BluePlan ENGINEERING

Niagara Region

REGIONAL MUNICIPALITY OF NIAGARA

SOUTH NIAGARA FALLS WASTEWATER SOLUTIONS

V3.6 – Air, Odour, and Noise Assessments

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LIST OF APPENDICES

BluePlan ENGINEERING

V3.6.1

REGIONAL MUNICIPALITY OF NIAGARA
SOUTH NIAGARA FALLS WASTEWATER SOLUTIONS

Air, Odour, and Noise Assessments

Air and Odour Impact Assessment – Preferred WWTP Site

REPORT

Air Quality and Odour Study

South Niagara Falls Wastewater Treatment Plant

Submitted to:

GM BluePlan Engineering Limited

Submitted by:

Golder Associates Ltd.

6925 Century Avenue, Suite #100, Mississauga, Ontario, L5N 7K2, Canada

+1 905 567 4444

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May 2022

Distribution List

Electronic copy - GM BluePlan Engineering Limited

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TABLES

FIGURES

1.0 INTRODUCTION

Golder Associates Ltd. (Golder), a member of WSP, has been retained by GM BluePlan Engineering Ltd. (GM BluePlan) on behalf of the Regional Municipality of Niagara (Niagara Region) to complete an Air Quality and Odour Study in support of the Environmental Study Report (ESR) for the proposed South Niagara Falls Wastewater Treatment Plant in the city of Niagara Falls, Ontario (the Project). The ESR is being developed in accordance with the requirements for a Schedule "C" Project as outlined in the Municipal Water & Wastewater projects in the Municipal Engineers Association document for Municipal Class Environmental Assessment, October 2000, as amended in 2007, 2011, and 2014 (MEA Class EA document).Niagara Region completed *Niagara 2041*, a Municipal Comprehensive Review (MCR) of water and wastewater infrastructure, growth planning, and transportation for the purposes of developing a plan for Niagara's future. It was concluded that 64% of growth (population and employment) expected in the City of Niagara Falls will fall in the south Niagara Falls area.

Based on the growth predicted in *Niagara 2041*, the existing wastewater treatment plant (WWTP) located on 3450 Stanley Avenue will not be able to withstand the demand exerted by this new growth. It was recommended from Niagara Region's *2016 Water and Wastewater Master Servicing Plan Update* (MSPU) that a new wastewater treatment plant be built in south Niagara Falls with connection to the sewer systems in the southern area. These recommendations were adopted by Niagara Region Council and the City of Niagara Falls Council in 2017. The Project will include construction of a new wastewater treatment plant, an outfall structure to the Welland River, and an underground connection pipe with shaft locations.

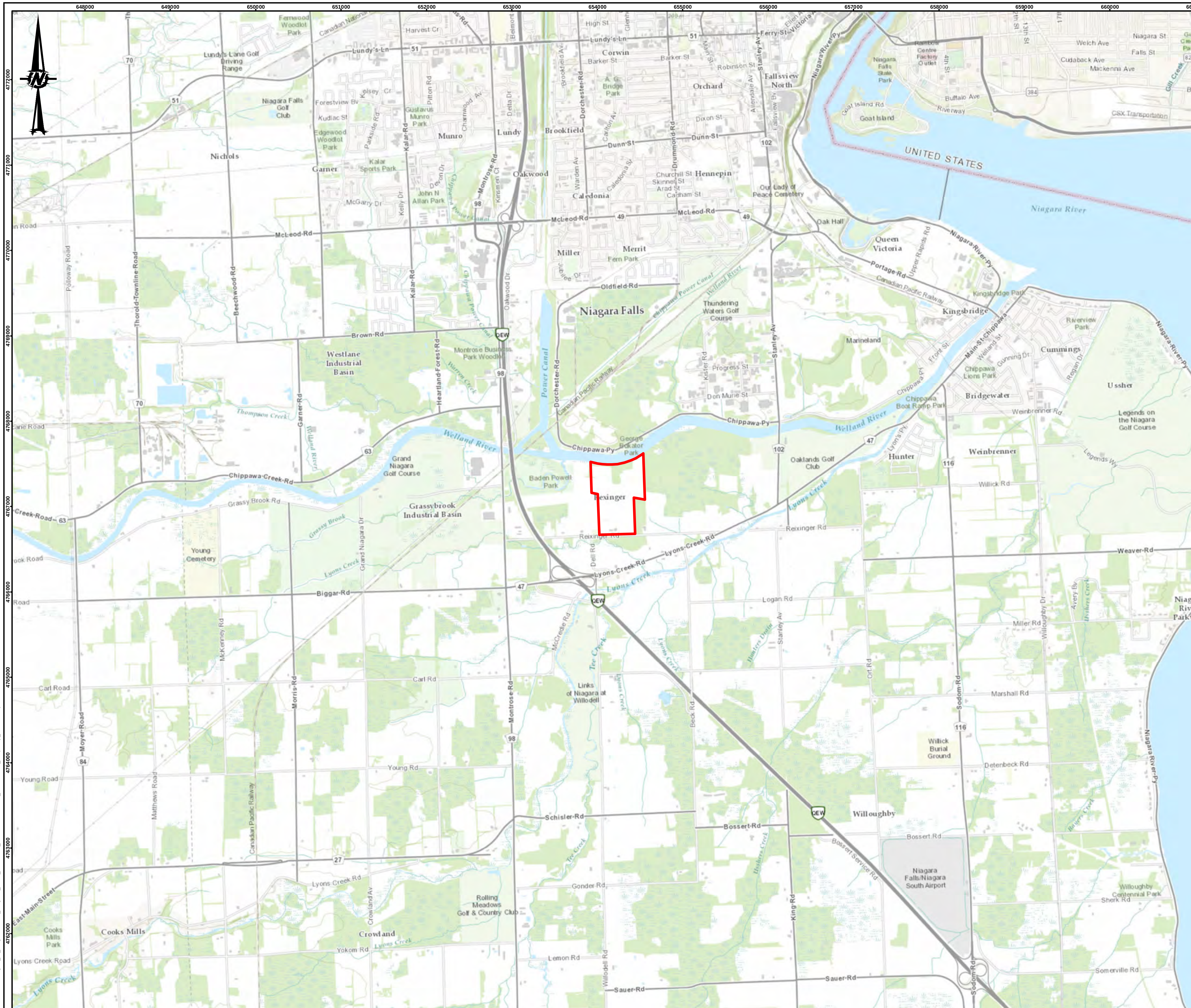
The air quality and odour assessment has been completed to achieve the following:

- characterize the existing air quality in the surrounding area;
- support the evaluation of alternative WWTP site layouts;
- estimate the emissions from the Project;
- predict the impact of the project on local air quality through dispersion modelling; and
- recommend best management practices to help mitigate the potential for odour.

1.1 Site Location

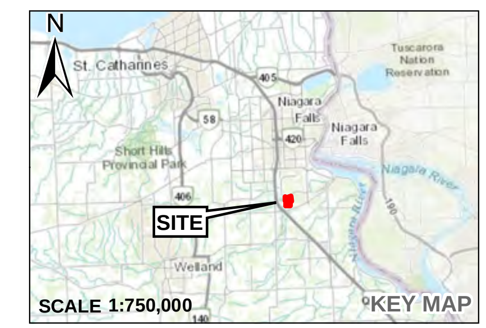
The Project will be located in South Niagara Falls, north of Reixinger Road and approximately 500 metres (m) east of the Queen Elizabeth Way (QEW) highway. The Welland River runs along the northern boundary of the Project site. A site location plan is included as Figure 1. The area immediately surrounding the site is zoned for industrial land use although there are a number of residences within 500 m along Reixinger Road.

The trunk sewer alignment, connecting the new WWTP to the existing sewer network, extends from an existing pipe alignment located off Oakwood Drive approximately 6 km south along Montrose Road to enter the WWTP Site north of Reixinger Road. Surface disturbance associated with construction of the trunk sewer pipe alignment is expected to be limited to the proposed footprint of the shaft locations, as the trunk sewer pipe will be tunnelled underground and accessed via temporary construction shafts. Please note that the focus of this assessment is on the new WWTP only, all other aspects of the Project (e.g. Trunk Sewer) are outside the scope of this assessment.



LEGEND

Site Boundary



0 | 750 | 1,500 | 2,250

1:45,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE.

REFERENCE(S)

BASE DATA - MNR LIO, OBTAINED 2020
SITE PLAN - GM BLUE PLAN (SNFWWS - ALIGNMENT & SHAFT LOCATIONS, 20210630)
BASE IMAGERY SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT

GM BLUEPLAN ENGINEERING LIMITED
NIAGARA FALLS, ON

PROJECT

AIR QUALITY AND ODOUR STUDY FOR PROPOSED SOUTH NIAGARA FALLS WASTEWATER TREATMENT PLANT

TITLE

SITE LOCATION PLAN

CONSULTANT

GOLDER MEMBER OF WSP

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1.2 Project Description

The Project is designed to be a conventional activated sludge plant with an average day flow capacity of 30 megalitres per day (30 MLD). The Project will accept pumped raw sewage and hauled wastewater. As wastewater enters the headworks, it will pass through mechanical screens and grit chambers. Material caught in the mechanical screens will be removed, cleaned, and dewatered before disposal. Grit will also be removed and dewatered before being transferred to disposal bins. The wastewater from the grit tanks will be transported to the primary clarifiers. Suspended solids (sludge) will settle at the bottom of the primary clarifying tanks and be pumped away for processing, while the remaining effluent will flow to the aeration tanks for secondary treatment.

In the secondary clarifiers, the waste activated sludge (WAS) will be collected and pumped to the primary clarifiers for co-thickening. Co-thickened WAS and raw sludge will be anaerobically digested on-site before being shipped off-site for disposal.

Secondary treated effluent will flow to the chlorination/dichlorination building where sodium hypochlorite is added for disinfection and sodium bisulphite is added for dechlorination.

The major liquid treatment processes will include screening and grit removal, aeration, secondary clarification, and effluent disinfection.

The Project will include storage lagoons and dewatering at the Garner Road Biosolids Management Centre. Any biogas generated as part of the onsite processes will be reused in the plant boilers, with excess gas sent to a flare. Emissions from the pumping station, headworks and primary clarifiers effluent launders will be treated by two odour control units.

Figure 2 illustrates a simplified process flow diagram of the Project.

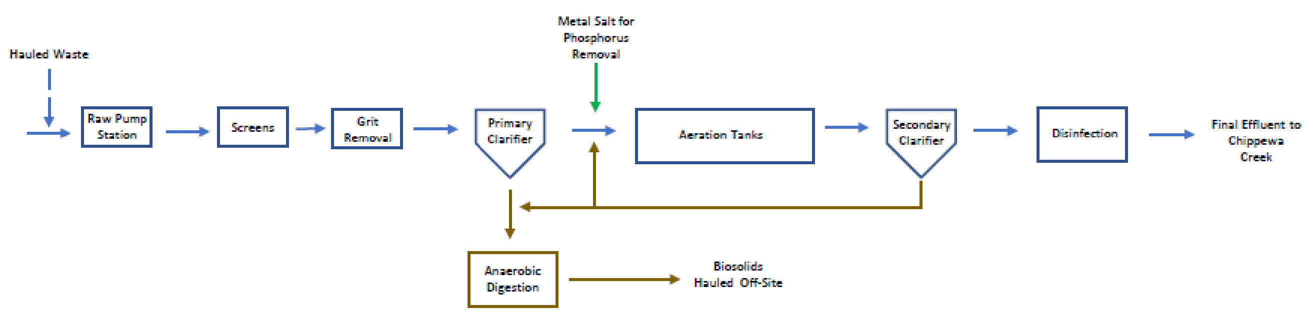


Figure 2: Process Flow Diagram

As per the information provided by GM BluePlan and Golder's experience on similar projects, the following sources were assumed to be part of the Project's normal operations for the purpose of this assessment:

- One odour control unit to control emissions from Raw Sewage Pumping (wet and dry wells);
- One odour control unit to control emissions from Headworks and Primary Clarifiers;
- Fugitive emissions from Anaerobic Digester Control Building;

- Two natural gas/digester fired boilers, each rated at 6 MMBTU/hour;
- One enclosed waste gas burner with a capacity of 9500 m^3 digester gas per day.

One emergency back-up diesel generator will operate at the Project, with a power rating of 2500 kW as per the Project design information. The emergency generator is primarily used during power outages or maintenance only but may be tested for approximately one hour, once per month.

Approximately 10 truck loads of hauled sewage are expected to arrive at the proposed WWTP per day. There will also be an estimated 12 truck loads of digested sludge leaving the WWTP each day and approximately 4 chemical trucks arriving on site per month.

1.3 Indicator Compounds

This air quality assessment focuses on predicting changes in the concentrations of Criteria Air Compounds (CACs). These compounds are generally indicative of air quality, and for which relevant air quality criteria exist. The indicator compounds for the Project are:

- **combustion gases**: nitrogen dioxide (NO_2), sulphur dioxide (SO_2), and carbon monoxide (CO).
- **particulate matter**: suspended particulate matter (SPM), particles nominally smaller than 10 µm in diameter (PM_{10}), and particles nominally smaller than 2.5 µm in diameter ($PM_{2.5}$);
- **Other Indicator Compounds**: Hydrogen Sulphide (H_2S) and Odour (expressed as whole odour (OU/m^3).

These compounds are associated with various wastewater treatment operations. Products of combustion (NO_2, SO_2 and CO) are associated with the exhaust from boilers, flaring and on-site vehicles. Particulate matter is typically associated with airborne dust from vehicles travelling along on-Site paved roads. Emissions of H_2S are the result of breakdown of material within the wastewater. To determine air quality impacts, the air quality predicted to result from the emissions from the proposed undertaking will be compared to existing ambient air quality objectives and criteria limits for the above compounds.

Odour represented as an odour threshold value (OTV) and described as “odour units” (OU/m^3), is the primary method used in Ontario to quantify the presence of odorous compounds in air. The concentration of whole odour can be measured at a facility and evaluated through the use of an odour panel. The panel is exposed to the odorant at various dilution thresholds (D/T). Due to the variability in human perception of odour, the point at which 50 percent of the panel can detect the odour is used as the threshold odour concentration. An odour unit (OU) is the number of dilutions required to reduce the odour to its detection threshold and is the emission variable used in dispersion modelling. An odour concentration (as an OU) is not an indicator of the offensiveness of a particular odour. Offensiveness is a subjective factor that varies by individual, thus has not been considered in this analysis.

In addition, Ozone (O_3) has also been quantified for this assessment. Although it will not be directly emitted as a result of the Project works and activities, it will be used to calculate NO_2 from the predicted nitrogen oxide (NO_X) concentrations. Ozone is not emitted directly into atmosphere but is associated with the reaction of NO_X (MECP 2019).

1.4 Applicable Guidelines

The air quality criteria used for assessing the air quality effects of the proposed Project on surrounding sensitive receptors include Ontario criteria, and federal standards and objectives where provincial guidelines are not available. The Ministry of the Environment, Conservation, and Parks (MECP) has issued guidelines related to ambient air concentrations, which are summarized in Ontario’s Ambient Air Quality Criteria (AAQC) (MECP, 2020). The Ontario AAQCs are characterized as desirable ambient air concentrations. They are not regulatory limits and are frequently exceeded at various locations across Ontario due to weather conditions and long-range transportation but represent an indicator of good air quality. The Ontario AAQCs are used for screening the air quality effects in environmental assessments, studies using ambient air monitoring data, and assessment of general air quality in a community or across the province (MECP 2020).

There are two sets of federal objectives and criteria: the National Ambient Air Quality Objectives (NAAQOs) and the Canadian Ambient Air Quality Standards (CAAQSs) (formerly National Ambient Air Quality Standards (NAAQS)). Similar to the Ontario AAQCs, the NAAQOs are benchmarks that can be used to facilitate air quality management on a regional scale and provide goals for outdoor air quality that protect public health, the environment, or aesthetic properties of the environment (CCME 1999). The federal government has established the following levels of NAAQOs (Health Canada 1994):

- the maximum ***Desirable*** level defines the long-term goal for air quality and provides a basis for an anti degradation policy for unpolluted parts of the country and for the continuing development of control technology; and
- the maximum ***Acceptable*** level is intended to provide adequate protection against adverse effects on soil, water, vegetation, materials, animals, visibility, personal comfort, and well-being.

The CAAQSs have been developed under the *Canadian Environmental Protection Act* (CEPA) and include standards for $PM_{2.5}$, NO_2 and SO_2. Like the Ontario AAQCs, the CAAQSs are not regulatory limits and are used as national targets for $PM_{2.5}$ and NO_2, excluding Quebec (CCME 2019). The CAAQSs are based on the long-term averages of measurement data not a short-term measurement value.

The CAAQS have been developed under the *Canadian Environmental Protection Act* and include new standards to be implemented by 2020 and 2025. The 2025 standards have been used for conservatism.

A summary of the applicable Ontario and federal standards, objectives and criteria are listed in Table 1 below, along with the selected Project criteria, which were typically selected to be the most stringent.

For Odour, the MECP uses a guideline of 1 odour unit (OU/m^3) based on the 99.5 percentile on a 10-minute time averaging period to assess the potential for nuisance. One (1) OU/m^3 is the concentration at which 50% of the population can perceive an odour, therefore 1 OU/m^3 is typically used as an indicator for the likelihood of nuisance.

Table 1: Ontario and Canadian Regulatory Air Quality Objectives and Criteria

Compound	Averaging Period	Ontario Ambient Air Quality Criteria (µg/m³) (a)	Canadian Ambient Air Quality Standards (µg/m³)	National Ambient Air Quality Standards and Objectives (µg/m³) (c)		Project Criteria (µg/m³)
				Desirable	Acceptable	
NO_2 (µg/m³)	1-hour	400	79 (42 ppb)(d)(g)	—	400	79/400
	24-hour	200	—	—	200	200
	Annual	—	22.6 (12 ppb)(e)(g)	60	100	22.6
NOx (µg/m³)	½ hour	—	—	—	—	1880(h)
SO_2 (µg/m³)	10-minute	178.2 (67 ppb)(f)	—	—	—	178.2
	1-hour	106.4 (40 ppb)(f)	170.3 (65 ppb)(g)	450	900	106.4
	Annual	10.6 (4 ppb)(f)	10.5 (4 ppb)(g)	30	60	10.5
CO (µg/m³)	1-Hour	36,200	—	15,000	35,000	15,000
	8-Hour	15,700	—	6,000	15,000	6,000
SPM (µg/m³)	24-hour	120	—	—	120	120
	Annual	60	—	60	70	60
PM_{10} (µg/m³)	24-hour	50	—	—	—	50
$PM_{2.5}$ (µg/m³)	24-hour	27	27(b)	—	—	27
	Annual	8.8	8.8(b)	—	—	8.8
O_3 (µg/m³)	1-Hour	165(f)	—	102	164	102
	8-Hour	—	118(g)	—	—	118
Odour (OU/m³)	10-min	—	—	—	—	1
H_2S (µg/m³)	10-min	13	—	—	—	13
	24-hour	7	—	—	—	7

— = No guideline available.

Notes:

(a) MECP 2020
(b) CAAQS published in the Canada Gazette Volume 147, No. 21 - May 25, 2013. Final standard phase in date of 2020 used.
(c) CCME 1999

(d) 1-hour CAAQS for NO_2 are based on the three-year average of the 98th percentile of the daily maximum 1-hour average concentration.
(e) CAAQS published in the Canada Gazette Volume 151, No. 43 – October 28, 2017, effective from 2020. The 1-hour standard is based on the three-year average of the 98th percentile of the daily maximum 1-hour average concentration. The annual standard is based on the average over a single calendar year of all 1-hour average concentrations.
(f) AAQC provided as parts per billion (ppb) were converted to µg/m^3 using a reference temperature of 20°C and pressure of 1 atmosphere (atm).
(g) CAAQS provided as parts per billion (ppb) were converted to µg/m^3 using a reference temperature of 25°C and pressure of 1 atmosphere (atm).
(h) The testing of generators used in emergency circumstances only occurs very infrequently. As a result, the modelled emissions are typically compared to the MECP generator screening limit of 1880 µg/m^3 for NOx, which applies on a half-hour basis

2.0 EXISTING AIR QUALITY

In Ontario, regional air quality is monitored through a network of air quality monitoring stations operated by the MECP and Environment and Climate Change Canada (ECCC) National Air Pollution Surveillance (NAPS) Network. These stations are operated under strict quality assurance and quality control procedures. Existing air quality was characterized using background air concentrations from local monitoring data sources.

2.1 Monitoring Data

The existing air quality was characterized using observations from the Environment and Climate Change Canada (ECCC) National Air Pollution Surveillance Network (NAPS) air quality monitoring stations (ECCC 2019). Monitoring stations are typically sited in locations where there are potential concerns about local air quality or in population centres, therefore there are no locations in the immediate vicinity of the Project and stations located some distance away were used. Figure 3, below shows the location of the monitoring stations included in the assessment and a windrose illustrating historic wind data from St Catherine's Airport Meteorological Station to illustrate the typical winds expected at the Project location and the prevailing wind direction for the area.

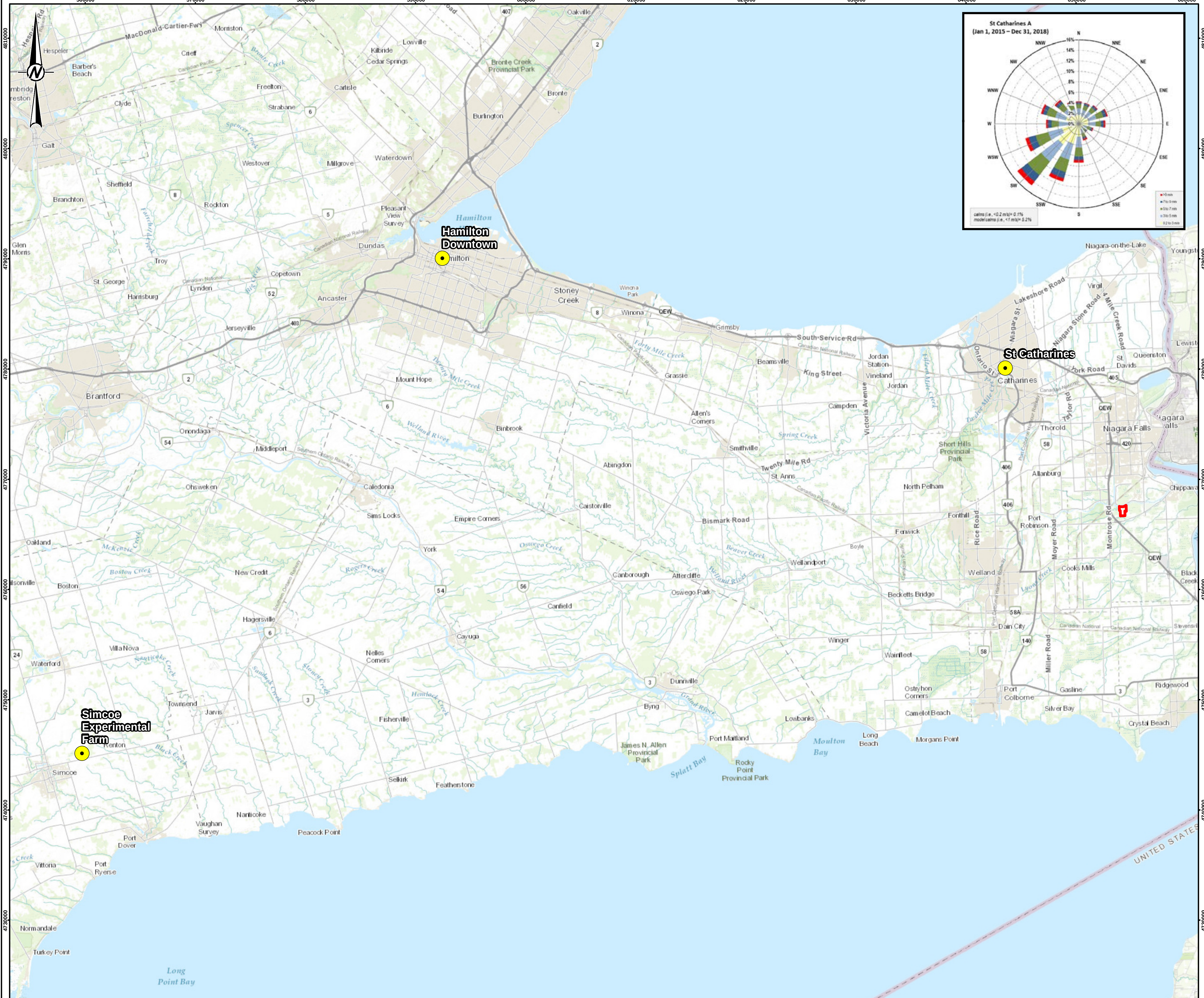
The relative locations of each of the air monitoring stations considered to describe the existing air quality is summarized in Table 2 below, which also includes the monitoring data that is available from each station.

