APPENDIX G

Air Quality Assessment

GANNETT FLEMING

Air Quality Assessment of Stevenson Road North (Taunton Road West to Conlin Road)

City of Oshawa, Ontario

Gannett Fleming

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Making Sustainability Happen

Revision Record

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0	January 7, 2025	M. Ghorbani	L. Clark	L. Clark

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Executive Summary

SLR Consulting (Canada) Ltd., was retained by Gannett Fleming to conduct an air quality assessment as part of the Schedule "C" Municipal Class Environmental Assessment (MCEA) process under the Ontario EA Act for improvements of Stevenson Road North from Taunton Road West to Conlin Road in the City of Oshawa, Ontario. The project involves the reconstruction of Stevenson Road North, addition of a multi-use pedestrian pathway, as well as adding turning lanes at the intersections from Stevenson Road North and Taunton Road West.

The main objective of the study was to assess the local air quality impacts due to the proposed Stevenson Road North improvements. The study also includes an overview of construction impacts and a screening level assessment of greenhouse gases (GHG). To meet these objectives, the following scenarios were considered:

- 2022 No Build (NB) – Assess the existing air quality conditions at representative receptors. Predicted contaminant concentrations from the existing traffic levels were combined with hourly measured ambient concentrations to determine combined impacts.
- 2033 Future Build (FB)– Assess the future air quality conditions with the proposed project in place. Predicted contaminant concentrations associated with traffic levels for the preferred alternatives were combined with hourly measured ambient concentrations to determine combined impacts.

The modelling considered vehicle emissions from Stevenson Road North, and its major intersecting roadways: Conlin Road and Taunton Road West.

The maximum combined concentrations for the Future Build emissions scenario were below their respective MECP guidelines or CAAQS, with the exception of the 24-hr PM10, annual benzene, and 24-hour and annual Benzo[a]Pyrene. Note that background concentrations exceeded the guideline for all of these contaminant averaging periods. The overall contribution from the roadway emissions to the combined concentrations was 8% or less.

Mitigation measures are not warranted, due to the small number of days which are expected to exceed the guideline.

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1.0 Introduction

SLR Consulting (Canada) Ltd. (SLR), was retained by Gannett Fleming to conduct an air quality assessment as part of the Schedule “C” Municipal Class Environmental Assessment (MCEA) process under the Ontario EA Act for the proposed improvement of Stevenson Road North from Taunton Road West to Conlin Road in the City of Oshawa, Ontario. The project involves the reconstructing of Stevenson Road North, addition of a multi-use pedestrian pathway, as well as adding turning lanes at the intersections from Stevenson Road North and Taunton Road West and Conlin Road.

1.1 Study Objectives

The main objective of the study was to assess the local air quality impacts due to the proposed Stevenson Road North reconstruction, addition of a multi-use pedestrian pathway, as well as adding turning lanes at the intersections from Stevenson Road North and Taunton Road West and Conlin Road. The study also includes an overview of construction impacts and a screening level assessment of greenhouse gases (GHG). To meet these objectives, the following scenarios were considered:

- **2022 No Build (NB)** – Assess the existing air quality conditions at representative receptors. Predicted contaminant concentrations from the existing traffic levels were combined with hourly measured ambient concentrations to determine combined impacts.
- **2033 Future Build (FB)** – Assess the future air quality conditions with the proposed project in place. Predicted contaminant concentrations associated with increased traffic levels for the preferred alternative was combined with hourly measured ambient concentrations to determine combined impacts.

The modelling considered vehicle emissions from Stevenson Road North, and its major intersecting roadways including Taunton Road West and Conlin Road. The roadway segments considered in this assessment are shown in Figure 1.

1.2 Contaminants of Interest

The contaminants of interest from vehicle emissions are based on the regularly assessed contaminants of interest for transportation assessments in Ontario, as determined by the Ministry of Transportation Ontario (MTO) and Ministry of Environment, Conservation and Parks (MECP). Motor vehicle emissions have largely been determined by scientists and engineers with United States and Canadian government agencies such as the U.S. Environmental Protection Agency (EPA), the MECP, Environment Canada (EC), Health Canada (HC), and the MTO. These contaminants are emitted due to fuel combustion, brake wear, tire wear, the breakdown of dust on the roadway, fuel leaks, evaporation and permeation, and refuelling leaks and spills as illustrated in Figure 2. Note that emissions related to refuelling leaks and spills are not applicable to motor vehicle emissions from roadway travel. Instead, these emissions contribute to the overall background levels of the applicable contaminants. All of the selected contaminants are emitted during fuel combustion, while emissions from brake wear, tire wear, and breakdown of road dust include only the particulates. A summary of these contaminants is provided in Table 1.

Table 1: Contaminant of Interest

Criteria Air Contaminants		Volatile Organic Compounds (VOCs)		Polycyclic Aromatic Hydrocarbons (PAH)	
Name	**Symbol**	**Name**	**Symbol**	**Name**	**Symbol**
Nitrogen Dioxide	NO_2	Acetaldehyde	C_2H_4O	Benzo[a]Pyrene	$C_{20}H_{12}$
Carbon Monoxide	CO	Acrolein	C_3H_4O		
Fine Particulate Matter (<2.5 microns in diameter)	$PM_{2.5}$	Benzene	C_6H_6		
Coarse Particulate Matter (<10 microns in diameter)	PM_{10}	1,3-Butadiene	C_4H_6		
Total Suspended Particulate Matter (<44 microns in diameter)	TSP	Formaldehyde	CH_2O		

1.3 Applicable Guidelines

In order to understand the existing conditions in the study area, ambient background concentrations have been compared to guidelines established by government agencies and organizations. Relevant agencies and organizations in Ontario and Canada, and their applicable contaminant guidelines are:

- MECP Ambient Air Quality Criteria (AAQC);
- Health Canada/Environment Canada National Ambient Air Quality Objectives (NAAQOs); and
- Canadian Council of Ministers of the Environment (CCME) Canadian Ambient Air Quality Standards (CAAQS).

Within the guidelines, the threshold value for each contaminant and its applicable averaging period were used to assess the maximum predicted impact at sensitive receptors derived from a combined result of ambient concentration and computer simulations. The contaminants of interest are compared against 1-hour, 8-hour, 24-hour, and annual averaging periods. The threshold values and averaging periods used in this assessment are presented in Table 2. It should be noted that the CAAQS for NO_2 and $PM_{2.5}$ are not based on the maximum concentration values; they are assessed based on the annual 98th percentile value, averaged over 3 consecutive years.

Table 2: Applicable Contaminant Guidelines

Contaminant	Averaging Period (hrs)	Threshold Value (µg/m3)	Source
NO_2	1	400	AAQC
	24	200	AAQC
	1	79 (42 ppb) [1]	CAAQS (2025)
	Annual	23 (12 ppb) [2]	CAAQS (2025)
CO	1	36,200	AAQC
	8	15,700	AAQC
$PM_{2.5}$	24	27 [3]	CAAQS
	Annual	8.8 [4]	CAAQS
PM_{10}	24	50	Interim AAQC
TSP	24	120	AAQC
Acetaldehyde	24	500	AAQC
Acrolein	24	0.4	AAQC
	1	4.5	AAQC
Benzene	Annual	0.45	AAQC
	24	2.3	AAQC
1,3-Butadiene	24	10	AAQC
	Annual	2	AAQC
Formaldehyde	24	65	AAQC
Benzo[a]Pyrene	24	0.00005	AAQC
	Annual	0.00001	AAQC

[1] The 1-hour NO_2 CAAQS is based on the 3-year average of the annual 98th percentile of the NO_2 daily maximum 1-hour average concentrations
[2] The annual NO_2 CAAQS is based on the average over a single calendar year of all the 1-hour average NO_2 concentrations
[3] The 24-hr $PM_{2.5}$ CAAQS is based on the 3-year average of the annual 98th percentile of the 24-hr average concentrations
[4] The annual $PM_{2.5}$ CAAQS is based on the average of the three highest annual average values over the study period

1.4 General Assessment Methodology

The worst-case contaminant concentrations due to motor vehicle emissions from the roadways were predicted at nearby receptors using dispersion modelling software on an hourly basis for a five-year period. 2018-2022 historical meteorological data from Oshawa Executive Airport was used. Five years were modelled in order to capture the worst-case meteorological conditions. Two emission scenarios were assessed: 2022 No Build and 2033 Future Build.

Combined concentrations were determined by adding modelled and background (i.e., ambient data) concentrations together on an hourly basis. Background concentrations for all available contaminants were determined from MECP and NAPS (National Air Pollution Surveillance) stations nearest to the study area with applicable datasets.

Maximum 1-hour, 8-hour, 24-hour, and annual predicted combined concentrations were determined for comparison with the applicable guidelines using emission and dispersion models published by the U.S. Environmental Protection Agency (EPA).

The worst-case predicted impacts are presented in this report; however, it is important to note that the worst-case impacts may occur infrequently and at only one receptor location.

2.0 Background Ambient Data

2.1 Overview

Background (ambient) conditions are measured contaminant concentrations that are independent of emissions from the proposed project infrastructure. These concentrations consist of trans-boundary (macro-scale), regional (meso-scale), and local (micro-scale) emission sources and result from both primary and secondary formation. Primary contaminants are emitted directly by the source and secondary contaminants are formed by complex chemical reactions in the atmosphere. Secondary pollution is generally formed over great distances in the presence of sunlight and heat and most noticeably results in the formation of fine particulate matter ($PM_{2.5}$) and ground-level ozone (O_3), also considered smog.

In Ontario, a significant amount of smog originates from emission sources in the United States, which is the major contributor during smog events that usually occur in the summer season (MECP, 2005). During smog episodes, the U.S. contribution to $PM_{2.5}$ levels can be as much as 90 percent near the southwest Ontario-U.S. border. The effects of U.S. air pollution in Ontario on a high $PM_{2.5}$ day and on an average $PM_{2.5}$ spring/summer day are illustrated in Figure 3.

Air pollution is strongly influenced by weather systems (i.e., meteorology) that commonly move out of central Canada into the mid-west of the U.S. then eastward to the Atlantic coast. This weather system generally produces winds blowing from the southwest, which can travel over major emission sources in the U.S. and result in the transport of pollution into Ontario. This phenomenon is demonstrated in Figure 4 and is based on a computer simulation from the Weather Research and Forecasting (WRF) Model.

As discussed, understanding the composition of background air pollution and its influences are important in determining potential impacts of a project, considering that the majority of the combined concentrations are typically due to existing ambient background levels. In this assessment, background conditions were characterized utilizing existing ambient monitoring data from MECP and NAPS Network stations and added to the modelled predictions in order to conservatively estimate combined concentrations.

2.2 Selection of Relevant Ambient Monitoring Stations

A review of MECP and NAPS ambient monitoring stations in Ontario was undertaken to identify the monitoring stations that are in relative proximity to the study area and that would be representative of background contaminant concentrations in the study area. The closest MECP station is located 1km east of the site (Oshawa). Note that CO is only monitored at the Toronto West Station, which was used in the analysis. The Toronto West was the nearest monitoring station to the site that measured 1-3 Butadiene, Benzene, and Benzo[a]Pyrene. Also note that Windsor is the only station in Ontario at which background Acrolein, Formaldehyde, and Acetaldehyde are measured in recent years. Only these contaminants were considered from the Windsor station; the remaining contaminants from the Windsor station were not considered given the stations' distance from the study area. The locations of the relevant ambient monitoring stations in relation to the study area are shown in Figure 5. Station information is presented in Table 3.

Table 3: Relevant MECP and NAPS Station Information

City/Town	Station ID	Location	Operator	Contaminant
Oshawa	45026	2000 Simcoe St. N.	MECP	NO_2 | $PM_{2.5}$
Toronto West	35125	125 Resources Road	MECP	CO
Toronto West	60438	401W - 125 Resources Road	NAPS	Benzo[a]Pyrene | 1,3-Butadiene | Benzene
Windsor West	60211	College St/Prince St	NAPS	Formaldehyde | Acetaldehyde | Acrolein

2.3 Detailed Analysis of Selected Worst-Case Monitoring Stations

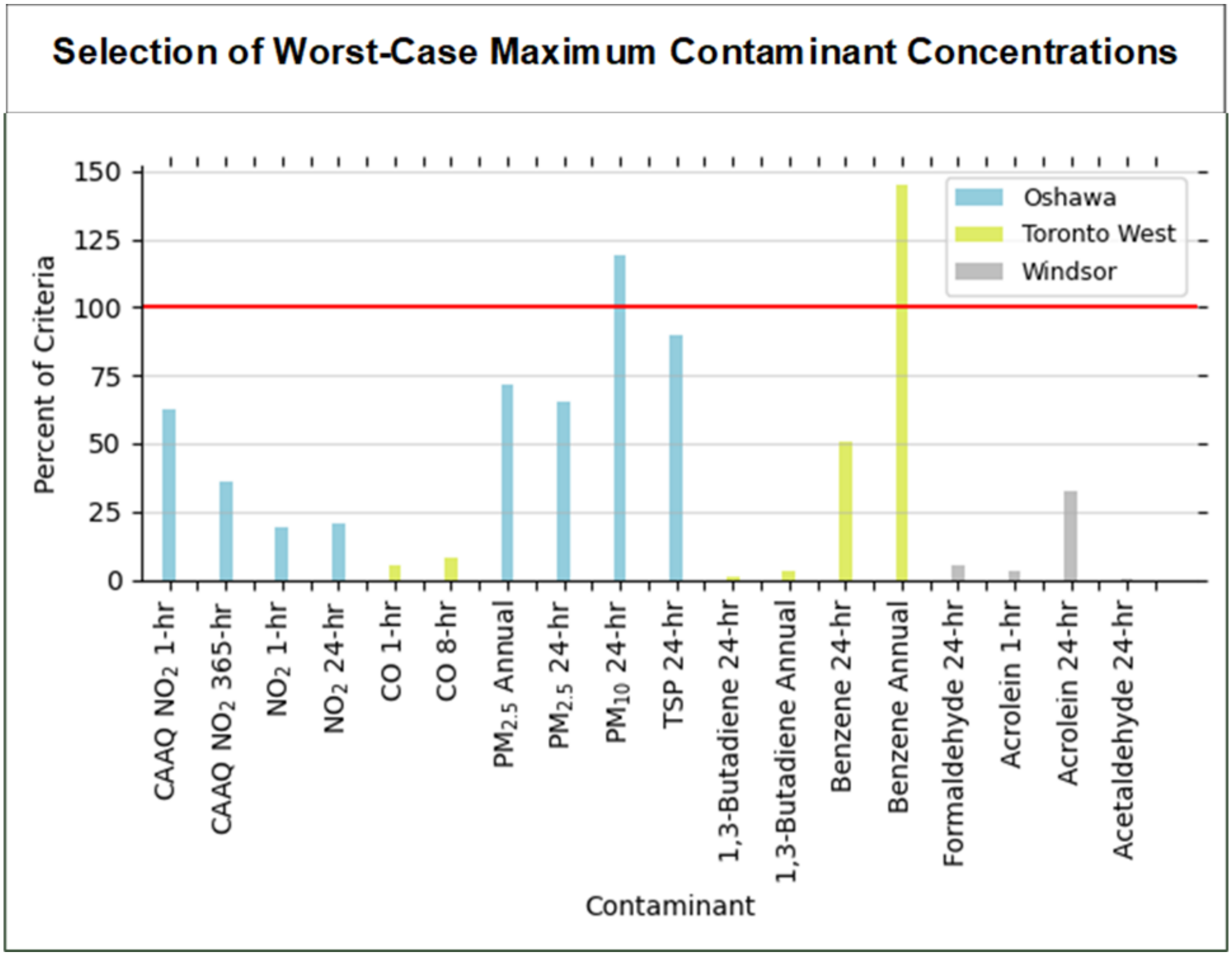
Hourly ambient monitoring data for 2018 to 2022 from the selected stations were statistically summarized for the desired averaging periods: 1-hour, 8-hour, 24-hour, and annual. Note that for the NAPS stations (VOCs) and PAHs, formaldehyde, acetaldehyde and acrolein are only measured at the Windsor station and were not measured after 2010. Therefore 2006-2010 data was used for these VOCs. Benzo[a]Pyrene is only monitored at some stations and data availability varies between NAPS stations.

Note that PM_{10} and TSP are not measured in Ontario; therefore, background concentrations were estimated by applying a $PM_{2.5}/PM_{10}$ ratio of 0.54 and a $PM_{2.5}$/TSP ratio of 0.3 (Lall et al. 2004). Ambient VOC concentrations are not monitored hourly but are typically measured every six days. To combine this dataset with the hourly modelled concentrations, each measured six-day value was applied to all hours between measurement dates, when there were 6 days between measurements. When there was greater than 6 days between measurements, the 90^{th} percentile measured value for the year in question was applied for those days in order to determine combined concentrations.

It was found that the available ambient Benzo[a]Pyrene data was measured at inconsistent frequencies and time intervals. Therefore, the 90^{th} percentile value of all measured concentrations between 2017 to 2022 at the Toronto West NAPS station was used in the assessment. Since there was no data available for 2020, six years of background data were considered for PAHs.

Table 4 shows the selected monitoring station for the various contaminants considered in the assessment.

Table 4: Selection of Background Monitoring Stations



Note [1]: PM10 and TSP are not measured in Ontario; therefore, background concentrations were estimated from PM2.5 concentrations.

Note [2]: Benzo[a]Pyrene is not shown on this graph, due to the fact that it exceeds the guideline by a significant amount and therefore skews the scale.

Contaminant	Worst-Case Station	Contaminant	Worst-Case Station
CAAQ NO_2 (1-Hr)	Oshawa	TSP	Oshawa
CAAQ NO_2 (annual)	Oshawa	1,3-Butadiene (24-hr)	Toronto West
NO_2 (1-Hr)	Oshawa	1,3-Butadiene (annual)	Toronto West
NO_2 (24-Hr)	Oshawa	Benzene (24-hr)	Toronto West
CO (1-Hr)	Toronto West	Benzene (annual)	Toronto West
CO (8-hr)	Toronto West	Formaldehyde	Windsor
$PM_{2.5}$ (24-hr)	Oshawa	Acrolein	Windsor
$PM_{2.5}$ (annual)	Oshawa	Acetaldehyde	Windsor
PM_{10}	Oshawa	Benzo[a]Pyrene	Toronto West

A detailed statistical analysis of the selected worst-case background monitoring station for each of the contaminants was performed and is summarized in Figure 6. Presented is the average, 90th percentile, and maximum concentrations as a percentage of the guideline for each contaminant from the worst-case monitoring station determined above. Maximum ambient concentrations represent a single worst-case value. The 90th percentile concentration represents a reasonably worst-case background concentration, and the average concentration represents a typical background value. The 98th percentile concentration is shown for CAAQS NO_2 1-hour and 24-hour $PM_{2.5}$, as the guideline for these contaminants is based on 98th percentile concentrations. Benzo[a]Pyrene is not shown in this summary as the 90th percentile 24-Hour Benzo[a]Pyrene concentrations were 270 % (0.000135 µg/m^3) of the applicable guidelines. Also, the 90th percentile annual average background concentration was 0.0000925 µg/m^3 and 925% of the applicable guidelines.

Based on a review of ambient monitoring data from 2018-2022, background concentrations were generally below their respective guidelines. The exceptions are annual and 24-hr average for Benzo[a]Pyrene, annual average for benzene, and the 24-hr average for particulate matter (<10 µm). In some cases, the exceedances represent maximum concentrations and the 90th percentile and/or average concentrations are below the guideline. It should be noted that PM_{10} and TSP were calculated based on their relationship to $PM_{2.5}$.

3.0 Local Air Quality Assessment

3.1 Location of Sensitive Receptors within the Study Area

Land uses which are defined as sensitive receptors for evaluating potential air quality effects are:

- Health care facilities;
- Senior citizens' residences or long-term care facilities;
- Childcare facilities;
- Educational facilities;
- Places of worship; and
- Residential dwellings.

Seventeen (17) sensitive receptor locations were selected to be representative of potential impacts within the study area. They include existing residential houses and a social service center for children in close proximity to Stevenson Road North, and thus the most likely impacted by the roadway improvements. The representative receptors include locations both east, west, and south of Stevenson Road North as shown in Figure 7A and 7B.

3.2 Road Traffic Data

Traffic data was provided by Gannett Fleming in the form of annual average daily traffic (AADT) values for Stevenson Road North and the major intersecting roads within the study area for both the 2022 No Build and 2033 Future Build configurations. The AADT volumes used in the assessment are shown in Table 5. Vehicle posted speeds for Stevenson Road North, and the intersecting arterial roads are also shown in Table 5.

