.00	2.00%
75 - 125	100.00	2.90%
		0.183

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP5
<2	1.0	0.27
2 - 4	3.0	0.03
4 - 5	4.5	0.03
5 - 20	12.5	0.13
20 - 31.2	25.6	0.07
31.2 - 50	40.6	0.09
50 - 63	56.5	0.10
63 - 75	69.0	0.11
75 - 125	100.0	0.16
		1.00

Calculating Size Fractions - PM44

		Size Fraction
Size (µm)	Midpoints	UP5
<2	1.0	5.00%
2 - 4	3.00	0.60%
4 - 5	4.50	0.60%
5 - 20	12.50	2.40%
20 - 31.2	25.60	1.20%
31.2 - 50	40.60	1.70%
		0.115

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP5
<2	1.0	0.43
2 - 4	3.0	0.05
4 - 5	4.5	0.05
5 - 20	12.5	0.21
20 - 31.2	25.6	0.10
31.2 - 50	40.6	0.15
		1.00000

Calculating Size Fractions - PM10

		Size Fraction
Size (µm)	Midpoints	UP5
<2	1.0	5.00%
2 - 4	3.00	0.60%
4 - 5	4.50	0.60%
5 - 20	12.50	2.40%
		0.086000

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP5
<2	1.0	0.58
2 - 4	3.0	0.07
4 - 5	4.5	0.07
5 - 20	12.5	0.28
		#DIV/0!

Calculating Size Fractions - PM2.5

		Size Fraction
Size (µm)	Midpoints	UP5
<2	1.0	5.00%
2 - 4	3.00	0.60%
		0.06

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP5
<2	1.0	0.89
2 - 4	3.0	0.11
		1.00

Appendix 13J: Waste Management Twin Creeks Environmental Center - Particle Size Data

From Particle Size Distribution Curve for UP6 Sample

Summary Of Lab Analysis - Raw Data

	Mass Under %
Size (µm)	UP6
9500.00	94.5%
4750.00	78.0%
19000.00	100.0%
25400.00	100.0%
38100.00	100.0%
50800.00	100.0%
76200.00	100.0%
1000.00	50.8%
841.00	48.8%
500.00	39.9%
420.00	37.7%
250.00	29.3%
149.00	23.6%
125.00	22.2%
75.00	19.2%
63.00	17.5%
50.00	15.8%
31.20	14.3%
20.00	13.0%
5.00	8.9%
4.00	7.6%
2.00	5.7%

sand (2.0mm - 0.05mm)	69.5
silt (0.05mm - 0.002mm)	18.4
clay (<0.002mm)	12.1

Sorted Lab Data

	Vol Under %
Size (µm)	UP6
2.00	5.70%
4.00	7.60%
5.00	8.90%
20.00	13.00%
31.20	14.30%
50.00	15.80%
63.00	17.50%
75.00	19.20%
125.00	22.20%
149.00	23.60%
250.00	29.30%
420.00	37.70%
500.00	39.90%
841.00	48.80%
1000.00	50.80%
4750.00	78.00%
9500.00	94.50%
19000.00	100.00%
25400.00	100.00%
38100.00	100.00%
50800.00	100.00%
76200.00	100.00%

Calculating Size Fractions - PM100

		Size Fraction
Size (µm)	Midpoints	UP6
<2	1.0	5.70%
2 - 4	3.00	1.90%
4 - 5	4.50	1.30%
5 - 20	12.50	4.10%
20 - 31.2	25.60	1.30%
31.2 - 50	40.60	1.50%
50 - 63	56.50	1.70%
63 - 75	69.00	1.70%
75 - 125	100.00	3.00%
		0.222

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP6
<2	1.0	0.26
2 - 4	3.0	0.09
4 - 5	4.5	0.06
5 - 20	12.5	0.18
20 - 31.2	25.6	0.06
31.2 - 50	40.6	0.07
50 - 63	56.5	0.08
63 - 75	69.0	0.08
75 - 125	100.0	0.14
		1.00

Calculating Size Fractions - PM44

		Size Fraction
Size (µm)	Midpoints	UP6
<2	1.0	5.70%
2 - 4	3.00	1.90%
4 - 5	4.50	1.30%
5 - 20	12.50	4.10%
20 - 31.2	25.60	1.30%
31.2 - 50	40.60	1.50%
		0.158

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP6
<2	1.0	0.36
2 - 4	3.0	0.12
4 - 5	4.5	0.08
5 - 20	12.5	0.26
20 - 31.2	25.6	0.08
31.2 - 50	40.6	0.09
		1.00000

Calculating Size Fractions - PM10

		Size Fraction
Size (µm)	Midpoints	UP6
<2	1.0	5.70%
2 - 4	3.00	1.90%
4 - 5	4.50	1.30%
5 - 20	12.50	4.10%
		0.130000

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP6
<2	1.0	0.44
2 - 4	3.0	0.15
4 - 5	4.5	0.10
5 - 20	12.5	0.32
		1.00

Calculating Size Fractions - PM2.5

		Size Fraction
Size (µm)	Midpoints	UP6
<2	1.0	5.70%
2 - 4	3.00	1.90%
		0.08

Percentage of Total

		% of Total
Size (µm)	Midpoints	UP6
<2	1.0	0.75
2 - 4	3.0	0.25
		1.00

Appendix 13J: Waste Management Twin Creeks Environmental Center - Particle Size Data