Table 2: NAPS Monitoring Stations Used for Assessment

Station Name	NAPS Station ID	Surrounding Land Use	Distance from Project	Direction from the Project	Monitored Parameters
St. Catharines (62 Argyle Crescent)	61302	Suburban area, primarily surrounded by residential land uses	17 km	Northwest	NO, NO_2, O_3, $PM_{2.5}$
Simcoe Experimental Farm	62601	Rural area, surrounded by agricultural land	98 km	Southwest	NO, NO_2, O_3, $PM_{2.5}$, SO_2
Hamilton Downtown (Beasley Park)	60512	Urban area	66 km	Northwest	CO, NO, NO_2, O_3, $PM_{2.5}$, SO_2

Notes:

"—" data not available/not used for indicator compound.



LEGEND

- Air Quality Monitoring Station
- Site Boundary

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1:350,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE.

REFERENCE(S)

BASE DATA - MNR LIO, OBTAINED 2020
SITE PLAN - GM BLUE PLAN (SNFWWS - ALIGNMENT & SHAFT LOCATIONS, 20210630)
BASE IMAGERY SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
GM BLUEPLAN ENGINEERING LIMITED
NIAGARA FALLS, ON

PROJECT
AIR QUALITY AND ODOUR STUDY FOR PROPOSED SOUTH NIAGARA FALLS WASTEWATER TREATMENT PLANT

TITLE
LOCATIONS OF SURROUNDING AIR QUALITY MONITORING STATIONS

CONSULTANT

GOLDER MEMBER OF WSP

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The air flow surrounding the Project is predominantly from the southwest. The closest air quality monitoring station is located in a suburban area of St. Catharines, primarily surrounded by residential land use. This station is generally cross-wind of the Project and is anticipated to be the most representative station of the area due to proximity to the Project as it would be subject to similar regional emissions, however not all indicator compounds are monitored at this station, in particular SO_2 and CO are not measured.

The Simcoe station is also generally upwind of the Project but located at a further distance of approximately 98 km from the Project. Monitoring at the Simcoe Station includes a larger number of compounds, including SO_2 but CO is not measured at this Station. The Hamilton station also measures SO_2 concentrations, in addition to CO. It is located closer to the Project than the Simcoe Station but in a much more urban environment surrounded by heavy industrial sources. As a result, the Simcoe Station is considered to be more representative of air quality in the area of the Project than the Hamilton Station given its surrounding land use which is a mix of rural, residential and few industrial facilities. CO is not monitored at the St. Catharines station or the Simcoe station. Due to decreasing trends in CO levels in the province over the past ten years (MECP, 2018a), there are few stations that currently monitor CO. The closest station to the Project with monitoring data for CO is the Hamilton station.

Table 3 summarizes monitoring data for the years 2014 through 2018 that were considered for this assessment. For analyzing monitoring data, the 90th percentile of the available monitoring data is typically considered a conservative estimate of background air quality (Alberta Environment, 2013). As a result, the 90th percentile of the measured concentrations have been used to represent background air quality for parameters with shorter averaging periods (i.e., 1-hour, 8-hour, and 24-hour). Annual background concentrations were calculated based on the mean of the available data. A summary of the background air quality concentrations for all compounds is provided below in Table 3, below.

Table 3: Summary of Air Quality Station Data

Indicator	Averaging Period	Assessment Criteria (µg/m³)	Concentration (µg/m³)		
			St. Catharines	Simcoe	Hamilton
NO_2 (a)	1-Hour	79/400	26.33		—
	24-Hour	200	22.34		—
	Annual	22.6	12.78		—
SO_2 (a)(c)	10-Minute	178.2	—	4.32	—
	1-Hour	106.4	—	2.62	—
	Annual	10.5	—	1.17	—
CO (a)	1-Hour	15,000	—	—	435.19
	8-Hour	6,000	—	—	553.15
SPM	24-hour	120	43.33		—
	Annual	60	25.14		—
PM_{10}	24-hour	50	24.07		—

Indicator	Averaging Period	Assessment Criteria (µg/m³)	Concentration (µg/m³)		
			St. Catharines	Simcoe	Hamilton
$PM_{2.5}$	24-hour	27	13.00 [(b)]		—
	Annual	8.8	7.54 [(b)]		—
SPM	24-hour	120	43.33		—
O_3 [(a)(c)]	1-Hour	102	88.31		—
	8-Hour	118	98.61		—

(a) Data measured in parts per billion (ppb) or parts per million (ppm), were converted to µg/m³ assuming standard temperature and pressure (25°C and one atmosphere of pressure).

(b) No data was available at the St. Catharines station for 2014, hence the data for 2013, 2015-2018 was assessed instead.

(c) Data for 2015-2019 was assessed.

2.2 Summary of Existing Air Quality

Table 4 summarizes the existing air quality in the area surrounding the Project, to be added to the dispersion modelling predictions as part of the air quality impacts assessment. The 90th percentile of the 1-hour, 8-hour, and 24-hour measurements are typically used to represent the existing air quality value when conducting an impact assessment and the annual average concentration is used for annual background levels (Alberta Environment 2013). The St. Catharines station is the only air quality monitoring station located 17 km cross-wind of the Project. Due to proximity and general air flow direction, data from the St. Catharines station is considered the most representative of the air quality surrounding the Project, and therefore is used for indicator compounds monitored at that station. Monitored SO_2 data from the Simcoe station is used as it is more representative of air quality in the area of the Project given its similar elevation and has fewer industrial influences than the Hamilton Station. The CO data from Hamilton is conservatively being used to represent existing air quality since the St. Catharines and Simcoe stations have historically not been used to monitor CO concentrations.

Table 4: Summary of Background Air Quality Monitoring Data

Indicator Compound	Averaging Period	Background Air Quality Concentration [µg/m³]	Project Criteria [µg/m³]	% of Project Criteria
NO_2	1-hour	26.33	79 (CAAQS)	33.3%
			400 (AAQC)	6.58%
	24-hour	22.34	200	11.2%
	Annual	12.78	22.6	56.5%
SO_2	10-minute	4.32	178.2	2.4%
	1-hour	2.62	106.4	2.5%
	Annual	1.17	10.5	11.1%

Indicator Compound	Averaging Period	Background Air Quality Concentration [µg/m³]	Project Criteria [µg/m³]	% of Project Criteria
CO	1-Hour	435.19	15,000	3.0%
	8-Hour	553.15	6,000	9.2%
SPM	24-hour	43.33	120	36.1%
	Annual	25.14	60	41.9%
PM_{10}	24-hour	24.07	50	48.1%
$PM_{2.5}$	24-hour	13.00	27	48.1%
	Annual	7.54	8.8	85.7%
O_3	1-Hour	88.31	102	86.6%
	8-Hour	98.61	118	83.6%

Notes:
1. All values are based on 90th percentile with the exception of annual averages.
2. "–" no data available

3.0 EMISSION RATE ESTIMATES

As described in Section 1.2, the Project is a Wastewater Treatment Plant with a capacity of 30 MLD. Emissions will occur from the various water treatment processes, during combustion of the biogas and from the haul trucks used to transport sewage on-site and biosolids off-site.

Emission rate estimates for each of the main sources of emission from the Project operations are provided in the sections below.

3.1 Raw Sewage Pumping Station

Emissions from the raw sewage pumping station (wet well/dry well) are controlled by an odour control unit, which is proposed to be similar in design to the bio-tricking filter operating at the GE Booth WWTP in Mississauga, Ontario. In particular, it was assumed to have a 99% control efficiency and exhaust flow rate of up to 20,400 m^3/hour (5.67 m^3/s).

The following equation was used to estimate the emission rate of odour:

$$ER = EF \times Q \times (1 - C)$$

Where:

- ER = Emission rate in Odour Units per second (OU/s)
- EF = Emission Factor (detection threshold) in Odour Units per cubic metre (OU/m^3)
- Q = Flow Rate in cubic metres per second (m^3/s)
- C = Control Efficiency (%)

Odour emission rates were calculated using emission factors for pumping stations calculated as the geometric mean of published sampling odour sampling data from wastewater treatment plants (McGinley and McGinley, 2008). Emission factors are provided for both a wet well and a pump station, therefore the maximum odour emission factor was selected for use in this assessment and applied to the maximum exhaust flow rate for conservatism. The following is a sample calculation for odour:

$$= 2245\,\frac{OU}{m^3} \times 5.67\,\frac{m^3}{s} \times (1 - 99\%)$$

$$= 127.2\,\frac{OU}{s}$$

H_2S emissions were calculated based on an inlet concentration of 20 ppm. The following equation was used to estimate the emission rate of H_2S:

$$ER = IC \times \frac{MW}{24.45} \times Q \times (1 - C) \times conversion\ to\ g/s$$

Where:

- ER= Emission rate in grams per second (g/s)
- IC = Inlet Concentration in parts per million (ppm)
- MW = Molecular weight of H_2S (g/mol)
- Q = Flow Rate in cubic metres per second (m^3/s)
- C = Control Efficiency (%)
- 24.25 is the molar volume of air in litres at 25°C

$$ER = 20\ ppm \times \frac{34\frac{g}{mol}}{24.45} \times (1 - 99\%) \times 5.67\frac{m^3}{s} \times \frac{1\ g}{1000\ mg}$$

$$= 0.0016\ \frac{g}{s}$$

3.2 Headworks and Primary Clarifiers

Both the headworks and primary clarifiers effluent launders are enclosed, with emissions controlled by odour control system. The odour control system will be designed to have a 99% control efficiency and exhaust flow rate of up to 20,400 m^3/hour (5.67 m^3/s), as per the Project design .

The following equation was used to estimate the emission rate of odour:

$$ER = EF \times Q \times (1 - C)$$

Where:

ER= Emission rate in Odour Units per second (OU/s)
EF = Emission Factor (detection threshold) in Odour Units per cubic metre (OU/m^3)
Q = Flow Rate in cubic metres per second (m^3/s)
C = Control Efficiency (%)

Odour emission rates were calculated using emission factors for headworks and primary treatment activities, calculated as the geometric mean of published sampling odour sampling data from wastewater treatment plants (McGinley and McGinley, 2008). Where more than one emission factor was provided, the highest emission factor for the controlled activities was selected for use, in conjunction with the maximum exhaust flow rate, for conservatism. The following is a sample calculation for odour:

$$= 2959\ \frac{OU}{m^3} \times 0.35\frac{m^3}{s} \times (1 - 99\%)$$

$$= 10.3\ \frac{OU}{s}$$

H_2S emissions were calculated based on an inlet concentration of 20 ppm. The following equation was used to estimate the emission rate of H_2S:

$$ER = IC \times \frac{MW}{24.45} \times Q \times (1 - C) \times conversion\ to\ g/s$$

Where:

ER = Emission rate in grams per second (g/s)
IC = Inlet Concentration in parts per million (ppm)
MW = Molecular weight of H_2S (g/mol)
Q = Flow Rate in cubic metres per second (m^3/s)
C = Control Efficiency (%)
24.25 is the molar volume of air in litres at 25°C

$$= 20\,ppm \times \frac{34\frac{g}{mol}}{24.45} \times (1 - 99\%) \times 0.35\frac{m^3}{s} \times \frac{1\,g}{1000\,mg}$$

$$= 0.0016\ \frac{g}{s}$$

3.3 Anaerobic Digester Building

The anaerobic digestion control building contains a boiler room, heat exchanger room, electrical room, gas room/drip trap room and digestion pump room. Emissions of odorous compounds occur during truck loading. Emissions were calculated based on a processing capacity of 500 m^3/day (0.012 m^3/s) of sludge, the design criteria for the Project.

The following equation was used to estimate the emission rate of odour:

$$ER = EF \times Q$$

Where:

- ER = Emission rate in Odour Units per second (OU/s)
- EF = Emission Factor (detection threshold) in Odour Units per cubic metre (OU/m^3)
- Q = Flow Rate in cubic metres per second (m^3/s)
- C = Control Efficiency (%)

Odour emission rates were calculated using emission factors for digester vents calculated as the geometric mean of published sampling odour sampling data from wastewater treatment plants (McGinley and McGinley, 2008). The following is a sample calculation for odour:

$$= 1471\ \frac{OU}{m^3} \times 0.012\frac{m^3}{s}$$

$$= 17.03\ \frac{OU}{s}$$

H_2S emissions were calculated based on an assumed concentration of 20 ppm. The following equation was used to estimate the emission rate of H_2S:

$$ER = IC \times \frac{MW}{24.45} \times Q \times (1 - C) \times conversion\ to\ g/s$$

Where:

- ER= Emission rate in grams per second (g/s)
- IC = Inlet Concentration in parts per million (ppm)
- MW = Molecular weight of H_2S (g/mol)
- Q = Flow Rate in cubic metres per second (m^3/s)
- C = Control Efficiency (%)
- 24.25 is the molar volume of air in litres at 25°C

$$= 20\,ppm \times \frac{34\frac{g}{mol}}{24.45} \times 0.01\frac{m^3}{s} \times \frac{1\,g}{1000\,mg}$$

$$= 0.0003\ \frac{g}{s}$$

3.4 Boilers

Biogas generated by the Project will be used to fuel two boilers, each with a design rating of 6 MM BTU/hour which may also operate on natural gas. The following equation was used to estimate the emission rates from the boilers:

$$ER = EF \times Thermal\ Heating\ Capacity \div HigherHeating\ Value \times Conversion\ to\ g/s$$

Where:

ER= Emission rate in grams per second (g/s)

EF = Emission Factor in pounds per 100,000 standard cubic feet of gas (lb/ 100,000 SCF)

Higher Heating Value of biogas is assumed to be 690 BTU/SCF

In the absence of emission factors for biogas combustion, published emission factors for natural gas combustion (US EPA, 1998) were used to calculate the emissions of all contaminants. The following is a sample calculation for emissions of CO:

$$= 84\ \frac{lb}{10^6 SCF} \times 6\frac{MMBTU}{hr} \div 690\frac{BTU}{SCF} \times \frac{1\ hr}{3600\ s} \times \frac{10^6\ BTU}{MMBTU} \times \frac{1000\ g}{kg} \times \frac{0.4536\ kg}{lb}$$

$$= 0.092\frac{g}{s}$$

The emission rates for SPM, SO_2, and NOx were calculated using the same general equation. Emissions of PM_{10} and $PM_{2.5}$ were conservatively assumed to be equivalent to SPM.

3.5 Waste Gas Burner

An enclosed flare will be used to combust excess biogas, up to 9500 m^3 of digester gas per day, as per the Project design. It was assumed that the flare would be in use for up to 12 hours per day.

The following predictive emissions equation was used to estimate the combustion emission rates from the flare:

$$\mathrm{ER} = \mathrm{EF} \times \mathrm{Digester\ gas\ flow\ rate} \times \mathrm{Methane\ Content} \times \mathrm{conversion\ to\ g/s}$$

Where:

ER = emission rate (g/s)

EF = emission factor in kilograms per 100,000 dry standard cubic metres of methane (kg/dscm CH_4).

Emission factors for CO, SPM and NOx were obtained from published data for landfill gas flares (US EPA, 2008). The digester gas flow rate was converted to dry standard conditions based on a temperature of 35 degrees, a moisture content of 5% and pressure of 0.39 PSI. The methane content of the digester gas is understood to be 61%.

The following is a sample calculation for the CO emissions.

$$= 737\ \frac{kg}{10^6 dsm^3 CH_4} \times 19.1\frac{dsm^3}{hr} \times 61\% \times 1000\frac{g}{kg} \times \frac{1\ hr}{3600\ s}$$

$$= 0.0024\frac{g}{s}$$

The emission rates for SPM and NOx were calculated using the same general equation. Emissions of PM_{10} and $PM_{2.5}$ were conservatively assumed to be equivalent to SPM.

The emission rate for SO_2 was estimated based on the concentration of compounds containing sulphur (US EPA, 2008) multiplied by the number of moles of sulphur in each compound. The following is a sample calculation for the emission rate of reduced sulphur from the flare.

$$ER = Concentration\ of\ sulphur\ in\ the\ gas \frac{m^3S}{m^3gas} \times flow\ rate\ \frac{m^3gas}{second} \times 1\ \frac{mol.K}{8.3145\ m^3S.Pa} \times \frac{101325Pa}{298.15\ K} \times \frac{32.1\ gS}{mol}$$

$$ER = 38.47 \frac{m^3S}{m^3gas} \times 0.219 \frac{m^3gas}{s} \times 1\ \frac{mol.K}{8.3145\ m^3S.Pa} \times \frac{101325Pa}{298.15\ K} \times \frac{32.1\ gS}{mol}$$

$$ER = 0.022 \frac{g}{s}$$

3.6 Emergency Generators

One emergency back-up diesel generator will operate at the Project, with a power rating of 2500 kW, as per the Project design. The following predictive emissions equation was used to estimate the combustion emission rates from the generator:

$$ER = EF \times Power\ Rating\ \times Conversion\ to\ g/s$$

Where:

ER = emission rate (g/s)

EF = emission factor in grams per horsepower hour (g/HP-hr or g/kW-hr).

Emission rates of CO and SPM from the generator were calculated using manufacturer's specifications for a similarly sized unit. Emissions of PM_{10} and $PM_{2.5}$ were conservatively assumed to be equivalent to SPM. An emission factor for SO_2 was taken from published emission factors for diesel combustion (US EPA, 1996). Emission rate of NOx from the generator was calculated using the Tier 2 exhaust emission standard for engines rated at greater than 900 kW from the US EPA document titled "Nonroad Compression-Ignition Engines: Exhaust Emission Standards". The following is a sample calculation for the emission rate of NOx from the generator.

$$= 6.4\ \frac{g}{kW - hr} \times 2500\ kW \times \frac{1\ hr}{3600\ s}$$

$$= 4.00 \frac{g}{s}$$

The generator is tested for approximately one hour, once per month, therefore, emissions from the generator are considered separately to normal operations.

3.7 Truck Movements – Tailpipe Emissions

Emission factors for the on-site vehicle exhaust for diesel waste trucks were obtained using the U.S. EPA MOVES3 emission model (US EPA 2020). The design of the Project includes up to 10 sewage haulers per day transporting sewage on-site, 12 trucks per day hauling biosolids off-site and approximately 4 chemical trucks per month. Truck movements are limited to 7 am to 7 pm. The emission factors developed for the diesel waste trucks operated at the Project are provided in

Table 5 below:

Table 5: Emission Factors for Waste Trucks Calculated Using MOVES Model

Compound	Emission Factor (g/VKT)[(a)]
CO	4.05
NOx	11.60
SO_2	0.01
SPM	0.53
PM_{10}	0.53
$PM_{2.5}$	0.49

Notes: [a)] VKT =vehicle kilometres travelled

The following predictive emissions equation was used to estimate the combustion emission rates from the Waste Trucks:

$$CO\ Emission\ Rate\ \left[\frac{g}{s}\right] = Emission\ Factor\ \times Total\ Distance\ of\ One\ Trip\ \times Number\ of\ Trips\ per\ Hour \times conversion\ to\ g/s$$

The following is a sample calculation for the emission rate of CO

$$= 4.05\ \frac{g}{VKT} \times \frac{1\ hr}{3600\ s} \times \frac{0.65\ km}{trip} \times \frac{3\ trip}{hour}$$

$$= 0.0022\,\frac{g}{s}$$

The emission rates for SPM, PM_{10}, $PM_{2.5}$, SO_2, and NOx were calculated using the same general equation.

3.8 Truck Movements – Fugitive Dust

Published emission factors were used to calculate the fugitive dust emissions from paved roadways (US EPA, 2011). The following predictive emissions equation was used to determine the fugitive dust emission factor for paved roads:

$$\mathrm{EF} = (\mathrm{k}(\mathrm{sL})^{0.91} \times (\mathrm{W})^{1.02})\ (1 - \mathrm{C})$$

Where:

EF = particulate emission factor (having units matching the units of k),
k = particle size multiplier for particle size range and units of interest (see Table 6),
sL = road surface silt loading (g/m^2) assumed to be 7.4 (as per US EPA 2011, silt loading for MSW landfills),
W = average weight (tons) of the vehicles traveling the road, and
C = Control efficiency, i.e., reduction of fugitive dust emissions due to dust suppression activities.

Table 6: Particle Size Assumptions for Paved Road Dust (US EPA, 2011)

Size Range	k (g/VKT)
SPM	3.23
PM_{10}	0.62
$PM_{2.5}$	0.15

The following is a sample calculation for SPM for the predictive emission factor for a waste truck that will travel along the on-site roads. The waste truck is estimated to have an average weight of 25 tons.

$$\mathrm{EF} = 3.23 \times (7.4)^{0.91} \times (25)^{1.02}$$

$$\mathrm{EF} = 523.23 \ \mathrm{g/VKT}$$

The following is a sample calculation for the SPM emission rate for vehicles travelling along the same paved road segment:

$$\mathrm{ER} = \frac{523.23 \ \mathrm{g}}{\mathrm{VKT}} \times \frac{1.95 \ \mathrm{VKT}}{\mathrm{hr}} \times \frac{1 \ \mathrm{hr}}{3600 \ \mathrm{s}}$$

$$\mathrm{ER} = 0.29 \ \mathrm{g/s}$$

The emission rates of PM_{10} and $PM_{2.5}$ were calculated as presented above.

3.9 Summary of Emissions

A summary of hourly emission rates from all significant sources at the Project is provided in Table 7, below.

Table 7: Summary of Emissions by Source

Source	Contaminant	Emission Rate [g/s]
Raw Sewage Pumping Station (odour control unit)	Odour (OU/s)	127.22
	H_2S	0.0016
Headworks and Primary Clarifiers (odour control unit)	Odour (OU/s)	167.68
	H_2S	0.0016
Anaerobic Digester Building	Odour (OU/s)	17.03
	H_2S	0.0003
Boilers	NO_x	0.22
	SO_2	0.0013
	CO	0.18
	SPM	0.017
	PM_{10}	0.017
	$PM_{2.5}$	0.017

Source	Contaminant	Emission Rate [g/s]
Waste Gas Burner	NO_x	0.0020
	SO_2	0.0222
	CO	0.0024
	SPM	0.0008
	PM_{10}	0.0008
	$PM_{2.5}$	0.0008
Emergency Generator	NO_x	4.00
	SO_2	0.0046
	CO	0.79
	SPM	0.06
	PM_{10}	0.06
	$PM_{2.5}$	0.06
Truck Movements – Tailpipe Emissions	NO_x	0.0063
	SO_2	0.000003
	CO	0.0022
	SPM	0.0003
	PM_{10}	0.0003
	$PM_{2.5}$	0.0003
Truck Movements – Fugitive dust	SPM	0.288
	PM_{10}	0.055
	$PM_{2.5}$	0.013

4.0 DISPERSION MODELLING

The likely environmental effects for the air quality indicators were evaluated using the AERMOD air dispersion model developed by the United States Environmental Protection Agency (U.S. EPA). AERMOD is recognized by federal and Ontario regulators as one of the regulatory dispersion models.

AERMOD consists of the model and two pre-processors: the AERMET meteorological pre-processor and the AERMAP terrain pre-processor. The following approved dispersion model and pre-processors were used in the assessment:

- AERMOD dispersion model (v. 19191);
- AERMAP surface pre-processor (v. 18081); and
- BPIP building downwash pre-processor (v.04274).

AERMET was not used since pre-processed meteorological datasets were obtained from the MECP. Dispersion modelling was completed considering guidance from the MECP Guide "*Air Dispersion Modelling Guideline for Ontario*" (ADMGO) dated February 2017 (MECP, 2017).

4.1 Model Development

The AERMOD dispersion modelling system was developed by the U.S. EPA as a replacement to the long-standing Industrial Source Complex (ISC) model, as the model recommended by the U.S. EPA for regulatory applications in the United States. This model has also been adopted in Ontario as the regulatory model recommended for permitting and regulatory applications (MECP, 2017). The model is generally based on Gaussian plume dispersion theory (U.S. EPA 2004), but also incorporates a series of specific algorithms to reflect current understanding of dispersion theory (U.S. EPA 2004).

4.1 Model Calibration

Digital terrain data for the site and surrounding area are also required inputs to the AERMAP pre-processor and used to characterize how the local topography could affect the dispersion of air contaminants. If buildings are present at a site, building heights are required inputs to assess building downwash using the BPIP pre-processor.