Lastly, a heavy-duty vehicle percentage was also provided by Gannett Flemming for the study area as shown between Taunton Road West and Conlin Road. The Future Build volumes include traffic projections along Stevenson Road North between Taunton Road West and Conlin Road.

Detailed breakdown of medium and heavy trucks on the arterial roads can be found in Table 6. Hourly traffic breakdowns were not available for Stevenson Road North and the intersecting arterial roads; therefore, the US EPA standard urban weekday and weekend hourly distribution was used for these roadways. The hourly distributions applied in this assessment are shown in Table 7.

Table 5: Traffic Volumes (AADT – Vehicles/Day) Used in the Assessment

Location	Posted Speed (km/hr)	2022 No Build AADT	2033 Future Build AADT
Stevenson Road North	50	1,617	1,991
Conlin Road	50	14,058	18,568
Taunton Road West	60	26,092	29,194

Table 6: Heavy Duty Vehicle Percentages used in the Assessment

Location	Medium Truck (%)	Heavy Truck (%)
Stevenson Road North	4.4	6.7
Conlin Road	3.6	4.0
Taunton Road West	3.4	5.1

Table 7: Hourly Vehicle Distribution Used in the Assessment

Hour [1]	US EPA Weekday	US EPA Weekend
01:00	0.9%	2.2%
02:00	0.6%	1.4%
03:00	0.5%	1.0%
04:00	0.4%	0.8%
05:00	0.6%	0.7%
06:00	1.9%	1.0%
07:00	4.6%	1.9%
08:00	6.9%	2.6%
09:00	6.1%	3.8%
10:00	5.0%	4.8%
11:00	5.1%	5.9%
12:00	5.4%	6.5%
13:00	5.8%	7.1%
14:00	5.9%	7.1%

Hour [1]	US EPA Weekday	US EPA Weekend
15:00	6.2%	7.1%
16:00	7.1%	7.2%
17:00	7.7%	7.1%
18:00	7.9%	6.8%
19:00	6.0%	6.0%
20:00	4.4%	5.2%
21:00	3.5%	4.3%
22:00	3.1%	3.9%
23:00	2.5%	3.2%
24:00	1.9%	2.4%

Note [1] – Beginning of hour period.

3.3 Meteorological Data

2018-2022 hourly meteorological data was obtained from the Oshawa Executive Airport in Oshawa and upper air data was obtained from Buffalo, New York as recommended by the MECP for the study area. The combined data was processed to reflect conditions in the study area using the U.S. EPA's PCRAMMET software program which prepares meteorological data for use with the CAL3QHCR vehicle emission dispersion model. A wind frequency diagram (wind rose) is shown in Figure 8.

As can be seen in Figure 8, predominant winds are from the southwesterly through northly directions, with a predominant easterly wind direction as well.

3.4 Motor Vehicle Emission Rates

The U.S. EPA's Motor Vehicle Emission Simulator (MOVES) model provides estimates of current and future emission rates from motor vehicles based on a variety of factors such as local meteorology, vehicle fleet composition and speed. MOVES 4.0, released in August 2023, is the U.S. EPA's latest tool for estimating vehicle emissions due to the combustion of fuel, brake and tire wear, fuel evaporation, permeation, and refuelling leaks. The MOVES model is based on "an analysis of millions of emission test results and considerable advances in the Agency's understanding of vehicle emissions and accounts for changes in emissions due to proposed standards and regulations." For this project, MOVES was used to estimate vehicle emissions based on vehicle type, road type, fuel type, and vehicle speed. Emission rates were estimated for the year 2022 and 2033 for various medium/heavy duty vehicle percentages (provided in Table 6). Vehicle age is based on the US EPA standard vehicle age distribution.

From the MOVES outputs, the highest monthly value for each contaminant was selected to represent a worst-case emission rate. The emission rates for each vehicle speed and contaminant modelled are shown in Table 8 for the Existing and Future Build years, for a heavy/medium duty vehicle percentage of 4.4/6.7%, respectively. As shown in Table 8, emissions in the future year are generally predicted to decrease. This is due to the key assumptions of the MOVES model which predicts decreases in emissions in the future due to improved technologies and stricter regulations. The MOVES default values for vehicle fleet population, including electric vehicle fractions was considered in this assessment.

Table 8: MOVES Output Emission Factors for Roadway Vehicles (g/VMT); Idle Emission Rates are grams per vehicle hour

Pollutant	2022			2033		
	50 km/hr	60 km/hr	Idle	50 km/hr	60 km/hr	Idle
Carbon Monoxide	3.23E+00	2.92E+00	6.24E+00	1.55E+00	1.41E+00	3.67E+00
Oxides of Nitrogen	4.66E-01	3.88E-01	4.39E+00	1.54E-01	1.24E-01	2.56E+00
Benzene	1.94E-03	1.72E-03	1.99E-02	1.17E-03	1.06E-03	1.27E-02
1,3-Butadiene	5.17E-05	4.53E-05	1.11E-03	4.61E-07	4.22E-07	3.64E-05
Formaldehyde	1.31E-03	1.15E-03	2.57E-02	5.04E-04	4.38E-04	7.38E-03
Acetaldehyde	8.12E-04	6.99E-04	1.44E-02	3.37E-04	2.80E-04	5.22E-03
Acrolein	8.11E-05	7.07E-05	1.79E-03	2.74E-05	2.29E-05	4.35E-04
Nitrogen Dioxide	7.96E-02	6.51E-02	7.00E-01	2.72E-02	2.14E-02	4.71E-01
Total PM_{10}	7.75E-02	6.11E-02	1.25E-01	7.18E-02	5.65E-02	2.48E-02
Total $PM_{2.5}$	1.59E-02	1.29E-02	1.14E-01	1.10E-02	8.86E-03	2.24E-02
Benzo[a]Pyrene	1.17E-06	1.05E-06	2.10E-05	5.12E-07	4.84E-07	5.10E-06

3.5 Re-suspended Particulate Matter Emission Rates

A large portion of highway particulate matter emissions comes from dust on the pavement which is re-suspended by vehicles travelling on the highway. These emissions are estimated using empirically derived values presented by the U.S. EPA in their AP-42 report. The emissions factors for re-suspended PM were estimated by using the following equation from U.S. EPA's Document AP-42 report, Chapter 13.2.1.3 and are summarized in Table 9.

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

Where: E = the particulate emission factor

k = the particulate size multiplier

sL = silt loading

W = average vehicle weight (Assumed 3 Tons based on fleet data and U.S. EPA vehicle weight and distribution

Table 9: Re-suspended Particulate Matter Emission Factors

Roadway AADT	K ($PM_{2.5}$/PM_{10}/TSP)	sL (g/m^2)	W (Tons)	E (g/VMT)		
				$PM_{2.5}$	PM_{10}	TSP
<500	0.25/1.0/5.24	0.6	3	0.503	2.015	10.561
500-5,000	0.25/1.0/5.24	0.2	3	0.185	0.741	3.886
5,000-10,000	0.25/1.0/5.24	0.06	3	0.061	0.247	1.299
>10,000	0.25/1.0/5.24	0.03	3	0.03299	0.13195	0.691

3.6 Air Dispersion Modelling Using CAL3QHCR

The U.S. EPA's CAL3QHCR (Calroads) dispersion model, based on the Gaussian plume equation, was specifically designed to predict air quality impacts from roadways using site specific meteorological data, vehicle emissions, traffic data, and signal data. The model input requirements include roadway geometry, sensitive receptor locations, meteorology, traffic volumes, and motor vehicle emission rates as well as some contaminant physical properties such as settling and deposition velocities. CAL3QHCR uses this information to calculate hourly concentrations which are then used to determine 1-hour, 8-hour, 24-hour, and annual averages for the contaminants of interest at the identified sensitive receptor locations. Table 10 provides the major inputs used in CAL3QHCR. The emission rates used in the model were the outputs from the MOVES and AP-42 models, weighted for the vehicle fleet distributions provided. The outputs of CAL3QHCR are presented in the results section.

Table 10: CAL3QHCR Model Input Parameters

Parameter	Input
Free-Flow and Queue Link Traffic Data	Hourly traffic distributions were applied to the AADT traffic volumes in order to input traffic volumes in vehicles/hour. Emission rates from the MOVES output were input in grams/VMT or grams per vehicle hour. Signal timings for the traffic signal were input in seconds.
Meteorological Data	2018-2022 data from Oshawa Executive Airport
Deposition Velocity	$PM_{2.5}$: 0.1 cm/s PM_{10}: 0.5 cm/s TSP: 0.15 cm/s Benzo[a]Pyrene, NO_2, CO and VOCs: 0 cm/s
Settling Velocity	$PM_{2.5}$: 0.02 cm/s PM_{10}: 0.3 cm/s TSP: 1.8 cm/s Benzo[a]Pyrene, CO, NO_2, and VOCs: 0 cm/s
Surface Roughness	The land type surrounding the project site is categorized as low residentials. Therefore, a surface roughness height of 52 cm was applied in the model.
Vehicle Emission Rate	Emission rates calculated in MOVES and AP-42 were input in g/VMT

3.7 Modelling Results

Presented below are the modelling results for the 2022 No Build and 2033 Future Build scenarios based on 5-years of meteorological data. For each contaminant, combined concentrations are presented along with the relevant contribution due to the background and roadway. Results in this section are presented for the worst-case sensitive receptors for each contaminant and averaging period (see Table 11), which were identified as the maximum combined concentration for the 2033 Future Build scenario. Results for all modelled receptors are provided in Appendix A. It should be noted that the maximum combined concentration at any sensitive receptor often occurs infrequently and may only occur for one hour or day over the 5-year period.

Table 11: Worst-Case Sensitive Receptors for 2033 Future Build Scenario

Contaminant	Averaging Period	Sensitive Receptor
CAAQ NO_2	1-hour	16
	Annual	16
NO_2	1-hour	16
	24-hour	16
CO	1-hour	17
	8-hour	17
$PM_{2.5}$	24-hour	8
	Annual	16
PM_{10}	24-hour	17
TSP	24-hour	17
Formaldehyde	24-hour	16
Benzene	24-hour	16
	Annual	16
1,3-Butadiene	24-hour	16
	Annual	16
Acrolein	1-hour	17
	24-hour	16
Acetaldehyde	24-hour	16
Benzo[a]Pyrene	24-hour	16
	Annual	16

Coincidental hourly modelled roadway and background concentrations were added to derive the combined concentration for each hour over the 5-year period. Hourly combined concentrations were then used to determine contaminant concentrations based on the applicable averaging period. Statistical analysis in the form of maximum, 90th percentile, and average combined concentrations were calculated for the worst-case sensitive receptor for each contaminant and are presented below. The maximum combined concentration was used to assess compliance with MECP guidelines or CAAQS.

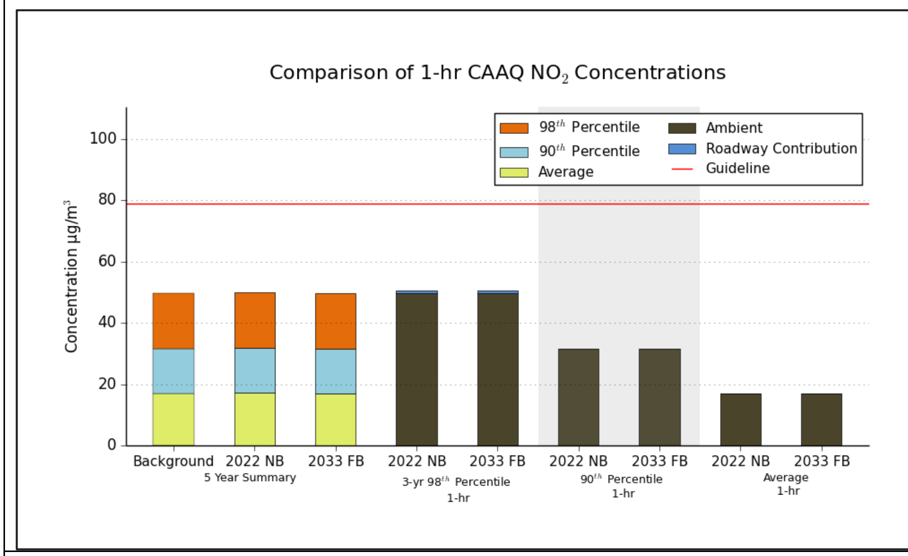
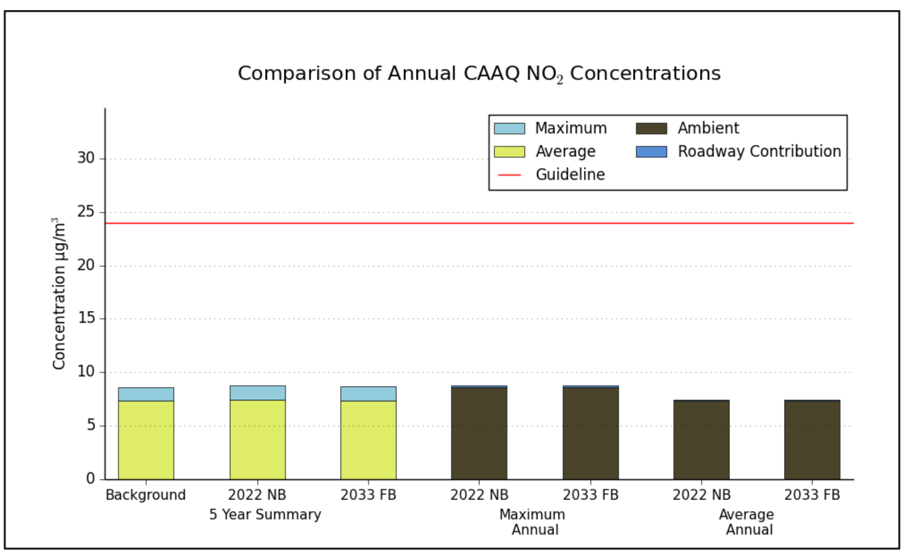
If excesses of the guideline were predicted, frequency analysis was undertaken in order to estimate the number of occurrences above the guideline. Provided below are the modelling results for the contaminants of interest.

3.7.1 Nitrogen Dioxide CAAQS

Table 12 presents the predicted combined concentrations for the worst-case sensitive receptor for 1-hour and annual NO2 based on the 5 years of meteorological data. The results conclude that:

- The annual 98th percentile of the daily maximum 1-hour NO_2 concentration, averaged over three consecutive years and the annual maximum combined concentrations are below the respective CAAQS guidelines.

Table 12: Summary of Predicted CAAQS NO_2 Concentrations

<table>
<tr><th>Statistical Analysis</th><th colspan="2">2033 FB</th></tr>
<tr><td rowspan="8">
</td><td colspan="2">% of CAAQS Guideline (1-hr):</td></tr>
<tr><td>98th Percentile</td><td>63%</td></tr>
<tr><td>90th Percentile</td><td>40%</td></tr>
<tr><td>Average</td><td>22%</td></tr>
<tr><td colspan="2">Roadway Contribution (1-hr):</td></tr>
<tr><td>98th Percentile</td><td>1%</td></tr>
<tr><td>90th Percentile</td><td><1%</td></tr>
<tr><td>Average</td><td><1%</td></tr>
<tr><td rowspan="6">
</td><td colspan="2">% of CAAQs Guideline (Annual):</td></tr>
<tr><td>Maximum</td><td>36%</td></tr>
<tr><td>Average</td><td>31%</td></tr>
<tr><td colspan="2">Roadway Contribution (Annual):</td></tr>
<tr><td>Maximum</td><td><1%</td></tr>
<tr><td>Average</td><td><1%</td></tr>
</table>

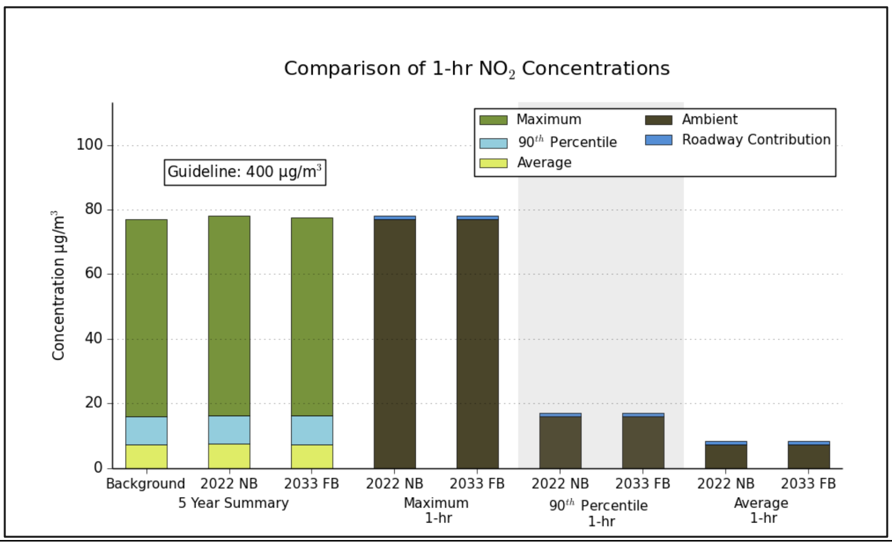
<table>
<tr><th>Statistical Analysis</th><th>2033 FB</th></tr>
<tr><td colspan="2">Conclusions:
• All combined concentrations were below their respective MECP guidelines.
• The contribution from the roadway to the combined concentrations was less than 1% of the combined total concentrations.</td></tr>
</table>

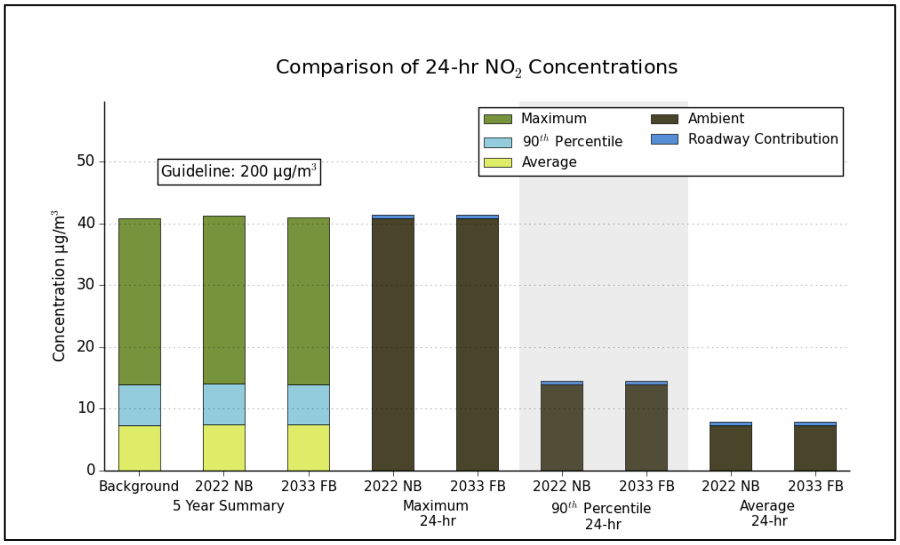
3.7.2 Nitrogen Dioxide

Table 13 presents the predicted combined concentrations for the worst-case sensitive receptor for 1-hour and 24-hour NO_2 based on the 5 years of meteorological data. The results conclude that:

- Both the maximum 1-hour and 24-hour NO_2 combined concentrations were below their respective MECP guidelines.