Calculating Size Fractions - PM100

Midpoints						
UP1	UP2	UP3	UP4	UP5	UP6	Average
1.0	1.0	1.0	1.0	1.0	1.0	1.0
3.0	3.0	3.0	3.0	3.0	3.0	3.0
4.5	4.5	4.5	4.5	4.5	4.5	4.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5
25.6	25.6	25.6	25.6	25.6	25.6	25.6
40.6	40.6	40.6	40.6	40.6	40.6	40.6
56.5	56.5	56.5	56.5	56.5	56.5	56.5
69.0	69.0	69.0	69.0	69.0	69.0	69.0
100.0	100.0	100.0	100.0	100.0	100.0	100.0

Calculating Size Fractions - PM100

Size Fractions						
UP1	UP2	UP3	UP4	UP5	UP6	Average
0.16	0.41	0.34	0.34	0.27	0.26	0.31
0.05	0.10	0.11	0.09	0.03	0.09	0.09
0.03	0.04	0.05	0.03	0.03	0.06	0.04
0.17	0.28	0.27	0.24	0.13	0.18	0.24
0.08	0.08	0.07	0.09	0.07	0.06	0.08
0.13	0.05	0.06	0.07	0.09	0.07	0.08
0.09	0.01	0.04	0.05	0.10	0.08	0.05
0.08	0.01	0.03	0.04	0.11	0.08	0.04
0.20	0.04	0.04	0.05	0.16	0.14	0.08

Calculating Size Fractions - PM44

Midpoints						
UP1	UP2	UP3	UP4	UP5	UP6	Average
1.0	1.0	1.0	1.0	1.0	1.0	1.0
3.0	3.0	3.0	3.0	3.0	3.0	3.0
4.5	4.5	4.5	4.5	4.5	4.5	4.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5
25.6	25.6	25.6	25.6	25.6	25.6	25.6
40.6	40.6	40.6	40.6	40.6	40.6	40.6

Calculating Size Fractions - PM44

Size Fractions						
UP1	UP2	UP3	UP4	UP5	UP6	Average
0.26	0.43	0.38	0.40	0.43	0.36	0.365
0.08	0.11	0.12	0.11	0.05	0.12	0.104
0.05	0.04	0.05	0.03	0.05	0.08	0.045
0.27	0.29	0.30	0.28	0.21	0.26	0.286
0.13	0.08	0.08	0.10	0.10	0.08	0.098
0.21	0.05	0.07	0.08	0.15	0.09	0.102

Calculating Size Fractions - PM10

Midpoints						
UP1	UP2	UP3	UP4	UP5	UP6	Average
1.0	1.0	1.0	1.0	1.0	1.0	1.0
3.0	3.0	3.0	3.0	3.0	3.0	3.0
4.5	4.5	4.5	4.5	4.5	4.5	4.5
12.5	12.5	12.5	12.5	12.5	12.5	12.5

Calculating Size Fractions - PM10

Size Fractions						
UP1	UP2	UP3	UP4	UP5	UP6	Average
0.39	0.50	0.44	0.48	0.58	0.44	0.453
0.13	0.12	0.14	0.13	0.07	0.15	0.130
0.08	0.05	0.06	0.04	0.07	0.10	0.057
0.40	0.33	0.36	0.35	0.28	0.32	0.360

Calculating Size Fractions - PM2.5

Midpoints						
UP1	UP2	UP3	UP4	UP5	UP6	Average
1.0	1.0	1.0	1.0	1.0	1.0	1.0
3.0	3.0	3.0	3.0	3.0	3.0	3.0

Calculating Size Fractions - PM2.5

Size Fractions						
UP1	UP2	UP3	UP4	UP5	UP6	Average
0.76	0.80	0.75	0.79	0.89	0.75	0.776
0.24	0.20	0.25	0.21	0.11	0.25	0.224

Calculating Silt Content

%						
UP1	UP2	UP3	UP4	UP5	UP6	Average
16.81	81.54	75.21	50.67	15.36	19.19	43.13

Appendix 13J: Waste Management Twin Creeks Environmental Center - Particle Size Data

From Particle Size Distribution Curve for B2 CONT Soil Sample -- Daily Cover

Summary Of Lab Analysis - Raw Data

	Mass Under %
Size (µm)	B2 CONT Soil
9500.00	87.1%
4750.00	77.9%
19000.00	89.0%
25400.00	100.0%
38100.00	100.0%
50800.00	100.0%
76200.00	100.0%
1000.00	61.6%
841.00	61.1%
500.00	57.8%
420.00	56.9%
250.00	52.6%
149.00	48.1%
125.00	47.0%
75.00	44.7%
63.00	42.7%
50.00	40.6%
31.20	37.2%
20.00	35.0%
5.00	25.4%
4.00	23.5%
2.00	18.7%

sand (2.0mm - 0.05mm)	32.6%
silt (0.05mm - 0.002mm)	34.6%
clay (<0.002mm)	32.8%

Sorted Lab Data

	Vol Under %
Size (µm)	B2 CONT Soil
2.00	18.70%
4.00	23.50%
5.00	25.40%
20.00	35.00%
31.20	37.20%
50.00	40.60%
63.00	42.70%
75.00	44.70%
125.00	47.00%
149.00	48.10%
250.00	52.60%
420.00	56.90%
500.00	57.80%
841.00	61.10%
1000.00	61.60%
4750.00	77.90%
9500.00	87.10%
19000.00	89.00%
25400.00	100.00%
38100.00	100.00%
50800.00	100.00%
76200.00	100.00%