4.2 Model Validation

Part of the rigorous process used by the U.S. EPA prior to adopting AERMOD as a regulatory model (U.S. EPA 2004) was a significant peer review process to confirm that the model could accurately predict ground level concentrations when compared to monitoring data (U.S. EPA 2003, 2004).

4.3 Model Uncertainty and Sensitivity

Dispersion models employ assumptions that simplify the random processes associated with atmospheric motions and turbulence. While this simplification limits the model's ability to replicate individual events, the strength of the model lies in the ability to predict overall values for a given set of meteorological conditions. The process undertaken by the U.S. EPA ensured that the model predictions can be relied on as reasonable estimates of the likely concentrations. AERMOD is based on known theory and has been proven to reliably produce repeatable results. To limit the uncertainty associated with emissions input to the model, conservative assumptions were made where practical (see Section 4.7). Finally, five years of publicly available meteorological data obtained from the MECP (MECP, 2020) are used as an input to the model so that a full range of possible meteorological conditions is evaluated.

Table 8: Reliability Summary for the AERMOD Dispersion Model

Model Name	Developer	Use in Assessment	Development	Calibration	Validation	Uncertainty and Sensitivity
AERMOD (Version 19191)	United States Environmental Protection Agency	Predict air quality concentrations and deposition	AERMOD was developed to replace the long-standing ISC model as the model recommended by the U.S. EPA. AERMOD is based on Gaussian plume dispersion theory (U.S. EPA 2004) that has been used for more than 30 years. The application of specific algorithms has been updated to reflect current understanding of dispersion theory (U.S. EPA 2004).	Five years of publicly available meteorological data were obtained from the MECP. Digital terrain data for the site and surrounding area input to the model.	AERMOD has been adopted by the U.S EPA as it is preferred and recommended dispersion model (U.S. EPA 2005). Prior to adoption, the U.S. EPA completed a rigorous review of the model performance (U.S. EPA 2003, 2005).	AERMOD is based on known theory and proven to reliably produce repeatable results. Uncertainty associated with emissions is managed by making conservative assumptions. Model predictions are sensitive to fluctuations in the meteorology, which can be managed by using a five-year data set. Five years of data should include the full range of possible meteorological conditions.

4.2 Model Inputs

To predict ambient air concentrations using AERMOD, a series of inputs are required that parameterize the sources of emissions as well as their transport. These inputs can be grouped into the categories listed below:

- Meteorological data;
- Terrain and receptors;
- Building downwash; and
- Emissions and model source configurations.

Each of these input categories are discussed separately in the following sections.

4.2.1 Meteorological Data

The MECP, as well as other agencies, recommends that five years of hourly data be used in the model to cover a wide range of potential meteorological conditions (MECP, 2017). In this assessment, the AERMOD model was run using a MECP pre-processed five-year dispersion meteorological dataset (i.e., surface and profile files), last updated in 2020, in accordance with paragraph 1 of s.13(1) of O.Reg.419/05. As the Project is located in the West Central MECP Region – Hamilton, Niagara, Guelph, the meteorological dataset for West Central ("London") Crops is used (MECP 2020). The data set covers the period of January 1996 to December 2000.

4.2.2 Terrain and Modelling Receptors

Terrain elevations have the potential to influence air quality concentrations at individual receptors, therefore surrounding terrain data is required when using regulatory dispersion models in both simple and complex terrain situations (U.S. EPA 2004). Digital terrain data is used in the AERMAP pre-processor to determine the base elevations of receptors, sources, and buildings. AERMAP then searches the terrain height and location that has the greatest influence on dispersion for each receptor (U.S. EPA 2004). This is referred to as the hill height scale. The base elevation and hill height scale produced by AERMAP are directly inserted into the AERMOD input file.

4.2.2.1 Digital Terrain Data

Digital terrain data was obtained from the MECP (NED GeoTIFF format) (MECP 2020). The GeoTIFF files used in this assessment were cdem_dem_030L.tif and cdem_dem_030M.tif.

4.2.2.2 Model Receptors

Receptors were chosen based on recommendations provided in Section 7.2 of the ADMGO, which is in accordance with s.14 of O.Reg. 419/05. Specifically, a nested grid, centred around the outer edges of the sources, was placed as follows:

a) 20 m spacing, within an area of 200 m by 200 m;

b) 50 m spacing, within an area surrounding the area described in (a) with a boundary at 300 m by 300 m outside the boundary of the area described in (a);

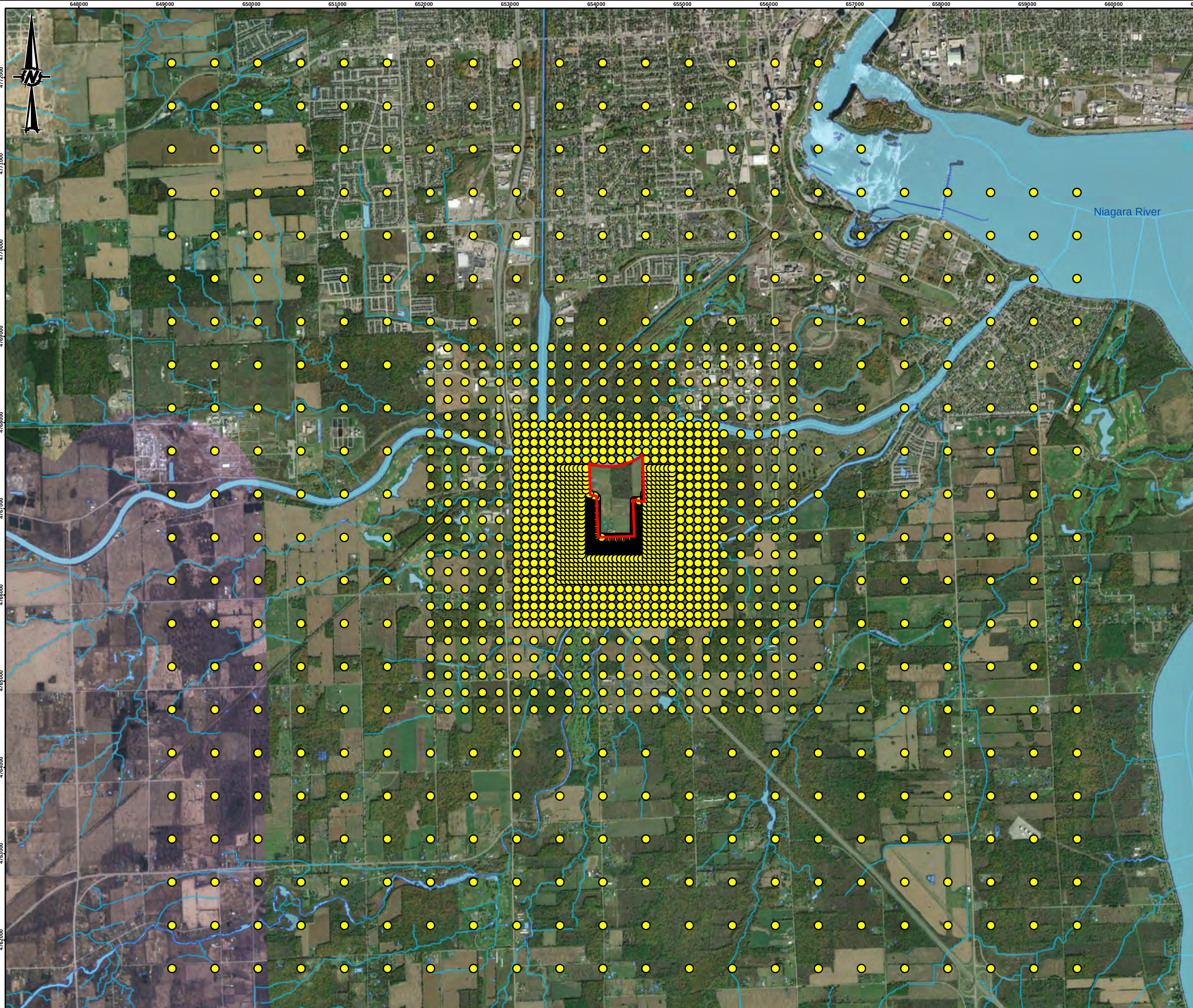
c) 100 m spacing, within an area surrounding the area described in (b) with a boundary at 800 m by 800 m outside the boundary of the area described in (a);

d) 200 m spacing, within an area surrounding the area described in (c) with a boundary at 1,800 m by 1,800 m outside the boundary of the area described in (a); and

e) 500 m spacing, within an area surrounding the area described in (d) with a boundary at 4,800 m by 4,800 m outside the boundary of the area described in (a).

In addition to the nested receptor grid, receptors were also placed every 10 m along the property line. The locations of all gridded and property line receptors are illustrated in Figure 4.

Discrete Cartesian Receptors were also placed at nearby sensitive receptors within a 2 km radius of the Project, as illustrated in Figure 5. Sensitive receptors include residences, health care facilities and locations where regular human activities are expected to occur.



LEGEND

- Receptor Location
- Site Boundary
- Waterbody
- Watercourse

0 750 1,500 2,250
1:45,000 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE.

REFERENCE(S)
BASE DATA - MNR LIO, OBTAINED 2020
SITE PLAN - GM BLUE PLAN (SNFWWS - ALIGNMENT & SHAFT LOCATIONS, 20210630)
BASE IMAGERY SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
GM BLUEPLAN ENGINEERING LIMITED
NIAGARA FALLS, ON

PROJECT
AIR QUALITY AND ODOUR STUDY FOR PROPOSED SOUTH NIAGARA FALLS WASTEWATER TREATMENT PLANT

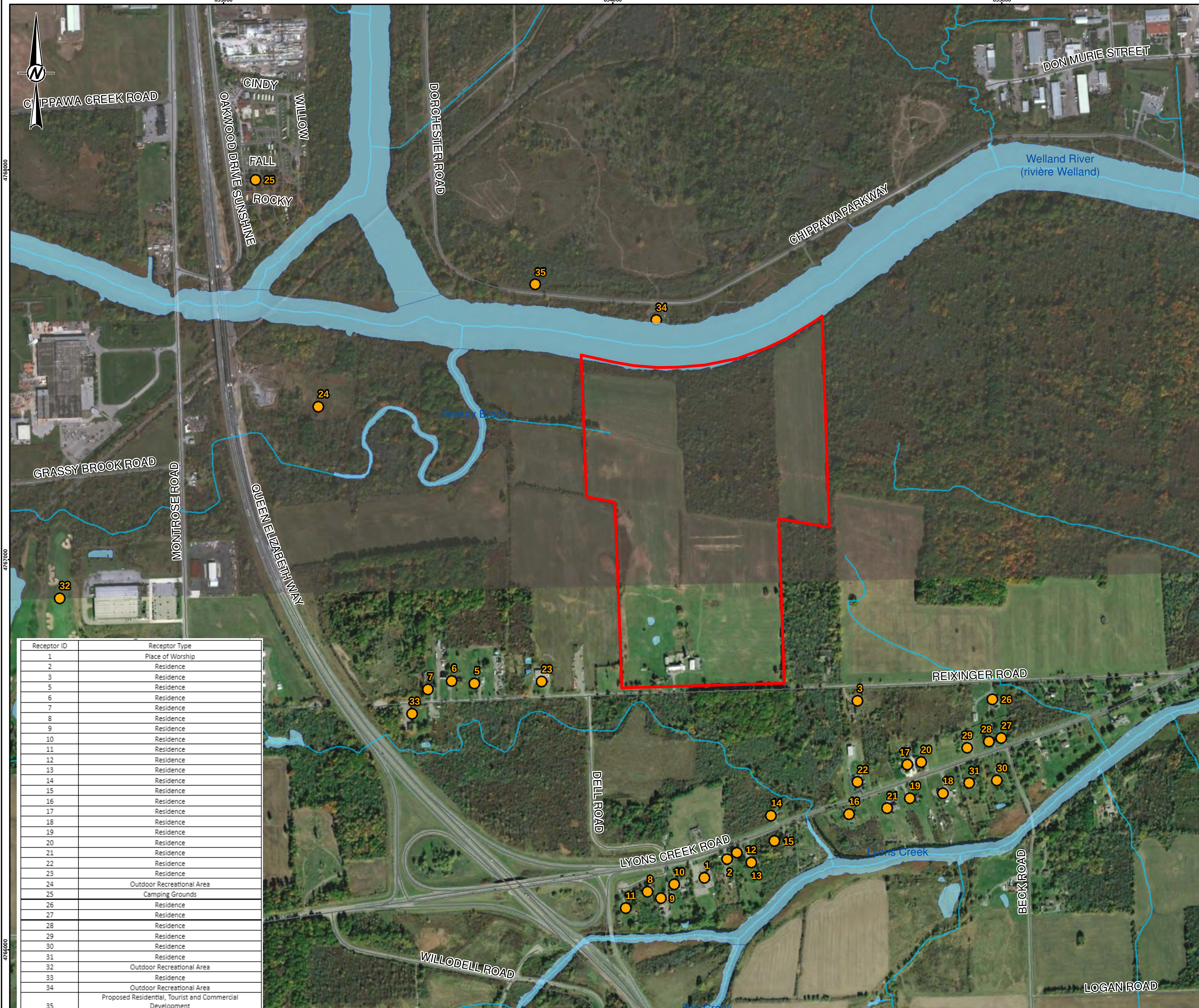
TITLE
DISPERSION MODELLING RECEPTORS (GRIDDED)

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2021-12-07
DESIGNED	ST
PREPARED	ST
REVIEWED	EC
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
18104462	0001	A	4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



Receptor ID	Receptor Type
1	Place of Worship
2	Residence
3	Residence
5	Residence
6	Residence
7	Residence
8	Residence
9	Residence
10	Residence
11	Residence
12	Residence
13	Residence
14	Residence
15	Residence
16	Residence
17	Residence
18	Residence
19	Residence
20	Residence
21	Residence
22	Residence
23	Residence
24	Outdoor Recreational Area
25	Camping Grounds
26	Residence
27	Residence
28	Residence
29	Residence
30	Residence
31	Residence
32	Outdoor Recreational Area
33	Residence
34	Outdoor Recreational Area
35	Proposed Residential, Tourist and Commercial Development

LEGEND

- Sensitive Receptor Location
- Site Boundary
- Waterbody
- Watercourse

0 150 300 450
1:10,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE.

REFERENCE(S)

BASE DATA - MNR LIO, OBTAINED 2020
SITE PLAN - GM BLUE PLAN (SNFWWS - ALIGNMENT & SHAFT LOCATIONS, 20210630)
BASE IMAGERY SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
GM BLUEPLAN ENGINEERING LIMITED
NIAGARA FALLS, ON

PROJECT
AIR QUALITY AND ODOUR STUDY FOR PROPOSED SOUTH NIAGARA FALLS WASTEWATER TREATMENT PLANT

TITLE
DISPERSION MODELLING RECEPTORS (SENSITIVE)

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-12-07
DESIGNED	ST
PREPARED	ST
REVIEWED	EC
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
18104462	0001	A	5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B
25mm

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4.3.1 Building Downwash

The PRIME algorithm, which is included within AERMOD, allows the effect of building wakes to be included in dispersion algorithms. Building wakes affect dispersion of plumes through two mechanisms:

- enhancing dispersion within the wake based on increased turbulence; and
- reducing plume rise by entrainment of the plume in the wake.

The reduced plume rise can contribute to larger ground-level concentrations as the building wake effectively brings the plume centreline closer to the ground. However, the increased turbulence of the wake will increase dilution. Both effects are accounted for by PRIME. Therefore, the inclusion of building wake effects into dispersion calculations may result in both higher ground-level concentrations and lower concentrations at elevated receptors. The parameters required by the PRIME algorithm are produced using the BPIP-PRIME building downwash pre-processor. Inputs into this program include the stack location, stack height and the footprints and heights of the buildings that will influence dispersion. The output data from BPIP is used in the AERMOD building wake effect calculations.

4.3.2 Model Source Configurations

4.3.2.1 Point Sources

Point sources are typically used to represent elevated stacks or vents as well as enclosed flares (MECP, 2017). The input parameters for the point sources at the Project were taken from manufacturers specifications for similar equipment installed at the GE Booth WWTP in Mississauga, where available as the same equipment is proposed. The input parameters used for the point sources are provided in Table 9, below

Table 9: Point Source Parameters

Source	Stack Height Above Grade [m]	Stack Gas Exhaust Velocity [m/s]	Stack Gas Exit Temperature [°C]	Stack Inner Diameter [m]	Compound	Hourly Emission Rate [g/s]
Raw Sewage Pumping Station (BIO1)	6	20	Ambient	0.6	Odour (OU/s)	127.22
					H_2S	0.0016
Headworks and Primary Clarifier (BIO2)	6	20	Ambient	0.6	Odour (OU/s)	127.22
					H_2S	0.0016
Boiler 1 (B1)	4.5	6.2	175	0.32	NOx	0.11
					SO_2	0.0007
					CO	0.09
					SPM	0.008
					PM_{10}	0.008
					$PM_{2.5}$	0.008
Boiler 2 (B2)	4.5	6.2	175	0.32	NOx	0.11
					SO_2	0.0007
					CO	0.09

Source	Stack Height Above Grade [m]	Stack Gas Exhaust Velocity [m/s]	Stack Gas Exit Temperature [°C]	Stack Inner Diameter [m]	Compound	Hourly Emission Rate [g/s]
					SPM	0.008
					PM_{10}	0.008
					$PM_{2.5}$	0.008
Waste Gas Burner (FLA)	6.2	8.5	1000	1.23	NO_x	0.0020
					SO_2	0.0222
					CO	0.0024
					SPM	0.0008
					PM_{10}	0.0008
					$PM_{2.5}$	0.0008
Emergency Power Generator (EPG1)	6.5	53.7	450	0.4	NO_x	4.00
					SO_2	0.0046
					CO	0.79
					SPM	0.06
					PM_{10}	0.06
					$PM_{2.5}$	0.06

4.3.2.2 Volume Sources

Volume sources are used to model releases from a variety of industrial sources that cannot be classified as being releases from a dedicated stack or from a large, fixed area, such as truck loading bays. Emissions from the Anaerobic digestion tank during truck filling were modelled as a volume source. The volume source parameters used in the modelling are provided in Table 10, below.

Table 10: Volume Source Parameters

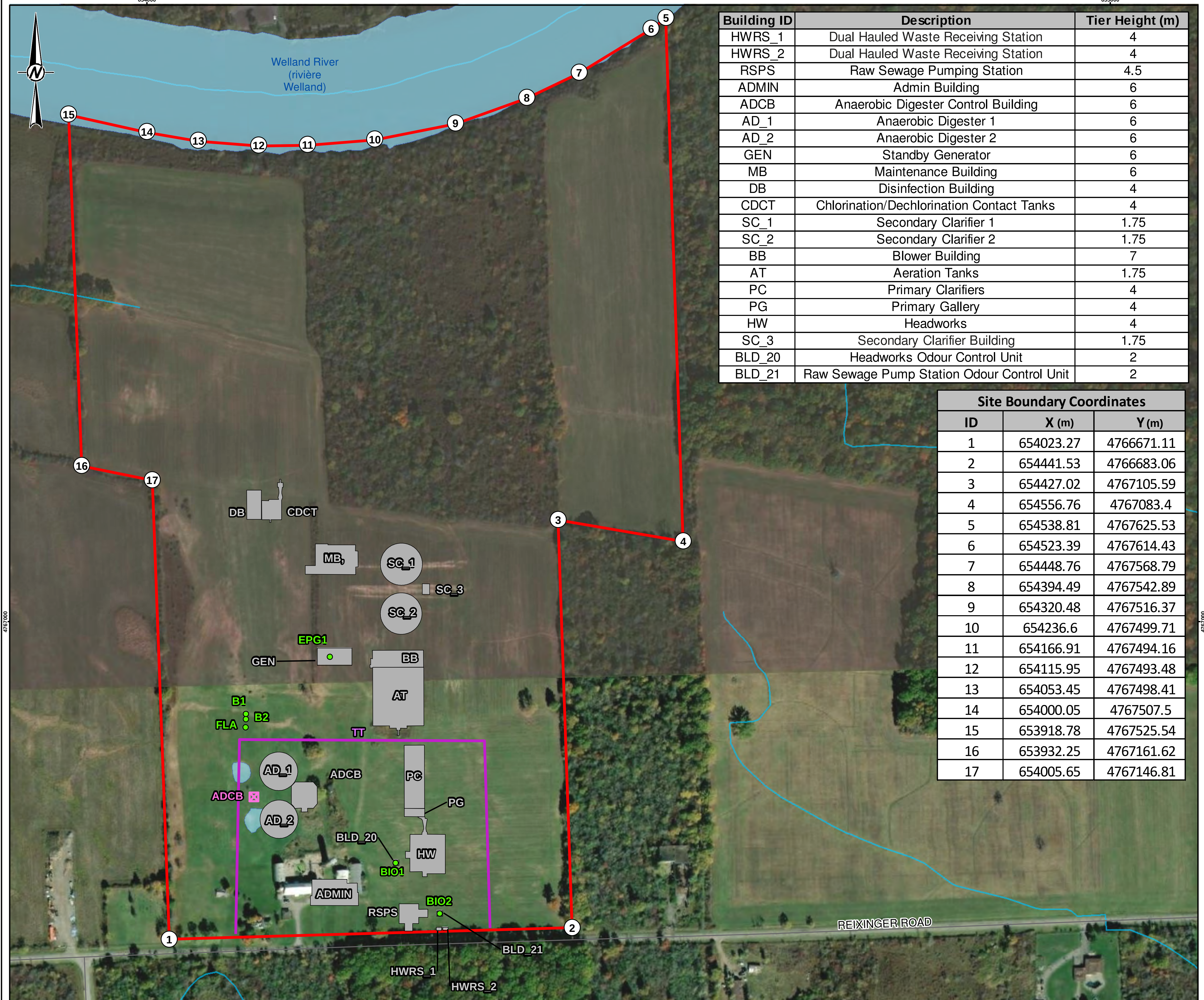
Source	Release Height Above Grade [m]	Initial Vertical Dimension [m]	Initial Lateral Dimension [m]	Compound	Hourly Emission Rate [g/s]
Anaerobic Digestion Building (ADCB)	3	2.79	2.09	Odour (OU/s)	17.03
				H_2S	0.0003

The MECP has suggested that roads should be modelled as a series of individual volume sources creating a line that follows the road (MECP 2017). On-site roads were modelled using this volume source approach. The roads were divided into contiguous volume sources with release heights assumed to be half the plume height (plume height is calculated as 1.7 x vehicle height as per US EPA, 2012)). The emission rate for the entire road segment was divided amongst the total volume sources for the entire segment. The Line volume source parameters used in the modelling are provided in Table 11, below.

Table 11: Line - Volume Source Parameters

Source	Release Height Above Grade [m]	Plume Height [m]	Plume Width [m]	Number of Modelling Sources	Compound	Hourly Emission Rate [g/s]
Truck Movements (TT)	3.49	6.99	8.59	76	NO_x	0.0063
					SO_2	0.000003
					CO	0.0022
					SPM	0.289
					PM_{10}	0.056
					$PM_{2.5}$	0.014

Please refer to Figure 6 below for the dispersion modelling plan showing source locations.



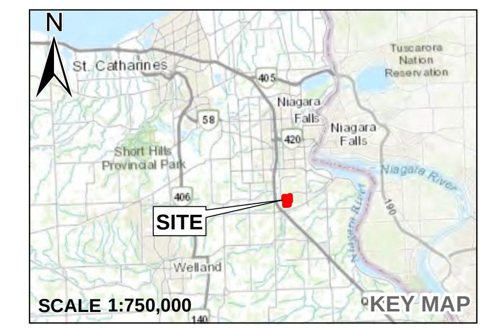
Building ID	Description	Tier Height (m)
HWRS_1	Dual Hauled Waste Receiving Station	4
HWRS_2	Dual Hauled Waste Receiving Station	4
RSPS	Raw Sewage Pumping Station	4.5
ADMIN	Admin Building	6
ADCB	Anaerobic Digester Control Building	6
AD_1	Anaerobic Digester 1	6
AD_2	Anaerobic Digester 2	6
GEN	Standby Generator	6
MB	Maintenance Building	6
DB	Disinfection Building	4
CDCT	Chlorination/Dechlorination Contact Tanks	4
SC_1	Secondary Clarifier 1	1.75
SC_2	Secondary Clarifier 2	1.75
BB	Blower Building	7
AT	Aeration Tanks	1.75
PC	Primary Clarifiers	4
PG	Primary Gallery	4
HW	Headworks	4
SC_3	Secondary Clarifier Building	1.75
BLD_20	Headworks Odour Control Unit	2
BLD_21	Raw Sewage Pump Station Odour Control Unit	2

Site Boundary Coordinates

ID	X (m)	Y (m)
1	654023.27	4766671.11
2	654441.53	4766683.06
3	654427.02	4767105.59
4	654556.76	4767083.4
5	654538.81	4767625.53
6	654523.39	4767614.43
7	654448.76	4767568.79
8	654394.49	4767542.89
9	654320.48	4767516.37
10	654236.6	4767499.71
11	654166.91	4767494.16
12	654115.95	4767493.48
13	654053.45	4767498.41
14	654000.05	4767507.5
15	653918.78	4767525.54
16	653932.25	4767161.62
17	654005.65	4767146.81

LEGEND

- Site Boundary Coordinate
- Point Sources
- Site Boundary
- Line Volume Source
- Volume Source
- Building
- Waterbody
- Watercourse



0 100 200 300
1:4,000 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE.