Table 13: Summary of Predicted NO_2 Concentrations

<table>
<tr><th>Statistical Analysis</th><th colspan="2">2033 FB</th></tr>
<tr><td rowspan="9">
</td><td colspan="2">% of MECP Guideline (1-hr):</td></tr>
<tr><td>Maximum</td><td>19%</td></tr>
<tr><td>90th Percentile</td><td>4%</td></tr>
<tr><td>Average</td><td>2%</td></tr>
<tr><td colspan="2">Roadway Contribution (1-hr):</td></tr>
<tr><td>Maximum</td><td><1%</td></tr>
<tr><td>90th Percentile</td><td><1%</td></tr>
<tr><td>Average</td><td>1%</td></tr>
<tr><td colspan="2"></td></tr>
</table>

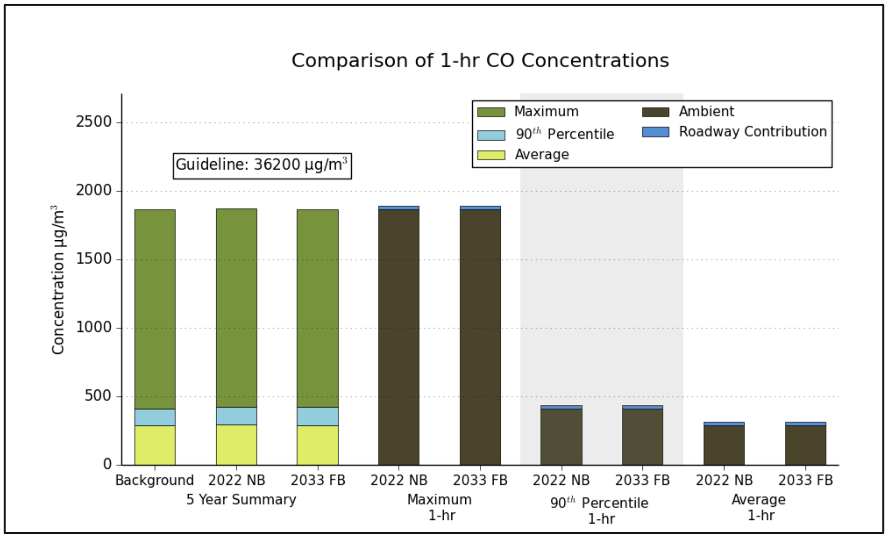
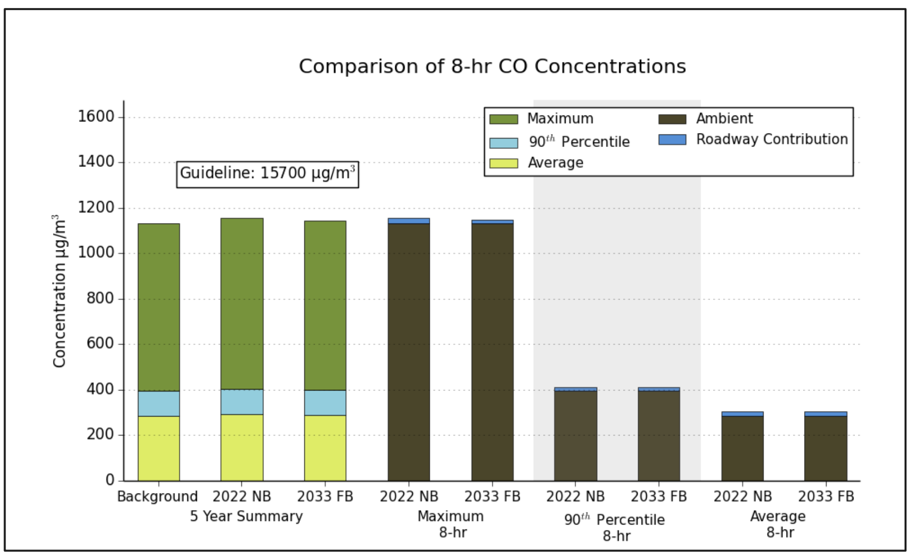
<table>
<tr><th>Statistical Analysis</th><th colspan="2">2033 FB</th></tr>
<tr><td rowspan="9">
</td><td colspan="2">% of MECP Guideline (24-hr):</td></tr>
<tr><td>Maximum</td><td>21%</td></tr>
<tr><td>90^{th} Percentile</td><td>7%</td></tr>
<tr><td>Average</td><td>4%</td></tr>
<tr><td colspan="2">Roadway Contribution (24-hr):</td></tr>
<tr><td>Maximum</td><td><1%</td></tr>
<tr><td>90th Percentile</td><td><1%</td></tr>
<tr><td>Average</td><td>1%</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="3">Conclusions:
• All combined concentrations were below their respective MECP guidelines.
• The contribution from the roadway to the combined concentrations was less than 1% of the combined total concentrations.</td></tr>
</table>

3.7.3 Carbon Monoxide

Table 14 presents the predicted combined concentrations for the worst-case sensitive receptor for 1-hour and 8-hour CO based on the 5 years of meteorological data. The results conclude that:

- Both the maximum 1-hour and 8-hour CO combined concentrations were well below their respective MECP guidelines.

Table 14: Summary of Predicted CO Concentrations

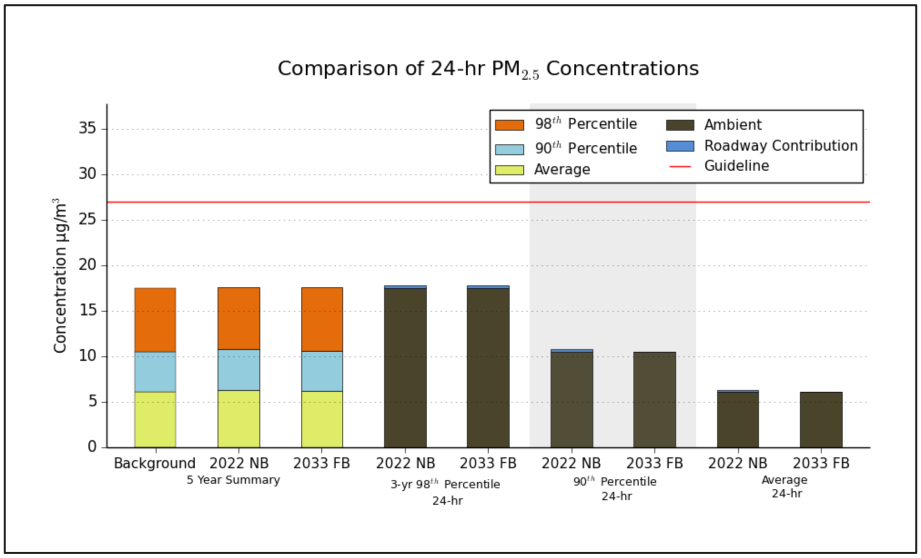
<table>
<tr><th>Statistical Analysis</th><th colspan="2">2033 FB</th></tr>
<tr><td rowspan="9">
</td><td colspan="2">% of MECP Guideline (1-hr):</td></tr>
<tr><td>Maximum</td><td>5%</td></tr>
<tr><td>90th Percentile</td><td>1%</td></tr>
<tr><td>Average</td><td><1%</td></tr>
<tr><td colspan="2">Roadway Contribution (1-hr):</td></tr>
<tr><td>Maximum</td><td><1%</td></tr>
<tr><td>90th Percentile</td><td>1%</td></tr>
<tr><td>Average</td><td><1%</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="9">
</td><td colspan="2">% of MECP Guideline (8-hr):</td></tr>
<tr><td>Maximum</td><td>7%</td></tr>
<tr><td>90th Percentile</td><td>3%</td></tr>
<tr><td>Average</td><td>2%</td></tr>
<tr><td colspan="2">Roadway Contribution (8-hr):</td></tr>
<tr><td>Maximum</td><td>2%</td></tr>
<tr><td>90th Percentile</td><td>1%</td></tr>
<tr><td>Average</td><td><1%</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="3">Conclusions:
• All combined concentrations were below their respective MECP guidelines.
• The contribution from the roadway to the combined concentrations was 2% or less of the combined total concentrations.</td></tr>
</table>

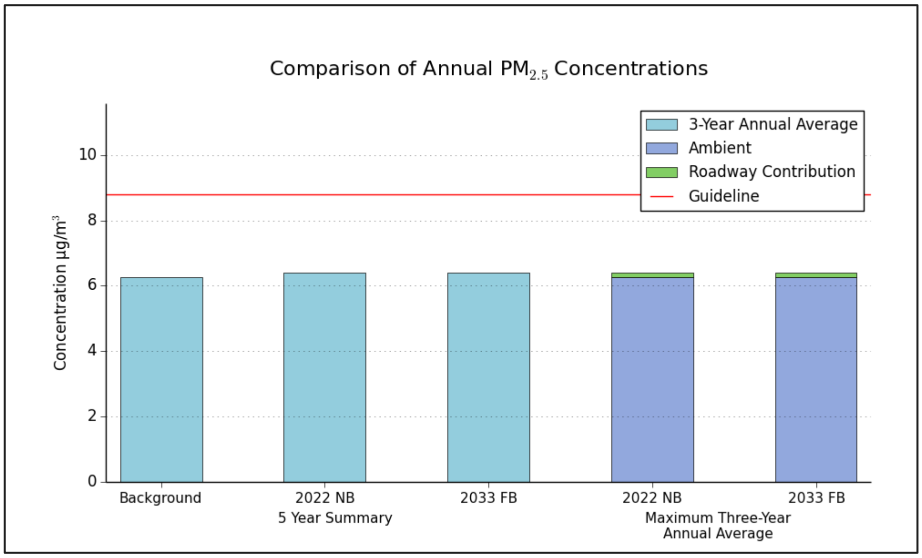
3.7.4 Fine Particulate Matter ($PM_{2.5}$)

Table 15 presents the predicted combined concentrations for the worst-case sensitive receptor for 24-hour and annual $PM_{2.5}$ based on the 5 years of meteorological data. The results conclude that:

- The average annual 98th percentile 24-hour $PM_{2.5}$ combined concentration, averaged over three consecutive years, was below the CAAQS.
- The three-year annual average $PM_{2.5}$ combined concentration was below the CAAQS.
- The $PM_{2.5}$ results were below the 3-year CAAQS. The highest 3 year rolling average of the yearly 98th percentile combined concentrations was calculated to be 17.60 µg/m³ or 65% of the CAAQS.

Table 15: Summary of Predicted $PM_{2.5}$ Concentrations

<table>
<tr><th>Statistical Analysis</th><th colspan="2">2033 FB</th></tr>
<tr><td rowspan="9">
</td><td colspan="2">% of CAAQs Guideline (24-hr):</td></tr>
<tr><td>98th Percentile</td><td>65%</td></tr>
<tr><td>90th Percentile</td><td>39%</td></tr>
<tr><td>Average</td><td>23%</td></tr>
<tr><td colspan="2">Roadway Contribution (24-hr):</td></tr>
<tr><td>98th Percentile</td><td>1%</td></tr>
<tr><td>90th Percentile</td><td>1%</td></tr>
<tr><td>Average</td><td>1%</td></tr>
<tr><td colspan="2"></td></tr>
</table>

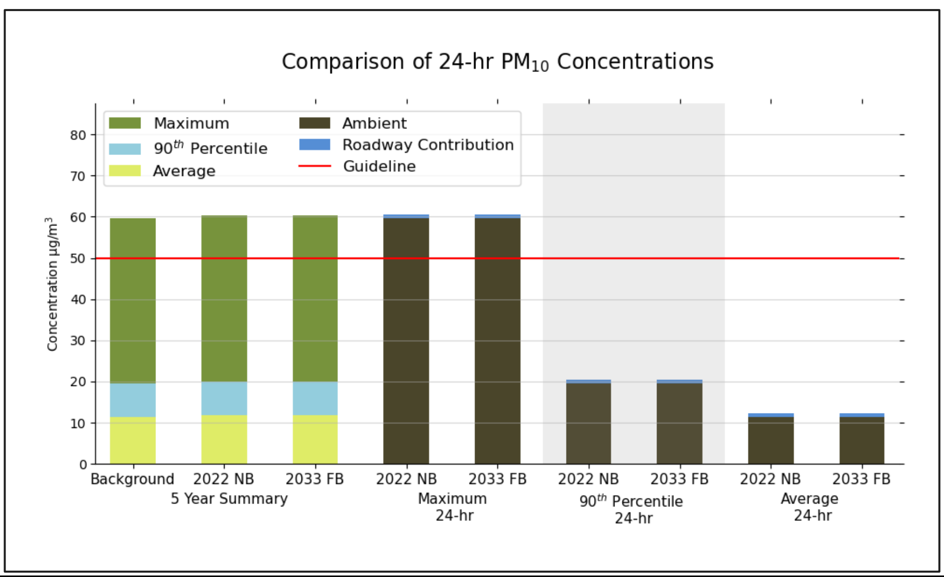
Statistical Analysis	2033 FB	
	**% of CAAQs Guideline (Annual):**	
	Maximum 3-Year Annual Average	76%
	Roadway Contribution (Annual):	
	Maximum 3-Year Annual Average	2%

3.7.5 Inhalable Particulate Matter (PM_{10})

Table 16 presents the predicted combined concentration for the worst-case sensitive receptor for 24-hour PM_{10} based on 5 years of meteorological data. The results conclude that:

- The maximum 24-hr PM_{10} combined concentration exceeded the MECP guideline.

Table 16: Summary of Predicted PM_{10} Concentrations

Statistical Analysis	2033 FB	
	**% of MECP Guideline (24-hr):**	
	Maximum	121%
	90th Percentile	40%
	Average	24%
	Roadway Contribution (24-hr):	
	Maximum	1%
	90th Percentile	2%
	Average	8%

<table>
<tr><th>Statistical Analysis</th><th>2033 FB</th></tr>
<tr><td colspan="2">

Conclusions:

- The maximum combined concentration of PM_{10} was found to exceed the standard of 50 µg/m³. It should be noted, however, that background concentrations alone exceeded the standard and that the roadway contribution is 1% of the combined total concentrations.
- Frequency analysis was conducted to determine the frequency of exceedances over the 5-year period.
- A total of 4 days exceeded the guideline in the five-year period, in both the Existing and Future Build scenarios, which equates to less than 1% of the time. Note that there are no additional exceedances between the Existing and Future Build scenarios.

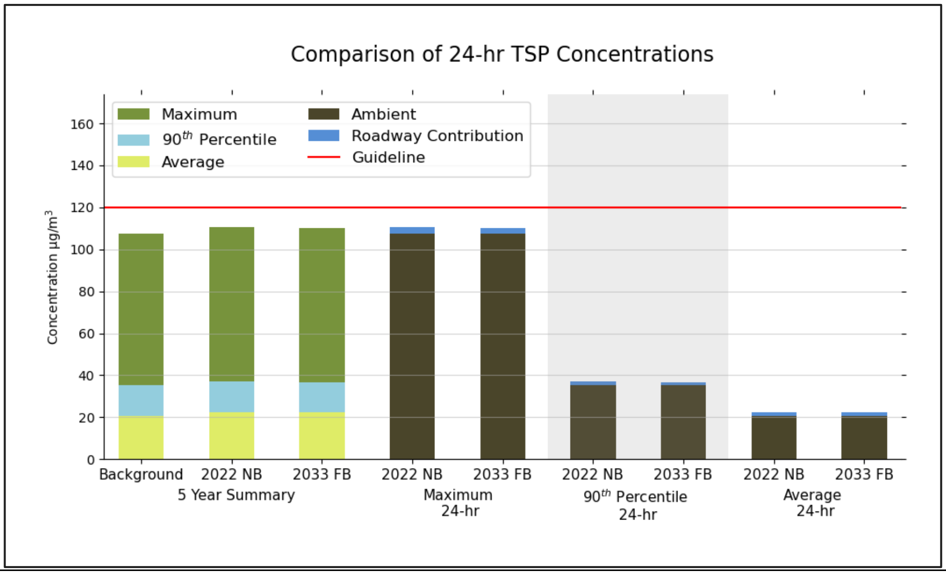
</td></tr>
</table>

3.7.6 Total Suspended Particulate Matter (TSP)

Table 17 presents the predicted combined concentration for the worst-case sensitive receptor for 24-hour TSP based on the 5 years of meteorological data. The results conclude that:

- The maximum 24-hr TSP combined concentration is below the MECP guideline.

Table 17: Summary of Predicted TSP Concentrations

<table>
<tr><th>Statistical Analysis</th><th colspan="2">2033FB</th></tr>
<tr><td rowspan="8">


</td><td colspan="2">% of MECP Guideline (24-hr):</td></tr>
<tr><td>Maximum</td><td>92%</td></tr>
<tr><td>90th Percentile</td><td>31%</td></tr>
<tr><td>Average</td><td>19%</td></tr>
<tr><td colspan="2">roadway Contribution (24-hr):</td></tr>
<tr><td>Maximum</td><td>3%</td></tr>
<tr><td>90th Percentile</td><td>8%</td></tr>
<tr><td>Average</td><td>7%</td></tr>
<tr><td colspan="3">

Conclusions:

- All combined concentrations were below their respective MECP guidelines.
- The contribution from the roadway to the combined concentrations was 3% or less of the total combined concentration.

</td></tr>
</table>

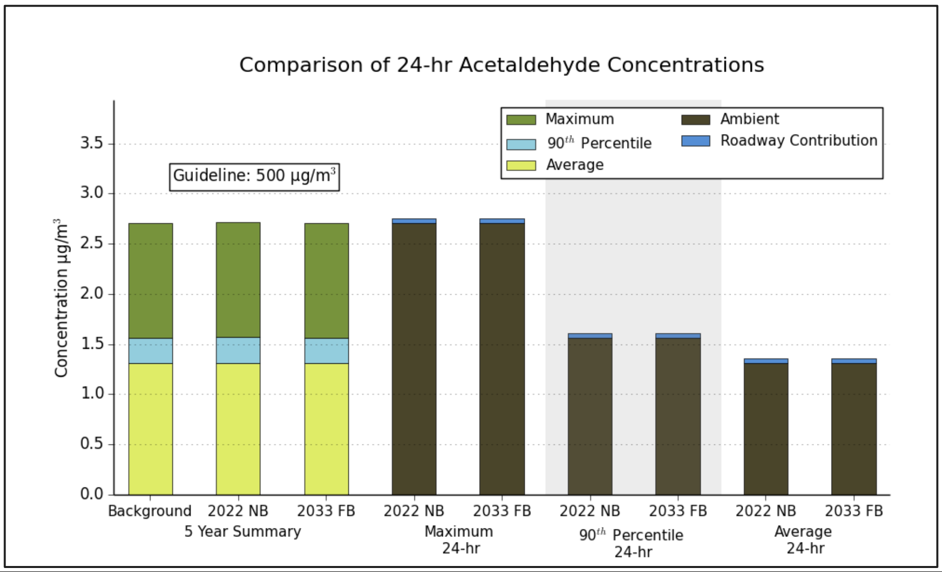
Ambient VOC concentrations are typically measured every 6 days in Ontario. To combine the ambient data with the modelled results, the measured concentrations were applied to the following 6 days when measurements were 6 days apart. When measurements were further than 6 days apart, the 90th percentile annual value was used to represent the missing data. This background data was added to the predicted hourly roadway concentrations at each receptor to obtain results for the VOCs.

3.7.7 Acetaldehyde

Table 18 presents the predicted combined concentration for the worst-case sensitive receptor for 24-hour acetaldehyde based on the 5 years of meteorological data. The results conclude that:

- The maximum 24-hour acetaldehyde combined concentration was well below the respective MECP guideline.

Table 18: Summary of Predicted Acetaldehyde Concentrations



Statistical Analysis	2033 FB	
	% of MECP Guideline (24-hr):	
	Maximum	<1%
	90th Percentile	<1%
	Average	<1%
	Roadway Contribution (24-hr):	
	Maximum	<1%
	90th Percentile	<1%
	Average	<1%

Conclusions:

- All combined concentrations were below the respective MECP guideline.
- The contribution from the roadway to the total combined concentrations was less than 1%.

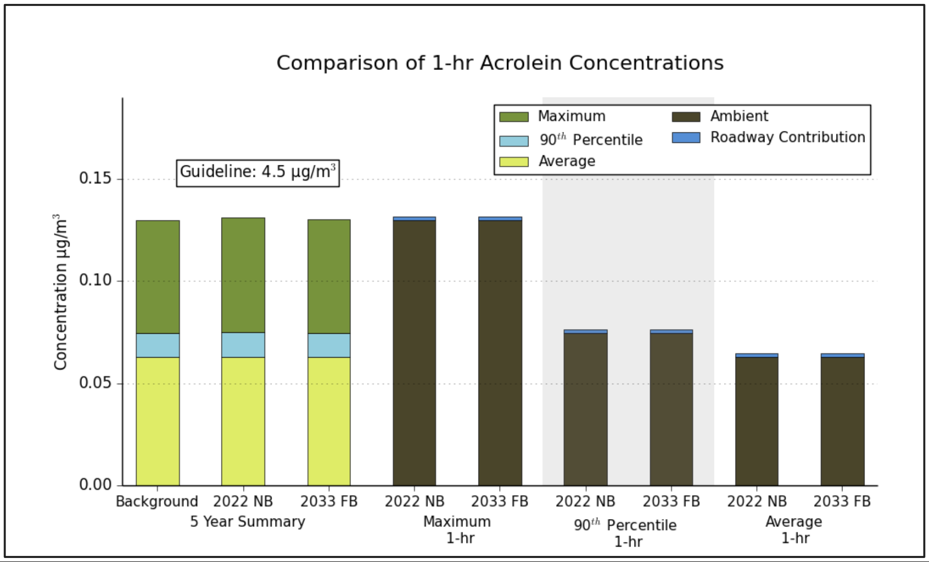
3.7.8 Acrolein

Table 19 presents the predicted combined concentrations for the worst-case sensitive receptor for 1-hour and 24-hour acrolein based on the 5 years of meteorological data. The results conclude that:

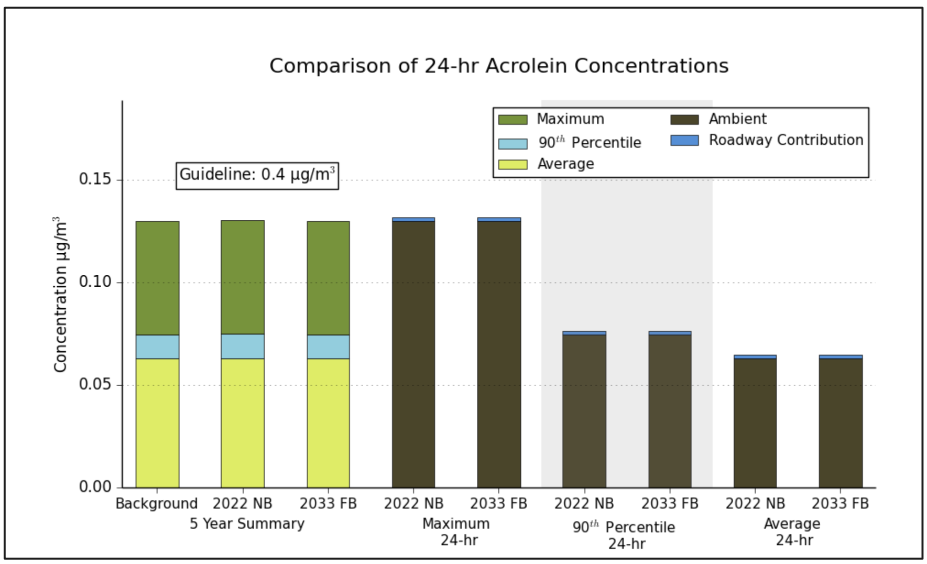
- The combined concentrations were below the respective MECP 1-hr guideline. The contribution from the roadway was less than 1%.
- The combined concentrations were below the respective MECP 24-hr guideline. The contribution from the roadway was less than 1%.

