

# Appendix J: Air Quality Report



**407 TRANSITWAY - KENNEDY ROAD TO BROCK ROAD**

**MINISTRY OF TRANSPORTATION - CENTRAL REGION**





# HIGHWAY 407 TRANSITWAY FROM EAST OF KENNEDY ROAD TO EAST OF BROCK ROAD

## Air Quality Impact Assessment

December 2016

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**HIGHWAY 407  
TRANSITWAY FROM  
EAST OF KENNEDY  
ROAD TO EAST OF  
BROCK ROAD**

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## ACRONYMS AND ABBREVIATIONS

$\mu\text{g}/\text{m}^3$	Micrograms per Cubic Metre
AADT	Annual Average Daily Traffic
AAQC	Ambient Air Quality Criteria
AQHI	Air Quality Health Index
AQIA	Air Quality Impact Assessment
AVFT	Alternative Vehicle Fuels and Technologies
CAAQS	Canadian Ambient Air Quality Standards
CO	Carbon Monoxide
CO <sub>2</sub>	Carbon Dioxide
CH <sub>4</sub>	Methane
g/h	Grams per Hour
GHG	Greenhouse Gas
g/VKT	Grams per Vehicle Kilometre Travelled
N <sub>2</sub> O	Nitrous Oxide
NO <sub>2</sub>	Nitrogen Dioxide
NO <sub>x</sub>	Nitrogen Oxides
MOECC	Ontario Ministry of the Environment and Climate Change
MOVES	Motor Vehicle Emissions Simulator
PM <sub>10</sub>	Particulate matter less than 10 microns
PM <sub>2.5</sub>	Particulate matter less than 2.5 microns
ppb	parts per billion
PPUDO	Passenger Pick-up and Drop-off
RVP	Reid Vapour Pressure
U.S. EPA	United States Environmental Protection Agency
VKT	Vehicle Kilometres Travelled
VMT	Vehicle Miles Travelled
VOC	Volatile Organic Compounds

# 1 INTRODUCTION

## 1.1 Project Overview

Arcadis Canada Inc. was retained by LGL Limited (LGL) to complete a preliminary Air Quality Impact Assessment (AQIA) in support of the Planning and Preliminary Design for the 407 Transitway project (the “Project”) between east of Kennedy Road to east of Brock Road in the municipalities of Markham and Pickering.

The 407 Transitway will be a high-speed, fully grade separated right-of-way running parallel, and crossing over or under Highway 407 ETR. The right-of-way will provide for a two-lane busway or a two-track light rail transit (LRT) facility. For the purpose of this assessment, only air quality effects due to the busway were examined since the LRT is committed to be electrified and therefore have negligible air emissions. A preliminary design of the busway developed by Parsons was used for this AQIA.

## 1.2 Summary of Assessment Approach

In accordance with a detailed work plan developed in consultation with the Ontario Ministry of Transportation (MTO) and the MOECC, an air quality assessment was conducted for the Project in the Study Area with and without the planned 407 Transitway for the future reference year 2031.

This assessment estimated the net change in pollutant emissions due to the Transitway in the Highway 407 transportation corridor for each pollutant of concern: CO, NO<sub>2</sub>, SO<sub>2</sub>, VOCs (including 1,3-butadiene, acrolein, acetaldehyde, benzene and formaldehyde), benzo[a]pyrene, which is a key representative of polycyclic aromatic hydrocarbons (PAH), TSP, PM<sub>10</sub>, and PM<sub>2.5</sub>. To evaluate the potential impact of the Project on ambient air quality, the CAL3QHCR specialized transportation dispersion model was used to predict concentrations for those contaminants of concern. Model-predicted concentrations were added to local background concentrations and compared to applicable provincial and/or federal ambient air quality criteria. The air quality criteria used for this assessment are outlined in Section 2.

Where there are estimated increases in emissions due to the Project, their significance relative to emissions incurred on Highway 407 ETR “now” (i.e., 2015) and in the future reference year was estimated. As established by MTO, an increase by more than 10% is deemed significant.

In addition to modelling air contaminants of concern, the change in greenhouse gas (GHG) emissions was also evaluated following the assessment approach outlined in Ontario Ministry of Transportation’s guidance document for assessing air quality impacts of transportation projects (MTO 2012). Details of the complete assessment methodology are provided in Section 4.2.

## 2 AMBIENT AIR QUALITY CRITERIA

The Ontario Ministry of the Environment and Climate Change (MOECC) has developed Ambient Air Quality Criteria (AAQC) as measures to protect outdoor air quality. An AAQC is a desirable concentration based on the protection against adverse effects on health and/or the environment and is meant to be used to assess general or “ambient” air quality conditions from all sources. As a result, the addition of a background contribution (i.e., sources other than project-related activities) is required before comparing to an AAQC.

The purpose of this assessment is to evaluate the potential effects of the proposed Project on ambient air quality. Therefore, the model-predicted concentrations were added to local background concentrations and compared with the applicable AAQCs. Details about the selected criteria for each air contaminant of concern are provided in the sections below.

### 2.1 Fine Particulate Matter (PM<sub>2.5</sub>), Particulate Matter (PM<sub>10</sub>) and TSP

Particulate matter less than 2.5 microns (PM<sub>2.5</sub>) is known as “respirable” particulate since the particles are generally small enough to be drawn in and deposited into the deepest portions of the lungs. In particular, many studies have indicated that airborne PM<sub>2.5</sub> is associated with various adverse health effects in people who have compromised respiratory systems from conditions such as asthma, chronic pneumonia and cardiovascular disease. Anthropogenic sources, such as combustion of fossil fuels like diesel, tend to be the largest contributor to PM<sub>2.5</sub> levels in the environment.

Footnote 8 of *Ontario’s Ambient Air Quality Criteria* (AAQC) document (MOECC 2012) presents an ambient air quality guide for decision making for PM<sub>2.5</sub> of 30 µg/m<sup>3</sup> (24-hour average), which is based on the Canadian Council of the Ministers of the Environment (CCME) Canada-Wide Standard (CWS) for fine particulate matter (CCME 2000). However, the CCME has since replaced the CWS with a Canadian Ambient Air Quality Standard (CAAQS) which was officially enacted under the *Canadian Environmental Protection Act* on May 25, 2013 (CCME 2012). The 24-hour PM<sub>2.5</sub> CWS has been revised to 28 µg/m<sup>3</sup> (effective in 2015) and to 27 µg/m<sup>3</sup> (effective in 2020). The CCME has also established an annual PM<sub>2.5</sub> CAAQS for 2015 (10.0 µg/m<sup>3</sup>) and for 2020 (8.8 µg/m<sup>3</sup>).