REFERENCE(S)
BASE DATA - MNR LIO, OBTAINED 2020
SITE PLAN - GM BLUE PLAN (SNFWWS - ALIGNMENT & SHAFT LOCATIONS, 20210630)
BASE IMAGERY SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
GM BLUEPLAN ENGINEERING LIMITED
NIAGARA FALLS, ON

PROJECT
AIR QUALITY AND ODOUR STUDY FOR PROPOSED SOUTH NIAGARA FALLS WASTEWATER TREATMENT PLANT

TITLE
DISPERSION MODELLING PLAN

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2021-12-09
DESIGNED	ST
PREPARED	ST
REVIEWED	EC
APPROVED	

PROJECT NO.	CONTROL	REV.	FIGURE
18104462	0001	A	6

4.4 Summary of Model Options

The options used in the AERMOD model are summarized in Table 12.

Table 12: Options Used in the AERMOD Model

Modelling Parameter	Description	Used in Concentration Modelling?
DFAULT	Specifies that regulatory default options will be used.	Yes, as per ADMGO recommendations
CONC	Specifies that concentration values will be calculated.	Yes
AVERTIME	Time averaging periods calculated.	1-hr, 24-hr, Annual
URBANOPT	Allows the model to incorporate the effects of increased surface heating from an urban area on pollutant dispersion under stable atmospheric conditions.	No, the Project is not located in an Urban Area
URBANROUGHNESS	Specifies the urban roughness length (m).	No, the Project is not located in an Urban Area

4.5 Special Modelling Considerations

On-site truck traffic and truck loading at the anaerobic digestion building were modelled using the emission factor card for day of week and hour of day of operation. Truck traffic and truck loading were assumed to occur from 7 am to 7 pm only.

4.6 Post Processing

Most air quality concentration predictions are output directly from the model, however there are certain parameters, including averaging periods less than 1-hour and conversion of NO_2 using existing regional ozone concentrations that require post processing. These post processing methods are described in the following sections.

4.6.1 Time Average Conversions

The smallest time scale that AERMOD predicts is a 1-hour average value. There are instances when criteria are based on different averaging times, and in these cases the following conversion factor, recommended by the MECP for conversion from a 1-hour averaging period to the applicable averaging period less than 1-hour could be used (MECP 2017). An example is given below for converting from a 1-hour averaging period to a 1/2-hour averaging period:

$$F = \left(\frac{t_1}{t_0}\right)^n$$

$$= \left(\frac{60}{30}\right)^{0.28}$$

$$= 1.21$$

Where:

F = the factor to convert from the averaging period t1 output from the model (MECP assumes AERMOD predicts true 60-minute averages) to the desired averaging period t0 (assumed to be 30 minutes in the example above), and

N = the exponent variable; in this case the MECP value of n = 0.28 is used for conversion.

For averaging periods greater than 1-hour, the AERMOD output was used directly.

4.6.2 Conversions of NO_x to NO_2

Emissions of oxides of nitrogen (NO_x) were used as inputs to the AERMOD model. Predictions of nitrogen dioxide (NO_2) can be calculated from modelled NO_x values using the Ozone Limiting Method (OLM). The OLM compares the maximum modelled NOx concentration to the background ozone concentration to assess the limiting factor to NO_2 (Cole and Summerhays 1979). The following equations present the methodology:

If background [O_3] >0.90 [NOx], total conversion: [NO_2] = [NO_x]

If background [O_3] <0.90 [NOx], NO_2 is limited by O_3: [NO_2] = [O_3] + 0.10 [NO_x]

For the air quality assessment, the background concentration of O_3 used in the OLM is presented in Table 13.

Table 13: Ozone concentrations used in OLM

Averaging Period	Concentration of O_3 [µg/m^3]
1-hour	88.31
24-hour	77.76

4.7 Conservative Assumptions in Modelling Approach

Table 14 outlines the conservative assumptions in the modelling approach which results in an assessment that is not likely to under-predict the air quality associated with the Project.

Table 14: Conservative Assumptions in Modelling Approach

Area	Conservative Assumption
Operations were modelled to be occurring simultaneously	The modelling assessment includes all operations occurring simultaneously at maximum capacity. This is unlikely to occur in practice.
Longest Haul Route Lengths were selected	It was assumed that on-site truck traffic drives around the anaerobic digestion tanks and headworks buildings. In reality, shorter routes are more likely.

It is assumed that the conservative emission rates, when combined with the conservative operating conditions and conservative dispersion modelling assumptions description herein, are not likely to under predict the modelled concentrations at each of the identified receptors.

5.0 AIR QUALITY PREDICTIONS

To assess the overall local air quality effects of a given facility, the existing air quality must be combined with the maximum predicted concentrations from the proposed activities. The resulting air quality concentrations are referred to as the cumulative predicted concentration, which is compared to the relevant air quality criteria.

As discussed in Section 2.0 above, the existing air quality for this assessment was described using the 90th percentile of monitoring data from stations located at considerable distances from the Project as there are no local monitoring stations close by. Additionally, the station data is collected in areas where there are more significant industrial sources of air emissions. As a result, the concentrations representing the existing air quality are conservative. In addition to this, the predicted concentrations that result from the dispersion modelling assessment are also conservative because they take into consideration the worst-case meteorological conditions occurring at the same time as maximum Project operations. In reality, there is a very low likelihood that the worst-case meteorology, the maximum Project operations and the conditions that result in 90th percentile of the existing air quality compounds occur simultaneously. As a result, the maximum predicted cumulative concentrations presented in this assessment are very conservative.

Maximum predicted concentrations at all off property receptors and at sensitive receptors are provided in Table 15, below. The results are compared to the relevant air quality criteria and are shown to be below the relevant guidelines at all sensitive receptors. Similarly, predicted cumulative concentrations were below the relevant air quality criteria at all gridded receptor locations, with the exception of 1-hour averaged nitrogen dioxides, which exceed the CAAQS but is below the relevant AAQC. This exceedance occurs along the western property fence line only, which is not an area where regular human activity is expected to occur. Concentrations at the closest residences are below both the CAAQS and AAQC.

It is also important to note that the provincial (AAQC) and federal (CAAQS) assessment criteria that are used in this assessment are not regulatory limits and are frequently exceeded at various locations across Ontario due to weather conditions and long-range transportation. Instead of being used for a pass or fail compliance assessment, these criteria are to be used as benchmarks to facilitate air quality management on a regional scale and provide reference desirable levels for outdoor air quality.

Table 15: Air Quality Predictions

Compound	Averaging Period	Criteria [µg/m³]	Existing Concentration [µg/m³]	Sensitive Receptors*			Off-site Gridded Receptors		
				Maximum Predicted Concentration [µg/m³]	Maximum Predicted Cumulative Concentration [µg/m³]	% Criteria	Maximum Off-Site Concentration [µg/m³]	Maximum Predicted Cumulative Concentration [µg/m³]	% Criteria
NO_2 (excluding emergency generator testing)	1-Hour (AAQC)	400	26.33	38.93	65.26	16%	84.91	111.24	28%
	1-Hour (CAAQS)	79	26.33	29.56	55.89	71%	82.04	108.37	137%
	24-Hour	200	22.34	11.59	33.93	17%	48.81	71.15	36%
	Annual	22.6	12.78	0.72	13.50	60%	5.35	18.13	80%
NOx (Including Emergency Generator Testing)	½-hour	1880	—	110.71	110.71	6%	315.60	315.60	17%
SO_2	10-min	178.2	4.32	0.28	4.60	3%	0.97	5.29	3%
	1-Hour	106.4	2.62	0.17	2.79	3%	0.59	3.21	3%
	Annual	10.5	1.17	0.01	1.18	11%	0.04	1.21	12%
CO	1-Hour	15,000	453.19	32.93	486.12	3%	88.56	541.75	4%
	8-Hour	6000	553.15	16.71	569.86	9%	62.45	615.60	10%
SPM	24-Hour	120	43.33	15.21	58.54	49%	65.21	108.54	90%
	Annual	60	25.14	0.68	25.82	43%	7.78	32.92	55%
PM_{10}	24-Hour	50	24.07	2.71	26.78	54%	12.95	37.02	74%

Compound	Averaging Period	Criteria [µg/m³]	Existing Concentration [µg/m³]	Sensitive Receptors*			Off-site Gridded Receptors		
				Maximum Predicted Concentration [µg/m³]	Maximum Predicted Cumulative Concentration [µg/m³]	% Criteria	Maximum Off-Site Concentration [µg/m³]	Maximum Predicted Cumulative Concentration [µg/m³]	% Criteria
$PM_{2.5}$	24-Hour	27	13	1.22	14.22	53%	5.07	18.07	67%
	Annual	8.8	7.54	0.12	7.66	87%	0.58	8.12	92%
Odour (OU/m³)	10-min	1	—	0.26	0.26	26%	—	—	—
H_2S	10-min	13	—	2.81	2.81	22%	12.85	12.85	99%
	24-hour	7	—	0.36	0.36	5%	2.35	2.35	34%

* As per the MECP ADMGO (MECP 2017) meteorological anomalies were removed for modelling results presented over the entire modelling grid, and not at individual sensitive receptor locations. . Sensitive receptors include residences (see figure 5). Off-site gridded receptors include a nested grid of all locations at or beyond the property line (see figure 4).

Odour was assessed at sensitive receptor locations only in accordance with standard practices (MECP, 2016)

6.0 RECOMMENDATIONS

The results presented in Section 5 indicate that maximum cumulative concentrations of all contaminants are below the relevant assessment criteria at surrounding sensitive receptors. Mitigation controls have been included into the design of the Project, which include the use of biofilters to control emissions from the activities with the greatest potential for odorous emissions. As the Project is not yet constructed, the inputs into the modelling have been prepared using published emission factors and data for similar wastewater treatment plants in Ontario. Once the Project is operational, it would be recommended that odour sampling is completed to verify the assumptions used in this assessment.

Additional odour management (including H_2S) procedures could include the following:

- Preventative maintenance and regularly scheduled cleaning of wastewater collection systems and sumps;
- Regular and scheduled cleaning of grease interceptors;
- Using lower temperature process or cleaning water where possible; and,
- monitoring and measurement of systems and air pollution control equipment to ensure optimal performance. Monitoring of the oxygen content of an aeration basin, for example, will serve to avoid odorous septic conditions.

Addition actions that could be taken to reduce concentrations of particulate matter, including SPM, PM_{10}, and $PM_{2.5}$, would include sweeping or maintenance of on-site roads.

Actions to reduce concentrations of NO_2 could include selection of combustion equipment with low NOx guarantees and/or a review of stack parameters.

7.0 CONCLUSIONS

An assessment of potential air quality impacts associated with the proposed South Niagara Falls Wastewater Treatment Plant was completed based on modelling of maximum emissions from the Project and the addition of ambient monitoring data to represent regional background air quality.

The results of the cumulative assessment are anticipated to represent a very conservative scenario as they assume that the meteorological conditions which result in the worst dispersion occur at the same time that maximum on-site activities take place, and during a period when ambient air quality conditions are at the 90th percentile. Ambient air quality conditions are typically lower 90% of the time. The likelihood of all these factors occurring concurrently is low.

Predicted concentrations were calculated at sensitive receptors (e.g. residences) located within a 2 km radius of the site and at a 10 km x 10 km nested grid of off-site receptors. Overall, the results of the modelling assessment indicate that the predicted cumulative concentrations of all contaminants are below the relevant air quality criteria for all Indicator Compounds at sensitive receptors. Similarly predicted cumulative concentrations were modelled to be below the relevant air quality criteria at all gridded receptor locations, with the exception of 1-hour averaged nitrogen dioxides, which exceed the CAAQS but are below the relevant AAQC. This exceedance occurs along the western property fence line only. Concentrations at all residences are predicted to be below both the CAAQS and AAQC.

Based on the proposed WWTP site layout, recommended mitigative design approaches, and the modelling completed to date, the Project is not expected to significantly impact local air quality at existing residences and sensitive receptors. Predicted air quality concentrations are below indicators of good air quality within the site boundary. The new SNF WWTP is designed to meet the relevant air quality criteria.

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Signature Page

Golder Associates Ltd.

Enoch Chan, B.Eng., EIT
Air Quality Specialist

Katherine Armstrong, M.Sc.
Senior Air Quality Specialist

EC/KSA/ng

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V3.6.2

REGIONAL MUNICIPALITY OF NIAGARA

SOUTH NIAGARA FALLS WASTEWATER SOLUTIONS

Air, Odour, and Noise Assessments

Odour Control Technology – Preferred WWTP Site

Regional Municipality of Niagara

South Niagara Falls Wastewater Solutions Schedule C Class Environmental Assessment and Conceptual Design

TM 4 Odour Control Technologies

March, 2022

T001140A

CIMA+

500-5935 Airport Road
Mississauga, ON L4V 1W5
T 905 695 1005 **F** 905 695 0525
cima.ca

Contact

Troy Briggs
Troy.Briggs@cima.ca
T 905 695-1005, 6705

Engineering for **people**

Technical Memorandum

South Niagara Falls Wastewater Solutions Schedule C Class Environmental Assessment and Conceptual Design
TM Headworks Odour Control

Project no T001140A | File no T001140A

Prepared by:

Marisa Scott, P.Eng.

Verified by:

Mina Yousif, M.Eng., P.Eng., PMP

Troy Briggs, M.Eng., P.Eng.

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1 Introduction

1.1 Background

The Regional Municipality of Niagara (Niagara Region) completed a Water and Wastewater Master Servicing Plan (Master Plan) in 2017 that provided a long-term planning strategy to address the water and wastewater system needs to the year 2041 (GM BluePlan, 2017). The Master Plan recommended a combination of solutions for meeting future needs, including improving the existing sewage collection systems, and construction of a new wastewater treatment plant (named South Niagara Falls WWTP) to service growth in south Niagara Falls in two stages:

- Stage 1: Provide a capacity of 30 megaliters per day (MLD), including approximately 15 MLD from the existing Niagara Falls WWTP, which currently services the existing developed South Niagara Falls area, and approximately 15 MLD from new growth in that area.
- Stage 2: Provide a capacity increase to 60 MLD to accommodate future servicing to full build-out capacity.

GM BluePlan, in association with CIMA+, has been retained by the Region to complete the Schedule “C” Class EA study and Conceptual Design for the proposed South Niagara Falls WWTP (SNF WWTP). The Class EA study will present development and evaluation of alternative design concepts for the preferred solution including their associated environmental impacts and proposed mitigation measures.

1.2 Purpose

The purpose of this Technical Memorandum (TM) Odour Headworks Odour Control is to review various odour control technologies for odorous air treatment at the proposed SNF WWTP.

2 Review of Odour Control Technologies

Many different technologies have been used to treat odours at the wastewater treatment plants. Table 1 provides a list of technologies that have been used to address hydrogen sulphide (H_2S) related odours at wastewater facilities.

Table 1 Summary of Odour Control Technologies

Method	Considerations
Chemical Addition	Requires storage, handling and dosing of hazardous chemicals
Chemical Scrubber	Requires a scrubbing reactor and storage, handling and dosing of hazardous chemicals
Biological Filter	New systems utilize inert media with long life that allow naturally growing organisms to degrade odours.
Carbon Filter	Requires on-going frequent media replacement and/or regeneration
Biological Trickling Filter/Scrubber	Similar to chemical scrubber but uses naturally occurring microorganisms rather than chemicals for treatment. Large footprint
Photoionization	New technology that replicates natural processes by using UV light to create hydroxyl (-OH) radicals that decompose chemicals in the air.

Chemical addition ($FeCl_3$ etc.) is only effective for inhibiting H_2S production (i.e. upstream of long forcemains), but is not effective for treatment of H_2S that has already formed. For this reason, it will not be included within this review.

2.1 Chemical Scrubber

Packed tower chemical scrubbers have been used at wastewater treatment plants for odor control for many years. This is an established technology that offers flexibility for customization and control. Through the use of multiple stages, a chemical scrubber system can be optimized to remove many different odorous compounds to very low levels. For example, a two stage unit can be used to maximize odor removal efficiency while reducing chemical usage over a comparable single stage unit. Additionally, an acid stage can be added to remove ammonia compounds. Most chemical scrubbers consist of a vertical FRP tank with packing media, a sump, and recirculation pump(s). Chemical scrubbers operate on the principles of gas absorption and chemical oxidation.

The two most commonly used wet scrubber designs are recirculating packed bed and mist. While considerably different in design and operation, their shared historical purpose is to collect and absorb air-borne odours into a liquid solution containing water and an oxidant chemical.

The most commonly used recirculating packed bed chemical scrubber is dosed with sodium hydroxide (to raise pH) and sodium hypochlorite (oxidizing agent) to dissolve odorous gases into solution and oxidize them. The treatment solution falls through the packing to a sump beneath. From the sump, the treatment solution is recirculated over the top of the packing. Fresh solution is added to replenish depleted chemicals. This feed loop includes a chemical solution tank, metering pump and piping, a recirculation pump and associated piping and valves.

Chemicals are added at a rate based on pH and ORP set-point controller readings to maintain the optimal concentration of chemical in the recirculating liquid based on the amount of odorous compounds present in the airstream.

The reaction rate of a chemical scrubber is very fast, allowing scrubber empty-bed residence times (EBRT) of less than 2 seconds. This allows for relatively small and compact chemical scrubber systems compared to other odour control system types (not accounting for chemical storage and dosing equipment).

Chemical demand and the associated operating cost is directly proportional to the concentration of H_2S being treated. One of the main disadvantages of chemical scrubbers is the maintenance required to keep the chemical feed pumps, scrubber recirculation pumps, system packing, and pH and ORP probes operational and clean.

2.2 Activated Carbon Scrubber

Carbon (and other dry media) scrubber systems typically treat odorous air in a single or dual bed vertical FRP or stainless steel tank. Air is directed through the carbon media bed where the odors are removed by a combination of physical and chemical absorption. Like chemical systems, activated carbon scrubbers can be configured to remove a wide range of odors including H_2S and reduced organic sulphides. Unlike chemical scrubbers, carbon scrubber systems are much simpler to operate and maintain. When all the reaction sites of the carbon are used up, the media must be recharged or replaced, depending on the type of carbon. There are many different types of impregnated carbons and they have different absorption capacities for H_2S and other odorous compounds. Depending on the type of carbon used, disposal of the spent carbon could also be classified as hazardous waste; although not typical in most municipal odour control applications.

Headloss and air loading rate (to prevent loss of media) limit the design depth and throughput rate and dictate the design sizing of a carbon scrubber. Typical carbon scrubbers have an EBRT of around 3-5 seconds. Carbon scrubbers are used in both relatively high and low flowrate systems provided there are relatively low concentrations of odorous compounds (typically below 5 mg/l) to be removed. When high concentrations of odours are encountered, the carbon media must be replaced frequently, significantly increasing operating costs.

2.3 Biological Odour Removal Systems

Biological odour removal systems include technologies that use naturally occurring bacteria to remove H_2S and reduced organic sulphides. Biological odour removal systems include different configurations, including:

- Biofilter: Media based system similar to a carbon scrubber with humidification systems to maintain biological activity
- Bio-trickling filter (BTF) system similar to a chemical scrubber, but uses naturally occurring microorganisms and a nutrient rich recycle stream (effluent water) to support biological growth.

BTFs are becoming more popular over the last decade due to their lower level of required maintenance, low life cycle costs, more compact units as compared to typical biofilter, and eco-friendliness as compared to chemical scrubbers. Biological odour control systems are also considered “green” treatment options when compared to carbon scrubber systems as they do not require the routine disposal and replacement of the spent media. One key advantage of biological treatment systems is that their operational costs do not increase significantly (if at all) with H_2S concentration. Therefore, the higher the odour concentration being removed, the faster the payback of a biological system when compared to a chemical or activated carbon based system. In systems with high airflow rates and high H_2S concentration, the savings can be substantial when compared to other technologies.

Advantages of biological odour removal systems compare to other technologies can be summarised as following:

- More sustainable
- Low maintenance
- Reduced operating costs due to no need to use chemicals and/or frequent replacement of the media
- Longer equipment life with proper design considerations
- Safer operations due to elimination of chemicals handling.

2.3.1 Biofilter

Biofilters can be open or enclosed in-ground, custom built onsite or modular pre-fabricated units. They typically utilize an organic media bed (woodchips and compost) or a proprietary synthetic media. Air is blown up through the media bed whose depth is dependent on the type of media. Organic media beds are typically limited to 0.9 m of depth to limit headloss and compaction, while synthetic media can be much deeper. Organic chipwood or compost media must be replaced every 1-4 years. Synthetic media allows more than double the bed depth of organic media, along with providing a guaranteed media life of 10 years. Due to the reduced footprint and longer media life, most new biofilter installations are based on synthetic media. Air needs to be humidified before treatment through biofilter, or biofilter needs to be irrigated in periods of dry weather.

Biofilters have relatively low loading rates and require a larger area on the plant site when compared to the other technologies. However, biofilters offer very good removal of both H_2S and more difficult reduced organic sulphides.

2.3.2 Bio-Trickling Filter

Bio-trickling filter (BTF) units typically consist of a vertical scrubber vessel packed with media, although horizontal units are also available. Air passes through a vessel containing wetted media where odours are absorbed in the liquid phase and treated on the fixed film bacteria on the media. Effluent water is commonly added as needed to the recirculating liquid to maintain optimal pH and nutrients balance. In general, a BTF is very effective in treating readily soluble H_2S, but are less effective in treating the more difficult to degrade reduced organic sulphides. This is due to the lower solubility of organic compounds, the longer time required to oxidize longer molecular chain compounds.

In BTFs with deeper media beds, the media bed may stratify and develop and sustain heterotrophic bacteria in the upper layers where fresh water is introduced and more neutral pH is maintained, while autotrophic bacteria will develop in the lower portion. Therefore BTFs are capable of removing some Organic Sulphur Compounds (OSCs). BTFs are typically designed with Empty Bed Residence Time (EBRT), in the range of 5-10 seconds. A pilot BTF operated at the Preston WWTP (Cambridge, ON) demonstrated excellent performance at very low EBRT and provided practically complete removal of both H_2S and Organic Sulphur Compounds.

The ideal BTF application is a system that has relatively high H_2S concentrations with lower concentrations of reduced organic sulphides. BTFs have a much smaller footprint than traditional biofilters and typically can treat significantly more H_2S before media replacement is required.

2.4 Photoionization

Photoionization (PI) utilizes ultraviolet light and a catalyst to treat odors. The process starts with UV treatment of the odorous air as it passes through the PI reactor chamber. The UV treatment creates free radicals (O- 2, OH-, O3, etc.) that begin to oxidize the odor causing compounds. After the UV treatment, the air passes into another chamber where any remaining odorous compounds are broken down by the flow of free radicals from the already cleansed air. The byproduct of this reaction is sulfur. The typical treatment assembly offers a very small footprint, unlike other approaches. The treatment packages can often be wall or closet mounted. Point of source treatment is more cost effective because only the contaminated air is treated. The system requires a small amount of energy to operate, saving time and resources. Additives like water or chemicals are not required to facilitate the treatment resulting in an environmentally friendly approach to odor control.

2.5 Technologies Performance Comparison

Table 2 summarizes the key advantages and limitations of the different odour treatment technologies.