Table 19: Summary of Predicted Acrolein Concentrations

Statistical Analysis



2033 FB	
% of MECP Guideline (1-hr):	
Maximum	3%
90th Percentile	2%
Average	1%
Roadway Contribution (1-hr):	
Maximum	<1%
90th Percentile	<1%
Average	<1%



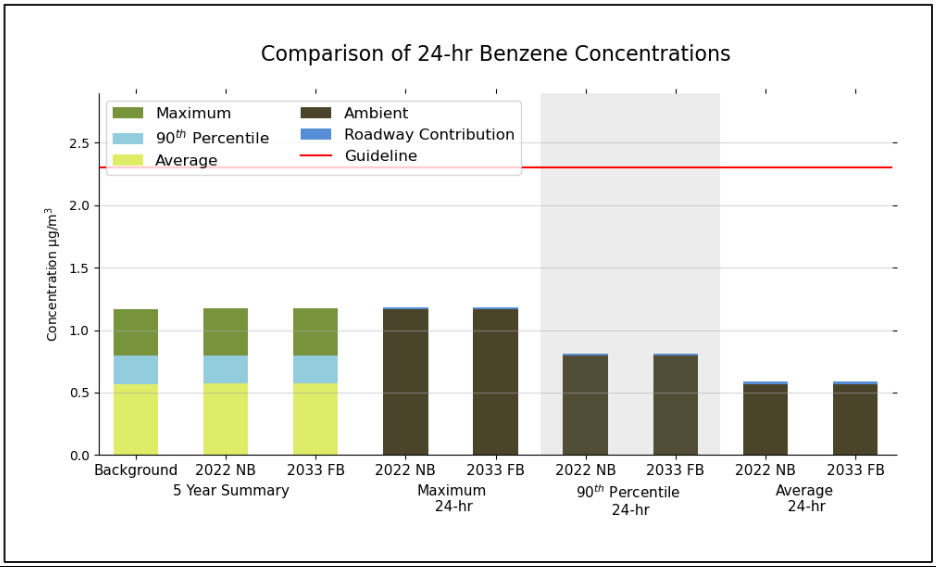
2033 FB	
% of MECP Guideline (24-hr):	
Maximum	32%
90th Percentile	19%
Average	16%
Roadway Contribution (24-hr):	
Maximum	<1%
90th Percentile	<1%
Average	<1%

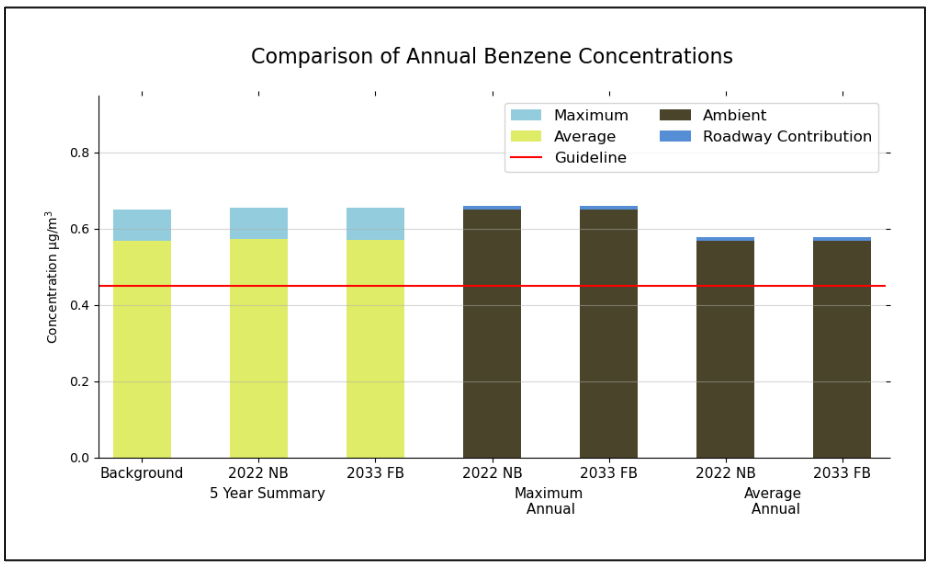
3.7.9 Benzene

Table 20 presents the predicted combined concentrations for the worst-case sensitive receptor for 24-hour and annual benzene based on the 5 years of meteorological data. The results conclude that:

- The combined concentrations were below the respective MECP 24-hr guideline. The contribution from the roadway was less than 1%.
- The combined concentration exceeded the MECP annual guideline. It should be noted that ambient concentrations were 145% of the guideline and the roadway contribution to the maximum was less than 1%.

Table 20: Summary of Predicted Benzene Concentrations

<table>
<tr><th>Statistical Analysis</th><th colspan="2">2033 FB</th></tr>
<tr><td rowspan="9">


</td><td colspan="2">% of MECP Guideline (24-hr):</td></tr>
<tr><td>Maximum</td><td>51%</td></tr>
<tr><td>90th Percentile</td><td>35%</td></tr>
<tr><td>Average</td><td>25%</td></tr>
<tr><td colspan="2">Roadway Contribution (24-hr):</td></tr>
<tr><td>Maximum</td><td><1%</td></tr>
<tr><td>90th Percentile</td><td><1%</td></tr>
<tr><td>Average</td><td><1%</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="7">


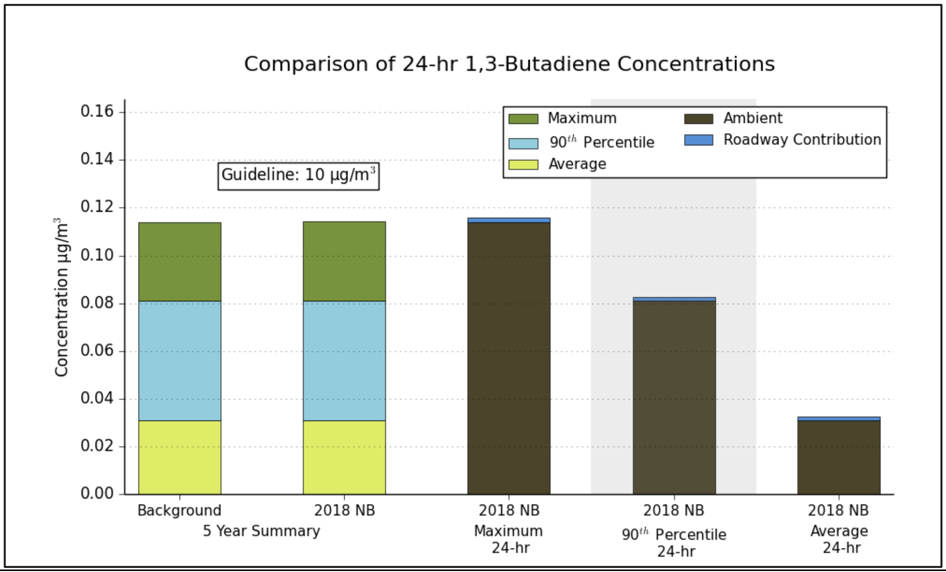
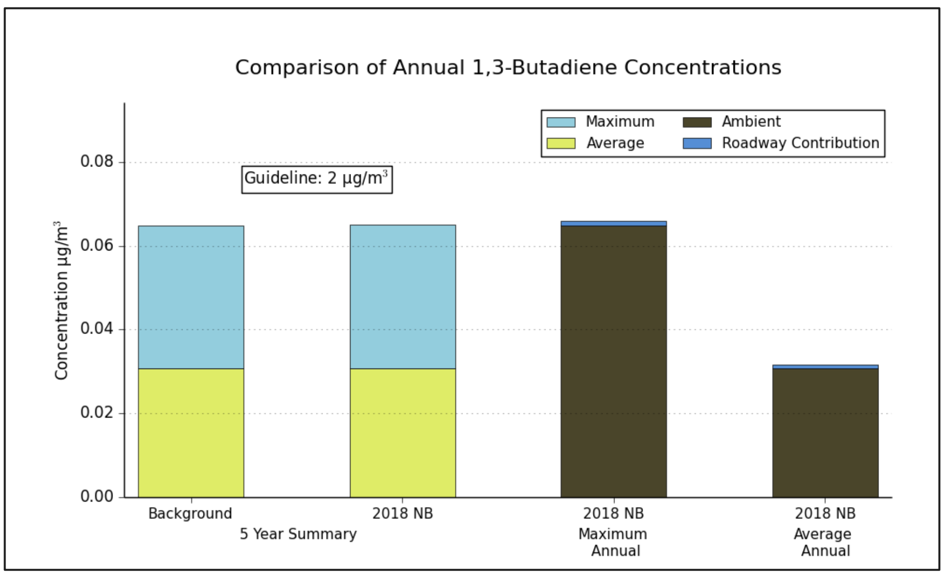
</td><td colspan="2">% of MECP Guideline (Annual):</td></tr>
<tr><td>Maximum</td><td>145%</td></tr>
<tr><td>Average</td><td>127%</td></tr>
<tr><td colspan="2">Roadway Contribution (Annual):</td></tr>
<tr><td>Maximum</td><td><1%</td></tr>
<tr><td>Average</td><td><1%</td></tr>
<tr><td colspan="2"></td></tr>
</table>

3.7.10 1,3-Butadiene

Table 21 presents the predicted combined concentrations for the worst-case sensitive receptor for 24-hour and annual 1,3-butadiene based on the 5 years of meteorological data. The results conclude that:

- The maximum 24-hour and annual 1,3-butadiene combined concentrations were well below the respective MECP guidelines for the Future Build Scenario.
- Overall, the combined concentrations were predicted to be a very small fraction of the applicable guidelines (3% or less).

Table 21: Summary of Predicted 1,3-Butadiene Concentrations

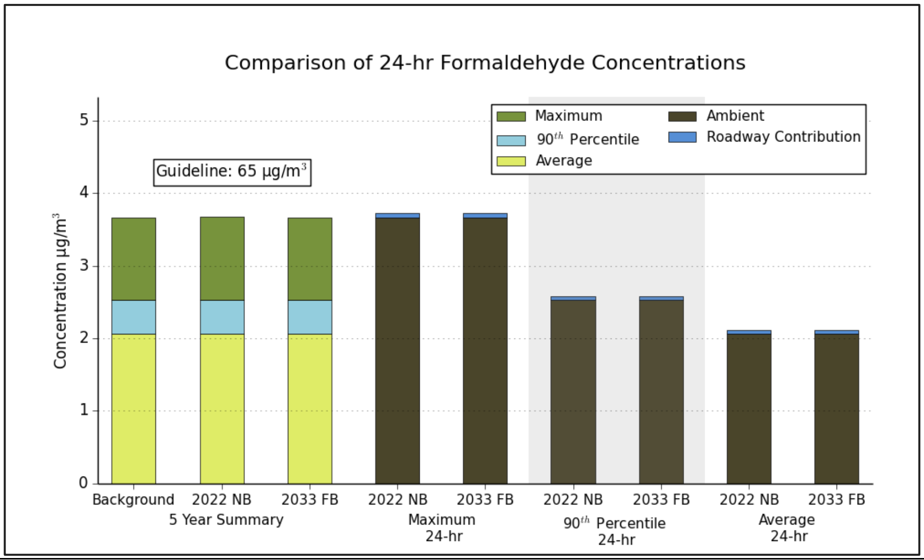
<table>
<tr><th>Statistical Analysis</th><th colspan="2">2033 NB</th></tr>
<tr><td rowspan="9">
</td><td colspan="2">% of MECP Guideline (24-hr):</td></tr>
<tr><td>Maximum</td><td>1%</td></tr>
<tr><td>90th Percentile</td><td><1%</td></tr>
<tr><td>Average</td><td><1%</td></tr>
<tr><td colspan="2">Roadway Contribution (24-hr):</td></tr>
<tr><td>Maximum</td><td><1%</td></tr>
<tr><td>90th Percentile</td><td><1%</td></tr>
<tr><td>Average</td><td><1%</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="7">
</td><td colspan="2">% of MECP Guideline (Annual):</td></tr>
<tr><td>Maximum</td><td>3%</td></tr>
<tr><td>Average</td><td>3%</td></tr>
<tr><td colspan="2">Roadway Contribution (Annual):</td></tr>
<tr><td>Maximum</td><td><1%</td></tr>
<tr><td>Average</td><td><1%</td></tr>
<tr><td colspan="2"></td></tr>
</table>

3.7.11 Formaldehyde

Table 22 presents the predicted combined concentration for the worst-case sensitive receptor for 24-hour formaldehyde based on the 5 years of meteorological data. The results conclude that:

- The maximum 24-hour formaldehyde combined concentration was below the respective MECP guideline.

Table 22: Summary of Predicted Formaldehyde Concentrations

<table>
<tr><th>Statistical Analysis</th><th colspan="2">2033 FB</th></tr>
<tr><td rowspan="9">
</td><td colspan="2">% of MECP Guideline (24-hr):</td></tr>
<tr><td>Maximum</td><td>6%</td></tr>
<tr><td>90th Percentile</td><td>4%</td></tr>
<tr><td>Average</td><td>3%</td></tr>
<tr><td colspan="2">Roadway Contribution (24-hr):</td></tr>
<tr><td>Maximum</td><td><1%</td></tr>
<tr><td>90th Percentile</td><td><1%</td></tr>
<tr><td>Average</td><td><1%</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td colspan="3">Conclusions:
• All combined concentrations were below the respective MECP guideline.
• The contribution from the roadway to the maximum combined concentration was <1%.</td></tr>
</table>

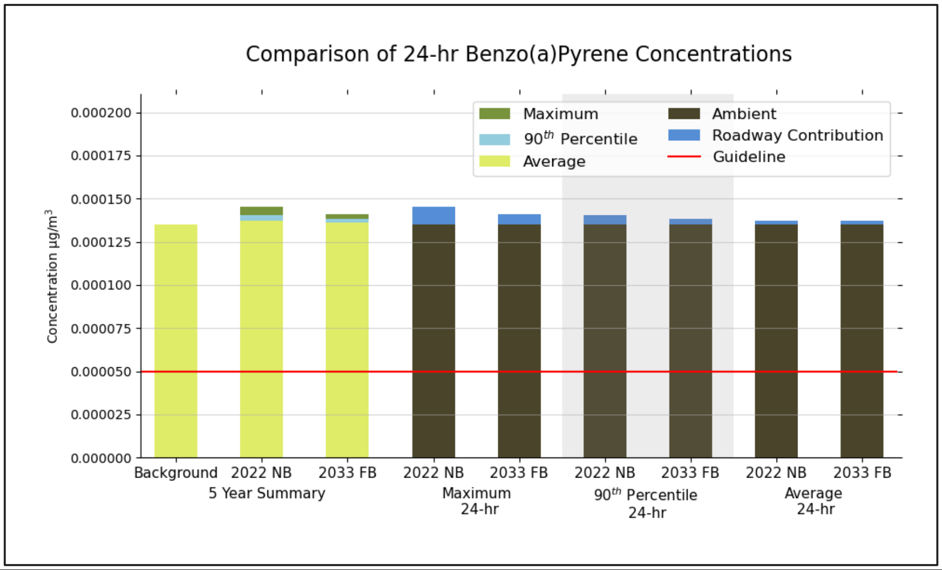
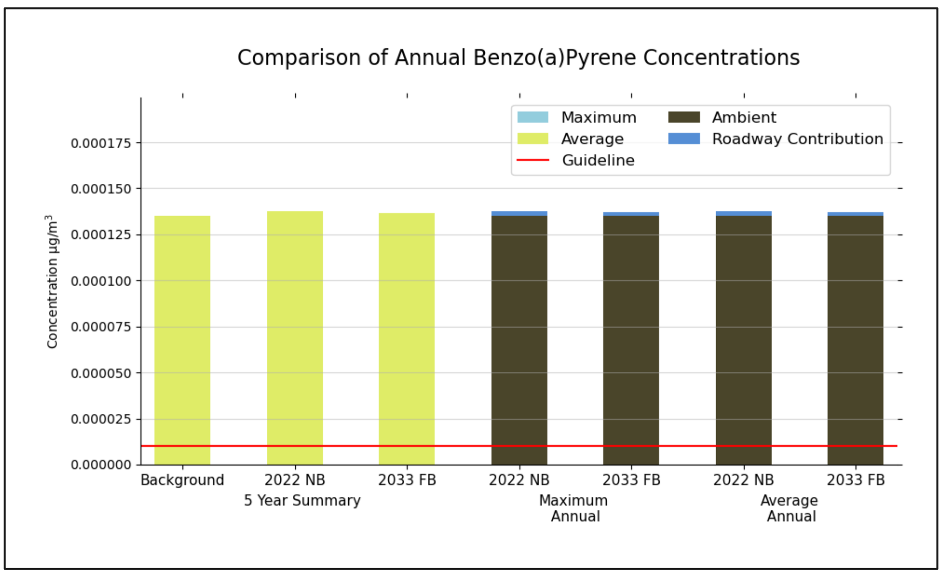
3.7.12 Benzo[a]Pyrene

It was found that the available ambient Benzo[a]Pyrene data was measured at inconsistent frequencies and time intervals. Therefore, the 90th percentile value of all measured concentrations between 2017 to 2022 at the Toronto West NAPS station was used in the assessment to assess combined impacts.

Table 23 presents the predicted combined concentrations for the worst-case sensitive receptor for 24-hour and annual Benzo[a]Pyrene. The results conclude that:

- The maximum combined concentrations were above the MECP 24-hr guideline for all modelled scenarios. The 90th percentile background concentration at Toronto West station was 0.000135 µg/m^3 or 270% of the guideline.
- The maximum roadway concentrations were above the MECP annual guideline for all modelled scenarios. The 90th percentile annual average background concentration at Toronto West station was 0.0000925 µg/m^3 or 925% of the guideline.

Table 23: Summary of Predicted Benzo[a]Pyrene Concentrations

<table>
<tr><th>Statistical Analysis</th><th colspan="2">2033 FB</th></tr>
<tr><td rowspan="8">
</td><td colspan="2">% of MECP Guideline (24-hr):</td></tr>
<tr><td>Maximum</td><td>282%</td></tr>
<tr><td>90th Percentile</td><td>276%</td></tr>
<tr><td>Average</td><td>273%</td></tr>
<tr><td colspan="2">Roadway Contribution (24-hr):</td></tr>
<tr><td>Maximum</td><td>4%</td></tr>
<tr><td>90th Percentile</td><td><1%</td></tr>
<tr><td>Average</td><td><1%</td></tr>
<tr><td rowspan="7">
</td><td colspan="2">% of MECP Guideline (Annual):</td></tr>
<tr><td>Maximum</td><td>1364%</td></tr>
<tr><td>Average</td><td>1363%</td></tr>
<tr><td colspan="2">Roadway Contribution (Annual):</td></tr>
<tr><td>Maximum</td><td>1%</td></tr>
<tr><td>Annual Average</td><td>1%</td></tr>
<tr><td colspan="2"></td></tr>
</table>

4.0 Greenhouse Gas Assessment

In addition to the contaminants of interest assessed in the local air quality assessment, greenhouse gas (GHG) emissions were predicted from the project. Potential impacts were assessed by calculating the relative change in total emissions between the 2022 Existing and 2033 Future Build scenarios as well as comparing the total emission to the 2030 provincial and Canada-wide GHG targets. Total GHG emissions from the roadway were determined based on the length of the roadway, traffic volumes, and predicted emission rates.