Calculating Size Fractions - PM100

		Size Fraction
Size (µm)	Midpoints	B2 CONT Soil
<2	1.0	18.70%
2 - 4	3.00	4.80%
4 - 5	4.50	1.90%
5 - 20	12.50	9.60%
20 - 31.2	25.60	2.20%
31.2 - 50	40.60	3.40%
50 - 63	56.50	2.10%
63 - 75	69.00	2.00%
75 - 125	100.00	2.30%
		0.47

Percentage of Total

		% of Total
Size (µm)	Midpoints	B2 CONT Soil
<2	1.0	0.40
2 - 4	3.0	0.10
4 - 5	4.5	0.04
5 - 20	12.5	0.20
20 - 31.2	25.6	0.05
31.2 - 50	40.6	0.07
50 - 63	56.5	0.04
63 - 75	69.0	0.04
75 - 125	100.0	0.05
		1.00

Calculating Size Fractions - PM44

		Size Fraction
Size (µm)	Midpoints	B2 CONT Soil
<2	1.0	18.70%
2 - 4	3.00	4.80%
4 - 5	4.50	1.90%
5 - 20	12.50	9.60%
20 - 31.2	25.60	2.20%
31.2 - 50	40.60	3.40%
		0.406

Percentage of Total

		% of Total
Size (µm)	Midpoints	B2 CONT Soil
<2	1.0	0.461
2 - 4	3.0	0.118
4 - 5	4.5	0.047
5 - 20	12.5	0.236
20 - 31.2	25.6	0.054
31.2 - 50	40.6	0.084
		1.00000

Calculating Size Fractions - PM10

		Size Fraction
Size (µm)	Midpoints	B2 CONT Soil
<2	1.0	18.70%
2 - 4	3.00	4.80%
4 - 5	4.50	1.90%
5 - 20	12.50	9.60%
		0.350000

Percentage of Total

		% of Total
Size (µm)	Midpoints	B2 CONT Soil
<2	1.0	0.534
2 - 4	3.0	0.137
4 - 5	4.5	0.054
5 - 20	12.5	0.274
		1.00

Calculating Size Fractions - PM2.5

		Size Fraction
Size (µm)	Midpoints	B2 CONT Soil
<2	1.0	18.70%
2 - 4	3.00	4.80%
		0.24

Percentage of Total

		% of Total
Size (µm)	Midpoints	B2 CONT Soil
<2	1.0	0.796
2 - 4	3.0	0.204
		1.00

Appendix 13J: Waste Management Twin Creeks Environmental Center - Particle Size Data

From Particle Size Distribution Curve for B1 Sample

Summary Of Lab Analysis - Raw Data

	Mass Under %
Size (µm)	B1
9500.00	97.9%
4750.00	96.8%
19000.00	100.0%
25400.00	100.0%
38100.00	100.0%
50800.00	100.0%
76200.00	100.0%
1000.00	87.6%
841.00	87.5%
500.00	87.0%
420.00	86.9%
250.00	86.4%
149.00	85.5%
125.00	84.1%
75.00	81.1%
63.00	75.7%
50.00	69.7%
31.20	60.2%
20.00	53.7%
5.00	29.0%
4.00	25.7%
2.00	19.3%

sand (2.0mm - 0.05mm)	14.8%
silt (0.05mm - 0.002mm)	57.8%
clay (<0.002mm)	27.4%

Sorted Lab Data

	Vol Under %
Size (µm)	B1
2.00	19.30%
4.00	25.70%
5.00	29.00%
20.00	53.70%
31.20	60.20%
50.00	69.70%
63.00	75.70%
75.00	81.10%
125.00	84.10%
149.00	85.50%
250.00	86.40%
420.00	86.90%
500.00	87.00%
841.00	87.50%
1000.00	87.60%
4750.00	96.80%
9500.00	97.90%
19000.00	100.00%
25400.00	100.00%
38100.00	100.00%
50800.00	100.00%
76200.00	100.00%

Calculating Size Fractions - PM100

		Size Fraction
Size (µm)	Midpoints	B1
<2	1.0	19.30%
2 - 4	3.00	6.40%
4 - 5	4.50	3.30%
5 - 20	12.50	24.70%
20 - 31.2	25.60	6.50%
31.2 - 50	40.60	9.50%
50 - 63	56.50	6.00%
63 - 75	69.00	5.40%
75 - 125	100.00	3.00%
		0.841

Percentage of Total

		% of Total
Size (µm)	Midpoints	B1
<2	1.0	0.23
2 - 4	3.0	0.08
4 - 5	4.5	0.04
5 - 20	12.5	0.29
20 - 31.2	25.6	0.08
31.2 - 50	40.6	0.11
50 - 63	56.5	0.07
63 - 75	69.0	0.06
75 - 125	100.0	0.04
		1.00

Calculating Size Fractions - PM44

		Size Fraction
Size (µm)	Midpoints	B1
<2	1.0	19.30%
2 - 4	3.00	6.40%
4 - 5	4.50	3.30%
5 - 20	12.50	24.70%
20 - 31.2	25.60	6.50%
31.2 - 50	40.60	9.50%
		0.697

Percentage of Total

		% of Total
Size (µm)	Midpoints	B1
<2	1.0	0.28
2 - 4	3.0	0.09
4 - 5	4.5	0.05
5 - 20	12.5	0.35
20 - 31.2	25.6	0.09
31.2 - 50	40.6	0.14
		1.00000

Calculating Size Fractions - PM10

		Size Fraction
Size (µm)	Midpoints	B1
<2	1.0	19.30%
2 - 4	3.00	6.40%
4 - 5	4.50	3.30%
5 - 20	12.50	24.70%
		0.537000