Table 2: Odour Control Technology Comparison

Odour Control Technology	Advantages	Disadvantages
Chemical Scrubber	• Reliable removal of reduced organic sulphides under design loading conditions • Adapts quickly and automatically to changing loading conditions • Ability to handle high loading rates	• Requires use of hazardous chemicals • High odour concentrations require high chemical usage • Maintenance intensive
Carbon Scrubber	• Simple operation with least required maintenance • Removes a wide range of odorous compounds • Preferred choice for small systems at remote locations	• High odour concentrations will exhaust media quickly – frequent replacement and disposal of spent media • Susceptible to moisture, must be operating in a non-condensing environment for optimal efficiency

Odour Control Technology	Advantages	Disadvantages
	• No acclimation period required like with biological systems • Installation in the Region	• Typically recommended for low air flows only
Biofilter	• Low life cycle cost • Ability to treat efficiently a broad range of odour compounds • Low maintenance • Reduced health and Safety risk due to elimination of the chemical handling • Installation in the Region	• Replacement of organic media is labour intensive, but typically only every couple of years • High H_2S levels will limit media life and reduce performance for reduced organic sulphides
Bio-trickling Filter (BTF)	• Highly efficient at H2S removal • Smaller footprint/higher loading rates than conventional biofilter • Significant cost savings vs. other technologies when treating high concentrations of H2S • Long media life • Low maintenance • "Green" technology • Reduced health and safety risk due to elimination of the chemical handling	• Typically, not very efficient for reduced organic sulphides • Requires acclimation period • May require carbon scrubber polishing for very low odour threshold levels
Photoionization	• Lower operating cost • Low capital cost • Low pressure drops • No chemical used, low energy requirements • Low maintenance • Suitable for odours at WWTP • Reduced health and safety risk due to elimination of the chemical handling • Installation in the Region	• Over sizing may be required to ensure operates efficiently under all flow rates to accommodate high ACH • May not achieve very low odour threshold values

3 Recommended Odour Control Technology

Based on the technology review, Bio-Trickling Filter (BTF) and Carbon Scrubber are considered viable technologies for the new SNF WWTP. A more through evaluation of the options along with the recommended odour control technology is recommended during detailed design.

V3.6.3

REGIONAL MUNICIPALITY OF NIAGARA
SOUTH NIAGARA FALLS WASTEWATER SOLUTIONS

Air, Odour, and Noise Assessments

Noise Impact Assessment – Preferred WWTP Site

REPORT

Noise Modelling Summary Report

South Niagara Falls Wastewater Treatment Plant

Submitted to:

GM BluePlan Engineering Limited

Submitted by:

Golder Associates Ltd.

6925 Century Avenue, Suite #100, Mississauga, Ontario, L5N 7K2, Canada

+1 905 567 4444

18104462

May 2022

Distribution List

1 e-copy: GM BluePlan Engineering Limited

1 e-copy: Golder Associates Ltd.

Acronym and Abbreviations

Acronym and Abbreviations	
AADT	Annual Average Daily Traffic
AAR	Acoustic Assessment Report
CadnaA	Computer Aided Noise Attenuation
dB	Decibel
dBA	A-weighted Decibels
EA	Environmental Assessment
EPA	Environmental Protection Agency
ESR	Environmental Screening Report
HVAC	Heating, Ventilation and Air Conditioning
ISO	International Organization for Standardization
Leq	Equivalent Noise Level
Leq, 1hr	one-hour equivalent sound level
MCR	Municipal Comprehensive Review
MEA	Municipal Engineers Association
MECP	Ministry of Environment, Climate Change and Parks
MLD	Megaliters Per Day
MOVES	Motor Vehicle Emissions Simulator
MSPU	Master Servicing Plan Update
MTO	Ontario Ministry of Transportation
NMSR	Noise Modelling Summary Report
ORNAMENT	Ontario Road Noise Analysis Method for Environment and Transportation
POR	Point of Reception
POW	Plane of Window
QEW	Queen Elizabeth Way
T	Time
WWTP	Wastewater Treatment Plan

Table of Contents

TABLES

FIGURES

1.0 INTRODUCTION

Golder Associates Ltd. (Golder), a member of WSP, was retained by GM BluePlan Engineering Limited (GM BluePlan) on behalf of the Regional Municipality of Niagara (Niagara Region) to complete a Noise Impact Assessment in support of the Environmental Screening Report (ESR) for the proposed South Niagara Falls Wastewater Treatment Plant in the city of Niagara Falls, Ontario (the Project). The ESR is being developed in accordance with the requirements for a Schedule "C" Project as outlined in the Municipal Water & Wastewater projects in the Municipal Engineers Association document for Municipal Class Environmental Assessment, October 2000, as amended in 2007, 2011, and 2014 (MEA Class EA document).

Niagara Region completed *Niagara 2041*, a Municipal Comprehensive Review (MCR) of water and wastewater infrastructure, growth planning, and transportation for the purposes of developing a plan for Niagara's future. It was concluded that 64% of growth (population and employment) expected in the City of Niagara Falls will fall in the south Niagara Falls area.

Based on the growth predicted in *Niagara 2041*, the existing wastewater treatment plant (WWTP) located on 3450 Stanley Avenue will not be able to withstand the demand exerted by this new growth. It was recommended from Niagara Region's *2016 Water and Wastewater Master Servicing Plan Update* (MSPU) that a new WWTP be built in south Niagara Falls with connection to the sewer systems in the southern area. These recommendations were adopted by Niagara Region Council and the City of Niagara Falls Council in 2017. The Project will include construction of a new wastewater treatment plant, an outfall structure to the Welland River, and an underground connection pipe with shaft locations.

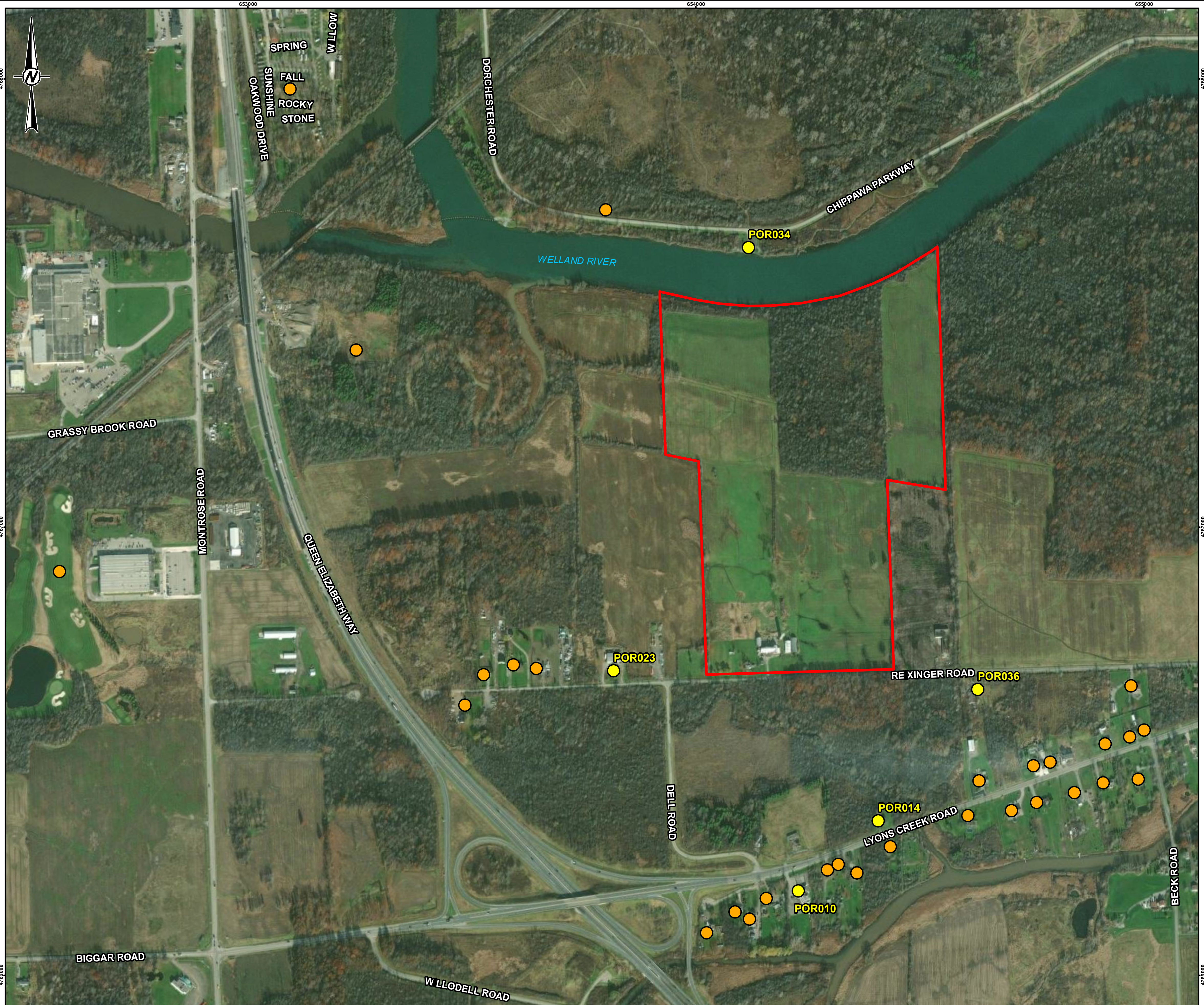
The noise assessment has been completed to achieve the following:

- characterize the existing noise levels at Points of Reception (PORs) in the surrounding area;
- support the evaluation of alternative WWTP site layouts;
- estimate the noise emissions from the Project; and
- predict the impact of the Project on noise levels at nearby PORs.

1.1 Site Location

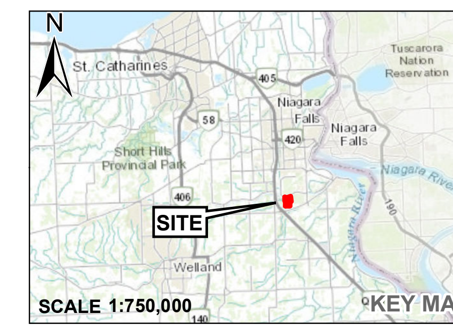
The Project will be located in South Niagara Falls, north of Reixinger Road and approximately 500 m east of the Queen Elizabeth Way (QEW) highway. The Welland River runs along the northern boundary of the Project site. A site location plan is included as Figure 1. The area immediately surrounding the site is zoned for industrial land use although there are a number of residences within 500 m of the Project site along Reixinger Road.

The trunk sewer alignment, connecting the new WWTP to the existing sewer network, will extend from an existing pipe alignment located off Oakwood Drive approximately 6 km south along Montrose Road to enter the WWTP site, north of Reixinger Road. Surface disturbance associated with construction of the trunk sewer pipe alignment is expected to be limited to the proposed footprint of the shaft locations, as the trunk sewer pipe will be tunnelled underground and accessed via temporary construction shafts. Please note that the focus of this assessment is on the new WWTP only, which includes equipment and activities associated with operations, and all other aspects of the Project (e.g., trunk sewer) are outside the scope of this assessment.



LEGEND

- Site Boundary
- Representative Points of Reception
- Points of Reception



0 150 300 450

1:8,632 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE.

REFERENCE(S)

BASE DATA - MNR LIO, OBTAINED 2020
SITE PLAN - GM BLUE PLAN (SNFWWS - ALIGNMENT & SHAFT LOCATIONS, 20210630)
BASE IMAGERY SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
GM BLUEPLAN ENGINEERING LIMITED
NIAGARA FALLS, ON

PROJECT
NOISE STUDY FOR PROPOSED SOUTH NIAGARA FALLS WASTEWATER TREATMENT PLANT

TITLE
NOISE POINTS OF RECEPTION

CONSULTANT
GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-04-26
DESIGNED	ST
PREPARED	ST
REVIEWED	EC
APPROVED	JT

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1.2 Project Description

The Project is designed to be a conventional activated sludge plant with an average day flow capacity of 30 megalitres per day (30 MLD). The Project will accept pumped raw sewage and hauled wastewater. As wastewater enters the headworks, it will pass through mechanical screens and grit chambers. Material caught in the mechanical screens will be removed, cleaned, and dewatered before disposal. Grit will also be removed and dewatered before being transferred to disposal bins. The wastewater from the grit tanks will be transported to the primary clarifiers. Suspended solids (sludge) will settle at the bottom of the primary clarifying tanks and be pumped away for processing, while the remaining effluent will flow to the aeration tanks for secondary treatment.

In the secondary clarifiers, the waste activated sludge (WAS) will be collected and pumped to the primary clarifiers for co-thickening. Co-thickened WAS and raw sludge will be anaerobically digested on-site before being shipped off-site for disposal.

Secondary treated effluent will flow to the chlorination/dichlorination building where sodium hypochlorite is added for disinfection and sodium bisulphite is added for dechlorination.

The major liquid treatment processes will include screening and grit removal, aeration, secondary clarification, and effluent disinfection.

The Project will include storage lagoons and dewatering at the management centre. Any biogas generated as part of the onsite processes will be reused in the plant boilers, with excess gas sent to a flare. Emissions from the pumping station, headworks and primary clarifiers effluent launders will be treated by two odour control units.

Figure 2 illustrates a simplified process flow diagram of the Project.

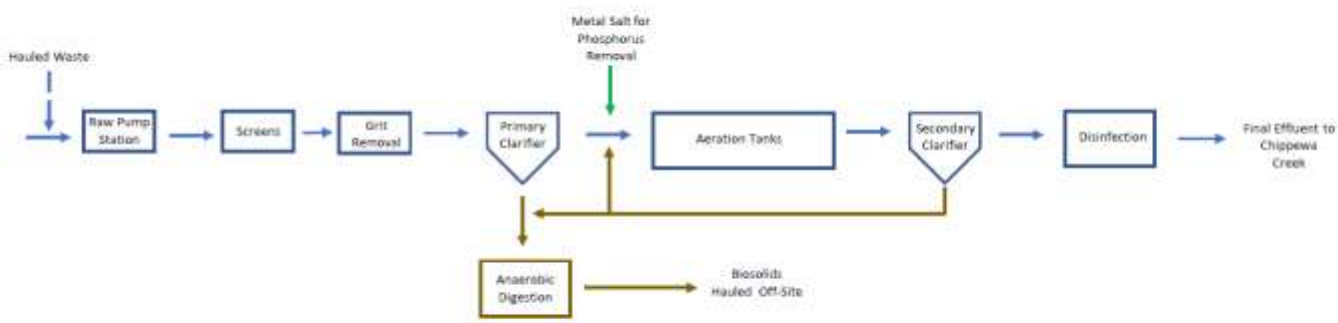


Figure 2: Process Flow Diagram

According to information received from the GM BluePlan and Golder's experience on similar projects, the following noise sources were assumed to be part of the Project's normal operations for the purposes of this assessment:

- two exhaust fans on the roof of the headworks;
- two exhaust fans and two air intakes at the raw sewage pumping station;
- wall exhausts on three sides of the primary clarifiers;

- four air intakes on the roof and wall exhausts around all sides of the blower building;
- two exhaust fans on the anaerobic digestion control building;
- two exhausts on disinfection building;
- two exhausts and two heating, ventilation and air conditioning (HVAC) units on maintenance building; and
- four HVAC units on the administration building.

One emergency back-up diesel generator will operate at the Project, with a power rating of 2500 kW as per the Project design information. The emergency generator is primarily used during power outages or maintenance only but may be tested for approximately one hour, once per month.

Approximately 10 truck loads of hauled sewage are expected to arrive at the proposed WWTP per day. There will be an estimated 12 truck loads of digested sludge going to the Garner Road Biosolids Facility from the proposed WWTP each day. There will also be other infrequent truck deliveries to support the Facility operations. In accordance with MECP accepted practices, these other infrequent truck deliveries were not explicitly considered in the noise modelling. The typical haul route from the proposed WWTP to the Garner Road Biosolids Facility is west on Reixinger Road, south on Dell Road, west on Lyons Creek Road, north on Montrose Road, and west on Chippawa Creek Road.

2.0 KEY NOISE CONCEPTS

Acoustic values can be described in terms of noise or sound. While noise is defined as unwanted sound, the terms noise and sound are often used interchangeably. An introduction to key concepts used in the assessment of outdoor acoustics is provided below:

- “Noise” or “noise levels” refers to the levels that can be heard or measured at a Point of Reception (POR).
- A noise “receptor” or “POR” is any location on a noise sensitive land use where noise is received.
- The “level” of a noise is expressed on a logarithmic scale, in units called decibels (dB). Since the scale is logarithmic, a noise that is twice the noise level as another will be three decibels (3 dB) higher. “Sound pressure level” is the physical quantity that is measured in the environment that describes sound waves quantitatively. It is a ratio of the absolute pressure relative to a reference (i.e., 20 micropascals [μPa]). This ratio of pressures is converted to a decibel scale (dB).
- Noise emissions and noise levels have an associated frequency. The human ear does not respond to all frequencies in the same way. Mid-range frequencies are most readily detected by the human ear, while the human ear is generally less sensitive to low and high frequencies. Environmental noise levels used in this assessment are presented as “A weighted decibels” (or dBA), which incorporates the frequency response of the human ear.
- Outdoor noise is usually expressed as an “equivalent noise level” (L_{eq}, T), which is a logarithmic average (i.e., energy average) of the measured or predicted noise levels over a given period of time (T). An equivalent noise level measured or predicted over the nighttime period would be referred to as L_{eq}, night.

- Environmental noise levels vary throughout the day, and it is therefore important to distinguish between the time of day (i.e., daytime / evening / nighttime). For the purposes of this assessment, the day is divided into two periods for which noise is evaluated: daytime from 07:00 to 23:00 and nighttime from 23:00 to 07:00. However, applicable guidance documents for this assessment provide other definitions of daytime and nighttime, or define three periods (i.e., daytime, evening, and nighttime), which were also considered depending on the assessment criteria being evaluated.

3.0 METHODOLOGY

The following methodology was carried out to establish existing noise levels and assess the potential impacts due to the Project:

- identification of noise sensitive receptors;
- determination of applicable noise criteria;
- determination of existing ambient noise levels without the Project;
- determination of future noise levels with the Project; and
- determination of potential noise impact.

3.1 Points of Reception

A desktop review was completed using orthoimagery and information provided by GM BluePlan to identify potential PORs in the vicinity of the Project where human activity is expected to occur. Points of Reception (PORs) were identified in general accordance with the Ministry of Environment, Climate Change and Parks (MECP) guideline *“Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning Publication NPC-300”* (NPC-300) (MECP 2013). NPC-300 defines PORs as sensitive land uses with human activity, including dwellings, campsites or campgrounds, sensitive institutional uses (e.g., educational, nursery, hospital, healthcare, community centre, place of worship, or detention centre), or sensitive commercial uses (e.g., hotel or motel).

Figure 1 presents 34 PORs that were identified in the vicinity of the Project. The most sensitive of these PORs, in all directions from the Project, were carried forward in the assessment to capture the greatest potential impacts. A total of five of the identified PORs were selected as being representative of the most sensitive PORs with respect to the Project for further assessment, which are summarized in Table 1. The five representative PORs were selected due to their proximity to the Project or to the off-site haul route in each cardinal direction.

Table 1: Summary of Representative Points of Reception Locations

Point of Reception ID	Description	UTM Coordinates X,Y (NAD83, Zone 17T)
POR010	Private Residence	654157, 4766171
POR014	Private Residence	654407, 4766345
POR023	Private Residence	653816, 4766679
POR034	George Bukator Park / Proposed Residential Development	654117, 4767623
POR036	Private Residence	654630, 4766637

3.2 Noise Criteria

The methodology used for the noise assessment was based on the MECP publications NPC-300 (MECP 2013) and *"Noise Guidelines for Landfill Sites"* (Landfill Guidelines) (MECP 1998). These guidelines outline the sound level limit criteria for evaluating the proposed WWTP (i.e., stationary noise sources) and the haul route respectively.

The noise assessment was carried out at the representative PORs, as discussed in Section 3.1. All representative PORs identified in this noise assessment are conservatively described as being located in a Class 2 area, as defined in NPC-300 as a blend of a major population centre and rural area.

The sound level limits for the Project ancillary facilities are established in accordance with NPC-300 for the daytime (07:00 to 19:00), evening (19:00 to 23:00), and nighttime (23:00 to 07:00) periods. In assessing steady sounds from stationary noise sources, the MECP has established exclusionary Plane of Window (POW) and outdoor sound level limits for Class 2 areas. The POW is typically assessed at the center of a window (i.e., for a two-storey home, typically it would be at a height of 4.5 m above grade). An outdoor location is assessed at a location within 30 m of a dwelling façade at a height of 1.5 m above grade. The POW sound level limit for the noise sensitive receptors in a Class 2 area is described as follows:

> *The sound level limit at a POW POR is set as the higher of either the applicable exclusionary limit of 50 dBA in the daytime period of 07:00-19:00, 50 dBA in the evening period of 19:00-23:00 and 45 dBA in the nighttime period of 23:00-07:00, or the minimum background sound level that occurs or is likely to occur during the time period corresponding to the operation of the stationary source under impact assessment.*

The outdoor sound level limit for the noise sensitive receptors in a Class 2 area is described as follows:

> *The sound level limit at an outdoor POR is set as the higher of either the applicable exclusionary limit of 50 dBA in the daytime period of 07:00-19:00 and 45 dBA in the evening period of 19:00-23:00, or the minimum background sound level that occurs or is likely to occur during the time period corresponding to the operation of the stationary source under impact assessment. In general, the outdoor POR will be protected during the nighttime as a consequence of meeting the sound level limit at the adjacent POW.*

The one-hour equivalent sound level ($L_{eq,1hr}$) MECP exclusionary sound level limits for steady sounds from stationary noise sources at a POR in a Class 2 area are summarized in Table 2, and are used to assess compliance of the Project.

Table 2: Sound Level Limits for Class 2 Area - Steady Stationary Sources

Time Period	POW MECP Exclusionary Sound Level Limit (dBA)	Outdoor MECP Exclusionary Sound Level Limit (dBA)
Daytime (07:00 – 19:00)	50	50
Evening (19:00 – 23:00)	50	45
Nighttime (23:00 – 07:00)	45	n/a [1]

Note: 1. In accordance with NPC 300, in general, the Outdoor POR will be protected during the night-time as a consequence of meeting the sound levels at the adjacent POW.

In assessing noise sources associated with emergency equipment (i.e., the emergency back-up diesel generator), NPC-300 outlines the emergency equipment sound level limits as follows:

> *The sound level limits for noise produced by emergency equipment operating in non-emergency situations, such as testing or maintenance of such equipment, are 5 dB greater than the sound level limits otherwise applicable to stationary sources.*
>
> *The noise produced by emergency equipment operating in non-emergency situations should be assessed independently of all other stationary sources of noise. Specifically, the emissions are not required to be included with the overall noise assessment of a stationary source facility*.

As testing of the emergency back-up diesel generator is to be assessed independently of other noise sources and against higher sound level limits, the noise impacts due to the back-up diesel generator are expected to be less than the normal operation scenario and therefore it was not further assessed.

The Landfill Guidelines are the only MECP document which outlines an assessment methodology and criteria for assessing noise impacts due to off-site road traffic along haul routes. They outline the protocol for evaluating off-site vehicle traffic for which there are no specific sound level limits. In accordance with the Landfill Guidelines, the potential noise impact of off-site vehicles on the existing noise environment is described qualitatively based on a quantitative assessment of the potential increase to the one hour equivalent sound level ($L_{eq,1hr}$), as described in Table 3.

Table 3: Landfill Guidelines Qualitative Noise Impact Ratings for Off-site Vehicles

Sound Level Increase (dB)	Qualitative Rating
1 to 3 inclusive	Insignificant
3 to 5 inclusive	Noticeable
5 to 10 inclusive	Significant
10 and over	Very significant

3.3 Noise Prediction Modelling

3.3.1 Stationary Sources

Noise predictions from the proposed WWTP stationary sources were carried out using the Computer Aided Noise Attenuation (CadnaA) noise modelling software to support the assessment of potential Project noise impacts at the representative PORs. The CadnaA noise modelling software (version 2021 MR 2), developed by DataKustik GmbH, is widely accepted for evaluating environmental noise. Numerous algorithms are made available for use within CadnaA but, for the purposes of this assessment, the model algorithm International Organization for Standardization (ISO) 9613 Acoustics: Attenuation of Sound during Propagation Outdoors (ISO 1993 and 1996) was considered.

The ISO 9613 prediction method is conservative as it assumes that all PORs are downwind from the noise source or that a moderate ground-based temperature inversion exists. In addition, ground cover and physical barriers, either natural (terrain-based) or constructed and atmospheric absorption are included as they relate specifically to the Project. Stationary noise sources were characterized by entering the sound power and/or sound pressure octave band spectrum associated with each source. Other parameters including building dimensions, frequency of use, hours of operation, and enclosure attenuation ratings also define the nature of sound emissions.