From a GHG perspective, the contaminants of concern from motor vehicle emissions are carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). These GHGs can be further classified according to their Global Warming Potential (GWP). The GWP is a multiplier developed for each GHG, which allows comparison of the ability of each GHG to trap heat in the atmosphere, relative to carbon dioxide. Using these multipliers, total GHG emissions can be classified as CO_2 equivalent emissions. For this assessment, the MOVES model was used to determine total CO_2 equivalent emission rates for the posted speed and heavy-duty vehicle percentage on Stevenson Road North. Table 24 summarizes the length of the roadway, traffic volumes, and emission rates used to determine total GHG emissions on Stevenson Road North in the 2022 Existing and 2033 Future Build scenarios.

Table 24: Summary of Stevenson Road North Traffic Volumes, Roadway Length and Emission Rates

Roadway	2022 Two-Way AADT	2033 Two-Way AADT	Length of Roadway (Miles)	Heavy/Medium Duty Vehicle Percentage (%)	Posted Speed (km/hr)	2022 CO_2 Equivalent Emission Rate (g/VMT)	2033 CO_2 Equivalent Emission Rate (g/VMT)
Stevenson Road North	1,617	1,991	1.24	4.4/6.7	50	478	344

The total predicted annual GHG emissions for the 2022 Existing and 2033 Future Build scenarios are shown in Table 25. Also shown is the percent change in total GHG emissions between the scenarios. The results show that the total GHG emissions decrease by 11%. While there is a 23% increase in road traffic, the decrease in the overall CO_2 equivalent emissions is due to improvements in vehicles emissions due to EPA predictions in engine efficiency and federal targets.

Table 26 shows the GHG emissions on Stevenson Road North represent 0.00022% of the provincial target and 0.00007% of the Canada-wide target. The contribution of GHG emissions from the project is small in comparison to these provincial and national targets.

Table 25: Changes in Predicted GHG Emissions

Roadway	2022 CO_2 Equivalent Emission Rate (tonnes/year)	2033 CO_2 Equivalent Emission Rate (tonnes/year)	Changes in Emission (%)
Stevenson Road North	350	310	-11%

Table 26: Predicted Future Build GHG Emissions Compare to GHG Targets

Roadway	Total CO_2 Equivalent (tonnes/year)
Stevenson Road North	310
Canada-Wide 2030 GHG Target1	443,000,000
Ontario-Wide 2030 GHG Target2	144,000,000
Comparison to Canada-wide Target	0.00007%
Comparison to Ontario-wide Target	0.00022%

5.0 Air Quality Impacts During Construction

During construction of the roadway, dust is the primary contaminant of concern. Other contaminants including NO_x and VOC's may be emitted from equipment used during construction activities. Due to the temporary nature of construction activities, there are no air quality criteria specific to construction activities. However, the Environment Canada "Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities" document provides several mitigation measures for reducing emissions during construction activities. Mitigation techniques discussed in the document include material wetting or use of non-chloride dust suppressants to reduce dust, use of wind barriers, and limiting exposed areas which may be a source of dust and equipment washing. Furthermore, as the 24-hr PM_{10} level will exceed the corresponding guideline due to ambient background levels, additional mitigation measures such as planting vegetation (for example coniferous species and shrubs) should be considered to minimize particulate impacts at nearby sensitive receptors. It is recommended that these best management practices be followed during construction of the roadway to reduce any air quality impacts that may occur.

6.0 Conclusion

Presented in Table 27 is a summary of the worst-case modelling results for the 2033 Future Build based on the 5-years of meteorological data. For each contaminant, combined concentrations are presented as a percentage of the applicable guideline.

The maximum combined concentrations for the Future Build emissions scenario were below their respective MECP guidelines or CAAQS, with the exception of the 24-hr PM_{10}, annual benzene, and 24-hour and annual Benzo[a]Pyrene. Note that background concentrations exceeded the guideline for all of these contaminant averaging periods. The overall contribution from the roadway emissions to the combined concentrations was 8% or less.

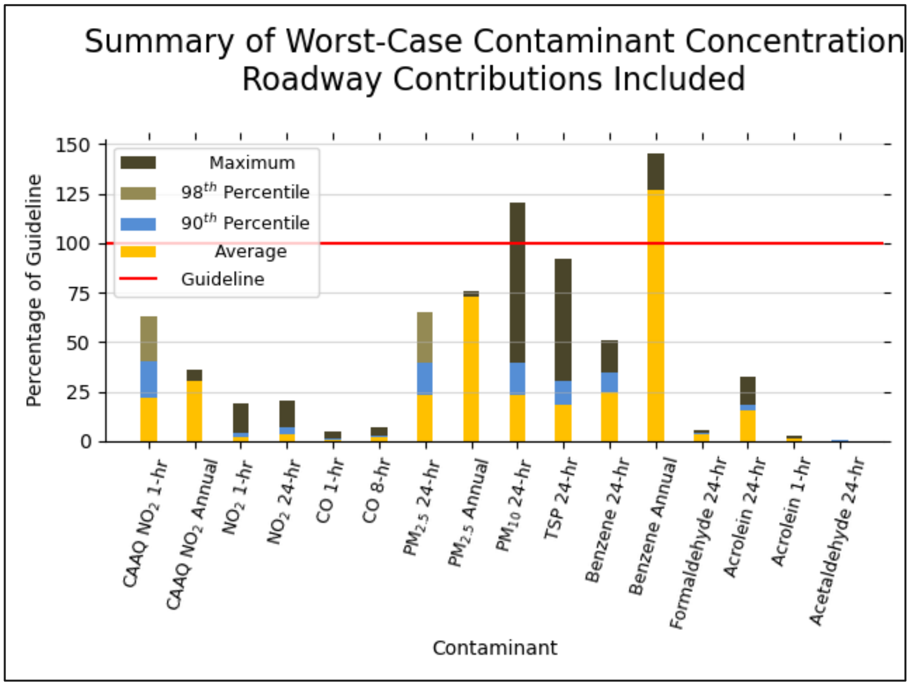
Mitigation measures are not warranted, due to the small number of days which are expected to exceed the guideline.

[1] Environment and Climate Change Canada (2030) Canadian Environmental Sustainability Indicators: Progress towards Canada's greenhouse gas emissions reduction plan. Available at: Clean Air, Strong Economy - Canada.ca

[2] Ontario Climate Change Strategy. Available at: 2030 Ontario Emissions Scenario as of March 25, 2022 (prod-environmental-registry.s3.amazonaws.com)

Table 27: Worst-Case Summary of Predicted Combined Contaminant Concentrations 2033 Future Build

5 Year Statistical Summary



1. Note Benzo[a]Pyrene is not shown on this graph, due to the fact that it exceeds the guideline by a significant amount and therefore skews the scale.

% of Guideline	
2033 FB	
CAAQ NO_2 (1-hr)	63%
CAAQ NO_2 (Annual)	36%
NO_2 (1-hr)	19%
NO_2 (24-hr)	21%
CO (1-hr)	5%
CO (8-hr)	7%
$PM_{2.5}$ (24-hr)	65%
$PM_{2.5}$ (Annual)	76%
PM_{10}	121%
TSP	92%
Acetaldehyde	<1%
Acrolein (1-hr)	3%
Acrolein (24-hr)	32%
Benzene (24-hr)	51%
Benzene (Annual)	145%
1,3-Butadiene (24-hr)	1%
1,3-Butadiene (Annual)	3%
Formaldehyde	6%
Benzo[a]Pyrene (24-hr)[1]	282%
Benzo[a]Pyrene (Annual)[1]	1364%

7.0 Closure

We trust that the information contained in this report meets your needs; however, should you have questions on the above report, please contact SLR.

Regards,

SLR Consulting (Canada) Ltd.

LICENSED PROFESSIONAL ENGINEER
L. F. CLARK
100191490
2025-01-07
PROVINCE OF ONTARIO

Mina Ghorbani, M.Eng., E.I.T.
Air Quality Engineer-in-Training

Laura Clark, P.Eng.
Senior Air Quality Engineer

Figures

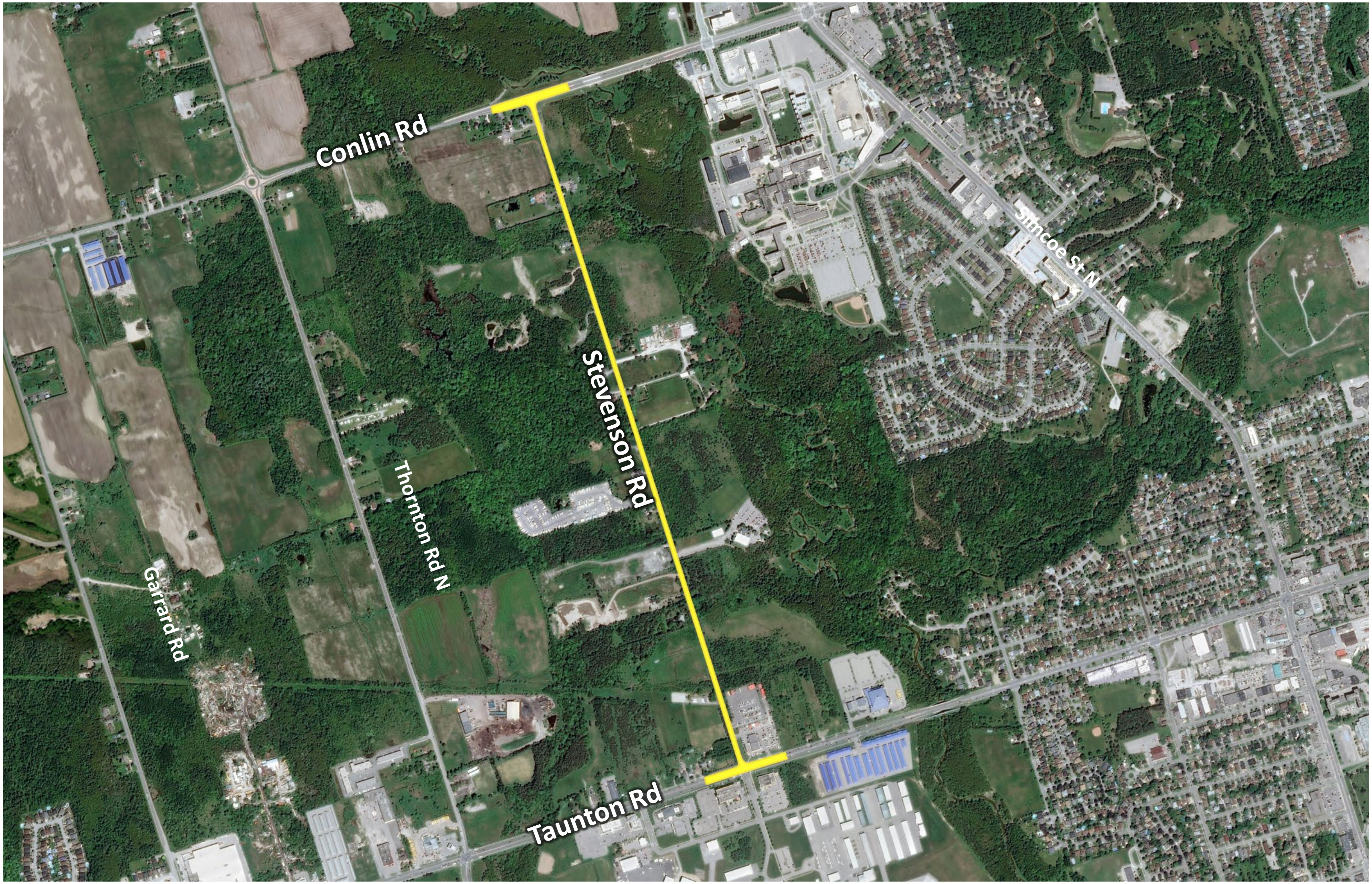
Air Quality Assessment of Stevenson Road North (Taunton Road West to Conlin Road)

City of Oshawa, Ontario

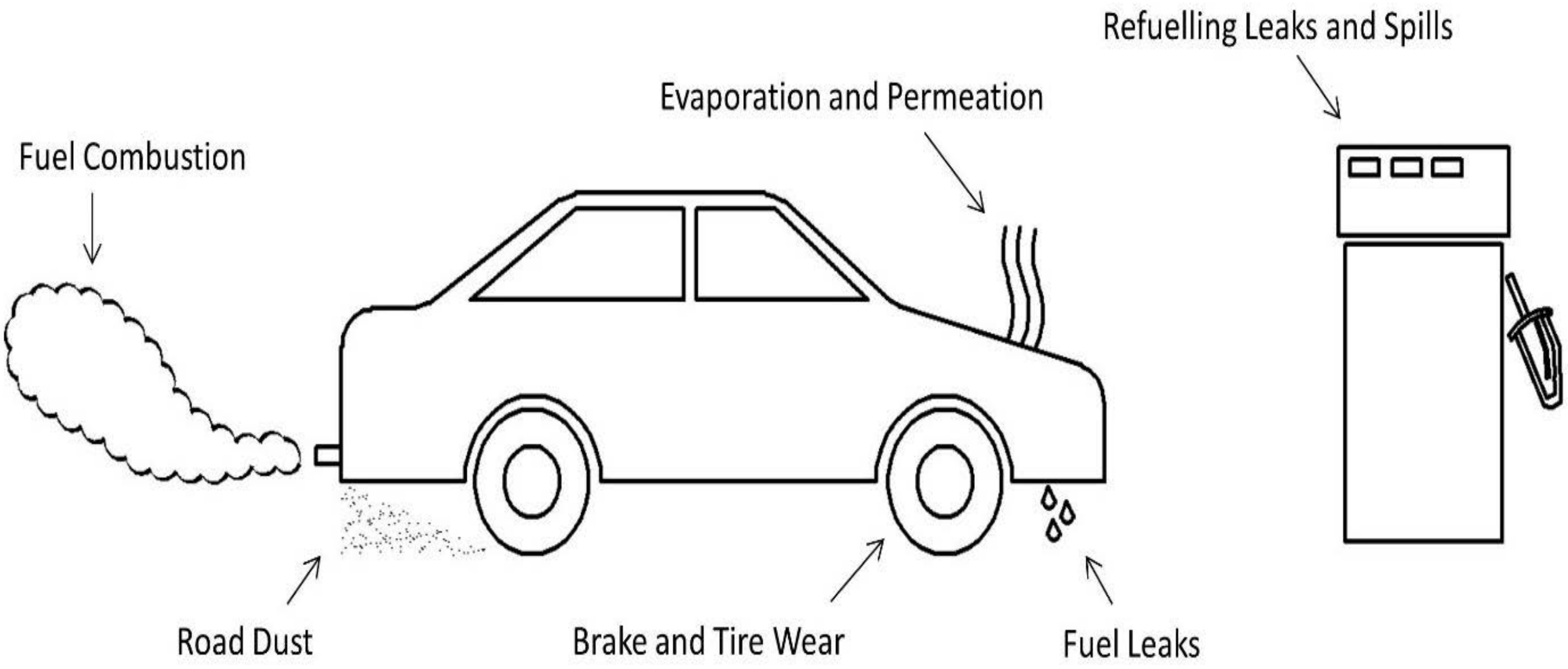
Gannett Fleming

SLR Project No.: 241.011196.00002

January 7, 2025

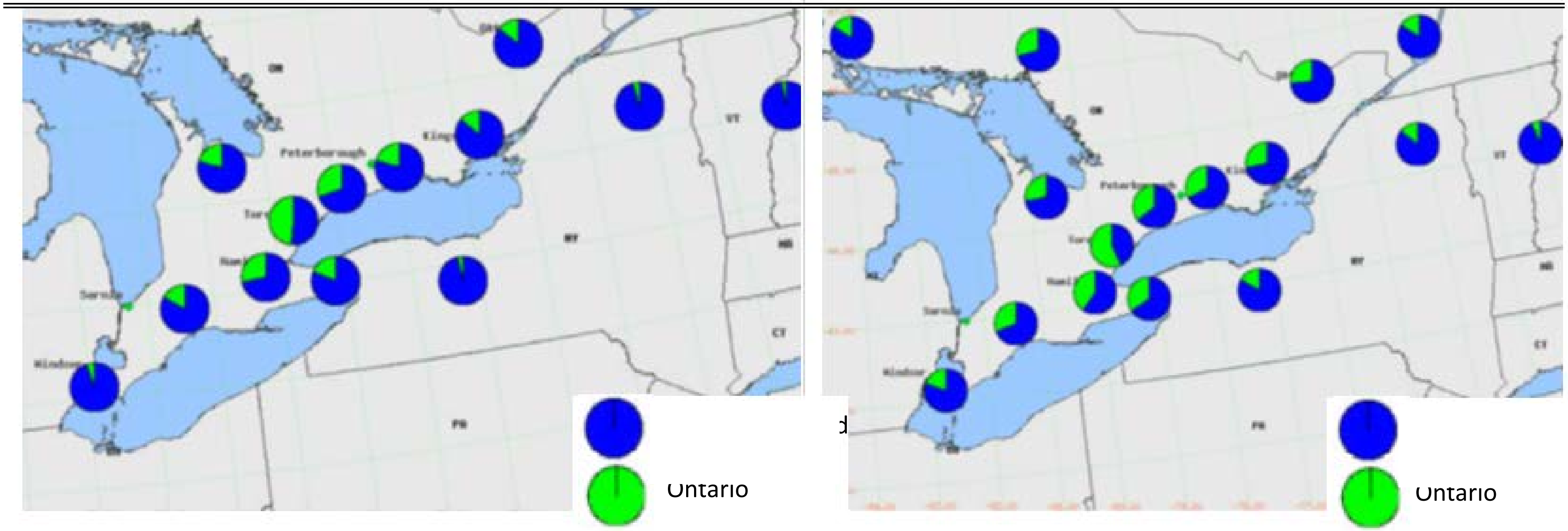


GANNETT FLEMING	True North	Scale: 1:12000	METRES	SLR
STEVENSON ROAD NORTH (TAUNTON ROAD WEST TO CONLIN ROAD) - OSHAWA, ONTARIO		Date: Jan 2025 / Rev 0.0	Figure No. 1	
SITE AND CONTEXT PLAN		Project No. 241.011196.00002		

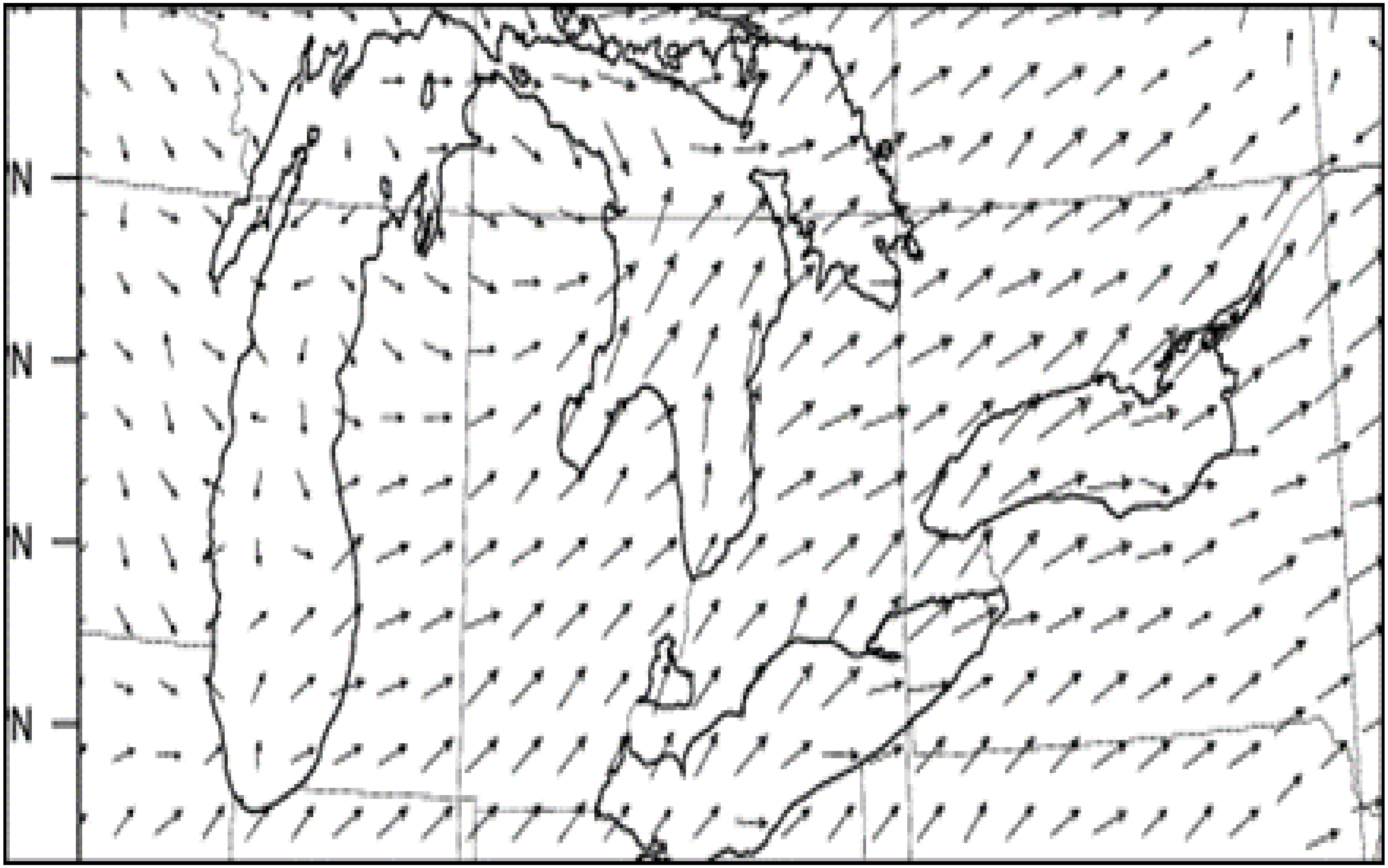


GANNETT FLEMING	True North	Scale: n/a		METRES	SLR
STEVENSON ROAD NORTH (TAUNTON ROAD WEST TO CONLIN ROAD) - OSHAWA, ONTARIO	NA	Date: Jan 2025	Rev 0.0	Figure No. 2	
MOTOR VEHICLE EMISSION SOURCES		Project No. 241.011196.00002			