It is assumed that Ontario will adopt the new PM<sub>2.5</sub> CAAQS and as a result, these new standards were considered in this assessment in lieu of the current CWS for PM<sub>2.5</sub>. Since the operational life of the Project will extend beyond 2020, the 2020 CAAQS were applied in this assessment. Table 2.1 presents the PM<sub>2.5</sub> ambient air quality criteria used in this assessment as well as the PM<sub>10</sub> AAQC limit. PM<sub>10</sub> is considered the filterable size particulate, however also hold its own health effects and therefore was included in this assessment. Total suspended particulate matter (TSP) is a measure of the particles in the atmosphere that are too small to settle out quickly, generally this means particulates with an aerodynamic diameter of less than 44 µm. The ambient TSP criteria were set to prevent a reduction in visibility, this reduction is a result of particles scattering or absorbing light coming from both the object and its background.

**Table 2.1 PM Ambient Air Quality Assessment Criteria**

Pollutant	Averaging Period	Source	Air Quality Criteria
PM <sub>2.5</sub>	24-hour	CAAQS	27 µg/m <sup>3</sup> [a]
	Annual	CAAQS	8.8 µg/m <sup>3</sup> [b]
PM <sub>10</sub>	24 Hour	AAQC	50 µg/m <sup>3</sup>
TSP	24 Hour	AAQC	120 µg/m <sup>3</sup>
	Annual	AAQC	60 µg/m <sup>3</sup> [c]

**Notes:**

[a] The Canadian Ambient Air Quality Standard (CAAQS) for 24-hr PM<sub>2.5</sub> is 28 µg/m<sup>3</sup> in 2015 and 27 µg/m<sup>3</sup> in 2020 based on the 98<sup>th</sup> percentile of 24-hour average concentrations, averaged over 3 consecutive years (CCME 2012). Since the Project will operate beyond 2020, the 2020 CAAQS was used.

[b] The Canadian Ambient Air Quality Standard (CAAQS) for annual PM<sub>2.5</sub> is 10 µg/m<sup>3</sup> in 2015 and 8.8 µg/m<sup>3</sup> in 2020. Since the Project will operate beyond 2020, the 2020 CAAQS was used.

[c] Geometric Mean

## 2.2 Criteria Air Contaminants

Criteria air contaminants (CACs) including nitrogen oxides (NO<sub>x</sub>), sulphur oxides (SO<sub>x</sub>) and carbon monoxide (CO) are considered common pollutants released into the air by activities such as the combustion of fossil fuels. Ozone is a CAC related to transportation, however, it is considered a secondary pollutant since it is formed through the photochemical reactions between NO<sub>x</sub> and VOCs directly emitted from transportation sources. Therefore, ozone has not been included in this assessment, however, the primary pollutants, including the ozone precursors, have all been assessed as part of this study.

Nitrogen dioxide (NO<sub>2</sub>) is a reddish brown, highly reactive gas that can be formed during high-temperature combustion in the presence of air. Nitrogen oxides (NO<sub>x</sub>), the term used to describe the sum of NO, NO<sub>2</sub> and other oxides of nitrogen play a major role in the formation of ozone. NO<sub>2</sub> has adverse health effects at much lower concentrations than NO. Consequently, the Ontario AAQC is based on the health effects of NO<sub>2</sub>. The AAQC for NO<sub>2</sub> is 400 µg/m<sup>3</sup> for a 1-hour averaging period and 200 µg/m<sup>3</sup> for a 24-hour averaging period.

Sulphur dioxide (SO<sub>2</sub>) is a colourless gas that smells like burnt matches. It can be oxidized to sulphur trioxide, which in the presence of water vapour, is readily transformed to sulphuric acid mist. SO<sub>2</sub> can be oxidized to form acid aerosols, and is a precursor of particulate sulphates, which are one of the main components of respirable particulates in the atmosphere. The AAQC for SO<sub>2</sub> is 690 µg/m<sup>3</sup> for a 1-hour averaging period, 275 µg/m<sup>3</sup> for a 24-hour averaging period and 55 µg/m<sup>3</sup> for an annual averaging period.

Carbon monoxide (CO) is a colourless, odourless gas, formed when hydrocarbon-based fuels are not completely combusted. It is a component of motor vehicle exhaust, with high concentrations of CO generally occurring in areas with heavy traffic congestion. The AAQC for CO is 36,200 µg/m<sup>3</sup> for a 1-hour averaging period and 15,700 µg/m<sup>3</sup> for an 8-hour averaging period.

The ambient air quality criteria for criteria air contaminants are shown in Table 2.2.

**Table 2.2 Ambient Air Quality Criteria for NO<sub>2</sub>, SO<sub>2</sub> and CO**

Pollutant	Ambient Air Quality Criteria (µg/m <sup>3</sup> )			
	Annual	24-hour	8-hour	1-hour
NO <sub>2</sub>	--	200	--	400
SO <sub>2</sub> (a)	55	275	--	690
CO	--	--	15,700	36,200

**Note:**

<sup>(a)</sup> New CAAQS for SO<sub>2</sub> were announced in October 2016 and which will come into effect in 2020 and 2025. The new CAAQS are more stringent than the current AAQC.

## 2.3 Volatile Organic Compounds

Volatile organic compounds (VOCs) are defined technically as organic compounds having a saturation vapour pressure greater than 0.1 mm of mercury at 25°C and standard atmospheric pressure. Certain VOCs warrant special concern because they are capable of being transported very long distances in the atmosphere and play an important role in the formation of ground-level ozone and fine particles. VOCs are emitted in vehicle exhaust. As part of this assessment six (6) typical VOCs that are emitted from vehicles were included, these are; acetaldehyde, acrolein, benzene, 1-3-butadiene, formaldehyde, and benzo[a]pyrene, which is a key representative of polycyclic aromatic hydrocarbons (PAHs).

The ambient air quality criteria associated with these VOCs are shown in Table 2.3.

**Table 2.3 Ambient Air Quality Criteria for Selected VOC**

Pollutant	Ambient Air Quality Criteria (µg/m <sup>3</sup> )		
	Annual	24-hour	1-hour
Acetaldehyde	--	500	--
Acrolein	--	0.4	4.5
Benzene	0.45	2.3	--
1-3 Butadiene	2	10	--
Formaldehyde	--	65	--
Benzo[a]pyrene	1.0E-05	5.0E-05	--

## 2.4 Greenhouse Gases

Greenhouse gases (GHGs) absorb and emit radiation within the thermal infrared range, which is the process regarded as the fundamental cause of the non-natural part of the “greenhouse effect.” Fossil fuel combustion is the main source of GHG emissions related to this project, which results in emissions of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O).

## Highway 407 Transitway from East of Kennedy Road to East of Brock Road

For a given mixture of different GHGs, the carbon dioxide equivalent (CO<sub>2</sub>e) is the unit of measure used to describe the amount of CO<sub>2</sub> that would have the same global warming potential as a mixture of GHGs when measured over a time period (typically a 100-year period). The carbon dioxide equivalency for a gas is calculated by multiplying the mass (of the gas) by its global warming potential (GWP). For example, the global GWP for CH<sub>4</sub> over 100 years is 25 and for N<sub>2</sub>O is 298 (IPCC 2007). This means that the emission of 1 tonne of CH<sub>4</sub> is equivalent, in its warming potential, to the emission of 25 tonnes of CO<sub>2</sub>, and the emission of 1 tonne of N<sub>2</sub>O is equivalent to the emission of 298 tonnes of CO<sub>2</sub>.