A summary of CadnaA model input parameters is presented in Table 4.

Table 4: CadnaA Model Input Parameters

Parameter	Model Setting	Notes
Software	CadnaA Version 2021 MR 2	CadnaA is a widely used environmental noise monitoring software package developed by DataKustik GmbH
Standards	ISO 9613-2	All sources and attenuation effects were treated as required by this standard
Ground effect	G = 0 (site) G = 1 (rest of modelling domain)	None
Temperature/ humidity	10°C / 70% relative humidity	MECP required modelling input values
Other meteorological conditions	**Wind**: 1 to 5 m/s; all receivers downwind from all sources; or **Temperature Inversion**: Moderate temperature inversion	Consistent with standard ISO 9613-2
Receptor height	1.5 m (outdoor PORs, POW one-storey homes) 4.5 m (POW two-storey homes)	None

Notes: Mitigation from existing off-site structures and woodlots were conservatively not considered in the modelling. It is expected this will result in an over-estimation of predicted noise levels for the assessed sources.

3.3.2 Road Traffic Along Haul Route

The noise predictions for road traffic along the haul route were carried out using the MECP's Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT), which is the basis of the DOS-based STAMSON modelling software provided by the MECP. Road traffic was assessed over a one-hour period for the purposes of completing an analysis of the haul route in accordance with the Landfill Guidelines, corresponding to the time of the greatest predicted impact due to the Project, as well as over the daytime and nighttime periods for the purposes of the assessment of the change in noise levels due to the Project (see Section 6.3).

Existing traffic was considered on the major roads in the vicinity of the Project, including the QEW, Lyons Creek Road and Montrose Road. Roads that were not considered to be acoustically significant at the identified PORs were not included in the assessment of existing noise levels. The Project truck traffic was considered along the entire haul route described in Section 1.2.

Existing and anticipated Project noise levels due to road traffic were established using Annual Average Daily Traffic (AADT) provided by Niagara Region's Open Data (Niagara Region 2020) or from published data from the Ontario Ministry of Transportation (MTO) (MTO 2016). The medium and heavy truck percentages were based on either the *"Adaptation and Verification of AASHTO Pavement Design Guide for Ontario Conditions – Final Report*" (ERES Consultants 2008) for local roadways or on the MTO's *"Environmental Guide for Noise*" (MTO 2006) for the QEW. Speed limits were determined from readily available public imagery. The hourly traffic breakdown for existing traffic was estimated using data provided in the US Environmental Protection Agency (EPA) software Motor Vehicle Emissions Simulator (MOVES).

To complete the haul route analysis, it was assumed that the 12 truck trips per day (as discussed in Section 1.2) each way along the haul route associated with the Project were evenly distributed across the daytime period (i.e., 07:00 to 19:00), and that all Project trucks were heavy trucks.

A summary of the existing road traffic data is provided in Table 5.

Table 5: Summary of Existing Road Traffic Data

Road Segment[1]	Speed Limit (km/hr)	AADT[2]	% of AADT During Hour with Worst Case Impacts[3]	% Daytime / % Nighttime	% Car / Medium Truck / Heavy Truck
Queen Elizabeth Way	100	36,700	5	91 / 9	80 / 5 / 15
Lyons Creek Road	80	9,000	5	91 / 9	94 / 2 / 4
Montrose Road	70	6,400	5	91 / 9	94 / 2 / 4

Notes: 1. In establishing baseline levels, Golder conservatively did not consider local roads with lower traffic volumes or roads located further from the identified PORs. Excluding these less acoustically significant roadways is expected to slightly underestimate baseline levels and overestimate potential noise impacts.

2. Average Annual Daily Traffic Niagara Region's Open Data, 2020

3. The road traffic modelling results, further discussed in Section 6.2, indicated the predictable worst-case hour was from 07:00 to 08:00.

3.4 Effects Characterization

To determine potential adverse effects from the Project, two criteria were used. The first was a comparison against applicable noise limits, and the second was an assessment of changes to noise levels relative to existing noise levels at the most sensitive PORs. These changes were assessed against the magnitude ratings identified in Table 6.

A change in noise level of 3 dB is generally accepted as the smallest change typically detectable by the human auditory system in the environment (MECP 1998). Changes in noise levels for the period L_{eq} (A-weighted energy equivalent sound level) that would be hardly perceptible (i.e., less than or equal to 3 dB) were assigned a negligible magnitude. A noticeable change in the period L_{eq} (i.e., greater than 3 dB, but less than or equal to a 5 dB change, based on Table 2) was classified as having a low magnitude. Clearly noticeable changes in the period L_{eq}, perceived as less than twice as loud (i.e., greater than 5 dB, but less than or equal to 10 dB), were considered of moderate magnitude. Very significant changes in the noise levels for the period L_{eq} that are perceived as more than twice as loud (i.e., greater than 10 dB) were classified as having a high magnitude.

A potential adverse effect is expected when a magnitude rating of moderate or high is predicted.

Table 6: Magnitude Ratings for Potential Noise Effects

Magnitude	Criteria
Negligible	▪ Project related noise levels do not exceed MECP sound level limits; and ▪ Project related change relative to existing noise levels in daytime and nighttime equivalent noise level is ≤ 3 dB.
Low	▪ Project related noise levels do not exceed MECP sound level limits; and ▪ Project related change relative to existing noise levels in daytime and nighttime equivalent noise level is > 3 dB and ≤ 5 dB.
Moderate	▪ Project related noise levels do not exceed MECP sound level limits; and ▪ Project related change relative to existing noise levels in daytime and nighttime equivalent noise level is > 5 dB and ≤ 10 dB.
High	▪ Project related noise levels exceed MECP sound level limits; or ▪ Project related change relative to existing noise levels in daytime and nighttime equivalent noise level is > 10 dB.

4.0 EXISTING CONDITIONS

Existing noise levels in the vicinity of the Project are influenced by vehicle traffic. As described in Section 3.2, the area surrounding the Project is best described as a Class 2 area. Existing conditions in the vicinity of the Project are generally consistent with a Class 2 area, however based on the existing traffic volumes on specific roads in the area, it is expected that existing conditions near some roads may be elevated.

Noise levels due to existing traffic were predicted using ORNAMENT, as discussed in Section 3.3.2. Predicted road traffic noise levels for the average daytime and nighttime periods as well as for the predictable worst-case hour (i.e., the hour when Project impacts are predicted to be the greatest) are presented in Table 7.

Table 7: Predicted Existing Noise Levels

Receptor	Predicted Existing Average Road Traffic Noise Level (dBA)		
	Daytime	Nighttime	Worst Case One Hour Period[1]
POR010	63	56	62
POR014	63	56	62
POR023	58	51	57
POR034	49	42	48
POR036	53	46	52

Note: 1. Hour with worst case predicted noise impact due to the Project is 07:00 to 08:00

Note that when establishing the applicable sound level limits to assess compliance with MECP guidelines, road traffic noise levels were not considered and therefore the MECP's Class 2 exclusionary sound level limits were conservatively considered in this assessment.

5.0 NOISE EMISSIONS

The assessment considered the noise emissions associated with the Project. Table 8 provides a summary of the overall sound power data for each noise source considered in the assessment. Noise emissions (i.e., sound power levels) were established using the Project information, Golder's database of similar noise sources, manufacturers' specifications, and an Acoustic Assessment Report (AAR) prepared by Wood Canada Limited (Wood) for a similar facility in the Region of Peel (Wood 2020, see Appendix A).

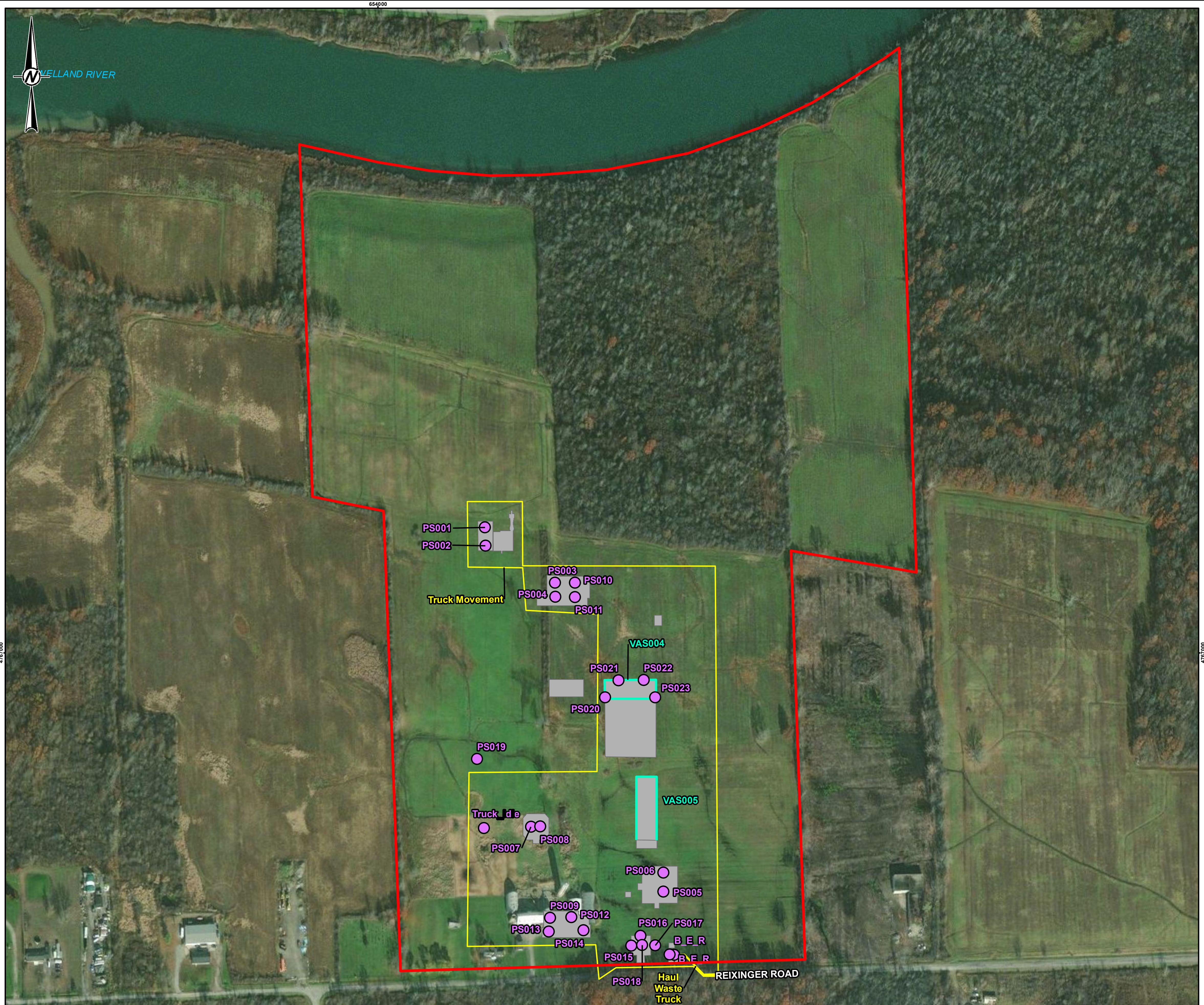
The noise sources are shown in Figure 3, with labels corresponding to the Source IDs provided in Table 8.

As noise is assessed over a one-hour period, in accordance with the MECP, it was conservatively assumed that all equipment in Table 8 can operate continuously for any one-hour period when assessing compliance with MECP sound level limits.

Table 8: Project Noise Source Summary

Source ID	Source Description	Overall Sound Power Level (dBA)
PS001	Disinfection Exhaust 1	92
PS002	Disinfection Exhaust 2	95
PS003	Maintenance Bldg Exhaust 1	92
PS004	Maintenance Bldg Exhaust 2	95
PS005	Headworks Exhaust 2	97
PS006	Headworks Exhaust 1	95
PS007	Digester Exhaust 1	95
PS008	Digester Exhaust 2	97
PS009	Admin HVAC 1	89
PS010	Maintenance Bldg HVAC 1	89
PS011	Maintenance Bldg HVAC 2	89
PS012	Admin HVAC 2	89
PS013	Admin HVAC 3	89
PS014	Admin HVAC 4	89
PS015	Pump Station Air Intake 1	86
PS016	Pump Station Air Intake 2	86
PS017	Pump Station Exhaust 1	95
PS018	Pump Station Exhaust 2	97
PS019	Flare	90
PS020	Blower Air Intake 1	86
PS021	Blower Air Intake 2	86
PS022	Blower Air Intake 3	86

Source ID	Source Description	Overall Sound Power Level (dBA)
PS023	Blower Air Intake 4	86
Truck_Idle	Truck Idle	97
B_E_R	Truck Idle 1	97
B_E_R	Back Pump - Truck	97
HaulWasteTruck	Haul Waste Truck	102
Truck_Move	Truck Movement	102
VAS004	Blower Building Wall Exhausts	95
VAS005	Primary Clarifier Wall Exhausts	95



LEGEND

- Point Source
- Site Boundary
- Vertical Area Source
- Line Source
- Building

0 100 200 300

1:4,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE.

REFERENCE(S)

BASE DATA - MNR LIO, OBTAINED 2020
SITE PLAN - GM BLUE PLAN (SNFWWS - ALIGNMENT & SHAFT LOCATIONS, 20210630)
BASE IMAGERY SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT

GM BLUEPLAN ENGINEERING LIMITED
NIAGARA FALLS, ON

PROJECT

NOISE STUDY FOR PROPOSED SOUTH NIAGARA FALLS WASTEWATER TREATMENT PLANT

TITLE

SITE LAYOUT PLAN

CONSULTANT

GOLDER
MEMBER OF WSP

YYYY-MM-DD	2022-04-26
DESIGNED	ST
PREPARED	ST
REVIEWED	EC
APPROVED	JT

PROJECT NO.	CONTROL	REV.	FIGURE
18104462	0001	A	3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

6.0 IMPACT ASSESSMENT

This section presents the noise prediction results of the Project's stationary sources and traffic on the off-site haul route, which were considered in both the assessment of compliance with MECP guidelines (if applicable) and the change due to the Project relative to existing noise levels. Therefore, noise predictions of stationary sources and off-site haul routes were each assessed independently against the MECP guidelines (where applicable), and then combined to assess change relative to existing noise levels.

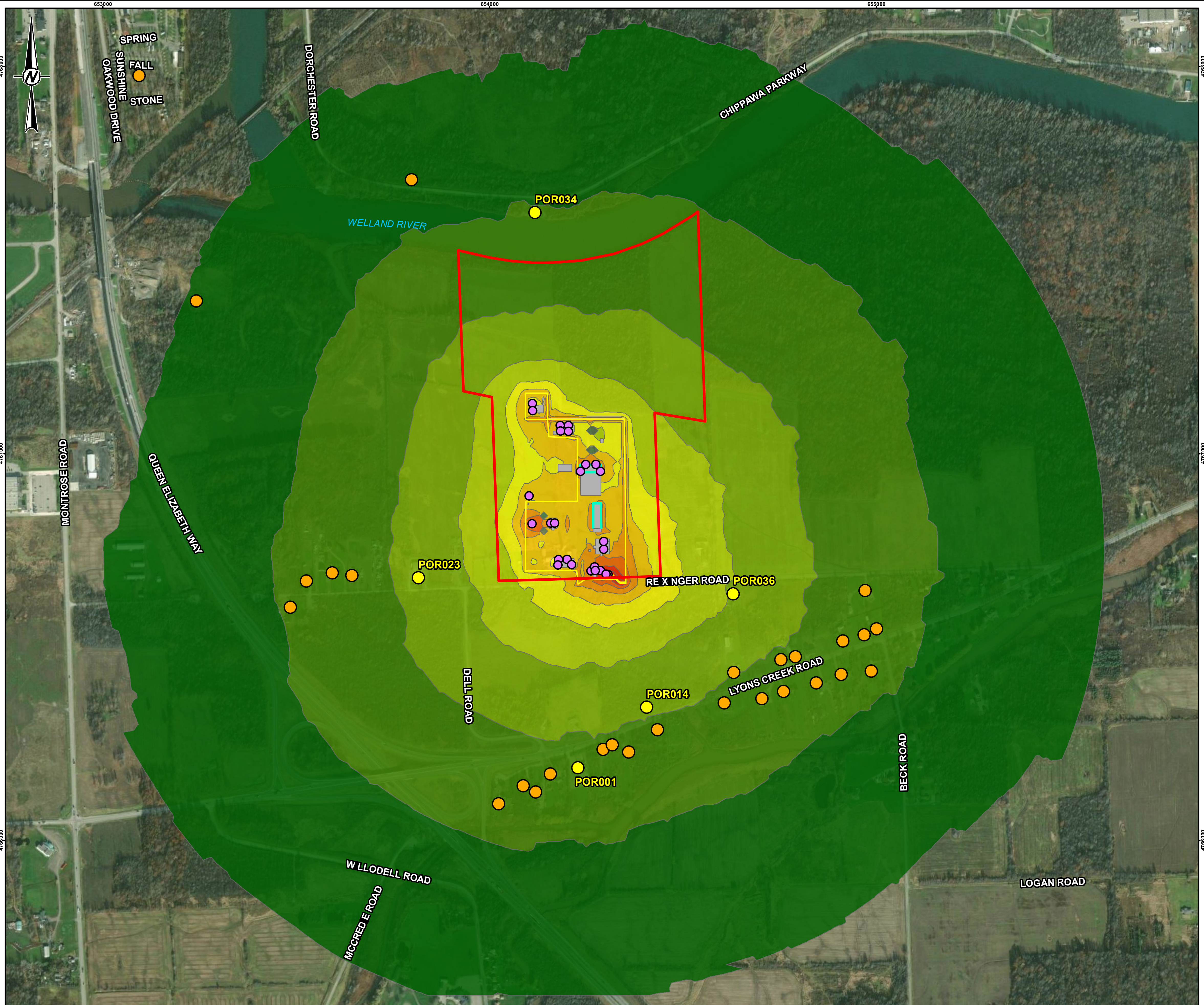
6.1 Stationary Sources

Table 9 provides a summary of the predictable worst-case hour predicted noise levels for the stationary sources described in Section 5.0 and a comparison to the applicable NPC-300 sound level limits. The potential Project noise levels at each POR were predicted at both the POW and Outdoor POR, but only the results from the location with the highest levels (i.e., POW or Outdoor) are shown in Table 9. Figures 4 and 5 illustrate the predictable worst-case hour predicted noise levels for stationary sources during the daytime and evening/nighttime, respectively.

Table 9: Stationary Source Noise Results

Receptor	Overall Daytime Noise Level (dBA)	Overall Evening Noise Level (dBA)	Overall Nighttime Noise Level (dBA)	Daytime Performance Limit (dBA)	Evening Performance Limit (dBA) (POW / Outdoor POR)	Nighttime Performance Limit (dBA) (POW)	Compliance with Performance Limit (Yes/No)
POR010	40	38	38	50	50 / 45	45	Yes
POR014	42	40	40	50	50 / 45	45	Yes
POR023	43	42	42	50	50 / 45	45	Yes
POR034	35	34	34	50	50 / 45	45	Yes
POR036	45	40	40	50	50 / 45	45	Yes

The predicted noise levels at all identified representative PORs meet the applicable NPC-300 sound level limits.

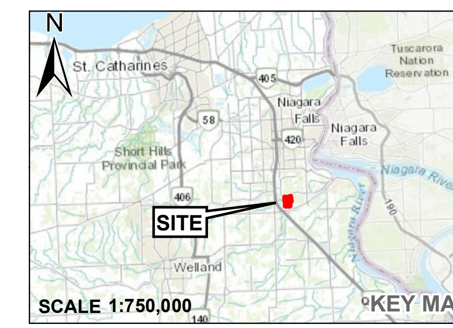


LEGEND

- POINT SOURCE
- REPRESENTATIVE POINTS OF RECEPTION
- POINTS OF RECEPTION
- VERTICAL AREA SOURCE
- LINE SOURCE
- SITE BOUNDARY
- BUILDING

DAYTIME NOISE CONTOUR (DBA)

- 30-35
- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- 70-75



0 150 300 450
1:10,000 METRES

NOTE(S)
1. ALL LOCATIONS ARE APPROXIMATE.

REFERENCE(S)
BASE DATA - MNR LIO, OBTAINED 2020
SITE PLAN - GM BLUE PLAN (SNFWWS - ALIGNMENT & SHAFT LOCATIONS, 20210630)
BASE IMAGERY SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
GM BLUEPLAN ENGINEERING LIMITED
NIAGARA FALLS, ON

PROJECT
NOISE STUDY FOR PROPOSED SOUTH NIAGARA FALLS WASTEWATER TREATMENT PLANT

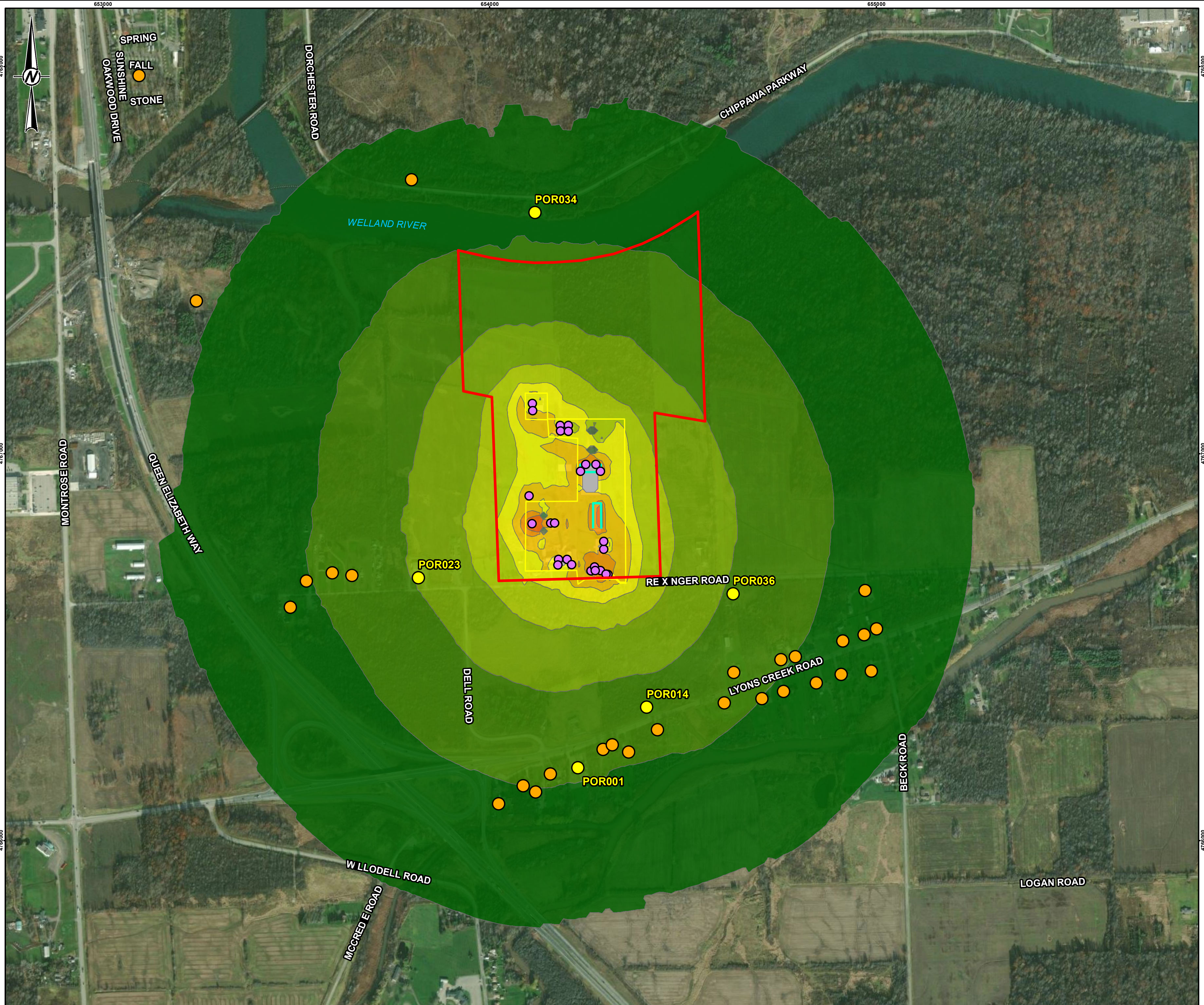
TITLE
DAYTIME PREDICTED STATIONARY SOURCE NOISE LEVELS

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-04-26
DESIGNED	ST
PREPARED	ST
REVIEWED	EC
APPROVED	JT

PROJECT NO.	CONTROL	REV.	FIGURE
18104462	0001	A	4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B



LEGEND

- POINT SOURCE
- REPRESENTATIVE POINTS OF RECEPTION
- POINTS OF RECEPTION
- VERTICAL AREA SOURCE
- LINE SOURCE
- SITE BOUNDARY
- BUILDING

EVENING/NIGHTTIME NOISE CONTOUR (DBA)

- 30-35
- 35-40
- 40-45
- 45-50
- 50-55
- 55-60
- 60-65
- 65-70
- 70-75

0 150 300 450

1:10,000 METRES

NOTE(S)

1. ALL LOCATIONS ARE APPROXIMATE.

REFERENCE(S)

BASE DATA - MNR LIO, OBTAINED 2020
SITE PLAN - GM BLUE PLAN (SNFWWS - ALIGNMENT & SHAFT LOCATIONS, 20210630)
BASE IMAGERY SOURCE: ESRI, MAXAR, GEOEYE, EARTHSTAR GEOGRAPHICS, CNES/AIRBUS DS, USDA, USGS, AEROGRID, IGN, AND THE GIS USER COMMUNITY
SOURCES: ESRI, HERE, GARMIN, INTERMAP, INCREMENT P CORP., GEBCO, USGS, FAO, NPS, NRCAN, GEOBASE, IGN, KADASTER NL, ORDNANCE SURVEY, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), (C) OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY
PROJECTION: TRANSVERSE MERCATOR DATUM: NAD 83 COORDINATE SYSTEM: UTM ZONE 17N

CLIENT
GM BLUEPLAN ENGINEERING LIMITED
NIAGARA FALLS, ON

PROJECT
NOISE STUDY FOR PROPOSED SOUTH NIAGARA FALLS WASTEWATER TREATMENT PLANT

TITLE
EVENING/NIGHTTIME PREDICTED STATIONARY SOURCE NOISE LEVELS

CONSULTANT
GOLDER MEMBER OF WSP

YYYY-MM-DD	2022-04-26
DESIGNED	ST
PREPARED	ST
REVIEWED	EC
APPROVED	JT

PROJECT NO.	CONTROL	REV.	FIGURE
18104462	0001	A	5

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: ANSI B

6.2 Road Traffic Along Haul Route

As discussed in Section 3.2, the Landfill Guidelines outline the protocol for evaluating the noise impact due to off-site haul road vehicles. Predicted noise levels due to the daytime existing traffic were compared to noise levels due to future expected traffic (i.e., existing plus the Project) during the predictable worst-case hour (i.e., the hour when Project impacts are predicted to be the greatest), with the assumption that the Project traffic will generally be evenly distributed across the daytime period (i.e., 07:00 to 19:00). The road traffic modelling indicated the predictable worst-case hour was from 07:00 to 08:00. Table 10 summarizes the expected change between future and existing noise levels at representative PORs as well as the associated qualitative rankings (as summarized in Table 3 in Section 3.2).