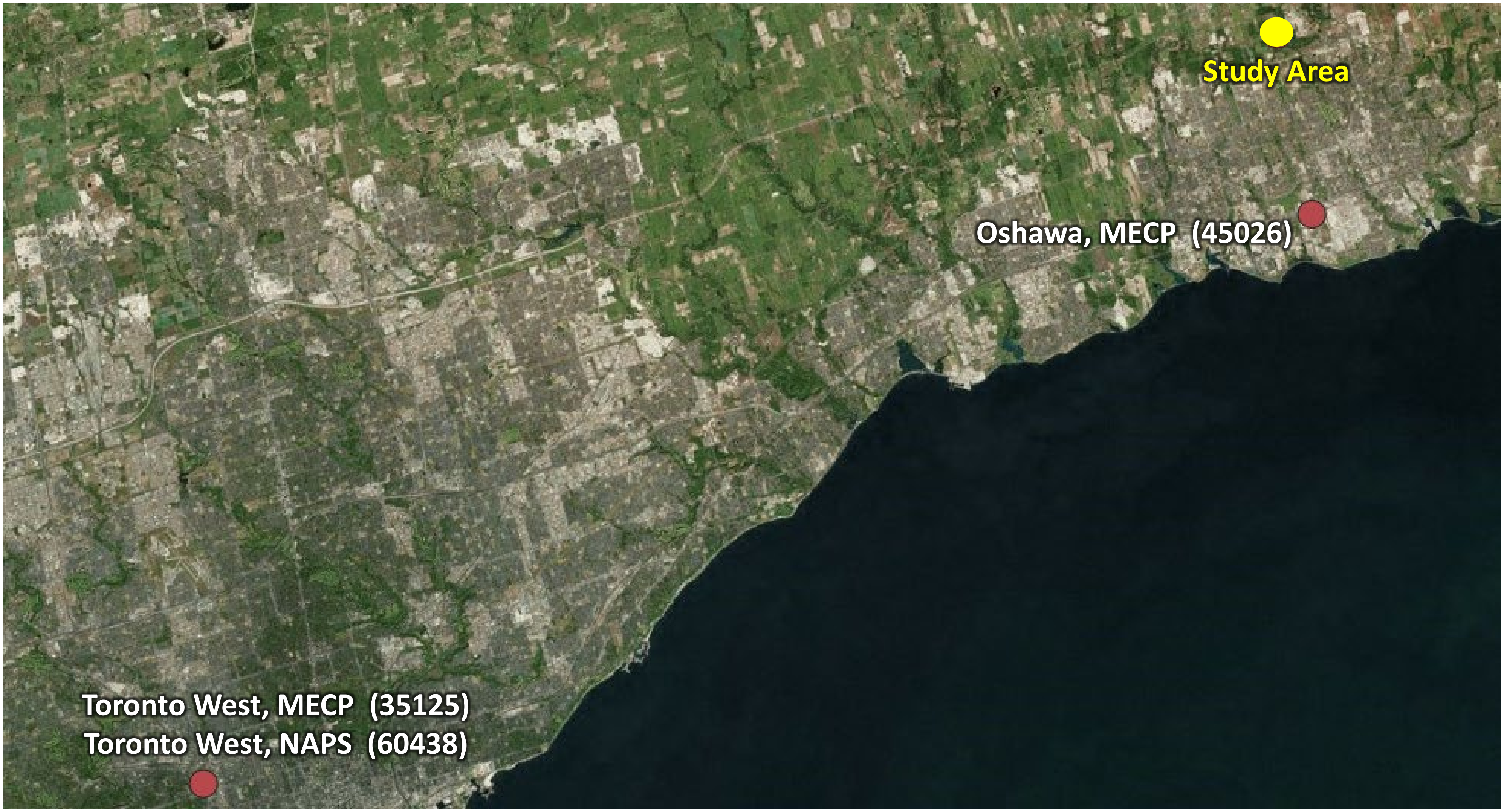
High $PM_{2.5}$ Days	Average $PM_{2.5}$ of Spring/Summer Season



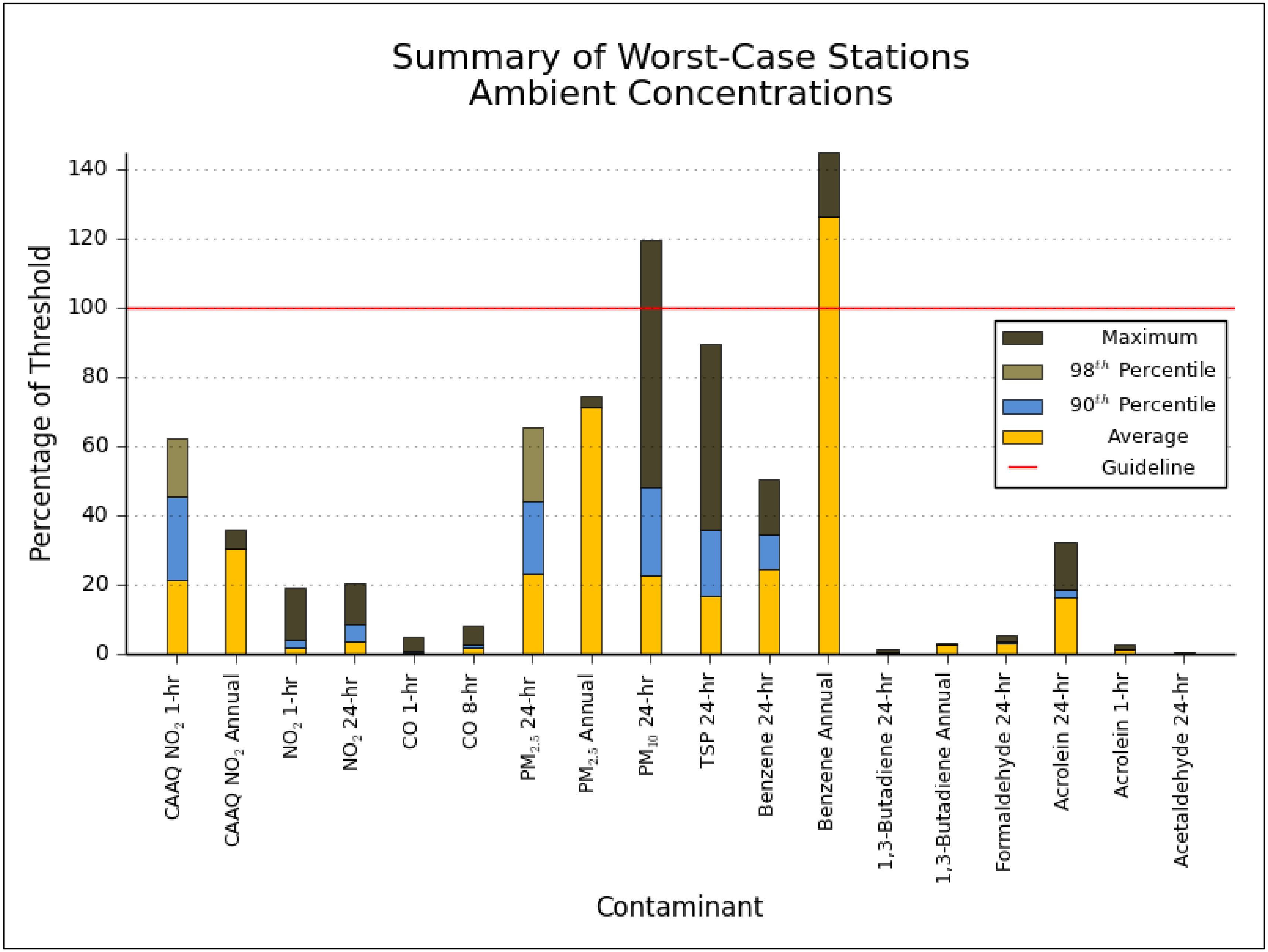
GANNETT FLEMING	True North	Scale: n/a	METRES	SLR
STEVENSON ROAD NORTH (TAUNTON ROAD WEST TO CONLIN ROAD) - OSHAWA, ONTARIO	NA	Date: Jan 2025 Rev 0.0	Figure No. 3	
EFFECT OF TRANS-BOUNDARY AIR POLLUTION (MECP, 2005)		Project No. 241.011196.00002		



GANNETT FLEMING	True North	Scale: n/a	METRES	SLR
STEVENSON ROAD NORTH (TAUNTON ROAD WEST TO CONLIN ROAD) - OSHAWA, ONTARIO	NA	Date: Jan 2025 Rev 0.0	Figure No. 4	
TYPICAL WIND DIRECTION DURING AN ONTARIO SMOG EPISODE		Project No. 241.011196.00002		



GANNETT FLEMING	True North	Scale: n/a		METRES	SLR
STEVENSON ROAD NORTH (TAUNTON ROAD WEST TO CONLIN ROAD) - OSHAWA, ONTARIO	NA	Date: Jan 2025	Rev 0.0	Figure No. **5**	
LOCATION OF AMBIENT MONITORING STATIONS, RELEVANT TO THE STUDY AREA		Project No. 241.011196.00002			

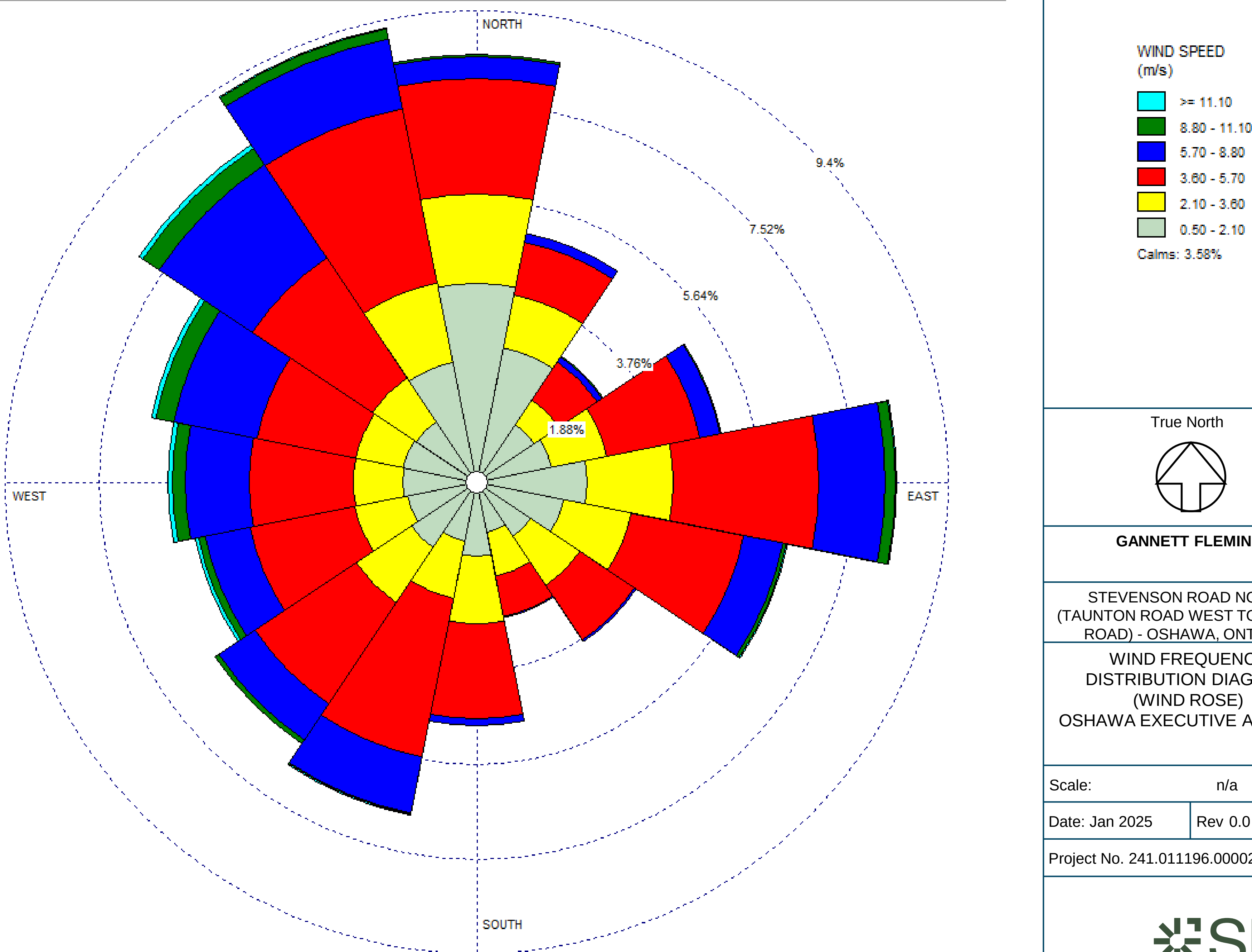


GANNETT FLEMING	True North	Scale: n/a	METRES
STEVENSON ROAD NORTH (TAUNTON ROAD WEST TO CONLIN ROAD) - OSHAWA, ONTARIO	NA	Date: Jan 2025 Rev 0.0	Figure No. 6
WORST-CASE SUMMARY OF AMBIENT BACKGROUND CONCENTRATIONS		Project No. 241.011196.00002	

SLR

GANNETT FLEMING	True North	Scale: n/a		METRES	
STEVENSON ROAD NORTH (TAUNTON ROAD WEST TO CONLIN ROAD) - OSHAWA, ONTARIO	NA	Date: Jan 2025	Rev 0.0	Figure No. 7A	SLR
SENSITIVE RECEPTOR LOCATIONS		Project No. 241.011196.00002			

GANNETT FLEMING	True North	Scale: n/a	METRES	SLR
STEVENSON ROAD NORTH (TAUNTON ROAD WEST TO CONLIN ROAD) - OSHAWA, ONTARIO	NA	Date: Jan 2025 Rev 0.0	Figure No. 7B	
SENSITIVE RECEPTOR LOCATIONS		Project No. 241.011196.00002		



True North

GANNETT FLEMING

STEVENSON ROAD NORTH
(TAUNTON ROAD WEST TO CONLIN ROAD) - OSHAWA, ONTARIO

WIND FREQUENCY
DISTRIBUTION DIAGRAM
(WIND ROSE)
OSHAWA EXECUTIVE AIRPORT

Scale: n/a		METRES
Date: Jan 2025	Rev 0.0	Figure No. **8**
Project No. 241.011196.00002		

SLR

Appendix A Result for Each Receptor

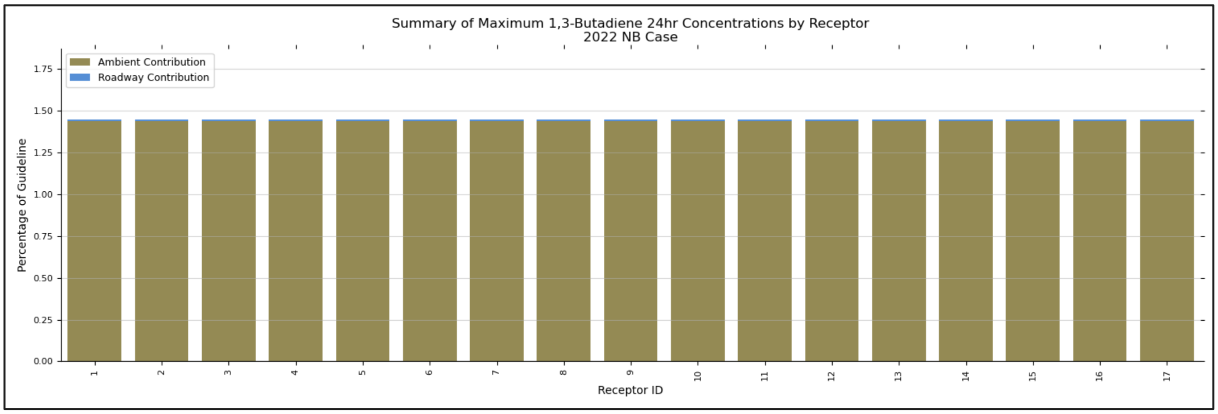
Air Quality Assessment of Stevenson Road North (Taunton Road West to Conlin Road)

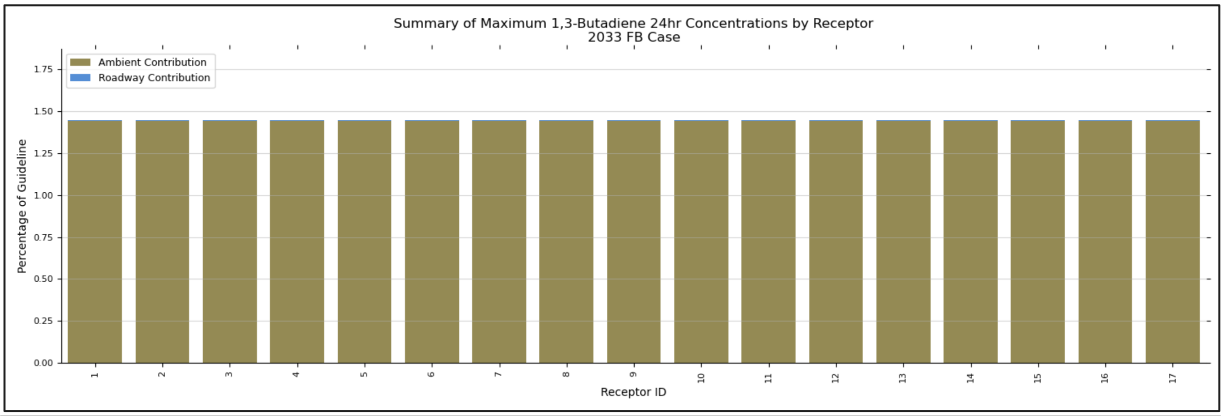
City of Oshawa, Ontario

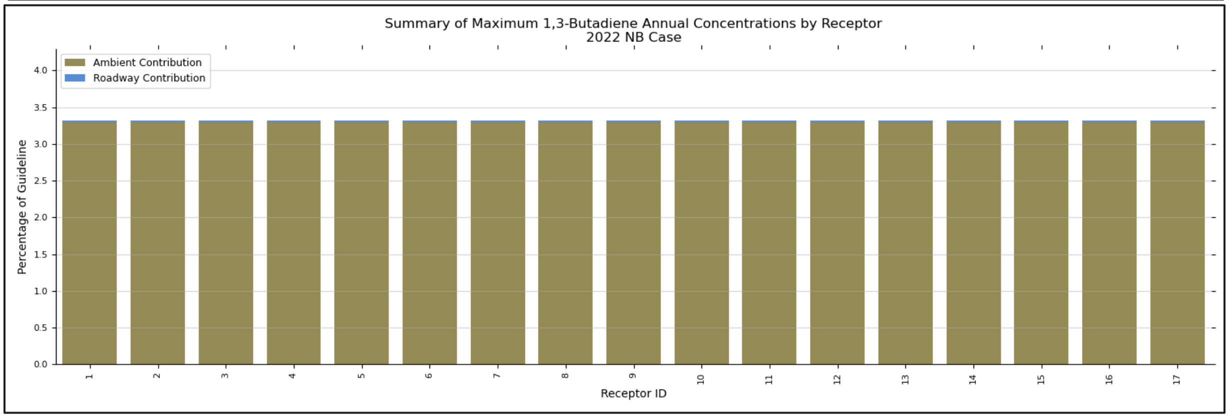
Gannett Fleming

SLR Project No.: 241.011196.00002

January 7, 2025


Summary of Maximum 1,3-Butadiene 24hr Concentrations by Receptor
2022 NB Case
Ambient Contribution
Roadway Contribution
Percentage of Guideline
Receptor ID