There are no ambient air quality criteria for greenhouse gases.

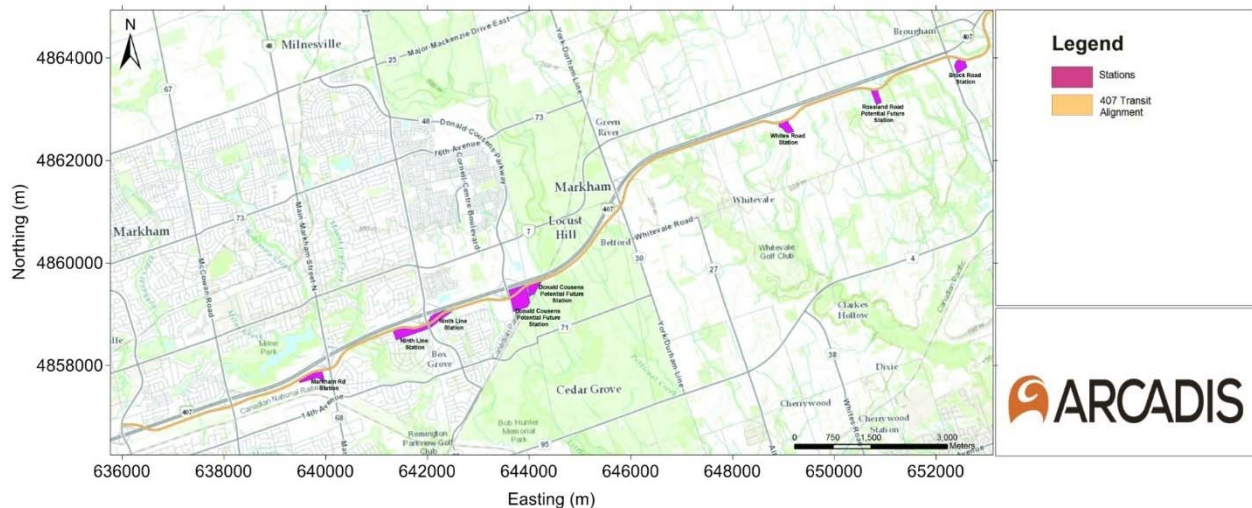
### 3 STUDY AREA DESCRIPTION

The Transitway will be a high-speed fully grade-separated facility on a separate right-of-way running parallel, and crossing over or under Highway 407. This 18-km section includes four transit stations at Markham Road, Ninth Line, Whites Road (Sideline 26), and Brock Road, and two potential additional stations at Donald Cousens Parkway/Reesor Road and Rossland Road (Sideline 22). There is also a possibility that the station at Rossland Road may be proposed for a bus garage. However, the site will require access from the Seaton Development and from Highway 407 ETR to become suited for a station or any other Transitway facility. Therefore, due to uncertainties regarding the construction of the Rossland Road Extension through the Seaton Development lands and the interchange that would connect the Rossland Road Extension to Highway 407 ETR, it was concluded that no station or any other 407 Transitway facility (i.e. bus garage) would be proposed at this site for this study (implementation by 2051). Only the proposed Donald Cousens Parkway/Reesor Road station was considered in this study in addition to the four main transit stations.

The station design will include bus access to and egress from the stations, bus platforms, layout of the access(es) to/from the arterial road, integration with local transit (bus platforms), parking spaces, Public Pick Up and Drop Off (PPUDO), shelters, building and other amenities. The Transitway and the stations will initially be designed to support the busway service with provisions for future conversion to light-rail transit technology.

The Study Area is shown in Figure 3.1. Note that the Rossland station is shown in Figure 3.1 even though this site will not be developed as discussed above.

**Figure 3.1 Air Quality Impact Assessment Study Area**



The west end of the study area is primarily comprised of high density residential and commercial properties, while the east end is largely undeveloped agricultural lands. As such, the primary source of contaminants within the study area are from the 407 ETR and the arterial roadways. Other insignificant minor sources of contaminants include sources of combustion from the residential and commercial properties within the west end of the study area.

## Highway 407 Transitway from East of Kennedy Road to East of Brock Road

Sensitive receptors were identified using recent aerial photography and confirmed during a field investigation on June 3<sup>rd</sup>, 2015. The sensitive receptors were identified to represent groups of receptors with similar exposure to the 407 Transitway. The receptors are summarized in Table 3.1 and illustrated in Figure 3.2.

**Table 3.1 Summary of Sensitive Receptors**

ID	Type of Unit	Segment
1	Residential	Kennedy Rd. to McCowan Rd.
2	Residential	Kennedy Rd. to McCowan Rd.
3	Residential	Kennedy Rd. to McCowan Rd.
4	Residential	Kennedy Rd. to McCowan Rd.
5	Residential	Kennedy Rd. to McCowan Rd.
6	Residential	Kennedy Rd. to McCowan Rd.
7	Residential	Markham Rd. to Ninth Line
8	Residential	Markham Rd. to Ninth Line
9	Residential	Markham Rd. to Ninth Line
10	Residential	Markham Rd. to Ninth Line
11	Residential	Markham Rd. to Ninth Line
12	Residential	Markham Rd. to Ninth Line
13	Residential	Markham Rd. to Ninth Line
14	Residential	Markham Rd. to Ninth Line
15	Health Care	Ninth Line to Donald Cousens Pkwy.
16	Senior Res. (F)	Ninth Line to Donald Cousens Pkwy.
17	Residential	Ninth Line to Donald Cousens Pkwy.
18	Residential	Donald Cousens Pkwy. to York-Durham Line
19	Residential	Donald Cousens Pkwy. to York-Durham Line
20	Residential (F)	York-Durham Line to Whites Road
21	School (F)	York-Durham Line to Whites Road
22	Residential (F)	Whites Road to Brock Road
23	Residential (F)	Whites Road to Brock Road
24	Residential (F)	Whites Road to Brock Road