Table 10: Predicted Worst Case One-Hour Change in Noise Levels along Haul Routes

Receptor	Existing Traffic Worst Case One Hour Noise Level[1] (dBA)	Project Traffic Worst Case One Hour Noise Level (dBA)	Change in One Hour Noise Level (dB)	Qualitative Rating[2]
POR010	62	62	0	Insignificant
POR014	62	62	0	Insignificant
POR023	57	57	0	Insignificant
POR034	48	48	0	Insignificant
POR036	52	52	0	Insignificant

Note: 1. Hour with worst case predicted noise impact due to the Project is 07:00 to 08:00
2. See Table 3 for details of qualitative ranking system

The results in Table 10 indicate that during the Project predictable worst-case hour, the change in hourly average noise levels along the haul route is expected to be ‘insignificant’ at all representative PORs.

For the purposes of assessing the change relative to existing noise levels (Section 6.3), the average daytime noise levels along the haul route, including traffic due to the Project, were also calculated and are presented in Table 11. Note that Project trucks will only operate during the daytime period (i.e., from 07:00 to 19:00) and therefore the existing nighttime noise levels presented in Table 7 are not expected to change.

Table 11: Predicted Project Daytime Noise Levels along Haul Routes

Receptor	Project Traffic Daytime Noise Level (dBA)
POR010	63
POR014	63
POR023	58
POR034	49
POR036	53

6.3 Change from Existing Noise Levels

In addition to meeting compliance with MECP guidelines, the change relative to existing noise levels at the representative PORs was evaluated. The combined noise levels from the Project stationary sources and traffic along the haul route during the predictable worst-case daytime and nighttime periods were calculated. Noise levels were evaluated as an average over the daytime (07:00 to 23:00) and nighttime (23:00 to 07:00) periods. Table 12 summarizes the existing noise levels, the predictable worst case Project noise levels (i.e., the logarithmic sum of the Project's stationary source noise levels and the traffic noise levels), and the corresponding change and magnitude rating, as defined in Table 6, at the identified representative PORs.

Table 12: Predicted Noise Levels and Change from Baseline due to the Project

Receptor	Existing Noise Level (dBA)		Project Average Noise Level (dBA)		Change in Noise Level (dB)		Magnitude Rating[1]	
	Day	Night	Day	Night	Day	Night	Day	Night
POR010	63	56	63	56	0	0	Negligible	Negligible
POR014	63	56	63	56	0	0	Negligible	Negligible
POR023	58	51	58	52	0	1	Negligible	Negligible
POR034	49	42	49	43	0	1	Negligible	Negligible
POR036	53	46	53	47	0	1	Negligible	Negligible

Note: 1 See Table 6 for details of magnitude ranking system.

The results in Table 12 indicate that the Project does not result in an adverse effect on noise (i.e., a moderate or high magnitude rating) at the representative PORs.

7.0 CONCLUSION

This noise assessment evaluated the potential effects of the Project on noise levels based on two criteria. The first was a comparison against applicable noise limits, and the second was an assessment of changes to noise levels relative to existing noise levels at the most sensitive PORs in the vicinity of the Project. Predictive noise modelling indicated that the Project is expected to meet MECP sound level limits at the identified representative PORs. The predicted change in noise levels resulted in a 'negligible' magnitude rating, and therefore no adverse noise effects are expected.

Based on the proposed WWTP site layout and the noise modelling completed to-date, the noise impacts from the new SNF WWTP are expected to be managed within the site boundary. The new SNF WWTP is designed to meet all applicable noise guidelines.

Signature Page

Golder Associates Ltd.

Shira Daltrop, MASc
Noise Specialist

Joe Tomaselli, MEng, PEng
Associate/Acoustic, Noise and Vibration Engineer

YZ/SD/JT/mp

https://golderassociates.sharepoint.com/sites/29902g/deliverables/09_air and noise/noise/18104462-r-rev0-noise modelling summary-v02-06may2022 (comments)-all.docx

IMPORTANT INFORMATION AND LIMITATIONS OF THIS REPORT

Standard of Care

Golder Associates Ltd. (Golder), a member of WSP, has prepared this report in a manner consistent with that level of care and skill ordinarily exercised by members of the engineering and science professions currently practicing under similar conditions in the jurisdiction in which the services are provided, subject to the time limits and physical constraints applicable to this report. No other warranty, expressed or implied is made.

Basis and Use of the Report

This Noise Modelling Summary Report (NMSR) was prepared for the exclusive use of GM BluePlan (the Client) and once finalized, is intended to support the Environmental Screening Report (ESR) for the proposed South Niagara Falls Wastewater Treatment Plant in the city of Niagara Falls, Ontario (the Project). The NMSR is based on a review of the Project proposed design (PHASE 1 Site Plan No. G-05-104, received from the Client by email on October 26, 2021), discussions with the Client, review of documentation provided by the Client, readily available public information and calculations made to identify potential noise impacts beyond the property boundary. This NMSR cannot account for changes in the proposed Project design (i.e., PHASE 1 Site Plan No. G-05-104) after it has been finalized or submitted to the Client.

The information, recommendations and opinions expressed in this report are for the sole benefit of the Client and the applicable regulatory authorities that are authorized to rely on the report as Authorized Users, subject to the limitations and purposes described herein. No other party may use or rely on this report or any portion thereof without Golder's express written consent. Any other use of this report by others is prohibited and is without responsibility to Golder. The report, all plans, data, drawings and other documents as well as all electronic media prepared by Golder are considered its professional work product and shall remain the copyright property of Golder, who authorizes only the Client and Approved Users to make copies of the report, but only in such quantities as are reasonably necessary for the use of the report by those parties. The Client and Approved Users may not give, lend, sell, or otherwise make available the report or any portion thereof to any other party without the express written permission of Golder. The Client acknowledges that electronic media is susceptible to unauthorized modification, deterioration and incompatibility and therefore the Client and any Authorized Users can not rely upon the electronic media versions of Golder's report or other work products unless it was directly provided by Golder.

When evaluating the Project and developing this report, Golder has relied on information provided by the Client, the regulatory authorities, and others. Golder has acted in good faith and accepts no responsibility for any deficiencies, misstatements, or inaccuracies contained in this report resulting from omissions, misinterpretations or falsifications by those who provided Golder with information.

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APPENDIX A

Wood Acoustic Assessment Report

Acoustic Assessment Report

G.E. Booth Wastewater Treatment Plant
The Regional Municipality of Peel
Project # TC200803A

Prepared for:

CIMA Canada Inc.

5935 Airport Road, Suite 500, Mississauga, Ontario L4V 1W5

August 2020

Acoustic Assessment Report

G.E. Booth Wastewater Treatment Plant
The Regional Municipality of Peel
Project # TC200803A

Prepared for:

CIMA Canada Inc.
5935 Airport Road, Suite 500, Mississauga, Ontario L4V 1W5

Prepared by:

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited
160 Traders Blvd. E.
Suite 110
Mississauga, ON L4Z 3K7
Canada
T: 905-568-2929

August 7, 2020

Executive Summary

CIMA Canada Inc. (CIMA+) retained Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood) on behalf of the Regional Municipality of Peel (Peel Region), to update the Acoustic Assessment Report (AAR) for the G.E. Booth Wastewater Treatment Plant (G.E. Booth WWTP), located at 1300 Lakeshore Road East in Mississauga, Ontario (the Facility). This AAR has been prepared in support of an amendment to the Environmental Compliance Approval (ECA) for the Facility.

The Facility is currently approved under ECA (Air and Noise) No. 6339-BJJRCS, issued on January 22, 2020. This AAR reflects proposed changes to the Facility and is an update to the latest AAR dated October 25, 2019 prepared by Wood and approved by the MECP. Eighteen (18) types of significant noise sources were identified at the Facility and included in this acoustic assessment. Details of the noise sources are provided in Section 3.0 of this report. The Facility operates 24 hours per day, 7 days per week.

There are no significant sources of vibration expected at the Facility and therefore, a vibration assessment is not necessary for the G.E. Booth WWTP.

Ten (10) representative Points of Reception (PORs) were identified and considered for this assessment. Points of reception considered in this assessment are described in Section 5.0 of this report.

The G.E. Booth WWTP is located in an area zoned for utility purpose and is surrounded by: a utility and business employment zoned land to the south and south-west, a business employment land and Lakeshore Road to the north-west with a mixed use and residential high density land beyond, a park to the north and a residential subdivision beyond, a vacant lot to the west and Lake Ontario to the east. Based on zoning and proximity to Lakeshore Road East and other commercial facilities, the area is best described as a Class 1 area (urban) in accordance with the area classifications defined within NPC-300.

The receptor noise impact associated with the G.E. Booth WWTP operations was assessed through predictive acoustic modelling. The MECP exclusionary sound level limits were used for this assessment. The non-emergency operation (i.e., testing and maintenance) of the emergency equipment (e.g., emergency generator) was assessed separately as required by the NPC-300 guidelines. Under the predictable worst-case noise emission scenario, the G.E. Booth WWTP is expected to be in compliance with the applicable MECP NPC-300 guideline at PORs 01 – 04. Exceedances over the applicable NPC-300 guideline limits are predicted at PORs 07 – 10.

A Noise Abatement Action Plan (NAAP) is prepared and is included with this report. Noise control measures are expected to bring the Facility into compliance with the applicable MECP NPC-300 guidelines.

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1.0 Introduction

CIMA Canada Inc. (CIMA+) retained Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood) on behalf of the Regional Municipality of Peel (Peel Region), to update the Acoustic Assessment Report (AAR) for the G.E. Booth Wastewater Treatment Plant[1] (G.E. Booth WWTP) located at 1300 Lakeshore Road East in Mississauga, Ontario (the Facility). A detailed acoustic assessment is required for this Facility as the separation distance between the closest receptor and the Facility is less than the minimum separation distance required by the Ministry of Environment, Conservation and Parks (MECP) Primary Noise Screening Method Guide [1]. This AAR has been prepared in support of an amendment to the Environmental Compliance Approval (ECA) for the G.E. Booth WWTP and is limited to the Facility at the aforementioned address.

The Facility is currently approved under ECA (Air and Noise) No. 6339-BJJRCS, issued on January 22, 2020. This AAR reflects proposed changes to the Facility and is an update to the latest AAR dated October 25, 2019 prepared by Wood and approved by the MECP.

Two new odour control units are being proposed and are further described in Section 3.0. To account for the continuously evolving development adjacent to the Facility named Lakeview Village, receptor locations have been adjusted to reflect the most up to date publicly available information and is further described in Section 5.0. This AAR follows the requirements in the MECP Environmental Noise Guideline NPC-300, *Noise Assessment Criteria for Stationary Sources and for Land Use Planning* and is assessed with the criteria limits provided in NPC-300 [2].

A completed copy of the Acoustic Assessment Report Checklist, as required by NPC-233, *Information to be Submitted for Approval of Stationary Sources of Sound* [3], has been included in Appendix A.

The G.E. Booth WWTP site does not have any large sources of vibration (e.g., stamping presses). Therefore, a vibration impact assessment is not required for this site. As such, this assessment focuses only on potential noise impacts.

An Emissions Summary and Dispersion Modelling Report (ESDM report) for the Facility has been completed by Wood in support of the ECA amendment application and is provided under separate cover.

2.0 Facility Description

The G.E. Booth WWTP processes wastewater from homes and businesses in the City of Toronto, Region of York, Bolton, Caledon East, Brampton and the eastern part of Mississauga. The wastewater processing design capacity of the Facility is 518,000 cubic metres per day (m^3/d). The Facility operates four fluidized bed sewage sludge incinerators this location. Each incinerator is capable of reducing approximately 100 dry tonnes of sludge per day.

The main treatment process equipment at the G.E. Booth WWTP include headworks exhaust fans, primary clarifiers, aeration tanks, secondary clarifiers, four (4) fluidized bed reactors for the combustion of dewatered biosolids and odour control units to treat odourous air from the underground wastewater collection system.

[1] Formerly known as the Lakeview Wastewater Treatment Plant.

Two North American Industry Classification System (NAICS) codes are applicable to the Facility: 221320 - described as "Sewage Treatment Facilities" and 562210 - described as "Waste Treatment and Disposal", which covers the incineration operations.

A complete description of the Facility and its operations, including process flow diagrams, etc., can be found as part of the ESDM Report. The Facility operates continuously 24 hours per day, 7 days per week.

The following figure and appendices contain information on the Facility and the points of reception as well as the surrounding land uses:

- Figure 1: Aerial Map of the Site with Points of Receptions;
- Appendix B: Zoning Map of the Site and Surrounding Areas; and
- Appendix C: Facility Drawings.

3.0 Noise Source Summary

Eighteen (18) types of noise sources were identified as significant (i.e., as emitting noise at a level where their cumulative impacts could be of concern) at the G.E. Booth WWTP. The significant noise sources included in this acoustic assessment are summarized below:

1. Fourteen (14) ventilation louvres;
2. Seven (7) overhead doors;
3. One (1) condenser unit;
4. Two (2) makeup air units;
5. Four (4) carbon unit stacks;
6. Thirty-one (31) exhaust fans;
7. One (1) fluidized air blower exhaust;
8. One (1) idling transport truck;
9. One (1) garbage truck passby;
10. One (1) sludge receiving truck passby:
11. One (1) polymer blow-off delivery (truck passby, engine idling and mounted blower);
12. One (1) sodium hypochlorite blow-off delivery (truck passby, engine idling and mounted blower);
13. One (1) ferrous chloride blow-off delivery (truck passby, engine idling and mounted blower);
14. One (1) ferrous chloride building open door;
15. One (1) West GAC Odour Control Unit Exhaust;
16. One (1) Plant 1 GAC Filter Vessel Exhaust Stack;
17. One (1) GEB Solids Exportation Portable Odour Unit; and
18. Two (2) emergency generators.

Noise source measurements were conducted by Wood on July 21 and 22, 2016. The boilers were not in operation during the site visit, and therefore, the sound data for the boilers was taken from the original AAR for the Facility. Additional noise measurements were taken on April 23, May 8 and October 4, 2019 to capture the activity of chemical solution unloading from truck beds into storage tanks and the West GAC Odour Control Unit Exhaust. Measured source sound pressure levels (SPLs) were used to estimate source sound power levels (PWLs). The Wood database of sound power levels was used where measurements of a source was not possible. Details of the significant noise sources considered in the assessment are provided in Table 1, including sound power levels, source emission characteristics, and any noise control measures. Locations of all the modeled noise sources are provided in Figures 2 and 3. Sound power calculations along with measurement details are provided in Appendix E.

The MECP NPC-104 noise guideline prescribes adjustments for sources with special characters of sound. These are punitive adjustments, which apply to sound sources with subjectively annoying characteristics, including tonal sounds, quasi-steady impulsive sounds, and beating sounds (sounds with cyclically varying amplitudes). The fluidized air bed blower exhaust (TOX_BE), open solids receiving overhead door (SR_OD), TOX4 intake louvre (TOX4_L), six exhaust fans (TOX3_EF 3 through 5 and TOX4_EF 1 through 3), the ferrous chloride building open door (FCB_OD), and the polymer truck blower (PO_TB) exhibit tonal characteristics based on the mathematical qualification outlined in NPC-104 [4]. Therefore, a 5 dB penalty was included for these sources in this assessment.

Blower trucks are used at the Facility for the delivery of polymer, sodium hypochlorite, sodium bisulfite and ferrous chloride solutions. Sodium hypochlorite deliveries take place in the same location used for sodium bisulfite and consequently do not occur simultaneously. The sodium bisulfite delivery which was measured only used vacuum assist from the truck's engine, which resulted in lower sound levels than the sodium hypochlorite delivery which used a truck mounted blower. Therefore, the delivery of sodium bisulfite was excluded from the assessment.

Typically, the Facility would see a worst-case hour of having two blower truck deliveries occurring at once. All three deliveries of sodium hypochlorite, polymer and ferrous chloride solutions were modelled to occur simultaneously for conservatism. The polymer delivery takes approximately 30 minutes to complete, whereas the sodium hypochlorite and ferrous chloride deliveries take a complete hour. Blower truck deliveries do not occur during nighttime. Truck movements for these deliveries around the Facility were also included in the assessment.

Regular truck shipments are for garbage collection and sludge receiving. These occur during daytime/evening only, and a worst-case hour includes one truck for garbage collection and sludge receiving (two in total).

All insignificant noise sources at the G.E. Booth WWTP are listed in Appendix F.

Two new pieces of equipment to be installed at the Facility are currently under design and procurement. One unit is a granulated activated carbon (GAC) filter vessel to be located south of New Plant 1 and the second is a portable germinable endospore biodosimetry (GEB) portable odour unit, to be located east of the Solids Handing Facility building, as shown in Appendix C. The noise emissions from the two new units are represented in the noise model by the Plant 1 GAC Filter Vessel Exhaust Stack (P1_GAC_ES) and the GEB Solids Exportation Portable Odour Unit (GEB_POU) point sources. For both two new units, it has been assumed that the majority of noise emits from their respective stacks and as such, the source height was defined at the stack heights.

The sound power level spectrum for both P1_GAC_ES and GEB_POU was estimated using empirical equations to develop the spectrum curve in third octave bands from 63 Hz to 8000 Hz. The 31.5 Hz was assumed to have a sound power level of 3 dB lower than its neighboring 63 Hz third octave band. The overall sound power level for both units was normalized to the overall specification provided by CIMA+. The specifications provided by CIMA+ are sound pressure levels of 67 dBA at 10ft and <75 dBA at 1 m for the GEB Solids Exportation Portable Odour Unit and the Plant 1 GAC Filter Vessel, respectively. As these units are still under design and sound pressure levels have not been provided by a manufacturer, the specifications are commitments from CIMA+ and the Region of Peel as part of this ECA amendment application. The specific sources of noise emissions from these new units should be confirmed through an in-person inspection once the equipment is installed and operational.

As part of the installation of the Plant 1 GAC Filter Vessel, the existing West GAC Odour Control Unit will be relocated. The unit has been modelled in the relocated position as per drawing no. 100-1A-D-2014, dated May 2020 and provided in Appendix C.

4.0 Existing Mitigation Measures Summary

Existing source-based noise mitigation measures already installed on noise sources are not identified, listed or described within this AAR as the measured sound levels include the effects of any mitigation measures.

5.0 Point of Reception Summary

Noise sensitive receptors of interest under NPC-300 guidelines include the following noise sensitive land uses:

- Permanent, seasonal, or rental residences;
- Hotels, motels and campgrounds;
- Schools, universities, libraries and daycare centres;
- Hospitals and clinics, nursing / retirement homes; and
- Churches and places of worship.

Ten (10) representative Points of Reception (PORs 01 through 10) are considered for this assessment. As included in the original AAR, POR01 to POR04 are existing points of reception. POR01 and POR04 are existing two-storey dwellings, and POR02 and POR03 are existing apartment buildings.

Wood acknowledges that a multi-phase development under the name of Lakeview Waterfront has been proposed upon the unused lands[2] located West of the Facility. At the time of writing this report, only subdivision and rezoning applications[3] have been submitted to the City of Mississauga (the City). The

[2] Current approved zoning map presented in Appendix B – City of Mississauga By-Law No. 0225-2007. Maps are publicly accessible from the City of Mississauga official website at: http://www.mississauga.ca/portal/residents/zoningbylaw

[3] A copy of the rezoning and subdivision application documents used for this study is presented in Appendix H. The latest planning proposal files are publicly accessible from the City of Mississauga official website at: http://www.mississauga.ca/portal/residents/inspirationlakeview

proposal for a zoning bylaw amendment to change the zoning designation from Utility (U-1)[4] to a variety of uses (e.g. residential, institutional, etc.) which has currently not been approved. The document titled "A by-law to amend By-law Number 0225-2007, as amended.", dated 2020 (provided in Appendix H and herein referred to as the "Draft Zoning By-law Amendment") found as part of the subdivision and rezoning application is currently in draft form and has not been signed by Council [5].

Although it is our professional opinion that these receptors need not be included until the zoning actually changes are approved, the G.E. Booth WWTP has agreed to voluntarily make this change to the AAR at this point in time in anticipation of the zoning change, and to address previous comments made by the MECP.

PORs 05 and 07 are representative of the first row of buildings designated as Residential Medium Density under the Concept Plan dated December 17, 2019 (provided in Appendix H and herein referred to as the "Concept Plan") [6]. The representative Residential Medium Density buildings considered are in lots designated as RA5-XX (Residential Apartment - Exception) under the Draft Zoning By-law Amendment. As per the Lakeview Village Development Master Plan 4.0 dated October 2019 (herein referred to as the "Development Master Plan"), the buildings representative of PORs 05 and 07 are to be 4 and 8 storeys in height, respectively [7].

PORs 06 and 08-10 are representative of the first two rows of buildings designated as Institutional under the Concept Plan. The representative Institutional building considered for POR 06 is in a lot designated as RA5-XX (Residential Apartment - Exception) under the Draft Zoning By-law Amendment. The RA5-XX zoning designation [8] allows for day cares and further to this, the Draft Plan of Subdivision dated December 17, 2019 (provided in Appendix H) labels this lot as a public elementary school. As such, this building has been considered sensitive [9, 5]. The representative Institutional buildings considered for PORs 08-10 are in lots designated as I-XX (Institutional – Exception) under the Draft Zoning By-law Amendment. As per the Draft Zoning By-law Amendment, the I-XX zoning designation permits for institutional uses such as a post-secondary school, research facilities, offices, and shall also permit various infrastructure uses (i.e. district energy, alternative waste collection system, and sanitary sewer requirements) [5].

At the time of writing this report, PORs 05-10 are in a conceptual planning stage and are therefore currently considered as vacant lots. Based on information provided by the City of Mississauga, the earliest that the first Site Plan application for development of residential and commercial buildings is expected to be submitted in Q1 of 2021 and they anticipate it to be approved in late 2021.