Percentage of Total

		% of Total
Size (µm)	Midpoints	B1
<2	1.0	0.36
2 - 4	3.0	0.12
4 - 5	4.5	0.06
5 - 20	12.5	0.46
		1.00

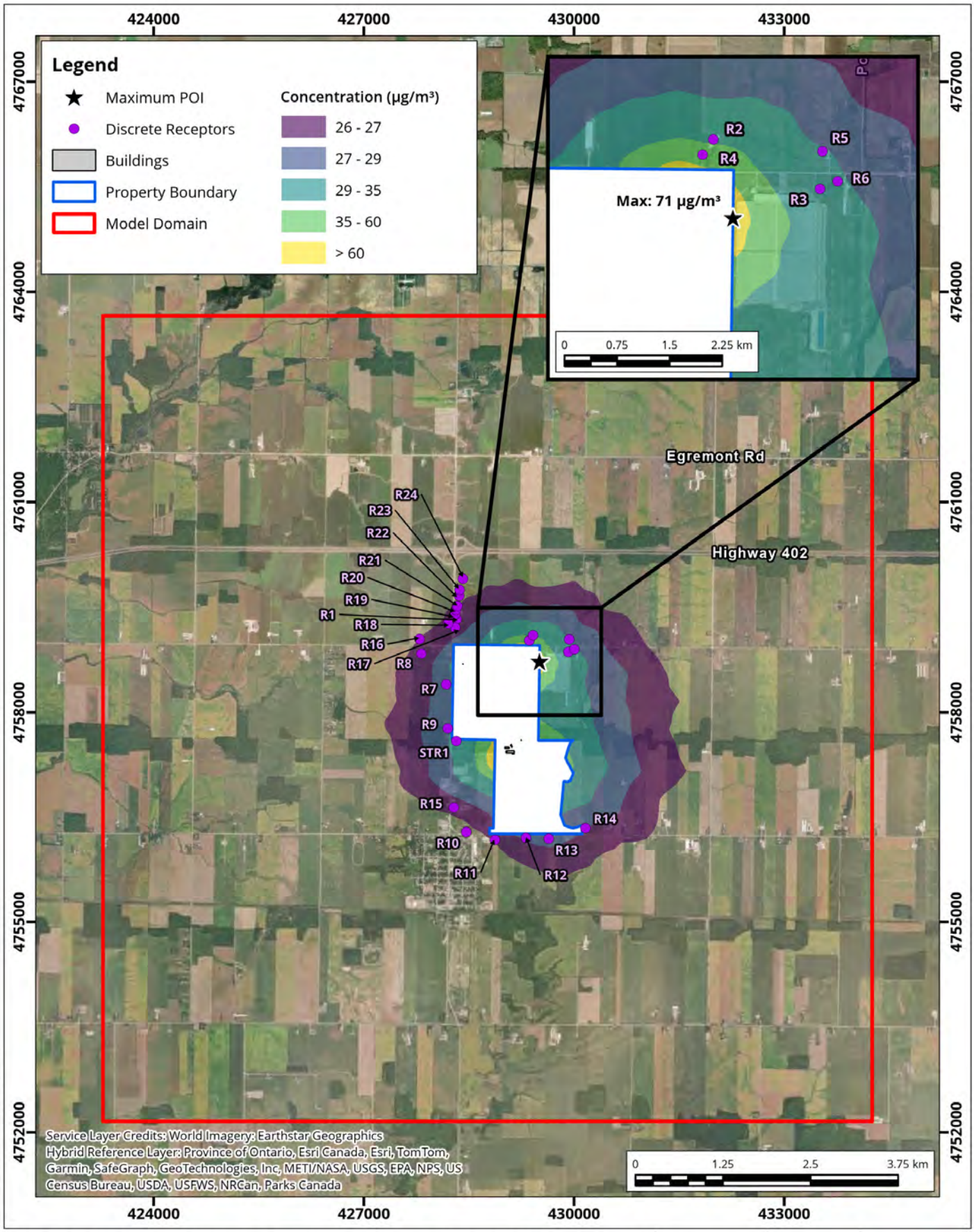
Calculating Size Fractions - PM2.5

		Size Fraction
Size (µm)	Midpoints	B1
<2	1.0	19.30%
2 - 4	3.00	25.70%
		0.45

Percentage of Total

		% of Total
Size (µm)	Midpoints	B1
<2	1.0	0.43
2 - 4	3.0	0.57
		1.00

APPENDIX 13K



Predicted Background Annual TSP Concentrations (in µg/m³)