**Note:**

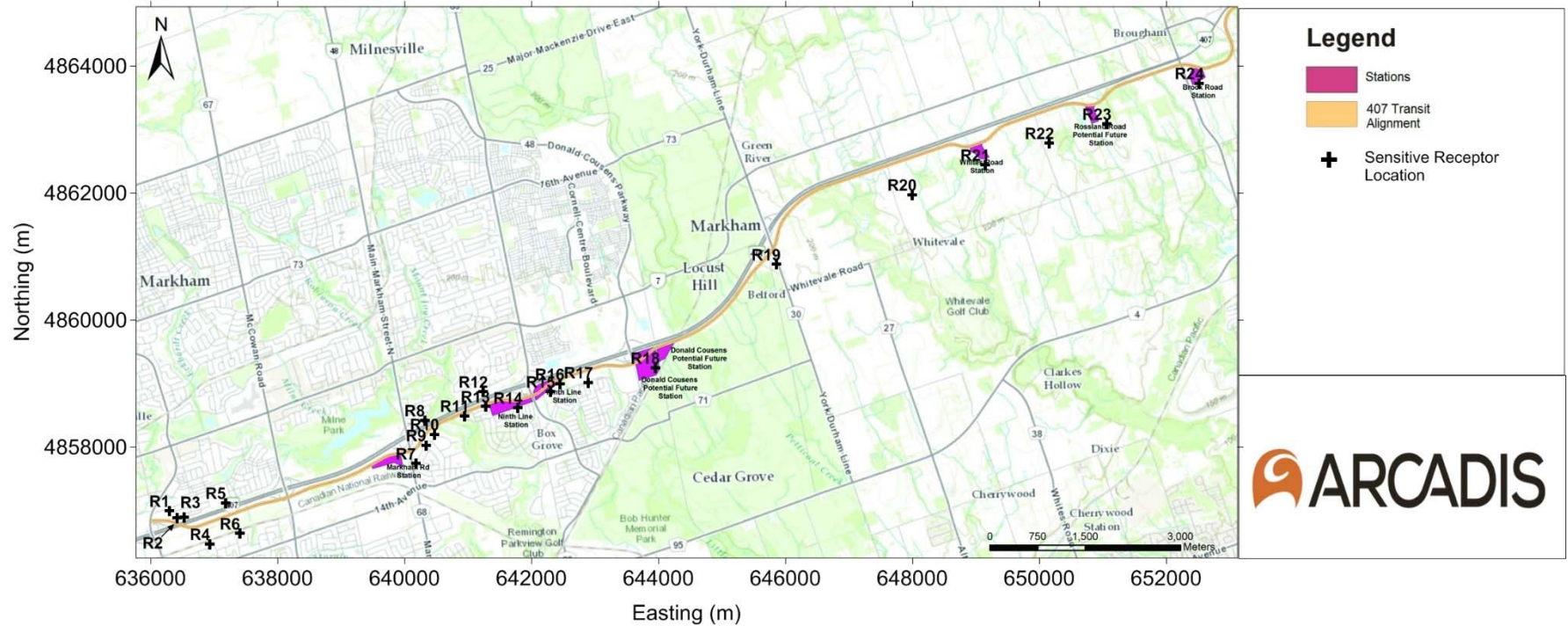
(F) Future Sensitive Receptor



# Highway 407 Transitway from East of Kennedy Road to East of Brock Road

It should be noted that the City of Pickering has approval from the Ontario government to begin development of a large community at the east end of the study area, called the Seaton Community. This assessment accounts for the future occupation of these lands with sensitive receptors located based on planning documents available from the City of Pickering.

**Figure 3.2 Location of Sensitive Receptors**



## 4 AIR QUALITY IMPACT ASSESSMENT METHODOLOGY

### 4.1 Background Air Quality

Ambient background concentrations used in air quality assessments represent the cumulative contribution of upwind sources such as industrial facilities, other roadways and transboundary pollution that are not included in the modelling. It is important to add background concentrations to modelled concentrations in order to assess the combined effect of all sources at a specific receptor location.

The MOECC measures air contaminants at various locations throughout Ontario, and reports on the state of Ontario's air quality on an annual basis. A review of MOECC monitoring stations in Ontario was undertaken to identify the monitoring stations that would be most representative of the study area and provide a conservative cumulative assessment. Data was obtained for the most recent consecutive five years available from the representative monitoring stations. The 90<sup>th</sup> percentile values are considered conservative as they represent values that will only be exceeded 10% of the time under adverse meteorological conditions.

For PM<sub>2.5</sub> and NO<sub>2</sub> background concentrations, there are currently two continuous air monitoring stations located in the general vicinity of the Study Area. The stations are MOECC Toronto East (Station #33003), which is located approximately 11 km west of the study area, and MOECC Oshawa (Station #45026), which is located approximately 17 km east of the Study Area. For this study, the MOECC Toronto East station was selected as it was in closer proximity to the Study Area and provided the more conservative background concentrations.

There are two continuous SO<sub>2</sub> air monitoring stations that were considered representative of the study area; MOECC Toronto Downtown (Station #31103) and MOECC Toronto West (Station #35125). Even though the MOECC Toronto West station has more recent data, the Toronto Downtown station was selected for this assessment due to its proximity to the Study Area and it resulted in more conservative ambient data.

The Toronto West station is one of the only stations in Ontario that monitors CO, therefore it was used in this assessment for the establishment of background concentrations for CO.

Table 4.1 outlines the recent measurement history for all monitoring stations considered for this study and presents a summary of the data in terms of the 90<sup>th</sup> percentile 1-hour, 8-hour, and 24-hour, as well as annual values. For each contaminant of concern, the selected background concentrations are based on a 5-year average of the measured concentrations.

In summary, the historical air quality data outlines that the Study Area is located within a typical urban/suburban air shed with occasional smog periods during which air quality is compromised. In Ontario, the smog season occurs from May through September.

**Table 4.1 Summary of Ambient Air Data for CACs**

Monitoring Station	Contaminant	Years					
		2011	2012	2013	2014	2015	5-yr avg
Toronto East MOECC # 33003	<b>PM<sub>2.5</sub> (µg/m<sup>3</sup>)</b>						
	24-hr 90th percentile	12.0	12.2	15.7	15.7	15.4	14.2
	Annual	6.2	6.2	8.2	9.0	7.6	7.4
	<b>NO<sub>2</sub> (µg/m<sup>3</sup>)</b>						
	1-hr 90th percentile	84.7	77.1	69.6	73.4	74.9	75.9
	24-hr 90th percentile	76.1	65.4	59.1	64.2	64.6	65.9
Oshawa MOECC # 45026	<b>PM<sub>2.5</sub> (µg/m<sup>3</sup>)</b>						
	24-hr 90th percentile	11	11	13	13.2	14.9	12.6
	Annual	5.5	5.5	7.4	7.7	7.5	6.7
	<b>NO<sub>2</sub> (µg/m<sup>3</sup>)</b>						
	1-hr 90th percentile	36	30	28	33.9	35.8	32.7
	24-hr 90th percentile	35	26	25	31.2	33.6	30.1
Toronto Downtown MOECC # 31103	<b>SO<sub>2</sub> (µg/m<sup>3</sup>)</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>5-yr avg</b>
	1-hr 90th percentile	13.1	9.4	7.5	3.8	3.8	7.5
	24-hr 90th percentile	11.3	8.4	6.7	4.5	3.7	6.9
	Annual	3.6	3.6	3.0	1.8	1.8	2.7
Toronto West MOEC # 35125	<b>CO (µg/m<sup>3</sup>)</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>5-yr avg</b>
	1-hr 90th percentile	226.0	292.0	291.0	297.0	285.0	278.2
	8-hr 90th percentile	358.0	405.0	401.0	414.0	404.0	396.4
	<b>SO<sub>2</sub> (µg/m<sup>3</sup>)</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>5-yr avg</b>
	1-hr 90th percentile	5.6	3.8	1.9	1.9	3.8	3.4
	24-hr 90th percentile	4.8	3.1	2.5	2.7	3.5	3.3
	Annual	2.9	1.1	1.1	1.4	1.9	1.7

(1) TSP is not monitored in Ontario; therefore, background concentrations were calculated based on the correlation  $PM_{2.5}/TSP = 0.3$   
 (2)  $PM_{10}$  is not monitored in Ontario; therefore,  $PM_{10}$  data were calculated from  $PM_{2.5}$  data using a correlation  $PM_{2.5}/PM_{10} = 0.5$

VOC concentrations are measured by Environment Canada at the NAPS monitoring stations. A review of NAPS ambient monitoring stations in Ontario was undertaken to identify the representative monitoring stations for study area. The station with the highest maximum value over the five-year period for each contaminant and averaging period was selected to represent background concentrations in the study area.