Summary of Maximum 1,3-Butadiene 24hr Concentrations by Receptor
2033 FB Case
Ambient Contribution
Roadway Contribution
Percentage of Guideline
Receptor ID


Summary of Maximum 1,3-Butadiene Annual Concentrations by Receptor
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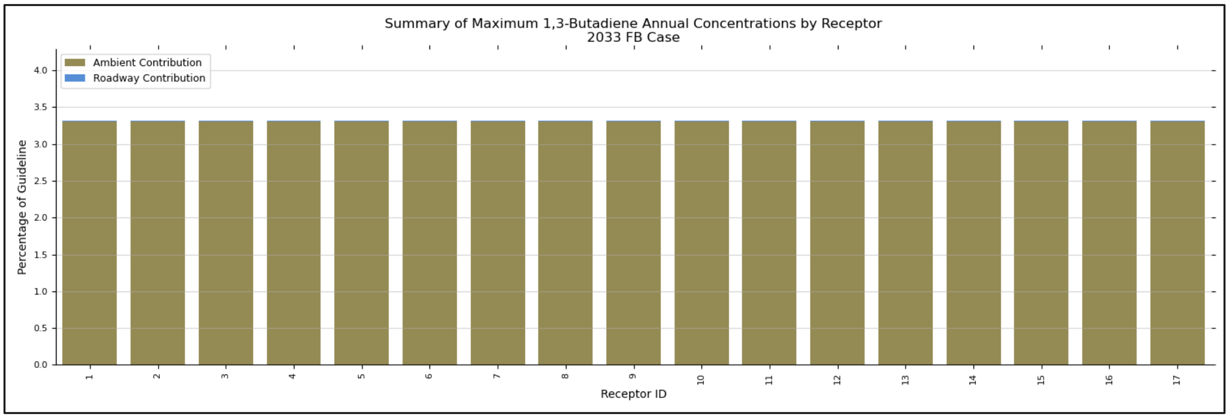
Roadway Contribution
Percentage of Guideline
Receptor ID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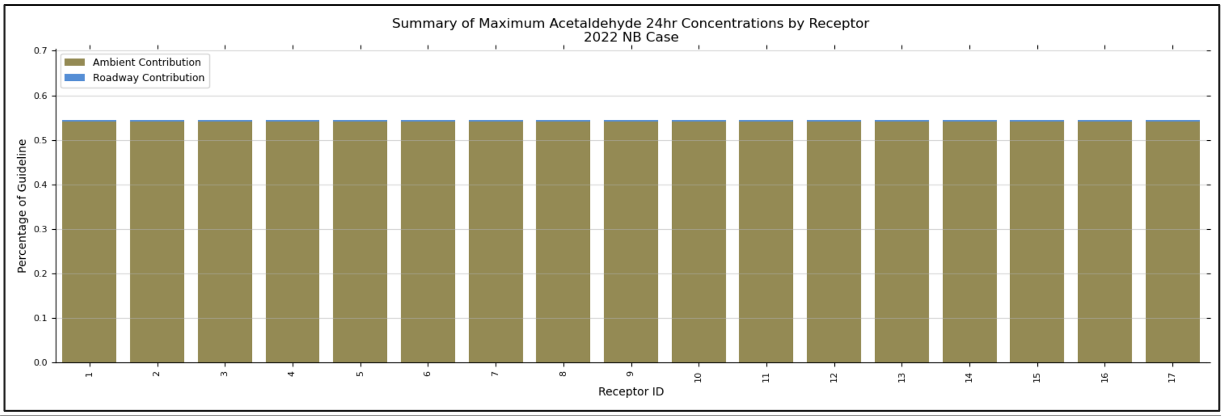
Ambient Contribution
Roadway Contribution
Percentage of Guideline
Receptor ID


Summary of Maximum Acetaldehyde 24hr Concentrations by Receptor
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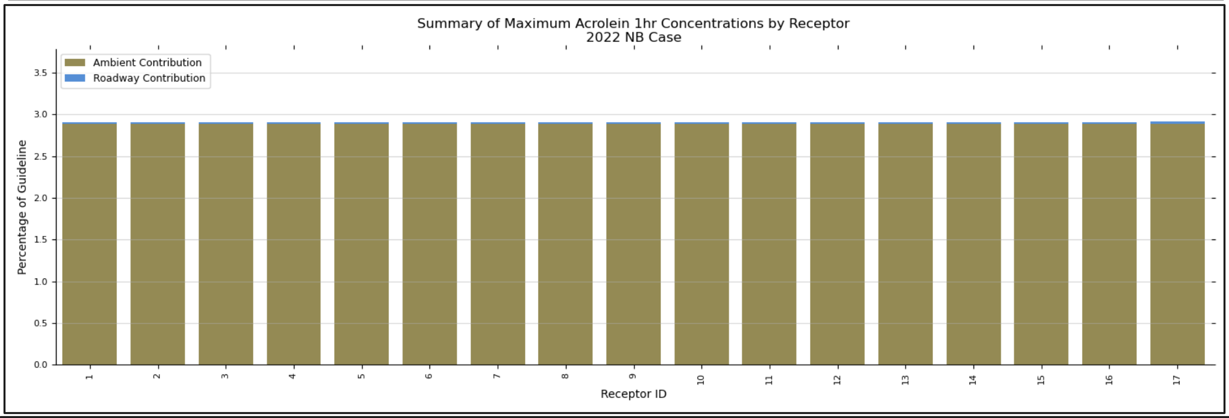
Roadway Contribution
Percentage of Guideline
Receptor ID