True North

Annual TSP AAQC = 60 µg/m³
Background = 24 µg/m³

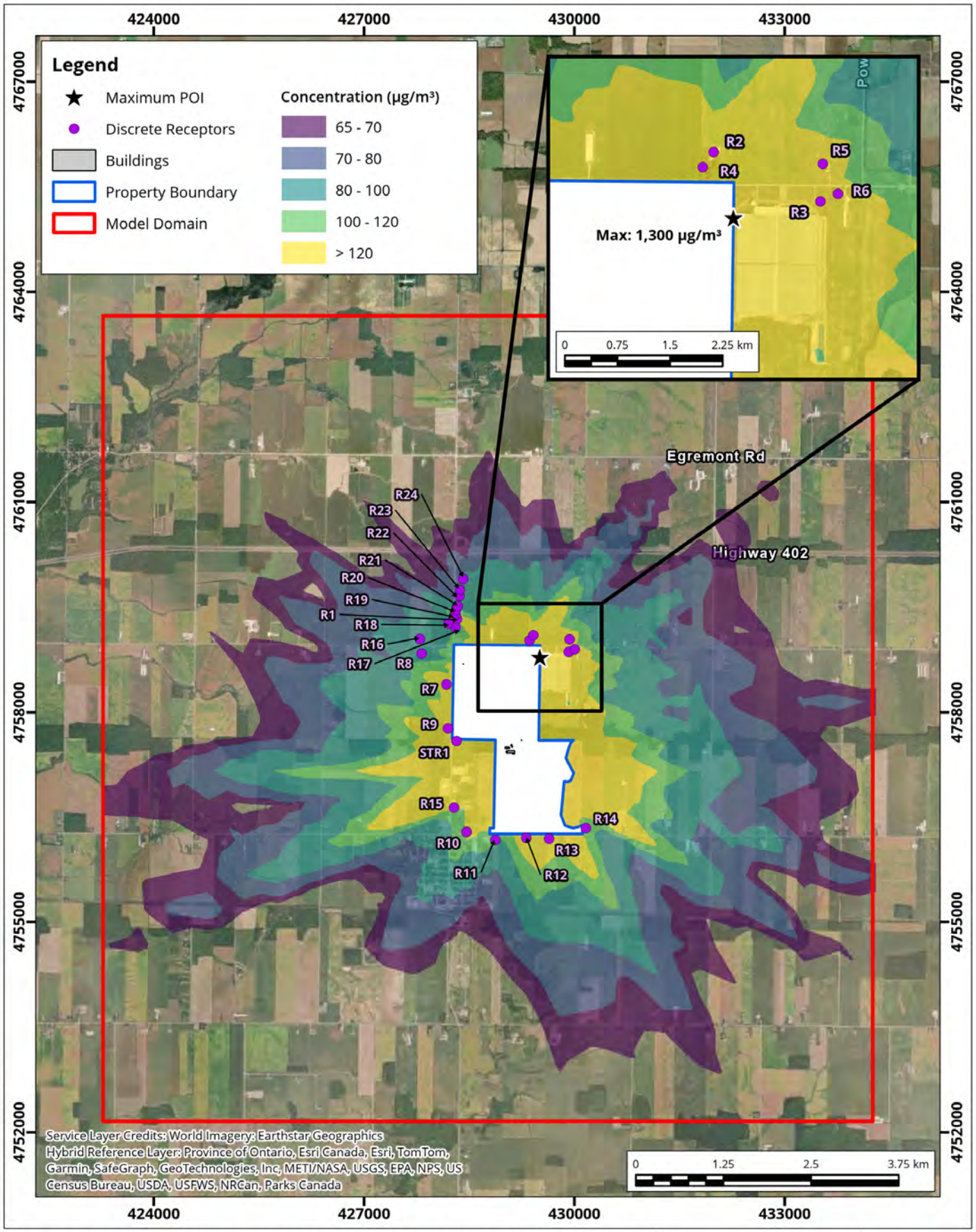
Map Projection: NAD 1983 UTM Zone 17N

Twin Creek Environmental Centre - Watford, ON

Project #: 2101750

Drawn by: RCL	Figure:13K-1
Approx. Scale:	1:75,000
Date Revised:	Jun 26, 2024

Map Document: C:\GIS\2101750_TwinCreeksEA\P2101750_TCEC_Figures13_2024.aprx



Predicted Background 24-Hour TSP Concentrations (in µg/m³)