The nearest stations to the project that monitor VOCs are Toronto Downtown (NAPS ID 60418), Toronto Etobicoke (NAPS ID 60435), and Toronto Downtown (NAPS ID 60427). However, not all compounds are monitored at each location, therefore, the stations were selected based on data availability, proximity to site, and conservative concentration data.

The most current data, 2010 to 2014, from the Toronto Etobicoke station was used as background for 1,3-butadiene and benzene. The 2010 to 2014 data from the Toronto Downtown station (ID 60427) was selected for benzo[a]pyrene

Acrolein, acetaldehyde, and formaldehyde were monitored at the Toronto Downtown station (ID 60418) for the period 2002 to 2006. While there is a NAPS station located in Windsor that has more recent data for these compounds, the Toronto station was selected for this study due to its representative concentration data and its proximity to the Study Area.

The 90<sup>th</sup> percentile concentrations for the VOCs of concern are summarized in Table 4.2 below. The ambient concentrations for benzene (annual average) and benzo[a]pyrene currently exceed their respective AAQCs.

**Table 4.2 Summary of Ambient Air Data for VOCs**

Contaminant	Averaging Period	Adopted Background Value ( $\mu\text{g}/\text{m}^3$ )	AAQC ( $\mu\text{g}/\text{m}^3$ )
1,3 – Butadiene	24 hr -90th percentile	0.11	10
	Annual Mean	0.058	2
Benzene	24 hr -90th percentile	1.03	2.3
	Annual Mean	0.61	0.45
Acetaldehyde	24 hr -90th percentile	2.95	500
Acrolein	1 hr	0.22	4.5
	24 hr -90th percentile	0.22	0.4
Formaldehyde	24 hr -90th percentile	6.47	65
Benzo[a]pyrene	24 hr -90th percentile	1.60E-04	5.00E-05
	Annual Mean	9.50E-05	1.00E-05

## 4.2 Assessment Methodology

To assess the impact on air quality based on the presence of the 407 Transitway, an emissions inventory of the proposed development and existing sources with a dispersion modelling study was prepared for the study area.

This air quality assessment estimated the number of vehicle-kilometers travelled (VKT) within the Study Area incurred by private passenger vehicles (cars and light trucks), public vehicles (i.e., transit buses) as well as heavy vehicles such as transport trucks. Based on the VKT estimates, emissions for each pollutant of concern were estimated including: CO, NO<sub>2</sub>, SO<sub>2</sub>, VOCs, (including 1,3-butadiene, acrolein, acetaldehyde, benzene, and formaldehyde), benzo[a]pyrene, TSP, PM<sub>10</sub>, and PM<sub>2.5</sub>. Emissions were

estimated for existing conditions (2015) as well as future conditions in 2031, with and without the proposed Transitway.

To assess the impact on air quality within the Study Area, the net change in pollutant concentrations due to the Transitway in the 407 transportation corridor was calculated for the reference year 2031 and compared against the applicable criteria and standards. Where there are estimated increases in emissions, their significance relative to emissions incurred on Highway 407 ETR “now” and in the future reference year without the Project was evaluated. As outlined in the Project terms of reference developed by the Ontario Ministry of Transportation, an increase of more than 10% is deemed significant.

As identified in Section 3, twenty-four (24) sensitive receptors were chosen to accurately represent the change in the Study Area for the Existing, Future No-Build, and Future Build scenarios.

### **4.3 Description of Assessment Scenarios**

The assessment covered three scenarios: Existing Conditions (2015), Future without the 407 Transitway (2031), and Future with the 407 Transitway (2031). Descriptions and assumptions used in each of the assessment scenarios are detailed in the following sections.

#### **4.3.1 Existing Conditions (2015)**

The 407 Transitway will be constructed in the major traffic corridor of Highway 7 and Highway 407 ETR from east of Kennedy Road in Markham to east of Brock Road in Pickering. In particular, the Transitway will be built parallel to and typically within 50 m of Highway 407 ETR for most of the route. Using the emissions estimating methods outlined in Section 4.3.4, an emissions inventory for existing conditions (2015) was developed for Highway 407 ETR between Kennedy Road and Brock Road, including its interchanges: Kennedy Road; McCowan Road; Markham Road; Ninth Line; Donald Cousens Pkwy; York Durham Line; Whites Road; and; Brock Road.

#### **4.3.2 Future without the 407 Transitway**

2031 is the expected year that the Transitway will be in full operation. The future (2031) scenario without the 407 Transitway assumes that there are no changes to the majority of the existing road network of Highway 407 ETR and its interchanges compared to the Existing Conditions scenario. The exception is in the vicinity of Brock Road where re-alignment of Highway 407 ETR and Brock Road is underway, the future extension of Whites Road, and the addition of ramps to the 407 ETR at Ninth Line, Donald Cousens Parkway, and York-Durham Townline Road.

In response to population growth, traffic volumes on Highway 407 ETR and its interchanges will increase in the future. A new emissions inventory was developed using the methods outlined in Section 4.3.4 for the future scenario without the Transitway.

### 4.3.3 Future with the 407 Transitway

This future (2031) scenario is the same as the above future scenario except for the addition of an 18-kilometre busway (the 407 Transitway) that will be fully grade-separated and approximately parallel to Highway 407 ETR from Kennedy Road to Brock Road. The preferred alignment consists of a two-lane roadway (one lane in each direction) occupied solely by buses. In this scenario, buses are restricted to the Transitway. It was assumed that the future bus fleet on the Transitway would be diesel fuelled as a worst-case scenario. An emissions inventory was developed using the methods outlined in Section 4.3.4 for the future scenario with the Transitway.

This scenario also considered five (5) potential 407 Transitway bus stops locations where buses will briefly idle to allow passengers to board/depart buses: Markham Road, Ninth Line, Donald Cousens Pkwy, Whites Road (Sideline 26), and Brock Road. As identified in Section 3, there are no current plans to construct a maintenance garage at the Rossland Road station. However, should plans for the garage proceed, the facility will require an Environmental Compliance Approval (ECA) prior to operating. A detailed air emissions assessment will be required to support the ECA application. It is recommended that an Emission Summary and Dispersion Modelling Report be undertaken during the detailed design stage such that the impact from the potential emissions from the facility can be assessed.