Submission documents have been made available on the City's website at http://www.mississauga.ca/portal/residents/inspirationlakeview, and the documents used for this study are included in Appendix H of this report.

[4] Current usage designation is U-1 which allows for: utility building, water treatment Facility, sewage treatment plant, electric transformer and distribution Facility, with the following additional permitted uses: power generating Facility and outdoor storage accessory to a power generating Facility.

A summary of each receptor is listed below and summarized in Table 2:

- **POR01** is a 2-storey residential dwelling located approximately 560 metres (m) west of the Facility.
- **POR02** is a 7-storey apartment building located approximately 400 m north-west of the Facility.
- **POR03** is a 20-storey apartment building located approximately 825 m north of the Facility.
- **POR04** is a 2-storey residential dwelling located approximately 685 m north-east of the Facility.
- **POR05** represents a building on a vacant lot currently proposed for residential use, approximately 220 m west of the Facility.
- **POR06** represents a building on a vacant lot currently proposed for institutional use, approximately 140 m west of the Facility.
- **POR07** represents a building on a vacant lot currently proposed for residential use, approximately 140 m west of the Facility.
- **POR08** represents a building on a vacant lot currently proposed for institutional use, approximately 50 m west of the Facility.
- **POR09** represents a building on a vacant lot currently proposed for institutional use, approximately 50 m west of the Facility.
- **POR10** represents a building on a vacant lot currently proposed for institutional use, approximately 50 m west of the Facility.

The physical receptor location considered for the PORs is given below:

- For POR01 and POR04, the receptor location is 4.5 m above ground representing 2nd storey plane of window.
- For POR02, the receptor location is 25.5 m above ground representing the 7th storey plane of window.
- For POR03, the receptor location is 7.5 m above ground representing the 3rd storey plane of window.
- For POR05, the receptor location is 10.5 m above ground representing a conceptual 4th storey plane of window.
- For POR06, the receptor location is 7.5 m above ground representing a conceptual 3rd storey plane of window.
- For POR07, the receptor location is 22.5 m above ground representing a conceptual 8th storey plane of window.
- For PORs 08 to 10, the receptor location is 16.5 m above ground representing a conceptual 6th storey plane of window.

The representative and physical receptors assessed and reported here in this report are the worst-impacted receptor locations only. For multi floor residential receivers, the worst impacted floor is presented.

The location of the modeled receptors with respect to the site location are also shown in Figure 1.

6.0 Assessment Criteria

The applicable noise guideline used to assess the G.E. Booth WWTP is the MECP Environmental Noise Guideline NPC-300, *Noise Assessment Criteria for Stationary Sources and for Land Use Planning*. The guideline establishes four classes of acoustical environment based on the ambient background sound environments and establishes class specific sound level limit criteria. The MECP classes are described below:

- Class 1 Area: an area with an acoustical environment typical of a major population centre, where the background sound level is dominated by the urban hum.
- Class 2 Area: an area with an acoustical environment that has qualities representative of both Class 1 and Class 3 Areas. Class 2 areas are characterized by the absence of urban hum, they have a relatively low ambient sound level, during early evening (i.e., between 19:00 and 23:00 hours) which is typically present within Class 1 Areas during the same time period.
- Class 3 Area: a rural area with an acoustical environment dominated by natural sounds having little or no road traffic. Examples are small communities with populations of less than 1,000, agricultural areas, rural recreational areas, such as a cottage or a resort area, and wilderness areas.
- Class 4 Area: an area that would otherwise be defined as Class 1 (urban) or Class 2 (suburban) which has relaxed sound level criteria compared to any other Class. This Class is intended to allow new sound-sensitive developments within or adjacent to industrial areas and to promote urban intensification. In contrast to the other classes this one must be implemented by the local land use planning authority to be recognized by MECP.

The G.E. Booth WWTP is located in an area zoned for utility purpose and is surrounded by: a utility and business employment zoned land to the south and south-west, a business employment land and Lakeshore Road to the north-west with a mixed use and residential high density land beyond, a park to the north and a residential subdivision beyond, a vacant lot to the west and Lake Ontario to the east. Based on zoning and proximity to Lakeshore Road East and other commercial facilities, the area is best described as a Class 1 area (urban) in accordance with the area classifications defined within NPC-300.

NPC-300 states that steady one-hour sound levels ($L_{eq\text{-}1hr}$) from stationary noise sources in Class 1 areas shall meet the following sound level limits:

- The higher of the 50 dBA MECP exclusionary sound level limit or the existing background sound level at ***both outdoor and plane of window receptor locations*** during daytime hours (0:700 to 19:00).
- The higher of the 50 dBA MECP exclusionary sound level limit or the existing background sound level at ***both outdoor and plane of window receptor locations*** during early evening hours (19:00 to 23:00).
- The higher of the 45 dBA MECP exclusionary sound level limit or the existing background sound level at the ***plane of window receptor locations*** during night-time hours (23:00 to 07:00).

The NPC-300 guideline also stipulates that the assessment consider the potential sound impact during a predictable worse case hour of operation, which is defined as a situation when the normally busy activity of the sources coincides with a low hourly background sound level. The MECP exclusionary sound limits were used for this assessment.

Non-emergency operation of emergency equipment is assessed separately from the continuous regular operations of the Facility and is assessed with 55 dBA criterion limit as they are expected during daytime/evening hours only.

A copy of the NPC-300 document can be found at the MECP website at:
https://www.ontario.ca/page/ministry-environment-conservation-parks

7.0 Noise Impact Assessment

The following sections of the report describe the G.E. Booth WWTP noise impact modelling methodology and the associated modelling results.

7.1 Methodology

The noise assessment for the G.E. Booth WWTP was completed using a sound prediction software package (Cadna/A), published by Datakustik GmbH, which was configured to implement the ISO 9613-2 environmental sound propagation algorithms. Off-site noise exposures due to the Facility operations were modelled. The Cadna/A noise modelling software is widely accepted by the consulting industry and the MECP. All noise sources were assumed to operate simultaneously to model the predictable worst-case scenario.

In order to provide an accurate prediction of sound levels at particular receptors, due to noise emissions from a specific source(s), the modelling took into account the following factors:

- Source sound power level and directivity;
- Distance attenuation;
- Source-receptor geometry, including heights and elevations;
- Barrier effects of the building and surrounding topography; and
- Ground and air (atmospheric) attenuation.

Non-emergency operation of emergency equipment was modeled and assessed separately as required by the MECP guideline.

7.2 Modelling Results

The combined steady sound levels ($L_{eq\text{-}1hr}$) in dBA values for the predictable worst-case Facility operations were calculated at all of the identified points of reception, POR01 through POR10, using the noise emissions from the individual significant sources, as summarized in Table 1. The noise contours for the predictable worst-case operation for various scenarios (e.g., regular operation, and non-emergency operation of emergency equipment) are shown in Figures 4, 5 and 6, and a point of reception impact summary is provided in Tables 3, 4 and 5 (i.e., individual contributions from each source).

An acoustic assessment summary is provided in Table 5. Under the predicable worst-case noise emission scenario, the G.E. Booth WWTP is expected to operate in compliance with the applicable MECP NPC-300 limits only at PORs 01-06 during daytime/evening and nighttime.

The predicted sound levels at the receptors from the existing operations are expected to exceed the applicable NPC-300 limits at PORs 07-10 during both daytime/evening and nighttime. The exceedances are within 3-13 dB of the applicable criteria limits.

The noise levels at the receptors reported as part of this acoustic assessment represent the predictable worst-case operational impact. Key parameters included in the model and sample calculations are provided in Appendix G. An acoustic assessment summary is provided in Table 6.

8.0 Noise Abatement Action Plan

Based on the results of the partial level assessment the largest contributors to the noise level exceedances at PORs 05-10 are the following equipment:

- TOX 1&2 Exhaust Fans 1-3 and 6-9 (TOX1_2EF1, TOX1_2EF2, TOX1_2EF3, TOX1_2EF6, TOX1_2EF7, TOX1_2EF8, TOX1_2EF9);
- TOX HVAC & Fluidized Air Blower Exhaust (TOX_BE);
- TOX3 Exhaust Fans 1, 3 and 5 (TOX3_EF1);
- TOX4 Exhaust Fans 1-3 (TOX4_EF1, TOX4_EF2 and TOX4_EF3);
- Headworks Exhaust Fan 1 (HW_EF1);
- Ferrous Chloride Truck Engine Idling (FC_TEI);
- West GAC Odour Control Unit Exhaust (WGAC); and
- HVAC Intake Louvre 1 and 2 (TOX 3) (TOX3_L1, TOX3_L2).

The individual contribution from each source to the noise levels at the receptors is presented in Tables 3, 3A, 4 and 4A.

Should a zoning bylaw come into force and effect for PORs 07-10 to permit residential and/or other noise sensitive uses, the G.E. Booth shall:

a) Develop and submit an updated NAAP (if required) that is acceptable to the MECP, not later than 3 months after the issuance of an above grade building permit and verified site inspection under the Building Code Act, 1992, for a building containing Sensitive Uses in respect of the Residential Properties or part thereof.

b) Implement the NAAP, as approved by the MECP, within six months after the approval of the NAAP, but no later than 12 months after the issuance of an above grade building permit and verified site inspection under the Building Code Act, 1992, for a building containing Sensitive Uses in respect of the Residential Properties or part thereof, whichever occurs later.

If a building permit is issued for a dwelling and/or noise sensitive use at PORs 07-10, G.E. Booth will update the acoustic assessment by including the actual location of the dwelling/noise sensitive use and the NAAP will be updated accordingly (if required). A conceptual NAAP is included herein.

The following conceptual noise control measures are required to bring the Facility into compliance with MECP NPC-300 guideline, if a building permit is issued for a dwelling and/or noise sensitive use at the vacant lot receptors PORs 07-10:

1. Install a silencer on TOX 1&2 Exhaust Fans 1-9 (TOX1_2EF1, TOX1_2EF2, TOX1_2EF3, TOX1_2EF4, TOX1_2EF5, TOX1_2EF6, TOX1_2EF7, TOX1_2EF8, TOX1_2EF9), TOX3 Exhaust Fans 1, 3 and 5 (TOX3_EF1, TOX3_EF3, TOX3_EF5), TOX4 Exhaust Fans 1, 2 and 3 (TOX4_EF1, TOX4_EF2 and TOX4_EF3) with the following minimum insertion losses:

Octave Band Centre Frequency (Hz)	31	63	125	250	500	1K	2K	4K	8K
Insertion Loss (dB)	0	5	11	23	25	27	20	18	14

2. Replace the existing louvres used for the HVAC Intake Louvre 1 and 2 (TOX3) (TOX3_L1, TOX3_L2) and the TOX HVAC & Fluidized Air Blower Exhaust (TOX_BE) with acoustic louvres with the following minimum insertion losses:

Octave Band Centre Frequency (Hz)	31	63	125	250	500	1K	2K	4K	8K
Insertion Loss (dB)	0	11	11	14	18	20	21	21	20

3. Install a silencer on Headworks Exhaust Fan 1 (HW_EF1) with the following minimum insertion losses:

Octave Band Centre Frequency (Hz)	31	63	125	250	500	1K	2K	4K	8K
Insertion Loss (dB)	0	1	5	10	10	8	7	6	4

4. Install a silencer on West GAC Odour Control Unit Exhaust (WGAC) with the following minimum insertion losses:

Octave Band Centre Frequency (Hz)	31	63	125	250	500	1K	2K	4K	8K
Insertion Loss (dB)	0	5	10	19	24	27	21	16	12

The insertion losses referenced above are conceptual minimum requirements, which will need to be confirmed during planning and design stages, taking into consideration the physical properties of the equipment installed.

Based on the information available and with the implementation of this NAAP, the Facility is predicted to operate in compliance with the applicable MECP NPC-300 guidelines for its daytime/evening and nighttime operations. A mitigated point of reception impact summary is provided in Tables 3A and 4A. A mitigated acoustic assessment summary is provided in Table 6A. The noise contours after implementation of the noise control measures is shown in Figures 4A and 5A.

9.0 Conclusions

An acoustic assessment report has been completed for the G.E. Booth WWTP located at 1300 Lakeshore Road East in Mississauga, Ontario. Ten representative points of reception were identified in the vicinity of the site and considered for this assessment.

The receptor noise impact associated with the Facility operation was assessed through predictive acoustic modelling. The MECP exclusionary sound level limits were used as the criteria for the assessment. Under the predictable worst-case operational scenario, the Facility modelled operation sound levels are within the applicable MECP NPC-300 guideline limits only at PORs 01 – 04. Exceedances over the NPC-300 limits are predicted at PORs 07-10 during both daytime/evening and nighttime. Noise mitigation measures are recommended and outlined in the Noise Abatement Action Plan section of this report (Section 8.0).

Under the predictable worst-case noise emission conditions, and after implementation of the NAAP as outlined in Section 8.0, the G.E. Booth operational sound levels are expected to comply with the established limits at all the receptor locations during both daytime/evening and nighttime.

The specific sources of noise emissions from the new GAC filter vessel and the new GEB portable odour unit should be confirmed through an in-person inspection once the equipment is installed and operational.

10.0 References

[1] Ministry of the Environment, Conservation and Parks (MECP), "Primary Noise Screening Method Guide," 31 January 2017. [Online]. Available: https://www.ontario.ca/page/primary-noise-screening-method-guide.

[2] Ontario Ministry of the Environment and Climate Change (MOECC), "Publication NPC-300, Noise Assessment Criteria for Stationary Sources and for Land Use Planning," August 2013.

[3] Ontario Ministry of the Environment and Climate Change (MOECC), "Publication NPC-233, Information to be Submitted for Approval of Stationary Sources of Sound," October 1995.

[4] Ontario Ministry of the Environment and Climate Change (MOECC), "Ontario Ministry of the Environment and Climate Change (MOECC)Publication NPC-104, Sound Level Adjustments, published under the Model Municipal Noise Control Bylaw," 1977.

[5] City of Mississauga, 2020. [Online]. Available: http://www.mississauga.ca/portal/residents/developmentinformation?paf_gear_id=10200022&itemId=9400198q&returnUrl=%2Fportal%2Fresidents%2Fdevelopmentinformation.

[6] Lakeview Community Partners Limited; Gerrard Design, "Development Applications," December 2019. [Online]. Available: http://www.mississauga.ca/portal/residents/developmentinformation?paf_gear_id=10200022&itemId=9400198q&returnUrl=%2Fportal%2Fresidents%2Fdevelopmentinformation.

[7] Lakeview Community Partners Limited; Sasaki, "Development Master Plan Updates," October 2019. [Online]. Available: https://lakeviewcommunitypartners.com/mississauga-project-lakeview/.

[8] HGC Engineering, "Environmental Acoustical Assessment Report Lakeview Wastewater Plant," 2009.

[9] Glen Schnarr & Associates Inc., "Development Applications; Lakeview Waterfront," [Online]. Available: http://www.mississauga.ca/portal/residents/developmentinformation?paf_gear_id=10200022&itemId=9400198q&returnUrl=%2Fportal%2Fresidents%2Fdevelopmentinformation.

11.0 Closing

This acoustic assessment report was prepared by Wood for the sole benefit of CIMA Canada Inc. and the Region of Peel for specific application to the G.E. Booth WWTP located at 1300 Lakeshore Road East in Mississauga, Ontario. The quality of information, conclusions and estimates contained herein are consistent with the level of effort involved in Wood 's services and based on: i) information available at the time of preparation, ii) data supplied by outside sources and iii) the assumptions, conditions and qualifications set forth in this document. This report is intended to be used by CIMA+ only, and its nominated representatives, subject to the terms and conditions of its contract with Wood. Any other use of, or reliance on, this report by any third party is at that party's sole risk. This report has been prepared in accordance with generally accepted industry-standard. No other warranty, expressed or implied, is made.

If you require further information regarding the above or the project in general, please contact the undersigned at (905) 568-2929. Thank you for the opportunity to be of service to CIMA Canada Inc.

Sincerely,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Prepared by:

Shivraj Sagar, B.Eng.
Specialist – Acoustics & Vibration

Reviewed by:

Alfredo Rodrigues, P. Eng.
Senior Engineer – Acoustics & Vibration

wood.

Table 1: Noise Source Summary

Project: G.E. Booth WWTP
Location: Mississauga, ON

Source ID	Source Description	Sound Power Level [1] (dBA)	Sound Power Level Adjustment [2] (+dB)	Source Location [3] (I or O)	Sound Characteristics [4] (S,Q,I,B,T,C)	Noise Control Measures [5] (S,A,B,L,E,O,U)
BB_AI1	Blower Building Air Intake1	86	0	O	S	U
BB_AI2	Blower Building Air Intake2	86	0	O	S	U
BB_AI3	Blower Building Air Intake3	86	0	O	S	U
BB_AI4	Blower Building Air Intake4	86	0	O	S	U
BB_AI5	Blower Building Air Intake5	86	0	O	S	U
BB_OD	Blower Building Overhead Door	86	0	O	S	U
CB_CU1	Condenser 1 - Centrifuge Bldg	84	0	O	S	U
CB_MAU1	Makeup Air Unit 1 - Centrifuge Bldg	89	0	O	S	U
CB_MAU2	Makeup Air Unit 2 - Centrifuge Bldg	89	0	O	S	U
BF_L2	Biofilter Building Louvre 1	75	0	O	S	U
BF_L1	Biofilter Building Louvre 1	79	0	O	S	U
HW_CUS1	Headworks Carbon Unit Stack 1	88	0	O	S	U
HW_CUS2	Headworks Carbon Unit Stack 2	88	0	O	S	U
HW_EF1	Headworks Exhaust Fan 1	95	0	O	S	U
HW_EF2	Headworks Exhaust Fan 2	95	0	O	S	U
HW_EF3	Headworks Exhaust Fan 3	93	0	O	S	U
HW_EF4	Headworks Exhaust Fan 4	93	0	O	S	U
HW_EF5	Headworks Exhaust Fan 5	97	0	O	S	U
ITT	Idling Transport Truck	97	0	O	S	U
OUB_CUS1	Odour Unit Building Carbon Unit Stack 1	88	0	O	S	U
OUB_CUS2	Odour Unit Building Carbon Unit Stack 2	88	0	O	S	U
SH_OD1	Solids Handling Overhead Door 1	99	0	O	S	U
SH_OD2	Solids Handling Overhead Door 2	99	0	O	S	U
SHCB_EF1	Exhaust fan 1 Solids Handling/Centrifuge Building	82	0	O	S	U
SHCB_EF2	Exhaust fan 2 Solids Handling/Centrifuge Building	82	0	O	S	U
SHCB_EF3	Exhaust fan 3 Solids Handling/Centrifuge Building	82	0	O	S	U
SHCB_EF4	Exhaust fan 4 Solids Handling/Centrifuge Building	82	0	O	S	U
SR_OD	Solids Receiving Overhead Door	90	5	O	S,T	U
TOX_B1	Boiler Exhaust 1	85	5	O	S,T	U
TOX_B2	Boiler Exhaust 2	85	5	O	S,T	U
TOX_B3	Boiler Exhaust 3	85	5	O	S,T	U
TOX_B4	Boiler Exhaust 4	85	5	O	S,T	U
TOX_B5	Boiler Exhaust 5	85	5	O	S,T	U
TOX1_2_OD	TOX1&2 Overhead Door	92	0	O	S	U
TOX1_2EF6	TOX1&2 Exhaust Fan6	92	0	O	S	U
TOX1_2EF7	TOX1&2 Exhaust Fan7	92	0	O	S	U
TOX1_2Inlet1	TOX 1&2 Inlet 1	88	0	O	S	U
TOX1_2Inlet2	TOX 1&2 Inlet 2	88	0	O	S	U
TOX3_OD	TOX3 Overhead Door	84	0	O	S	U
TOX3_4Inlet1	TOX 3&4 Inlet 1 (West side)	88	0	O	S	U
TOX3_4Inlet2	TOX 3&4 Inlet 2 (North side)	88	0	O	S	U
TOX3_EF2	TOX3 Exhaust Fan2	87	0	O	S	U
TOX3_EF4	TOX3 Exhaust Fan4	90	5	O	S,T	U
TOX4_L	HVAC Intake Louvre 1 (TOX4)	95	5	O	S,T	U
TOX4_OD	TOX4 Overhead Door	89	0	O	S	U
SH_TEI	Sodium Hypochlorite Truck Engine Idling	100	0	O	S	U
SH_TB	Sodium Hypochlorite Truck Blower	103	0	O	S	U
FC_TEI	Ferrous Chloride Truck Engine Idling	110	0	O	S	U
FC_TB	Ferrous Chloride Truck Blower	100	0	O	S	U
PO_TEI	Polymer Truck Engine Idling	96	0	O	S	U
PO_TB	Polymer Truck Blower	101	5	O	S,T	U
FCB_OD	Ferrous Chloride Building Open Door	81	5	O	S,T	U

wood.

Table 1: Noise Source Summary

Project: G.E. Booth WWTP
Location: Mississauga, ON

Source ID	Source Description	Sound Power Level [1] (dBA)	Sound Power Level Adjustment [2] (+dB)	Source Location [3] (I or O)	Sound Characteristics [4] (S,Q,I,B,T,C)	Noise Control Measures [5] (S,A,B,L,E,O,U)
TOX3_L1	HVAC Intake Louvre 1 (TOX3)	101	0	O	S	U
TOX3_L2	HVAC Intake Louvre 2 (TOX3)	93	0	O	S	U
TOX_BE	TOX HVAC & Fluidized Air Blower Exhaust	101	5	O	S,T	U
TOX1_2EF1	TOX1&2 Exhaust Fan1	92	0	O	S	U
TOX1_2EF2	TOX1&2 Exhaust Fan2	92	0	O	S	U
TOX1_2EF3	TOX1&2 Exhaust Fan3	92	0	O	S	U
TOX1_2EF4	TOX1&2 Exhaust Fan4	92	0	O	S	U
TOX1_2EF5	TOX1&2 Exhaust Fan5	92	0	O	S	U
TOX1_2EF8	TOX1&2 Exhaust Fan8	92	0	O	S	U
TOX1_2EF9	TOX1&2 Exhaust Fan9	92	0	O	S	U
TOX3_EF1	TOX3 Exhaust Fan1	104	0	O	S	U
TOX3_EF3	TOX3 Exhaust Fan3	90	5	O	S,T	U
TOX3_EF5	TOX3 Exhaust Fan5	90	5	O	S,T	U
TOX4_EF1	TOX4 Exhaust Fan1	102	5	O	S,T	U
TOX4_EF2	TOX4 Exhaust Fan2	102	5	O	S,T	U
TOX4_EF3	TOX4 Exhaust Fan3	102	5	O	S,T	U
WGAC	West GAC Odour Control Unit Exhaust	104	0	O	S	U
P1_GAC_ES	Plant 1 GAC Filter Vessel Exhaust Stack	86	0	O	S	U
GEB_POU	GEB Solids Exportation Portable Odour Unit	88	0	O	S	U
HW_GenIntake	Headworks Generator Room Intake	93	0	O	S	U
HW_GenRadExh	Headworks Generator Radiator Exhaust	93	0	O	S	U
HW_GenStackExh	Headworks Generator Exhaust Stack	88	0	O	S	U
TCF_GenIntake	Thermal Conditioning Facility Generator Room Intake	105	0	O	S	U
TCF_GenRadExh	Thermal Conditioning Facility Generator Radiator Exhaust	112	0	O	S	U
TCF_GenStackExh	Thermal Conditioning Facility Generator Exhaust Stack	86	0	O	S	U
SHTP	Sodium Hypochlorite Truck Passby	92	0	O	S	U
FCTP	Ferrous Chloride Truck Passby	90	0	O	S	U
GTP	Garbage Truck Passby	91	0	O	S	U
PTP	Polymer Truck Passby	92	0	O	S	U
SRTP	Sludge Receiving Truck Passby	93	0	O	S	U

Notes on Table:

1. Sound Power Level of Source, in dBA, without sound characteristic adjustment as per NPC-104.
2. Sound characteristic adjustment (addition to sound power level), as applicable to the source as per NPC-104.
3. Source Location: O = Outside of building, including the roof, I = Inside of building
4. Sound Characteristic, per NPC-104
   S = Steady   I = Impulsive   T = Tonal
   Q = Quasi-Steady Impulsive   B = Buzzing   C = Cyclic
5. Noise Control Measures Included
   S = Silencer/Muffler   L = Lagging   O = Other
   A = Acoustic lining, plenum   E = acoustic enclosure   U = uncontrolled
   B = Barrier

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