True North

24-Hour TSP O. Reg 419/05 & AAQC = 120 µg/m³
Background = 46 µg/m³

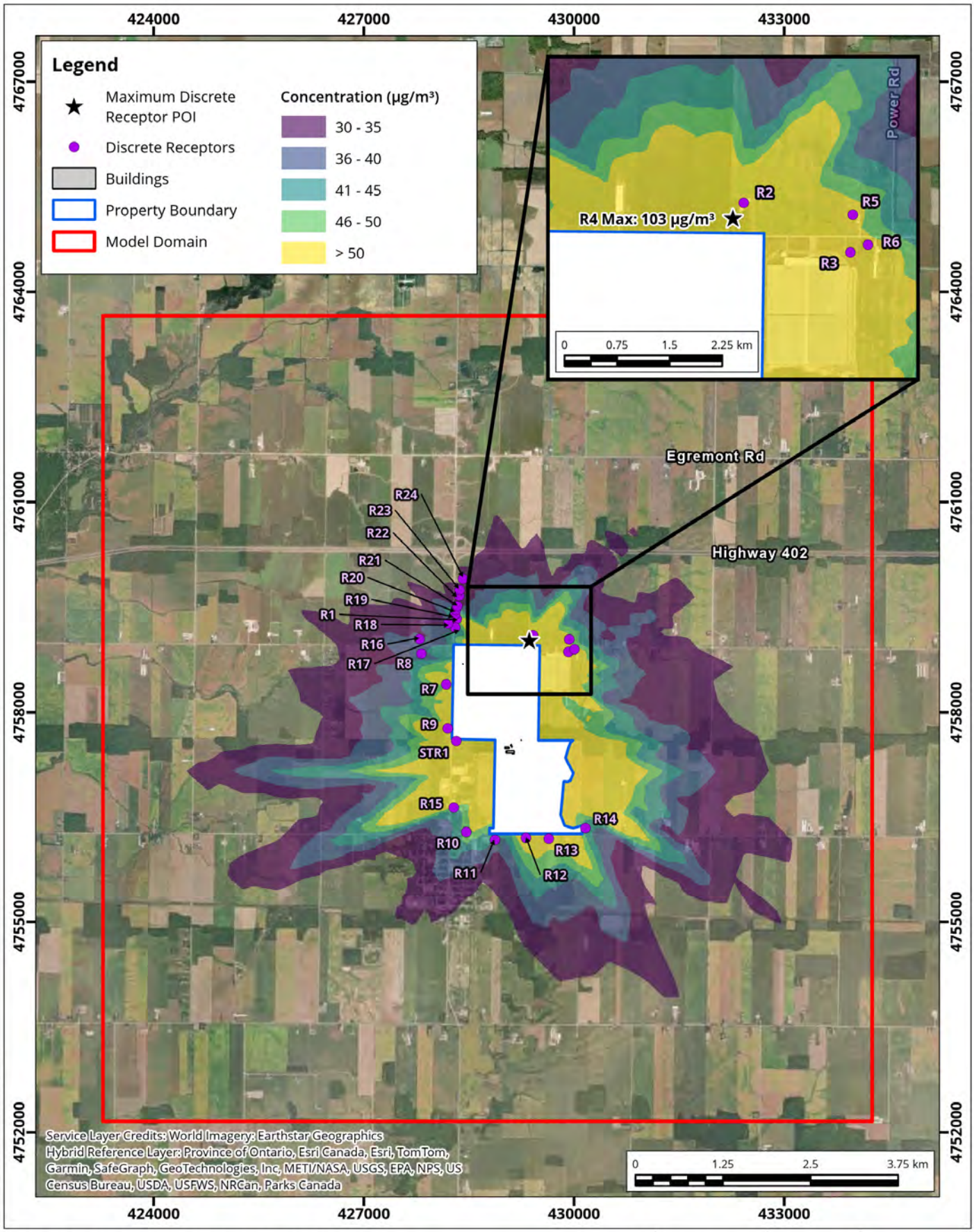
Map Projection: NAD 1983 UTM Zone 17N

Twin Creek Environmental Centre - Watford, ON

Project #: 2101750

Drawn by: RCL	Figure:13K-2
Approx. Scale:	1:75,000
Date Revised:	Jun 26, 2024

Map Document: C:\GIS\2101750_TwinCreeksEA\P2101750_TCEC_Figures13_2024.aprx



Predicted Background 24-Hour PM_{10} Concentrations (in µg/m³)

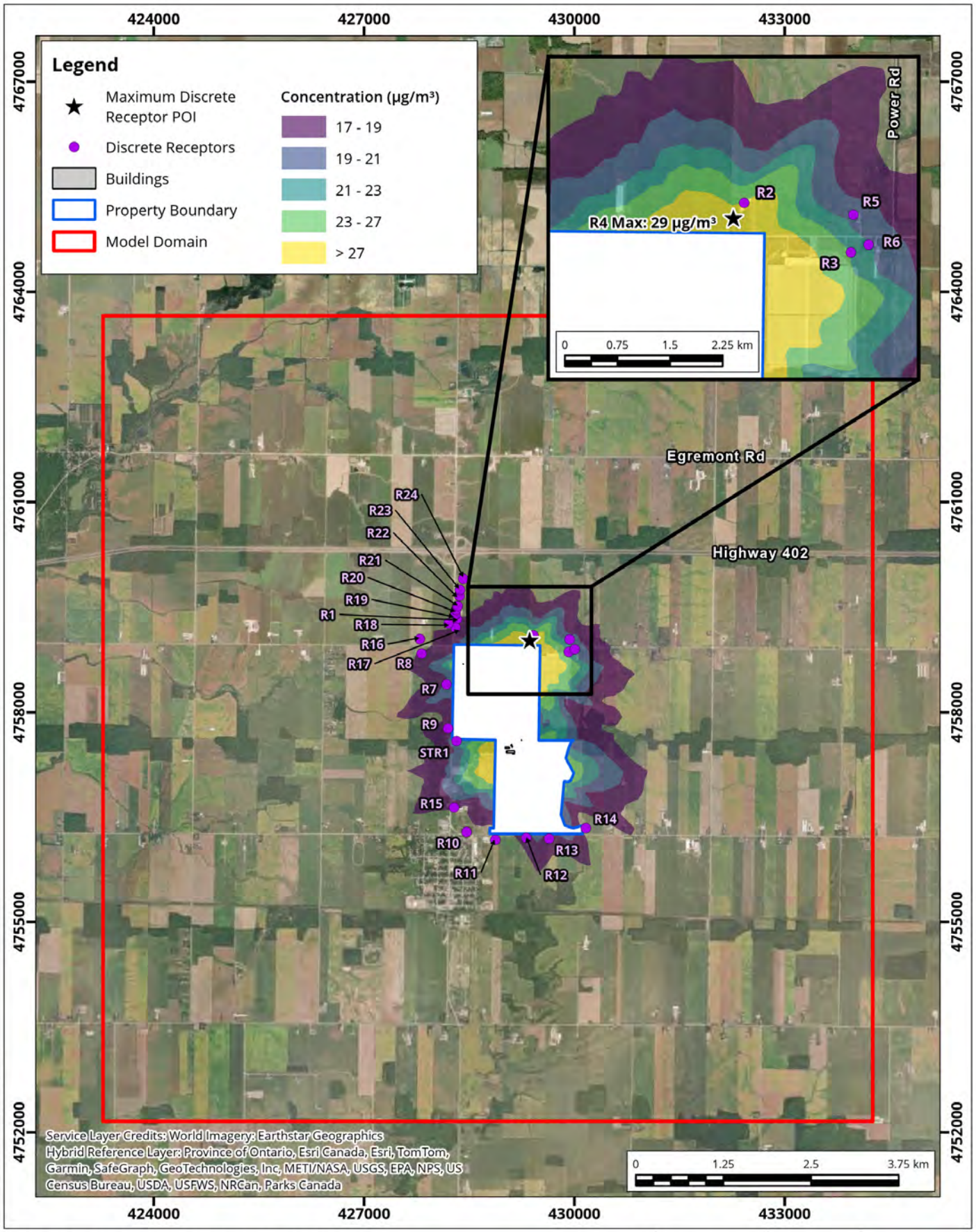
Map Projection: NAD 1983 UTM Zone 17N
Twin Creek Environmental Centre - Watford, ON