It should be noted that idling transit bus emissions were not considered in this assessment. All stations will operate as regular bus street stops with passing lanes for express service; consequently, bus idling is not anticipated. Buses will only drop-off and pick-up passengers. In addition, during peak hours there will be approximately one bus per minute travelling through each of the stations; therefore, buses will stop for very short periods to allow passengers to board and exit. Therefore, the emissions from bus idling are expected to be insignificant.

Neither the Transitway nor Highway 407 ETR have signalled road intersections, therefore, idling emissions from these alignments are estimated to be insignificant and were not considered in this assessment. However, passenger vehicle emissions from within station parking lots and PPUDO areas were assessed.

### 4.3.4 Vehicle Emissions Estimation

The rate of contaminant emissions from a section of road is proportional to the number and types of vehicles travelling along that road as well as vehicle speed. Hourly traffic flows for Highway 407 ETR (and its interchanges) and the 407 Transitway (and its stations) were calculated based on average daily traffic flows. IBI Group provided annual average daily traffic (AADT) volumes for Highway 407 ETR and the proposed 407 Transitway and stations for the following three scenarios:

- Existing Conditions – 2015;
- Future without the 407 Transitway – 2031; and,
- Future with the 407 Transitway – 2031.

## Highway 407 Transitway from East of Kennedy Road to East of Brock Road

Note that according to Parsons, the number of buses (currently operated by GO Transit) will increase whether the Transitway is implemented or not. However, the forecast volume of buses if the 407 Transitway is not implemented is uncertain. As a result, the analysis followed a conservative approach which assumed that for the “Future without the 407 Transitway” scenario, the traffic increment on Highway 407 ETR does not include buses. In other words, transit buses were not added to Highway 407 ETR in the absence of the 407 Transitway.

IBI Group and Parsons also suggested that it is reasonable to assume the introduction of the 407 Transitway into the Study Area will reduce the number of passenger vehicles present within the transportation corridor. The forecasted traffic increase between now and 2031 on Highway 407 ETR is about 3%, and Parsons indicated that it is reasonable to assume the equivalent increment of highway users (if no Transitway is built), would use the Transitway if it is constructed. Therefore, a 3% reduction to the Future with the 407 Transitway (2031) estimate of passenger cars relative to Existing Conditions (2015) was applied along Highway 407 ETR. Therefore, based on this assessment, with the implementation of the Transitway, the reduction of automobiles would be on the order of 1,500 to 1,800 per hour.

The average daily traffic volumes and average daily vehicle-kilometres travelled (VKT) for Highway 407 ETR are considered proprietary information and have not been included in this report. However, average daily traffic volumes and daily VKT for the 407 Transitway and its stations are presented in Table 4.3 for the “Future with the 407 Transitway” scenario. The station traffic hourly volumes were estimated as a fraction of the worst-case hour for the station and the fraction of the applicable 407 ETR eastbound and westbound traffic volumes for the particular station.

**Table 4.3 Annual Average Daily Traffic Volumes (AADT) and Daily Vehicle Kilometres Travelled (VKT) for the 407 Transitway and Stations**

Assessment Scenario	Roadway	Vehicle Type	AADT	Daily VKT
Future with the 407 Transitway (2031)	407 Transitway	Transit Bus	508*	10,412
	Markham Road Station	Passenger Vehicle	4,440	1,680
	Ninth Line Station	Passenger Vehicle	5,900	2,830
	Donald Cousens Station	Passenger Vehicle	2,842	937
	Whites Road Station	Passenger Vehicle	4,240	850
	Brock Road Station	Passenger Vehicle	3,536	940

**Note:**

\*Based on a weighted average of weekday (552) and weekend (400) two-way traffic volumes.  $AADT = 552 \times 0.71 + 400 \times 0.29 = 508$ . Station traffic volumes includes both passenger vehicles that park, and PPUDO vehicles. Station traffic volumes also accounts for in/out traffic.

#### 4.3.4.1 Tailpipe Emissions

All contaminants of concern considered in this study are emitted in vehicle exhaust. Additionally, particulate matter (TSP, PM<sub>10</sub> and PM<sub>2.5</sub>) is emitted from the roadway surface as a result of tire/brake wear, and re-suspension of surface dust by: (1) the action of the tires on the surface; and (2) the wake created by the passing of the vehicle. Both tailpipe and mechanically-generated fractions of PM<sub>10</sub> and PM<sub>2.5</sub> were included in this study. Tailpipe emissions from vehicles are a function of many variables. Some of the more important parameters are listed below:

- age of the vehicle (newer vehicles emit less);
- number of kilometers which the vehicle has driven;
- emission control equipment;
- type of fuel (gasoline, diesel);
- Reid Vapour Pressure (RVP) of gasoline used (adjusted seasonally);
- ambient air temperature;
- vehicle speed;
- rate of acceleration;
- time spent idling;
- type of vehicle (automobile, light truck, heavy truck, bus, etc.); and,
- cold or hot start mode.

Vehicular emissions are generally estimated by using emission factors in units of mass of contaminant emitted per vehicle, per distance travelled. To obtain a mass emission rate for a particular road section, the length of the road section is multiplied by the number of vehicles using that section to obtain the total VKT. The VKT are then multiplied by the appropriate emission factors.

The vehicular exhaust emission rates were estimated for Existing Conditions (2015), and for the Future with and Without Transitway (2031) scenarios. Emission factors were obtained by running the U.S. EPA MOVES2014 model. The model output provided emission factors in grams per vehicle-kilometre travelled (g/VKT) for all contaminants of concern. All expected technological and regulatory changes affecting future emissions are built into the model, in order to generate the most representative emission factors possible. Details about MOVES2014 inputs are provided in Appendix A.

As previously mentioned, it was assumed that the future bus fleet on the Transitway will be diesel fuelled. Even though bus propulsion is expected to evolve away from diesel technology to more clean and sustainable systems such as natural gas or electric propulsion, the timing for this change is uncertain. Therefore, by assuming that buses operating on the Transitway will still be based on diesel technology, emissions from Transitway buses are conservative.



## Highway 407 Transitway from East of Kennedy Road to East of Brock Road

Table 4.4 and Table 4.5 summarize the final vehicular exhaust emission factors used in the existing conditions and future reference year for idling conditions, 30 km/hr, which is the posted speed limit in the parking lots and PPUJO areas, 60 km/h which is the posted speed limit along the interchange roadways, and 100 km/h, which is the posted speed limit on Highway 407 ETR and the 407 Transitway. Emission factors at 30, 60 and 100 km/h are in g/VKT whereas idle emission factors are in g/hr.