Summary of Maximum Acrolein 1hr Concentrations by Receptor
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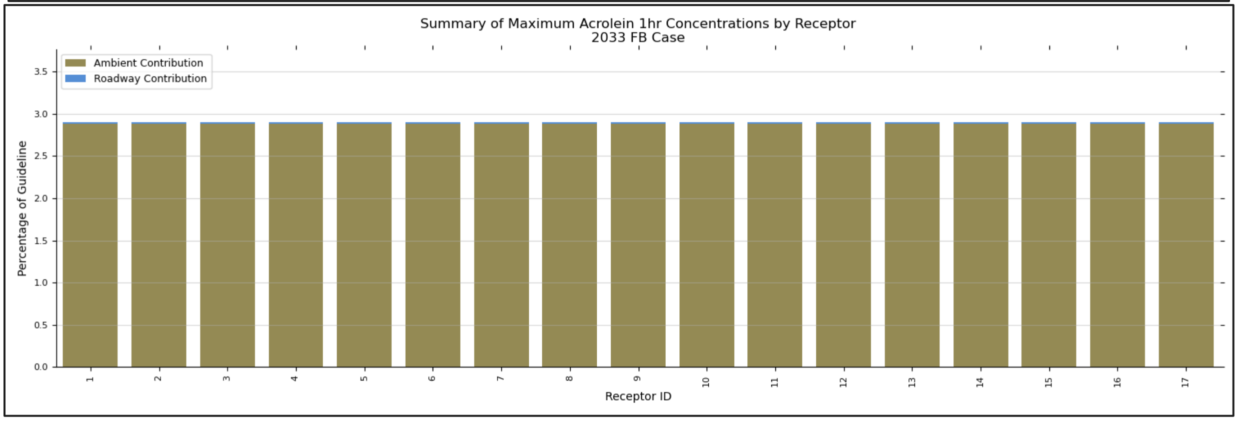
Ambient Contribution
Roadway Contribution
Percentage of Guideline
Receptor ID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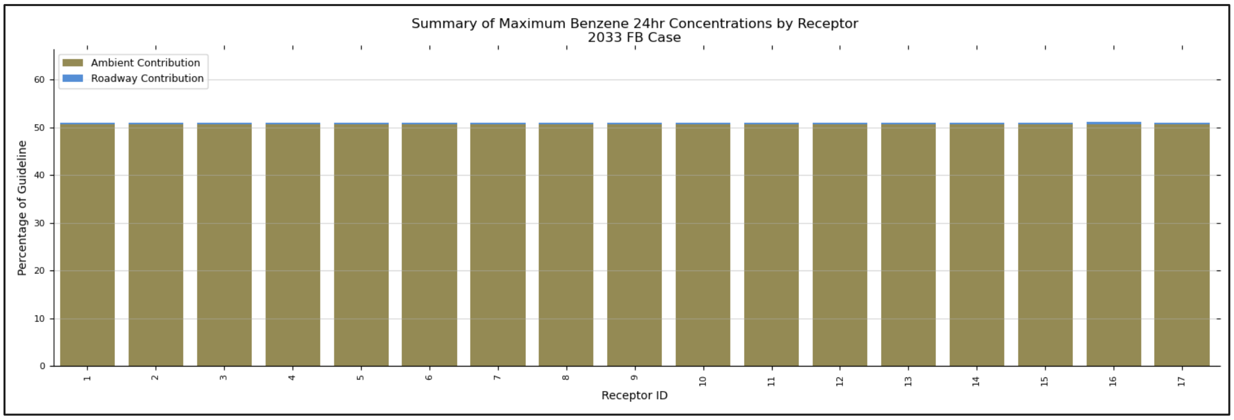
Roadway Contribution
Percentage of Guideline
Receptor ID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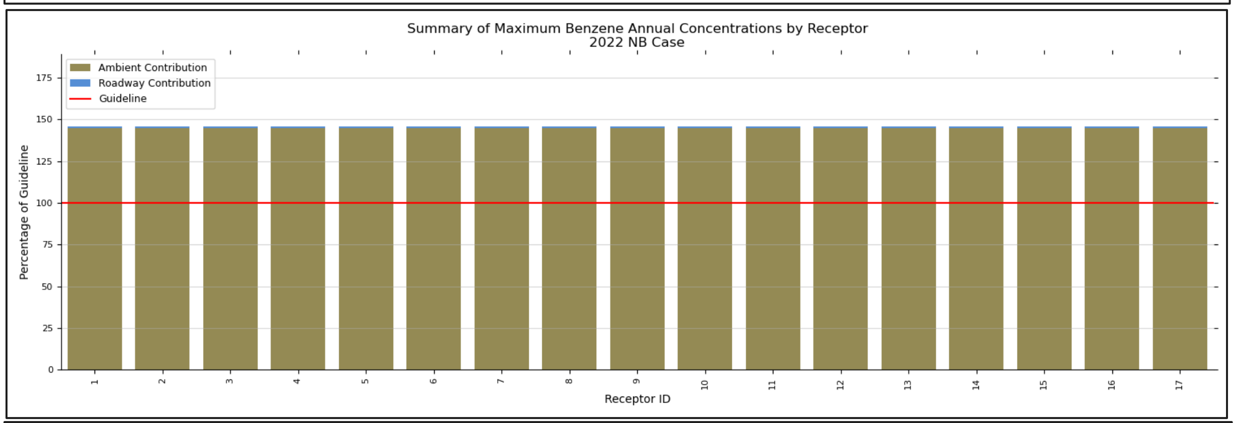
Roadway Contribution
Percentage of Guideline
Receptor ID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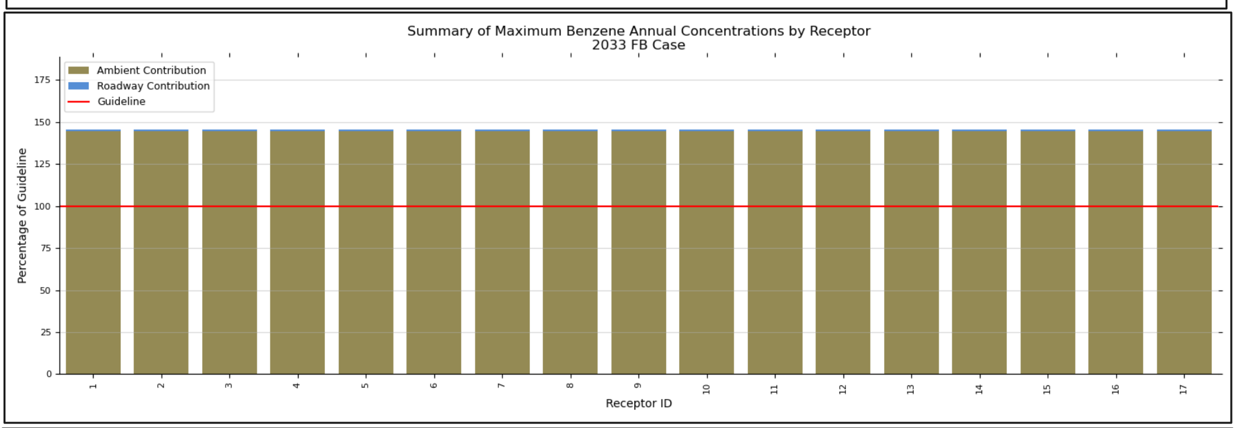
Roadway Contribution
Guideline
Percentage of Guideline
Receptor ID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Guideline
Percentage of Guideline
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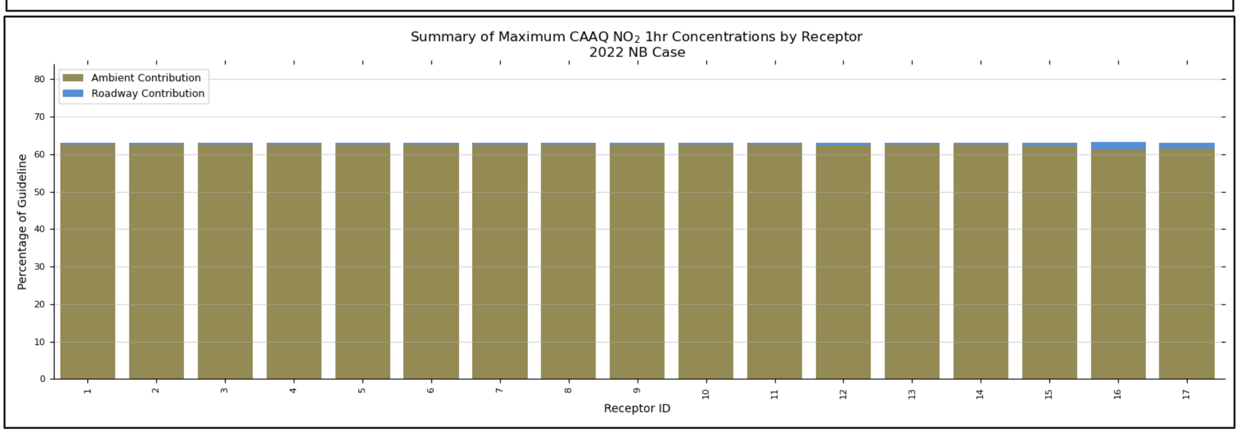
Summary of Maximum CAAQ NO_2 1hr Concentrations by Receptor
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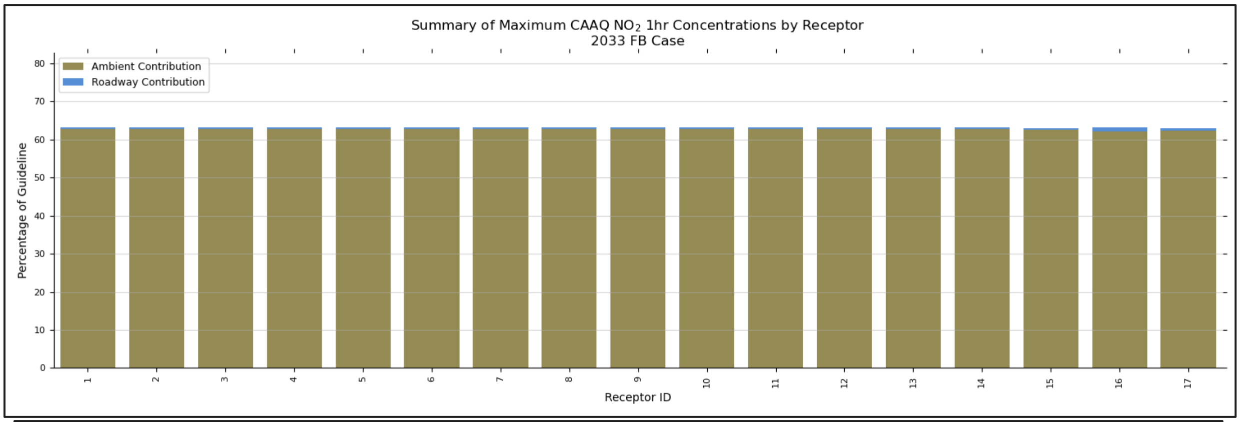
Ambient Contribution
Roadway Contribution
Percentage of Guideline
Receptor ID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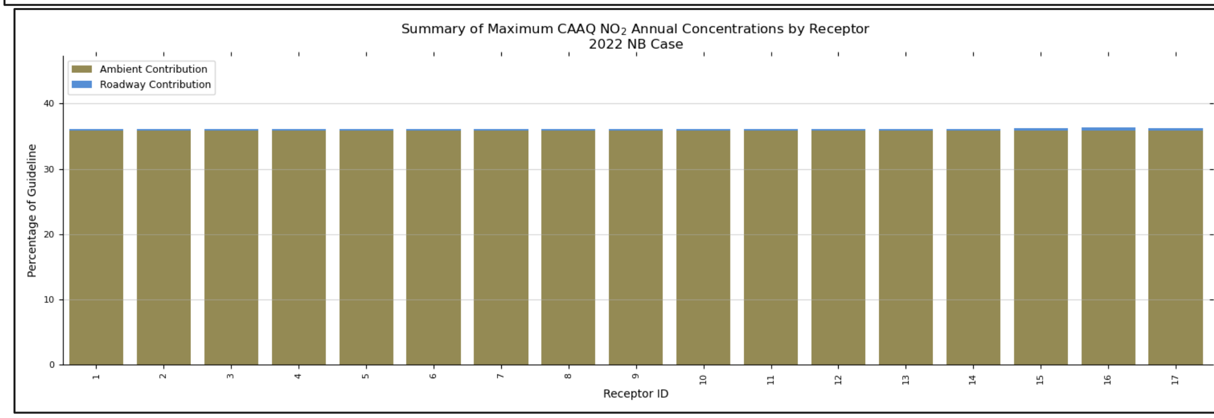
Roadway Contribution
Percentage of Guideline
Receptor ID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Percentage of Guideline
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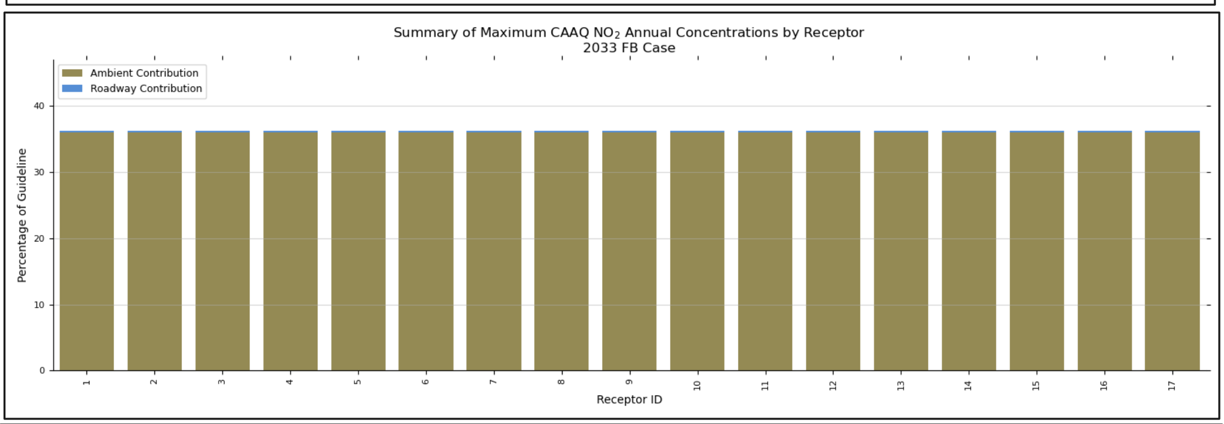
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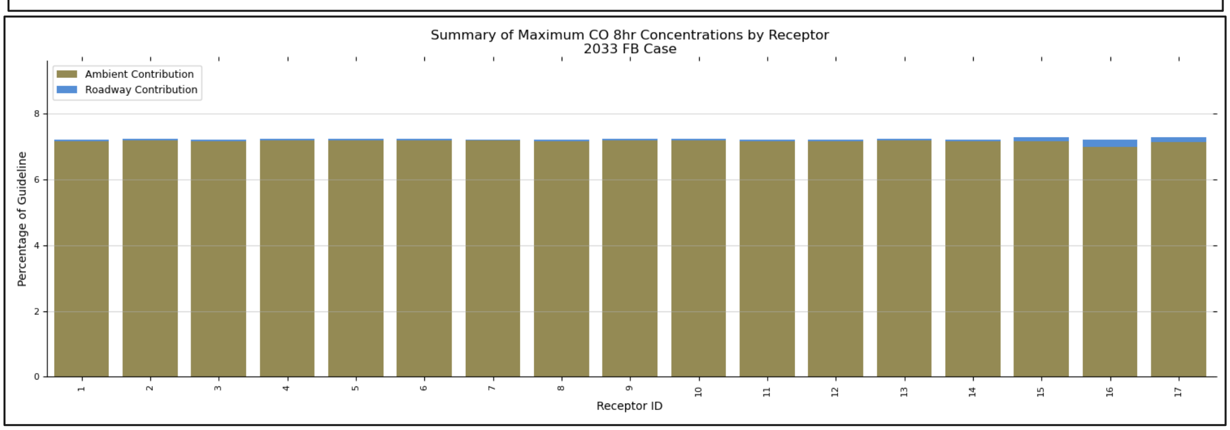
Receptor ID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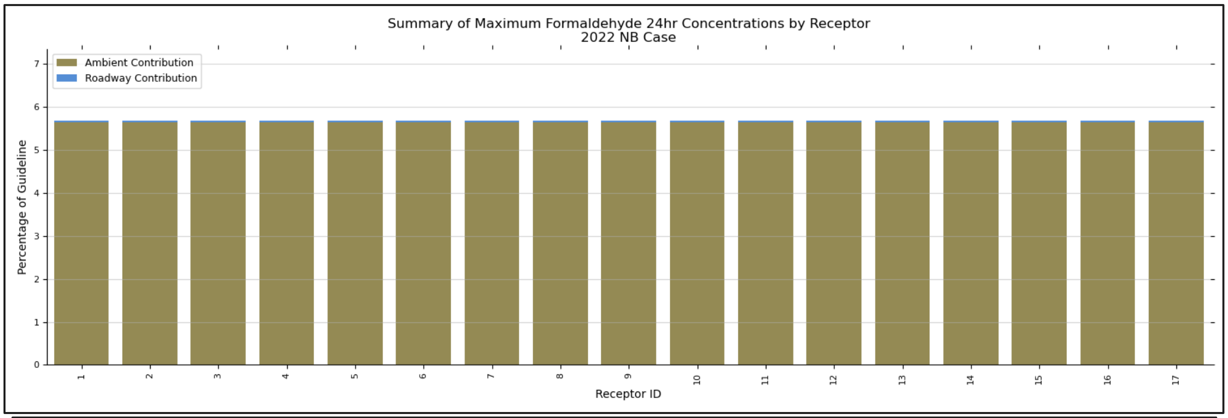
Percentage of Guideline
Receptor ID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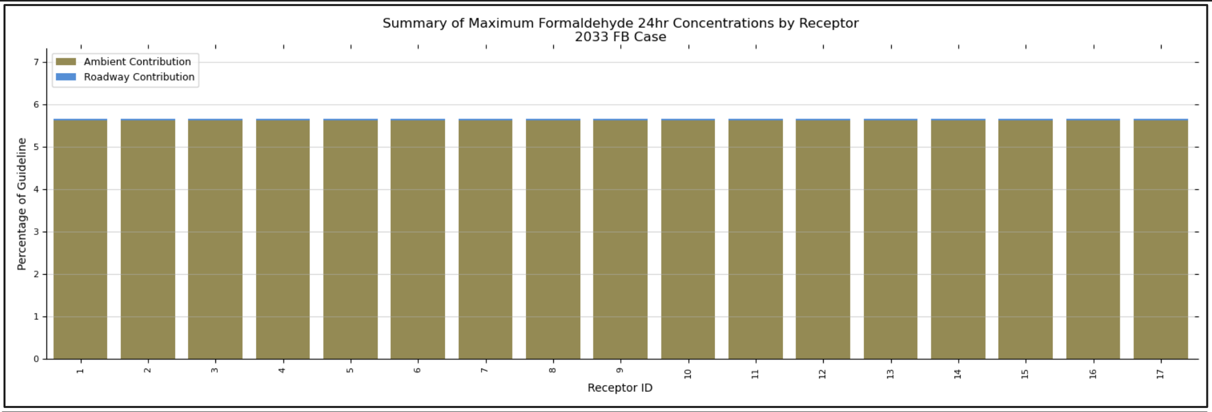
Roadway Contribution
Percentage of Guideline
Receptor ID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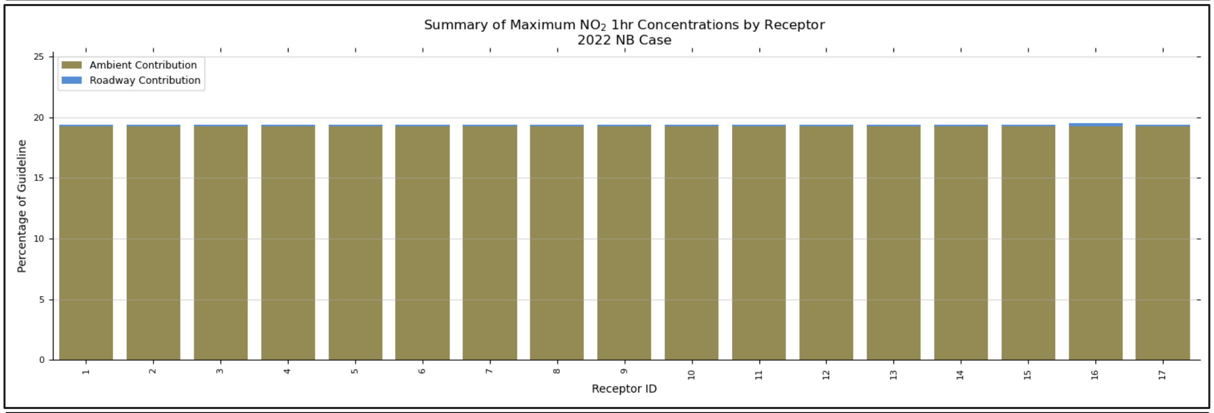
Summary of Maximum NO_2 1hr Concentrations by Receptor
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Roadway Contribution
Percentage of Guideline
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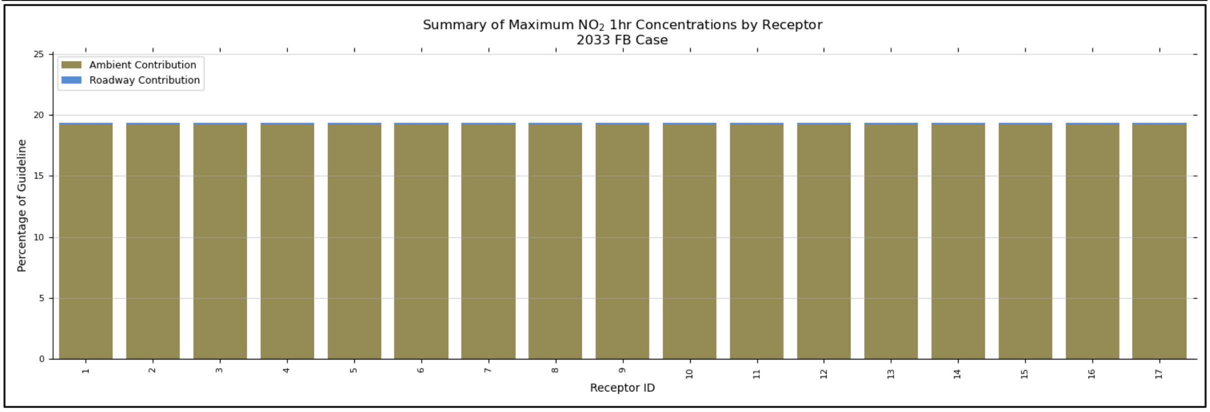
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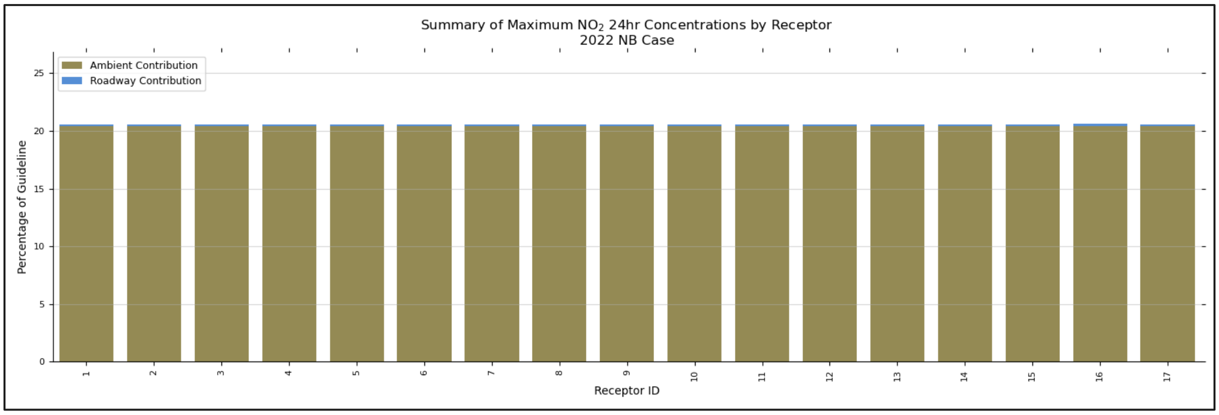
Percentage of Guideline
Receptor ID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2022 NB Case
Ambient Contribution
Roadway Contribution
Percentage of Guideline
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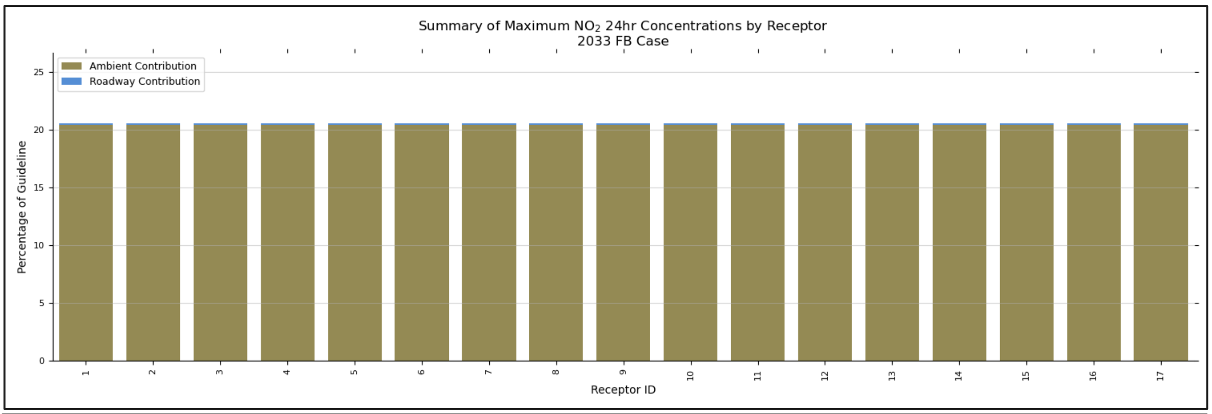
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Roadway Contribution
Percentage of Guideline
Receptor ID
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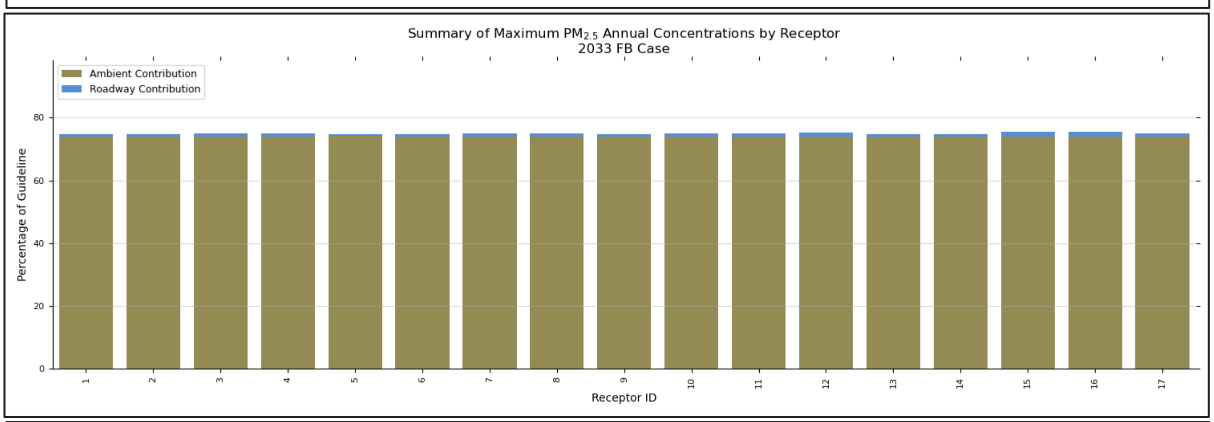
Summary of Maximum $PM_{2.5}$ Annual Concentrations by Receptor
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Roadway Contribution
Percentage of Guideline
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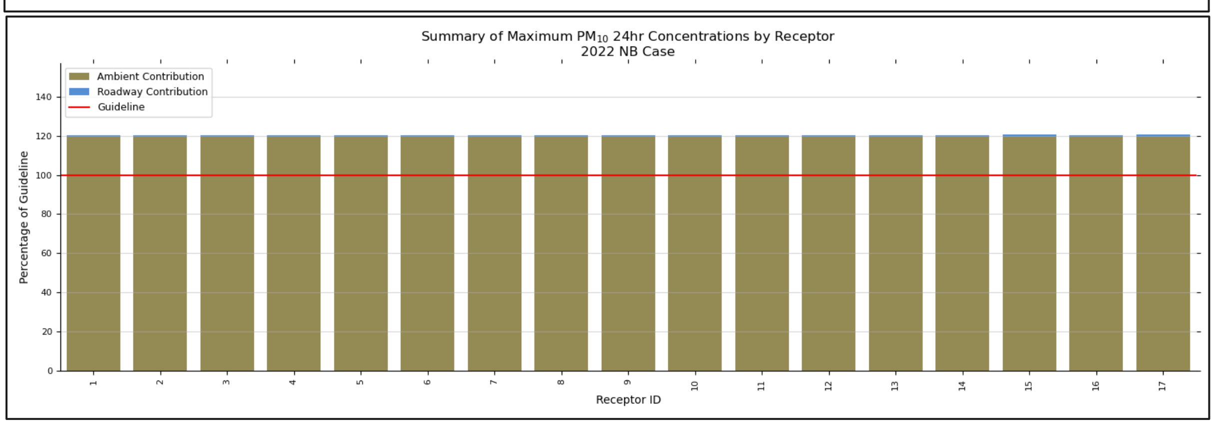
Summary of Maximum PM_{10} 24hr Concentrations by Receptor
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Roadway Contribution
Guideline
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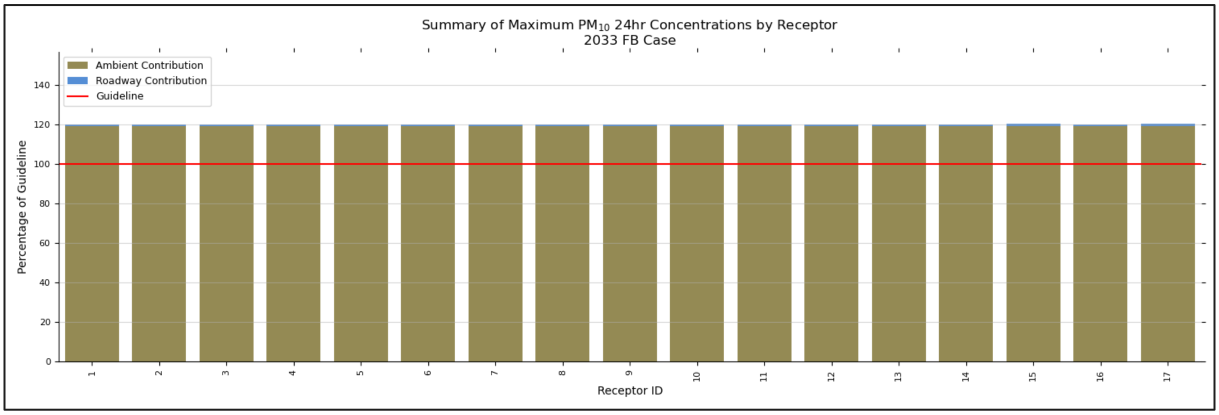
Summary of Maximum PM10 24hr Concentrations by Receptor
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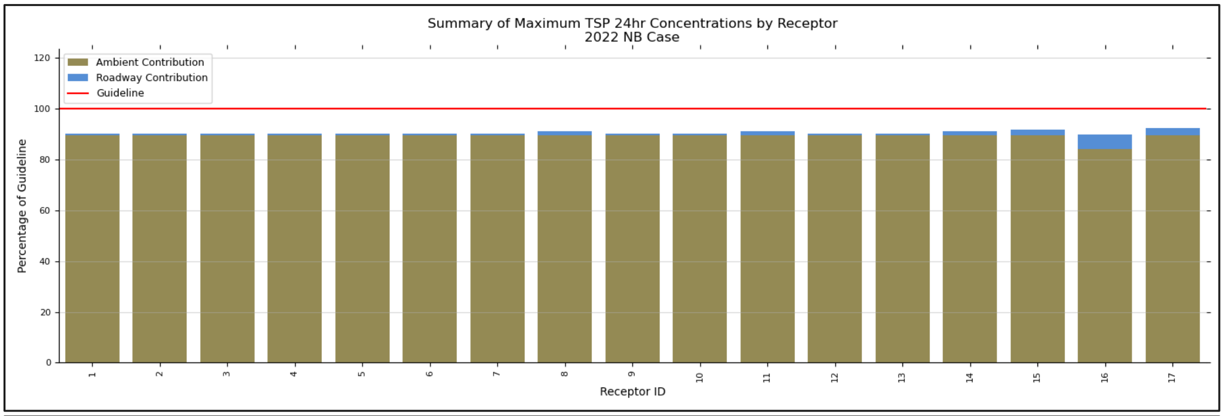
Guideline
Percentage of Guideline
Receptor ID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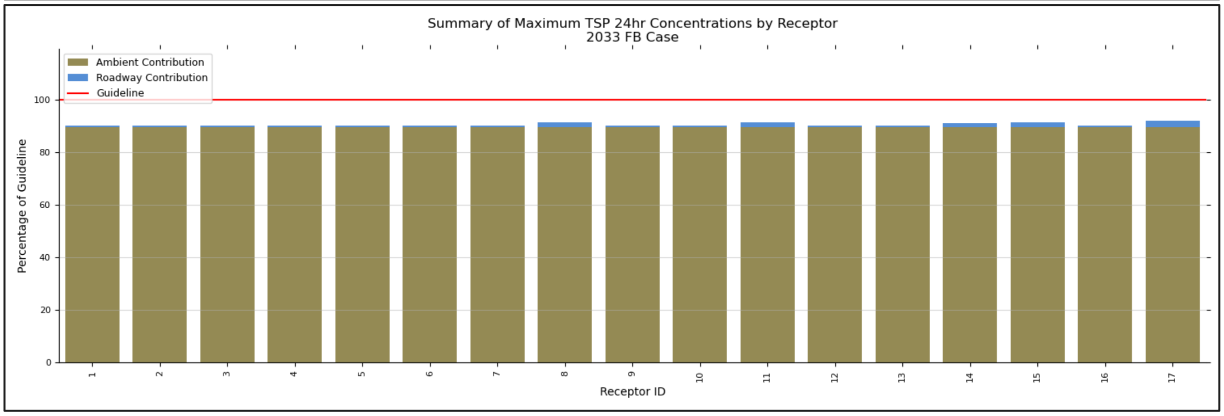
Roadway Contribution
Guideline
Percentage of Guideline
Receptor ID


Summary of Maximum TSP 24hr Concentrations by Receptor
2033 FB Case
Ambient Contribution
Roadway Contribution
Guideline
Percentage of Guideline
Receptor ID

Making Sustainability Happen