True North

24-Hour PM_{10} AAQC = 50 µg/m³
Background = 19 µg/m³
Project #: 2101750

Drawn by: RCL	Figure:13K-3
Approx. Scale:	1:75,000
Date Revised:	Jun 26, 2024

Map Document: C:\GIS\2101750_TwinCreeksEA\P2101750_TCEC_Figures13_2024.aprx



Predicted Background 24-Hour $PM_{2.5}$ Concentrations (in µg/m³)

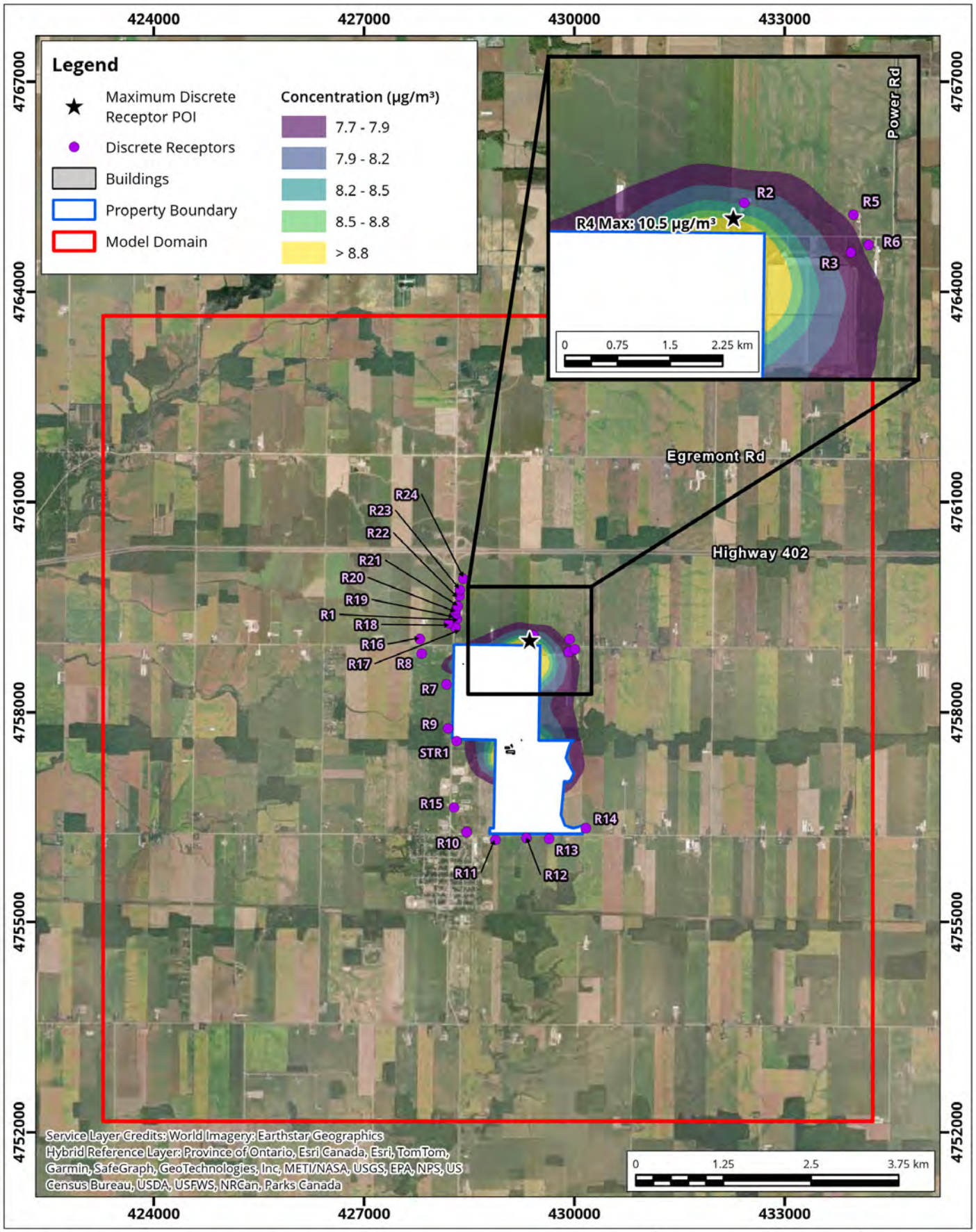
Map Projection: NAD 1983 UTM Zone 17N
Twin Creek Environmental Centre - Watford, ON

True North

24-Hour $PM_{2.5}$ CAAQS = 27 µg/m³
Background = 12 µg/m³
Project #: 2101750

Drawn by: RCL	Figure:13K-4
Approx. Scale:	1:75,000
Date Revised:	Jun 27, 2024

Map Document: C:\GIS\2101750_TwinCreeksEA\P2101750_TCEC_Figures13_2024.aprx



Predicted Background Annual $PM_{2.5}$ Concentrations (in µg/m³)