**Table 4.4 Tailpipe Emission Factors for Cars and Medium Trucks for 2015 and 2031**

Year	Speed	Cars												
		PM <sub>10</sub> *	PM <sub>2.5</sub> *	CO	NO <sub>2</sub>	SO <sub>2</sub>	VOC	1,3-Butadiene	Acetaldehyde	Acrolein	Benzene	Formaldehyde	Benzo[a]pyrene	CO <sub>2e</sub>
2015	Idle (g/h)	7.50E-02	6.70E-02	2.30E+01	1.60E+00	1.00E-01	1.80E+00	3.20E-03	1.00E-02	7.50E-04	2.60E-02	1.30E-02	7.46E-04	5.30E+03
	30 km/h (g/VKT)	7.10E-03	6.30E-03	2.10E+00	2.20E-01	6.90E-03	1.00E-01	1.90E-04	6.50E-04	4.80E-05	1.90E-03	8.80E-04	5.42E-05	3.50E+02
	60 km/h (g/VKT)	6.70E-03	5.90E-03	1.60E+00	2.10E-01	4.50E-03	5.90E-02	1.00E-04	3.80E-04	2.80E-05	1.20E-03	5.30E-04	9.41E-05	2.30E+02
	100 km/h (g/VKT)	6.40E-03	5.60E-03	1.60E+00	2.50E-01	4.30E-03	5.30E-02	9.10E-05	3.50E-04	2.60E-05	1.10E-03	5.00E-04	8.48E-05	2.20E+02
2031	Idle (g/h)	2.70E-02	2.40E-02	7.10E+00	1.30E-01	2.20E-02	6.50E-01	8.90E-06	7.60E-04	1.00E-04	3.00E-03	2.10E-03	2.75E-04	3.30E+03
	30 km/h (g/VKT)	2.20E-03	2.00E-03	7.20E-01	2.10E-02	1.50E-03	3.40E-02	4.70E-07	5.80E-05	7.30E-06	2.70E-04	1.50E-04	1.88E-05	2.20E+02
	60 km/h (g/VKT)	1.90E-03	1.70E-03	6.50E-01	2.80E-02	9.60E-04	1.80E-02	2.40E-07	4.60E-05	5.50E-06	2.30E-04	1.10E-04	2.54E-5	1.40E+02
	100 km/h (g/VKT)	1.90E-03	1.70E-03	7.10E-01	3.90E-02	9.20E-04	1.60E-02	2.00E-07	5.10E-05	5.90E-06	2.70E-04	1.20E-04	2.38E-5	1.40E+02
Year	Speed	Medium Trucks												
		PM <sub>10</sub>	PM <sub>2.5</sub>	CO	NO <sub>2</sub>	SO <sub>2</sub>	VOC	1,3-Butadiene	Acetaldehyde	Acrolein	Benzene	Formaldehyde	Benzo[a]pyrene	CO <sub>2e</sub>
2015	Idle (g/h)	2.40E+00	2.20E+00	3.40E+01	3.90E+01	1.60E-01	6.90E+00	1.40E-02	1.90E-01	3.20E-02	9.00E-02	4.60E-01	1.05E-02	1.40E+04
	30 km/h (g/VKT)	1.20E-01	1.10E-01	2.50E+00	2.10E+00	9.70E-03	3.80E-01	7.30E-04	9.80E-03	1.60E-03	5.40E-03	2.30E-02	4.96E-04	8.20E+02
	60 km/h (g/VKT)	6.30E-02	5.80E-02	1.70E+00	1.30E+00	6.00E-03	1.80E-01	3.40E-04	4.50E-03	7.50E-04	2.40E-03	1.10E-02	2.78E-04	5.00E+02
	100 km/h (g/VKT)	4.70E-02	4.30E-02	1.50E+00	1.00E+00	5.00E-03	1.30E-01	2.30E-04	3.00E-03	5.00E-04	1.50E-03	7.10E-03	2.08E-04	4.00E+02
2031	Idle (g/h)	3.10E-01	2.80E-01	9.90E+00	1.10E+01	1.00E-01	2.10E+00	9.10E-04	5.50E-02	8.10E-03	2.20E-02	1.70E-01	5.1E-04	1.30E+04
	30 km/h (g/VKT)	1.60E-02	1.40E-02	7.50E-01	5.60E-01	5.90E-03	1.10E-01	4.60E-05	2.80E-03	4.10E-04	1.30E-03	8.40E-03	2.71E-05	7.30E+02
	60 km/h (g/VKT)	9.80E-03	8.90E-03	5.50E-01	3.20E-01	3.50E-03	5.90E-02	2.10E-05	1.30E-03	1.80E-04	5.90E-04	3.80E-03	3.29E-05	4.40E+02
	100 km/h (g/VKT)	8.20E-03	7.50E-03	4.90E-01	2.60E-01	2.80E-03	4.30E-02	1.40E-05	8.30E-04	1.20E-04	3.80E-04	2.50E-03	3.42E-05	3.50E+02

**Note:**

\* PM<sub>10</sub> and PM<sub>2.5</sub> emission factors do not include road dust. See Section 4.3.4.2.