Map Projection: NAD 1983 UTM Zone 17N
Twin Creek Environmental Centre - Watford, ON

True North

Annual $PM_{2.5}$ CAAQS = 8.8 µg/m³
Background = 7.2 µg/m³
Project #: 2101750

Drawn by: RCL	Figure:13K-5
Approx. Scale:	1:75,000
Date Revised:	Jun 27, 2024

Map Document: C:\GIS\2101750_TwinCreeksEA\P2101750_TCEC_Figures13_2024.aprx

APPENDIX 13L

Appendix 13L: Measured and Modelled Events Above 24-hour AAQC for Particulate Matter at Ambient Monitoring Stations

Table 13L-1: Summary of Total Particulate Matter Monitoring Data (2017-2023)

Year	PM / TSP, 24-hour [1]									
	Northeast Events > 120 µg/m³	No. of Valid Samples	Southeast Events > 120 µg/m³	No. of Valid Samples	West Events > 120 µg/m³	No. of Valid Samples	Total Measured Events	Total Valid Samples	Measured Events Percentageof Total Valid Samples	Maximum (µg/m³)
2017	5	35	1	34	0	32	6	101	5.9%	278
2018	6	37	7	38	4	35	17	110	15.5%	210
2019	3	41	2	39	3	33	8	113	7.1%	588
2020	4	80	3	68	6	75	13	223	5.8%	263
2021	1	79	3	73	0	74	4	226	1.8%	134
2022	6	77	7	70	2	79	15	226	6.6%	347
2023	6	73	3	75	4	78	13	226	5.8%	236

Table 13L-2: Summary of 2023 PM10 Monitoring Data

Year	PM10, 24-hour [2]									
	Northeast Events > 50 µg/m³	No. of Valid Samples	Southeast Events > 50 µg/m³	No. of Valid Samples	West Events > 50 µg/m³	No. of Valid Samples	Total Measured Events	Total Valid Samples	Measured Events Percentage of Total Valid Samples	Maximum (µg/m³)
2023	8	78	2	70	7	77	17	225	7.6%	106

Table 13L-3: Summary of 2023 PM2.5 Monitoring Data

Year	PM2.5, 24-hour [2]									
	Northeast Events > 27 µg/m³	No. of Valid Samples	Southeast Events > 27 µg/m³	No. of Valid Samples	West Events > 27 µg/m³	No. of Valid Samples	Total Measured Events	Total Valid Samples	Measured Events Percentage of Total Valid Samples	Maximum (µg/m³)
2023	5	75	3	72	2	79	10	226	4.4%	54

Table 13L-4: Summary of Predicted Exceedances using Dispersion Modelling

Modelled Year	PM / TSP, 24-hour						PM10, 24-hour						PM2.5, 24-hour					
	Northeast > 120 µg/m3	Southeast > 120 µg/m3	West > 120 µg/m3	Total Modelled Events	Total Percent	Background Concentration (µg/m³) 46 Maximum	Northeast > 50 µg/m3	Southeast > 50 µg/m3	West > 50 µg/m3	Total Modelled Events	Total Percent	Background Concentration (µg/m³) 19 Maximum	Northeast > 27 µg/m3	Southeast > 27 µg/m3	West > 27 µg/m3	Total Modelled Events	Total Percent	Background Concentration (µg/m³) 12 Maximum
2011	34	27	0	61	16.7%	552	28	18	0	46	12.6%	212	22	2	0	24	6.6%	65
2012	35	25	0	60	16.4%	493	31	17	0	48	13.1%	186	16	0	0	16	4.4%	66
2013	44	25	0	69	18.9%	466	40	17	0	57	15.6%	170	20	0	0	20	5.5%	50
2014	45	16	1	62	17.0%	361	38	12	1	51	14.0%	150	22	0	1	23	6.3%	56
2015	33	21	1	55	15.1%	494	29	18	0	47	12.9%	195	13	0	0	13	3.6%	62

Notes
[1] Measured TSP events exceeding 24-hour AAQC from the Twin Creeks Environmental Centre Annual Monitoring Report (Volume 4 of 5) for 2017 to 2023
[2] The ambient monitoring program was expanded to measure particulate matter fractions PM10 and PM2.5 in 2023, there is no prior data available.

APPENDIX 13M

Appendix 13M: Final Cap Construction Material Calculation

Haul Trucks	Value	Units
Number of Haul Trucks:	6.00	
Trips per truck per hour	3.00	
Total Number of Trucks:	18	per hour
Construction Hours:	10	per day
Haul Truck Payload Capacity:	40	tons

Material Handling	Value	Units
Daily Tonnage (Imperial):	7,200	tons per day
Converstion from tons to tonnes:	0.907	tonnes per ton
Daily Tonnage (Metric):	6,532	tonnes per day
Handling per hour:	653	tonnes per hour

Additional Final Cap Activities	Count	Description
Truck Loading	2	One truck loading operation at the clay storage pile.
Truck Unloading	1	One truck dumping at the cap construction face.
Bulldozer Movements	2	One bulldozer working the material around the final cap construction area.

Sample Calculation

Material Handling

$$\text{Tonnes per hour} = \frac{6 \text{ trucks}}{\text{hour}} \times \frac{3 \text{ trips}}{\text{trip}} \times \frac{40 \text{ tons}}{\text{ton}} \times \frac{0.907 \text{ tonnes}}{\text{ton}}$$

$$\text{Tonnes per hour} = \frac{653.2 \text{ tonnes}}{\text{hour}}$$