**Table 4.5 Tailpipe Emission Factors for Heavy Trucks and Buses for 2015 and 2031**

Year	Speed	Heavy Trucks												
		PM <sub>10</sub> *	PM <sub>2.5</sub> *	CO	NO <sub>2</sub> **	SO <sub>2</sub>	VOC	1,3-Butadiene	Acetaldehyde	Acrolein	Benzene	Formaldehyde	Benzo[a]pyrene	CO <sub>2e</sub>
2015	Idle (g/h)	5.80E+00	5.40E+00	2.40E+01	8.70E+01	1.70E-01	8.80E+00	2.00E-02	3.10E-01	5.50E-02	6.70E-02	7.60E-01	2.55E-02	2.00E+04
	30 km/h (g/VKT)	3.50E-01	3.30E-01	1.50E+00	5.80E+00	1.40E-02	4.70E-01	1.00E-03	1.60E-02	2.80E-03	3.40E-03	3.90E-02	9.80E-04	1.60E+03
	60 km/h (g/VKT)	1.90E-01	1.70E-01	8.70E-01	3.70E+00	9.40E-03	2.30E-01	4.70E-04	7.10E-03	1.30E-03	1.50E-03	1.70E-02	3.68E-04	1.10E+03
	100 km/h (g/VKT)	1.20E-01	1.10E-01	6.80E-01	3.50E+00	9.20E-03	1.80E-01	3.30E-04	4.90E-03	8.70E-04	1.10E-03	1.20E-02	1.66E-04	1.00E+03
2031	Idle (g/h)	8.20E-01	7.60E-01	7.10E+00	2.50E+01	1.60E-01	2.60E+00	2.10E-03	1.00E-01	1.50E-02	1.90E-02	3.00E-01	1.45E-03	1.90E+04
	30 km/h (g/VKT)	5.80E-02	5.30E-02	4.20E-01	1.70E+00	1.30E-02	1.60E-01	1.10E-04	5.10E-03	7.60E-04	9.70E-04	1.50E-02	5.60E-05	1.50E+03
	60 km/h (g/VKT)	3.30E-02	3.00E-02	2.50E-01	1.00E+00	8.40E-03	8.40E-02	4.60E-05	2.20E-03	3.30E-04	4.20E-04	6.50E-03	2.14E-05	9.70E+02
	100 km/h (g/VKT)	2.20E-02	2.00E-02	1.90E-01	9.30E-01	8.10E-03	7.00E-02	3.00E-05	1.40E-03	2.10E-04	2.70E-04	4.20E-03	9.88E-06	9.40E+02
Year	Speed	Transit Bus												
		PM <sub>10</sub>	PM <sub>2.5</sub>	CO	NO <sub>2</sub>	SO <sub>2</sub>	VOC	1,3-Butadiene	Acetaldehyde	Acrolein	Benzene	Formaldehyde	Benzo[a]pyrene	CO <sub>2e</sub>
2015	Idle (g/h)	4.10E+00	3.80E+00	2.90E+01	6.30E+01	1.70E-01	7.90E+00	1.70E-02	2.50E-01	4.40E-02	7.90E-02	6.10E-01	1.80E-02	1.70E+04
	30 km/h (g/VKT)	2.40E-01	2.20E-01	2.00E+00	4.00E+00	1.20E-02	4.30E-01	8.80E-04	1.30E-02	2.20E-03	4.40E-03	3.10E-02	7.38E-04	1.20E+03
	60 km/h (g/VKT)	1.30E-01	1.20E-01	1.30E+00	2.50E+00	7.70E-03	2.10E-01	4.00E-04	5.80E-03	1.00E-03	1.90E-03	1.40E-02	3.23E-04	7.80E+02
	100 km/h (g/VKT)	8.40E-02	7.70E-02	1.10E+00	2.30E+00	7.10E-03	1.50E-01	2.80E-04	4.00E-03	6.90E-04	1.30E-03	9.40E-03	1.87E-04	7.20E+02
2031	Idle (g/h)	5.70E-01	5.20E-01	8.50E+00	1.80E+01	1.30E-01	2.30E+00	1.50E-03	7.80E-02	1.20E-02	2.10E-02	2.40E-01	9.80E-04	1.60E+04
	30 km/h (g/VKT)	3.70E-02	3.40E-02	5.90E-01	1.10E+00	9.30E-03	1.40E-01	7.60E-05	3.90E-03	5.80E-04	1.10E-03	1.20E-02	4.15E-05	1.10E+03
	60 km/h (g/VKT)	2.10E-02	1.90E-02	4.00E-01	6.60E-01	6.00E-03	7.20E-02	3.30E-05	1.70E-03	2.50E-04	5.00E-04	5.20E-03	2.71E-05	7.10E+02
	100 km/h (g/VKT)	1.50E-02	1.40E-02	3.40E-01	5.90E-01	5.50E-03	5.70E-02	2.20E-05	1.10E-03	1.70E-04	3.20E-04	3.40E-03	2.20E-05	6.50E+02

**Note:**

\*PM<sub>10</sub> and PM<sub>2.5</sub> emission factors do not include road dust. See Section 4.3.4.2.

#### 4.3.4.2 Mechanically-Generated Dust Emissions

U.S. EPA AP-42 Section 13.2.1 provides an emission factor to estimate the amount of dust suspended by vehicles on the road (U.S. EPA, 2011), according to the following equation:

$$E = k(sL)^{0.91} \times (W)^{1.02} \times (1 - P/4N)$$

Where:

E = particulate emission factor (g/VKT)

k = particle size multiplier = 0.62 (g/VKT) for PM<sub>10</sub> and 0.15 (g/VKT) for PM<sub>2.5</sub>

sL = silt loading (g/m<sup>2</sup>)

0.6 (< 500 vehicles per day)

0.2 (500 – 5,000 vehicles per day)

0.06 (5,000 – 10,000 vehicles per day)

0.03 (> 10,000 vehicles per day)

W = weight of fleet (tons/vehicle)

P = number of "wet" days with at least 0.254 mm of precipitation during the averaging period = 137

(obtained from Toronto Pearson Airport data)

N = number of days in the averaging period = 365 days

Silt loading was determined using the AADT. In general, the AADT along Highway 407 ETR and its interchanges is greater than 10,000 vehicles per day. The AADT along the proposed 407 Transitway will be just over 500 buses per day when both directions are considered. As a result, the silt loading for Highway 407 ETR and its interchanges is 0.03 g/m<sup>2</sup>, whereas the silt loading for the proposed 407 Transitway is 0.2 g/m<sup>2</sup>.

The road dust emission factor equation also includes vehicle weight as a variable. For this assessment, the following vehicle weights were used:

- 2,500 kg gross vehicle weight for passenger vehicles (provided by Parsons);
- 24,000 kg gross vehicle weight for Transitway buses (provided by Parsons);
- 9,000 kg gross vehicle weight for medium trucks;
- 30,000 kg gross vehicle weight for heavy trucks.

In addition, according to the WRAP Fugitive Dust Handbook (Countess Environmental, 2006), a control efficiency of 40% can be applied to roadways where the posted speed limit is less than 40 km/h. Since the posted speed limit in the station parking lots and PPUDO areas will be 30 km/h, a control efficiency of 40% was applied.

Note that mechanically-generated dust emissions from vehicular travel on paved roads are not expected to change over time.

#### 4.4 Assessment Criteria

As previously mentioned in Section 4.3, where there are estimated increases in emissions in the “Future with the 407 Transitway” scenario compared to the “Future without the 407 Transitway” scenario, their significance relative to the emissions incurred on Highway 407 “now” and in the future without the Project was evaluated. As outlined in the Project terms of reference developed by the Ontario Ministry of Transportation, an increase of more than 10% is deemed significant.

#### 4.5 Air Dispersion Modelling

The quality of the air can be characterized as a measure of the amount of contaminant in a given volume of air. The typical unit of measurement is concentration or the number of micrograms of chemical, or particles, per cubic metre of air ( $\mu\text{g}/\text{m}^3$ ). This concentration will vary from point-to-point and from minute-to-minute in response to changing atmospheric conditions (wind speed, wind direction, temperature, atmospheric stability and mixing height) and the amount of pollutant emitted. To calculate the concentration at a given location, an atmospheric dispersion model is used. These models take the emissions from a source and disperse them into the surrounding atmosphere, typically using historical hourly meteorological data from a local weather station.

To assess the impact on air quality within the Study Area based on the presence of the 407 Transitway, air dispersion modelling was completed using the U.S. EPA’s recommended air dispersion model, CAL3QHCR. Model is described in further detail in the following section.

Local air quality impacts related to the project emissions were assessed for twelve pollutants and resulting concentrations were obtained for three different scenarios (see sections 4.3.1-4.3.3 for a list of scenarios).

This is a steady-state Gaussian dispersion model designed to determine air pollution concentrations at receptor locations downwind of linear emission sources (e.g., railways, roads), which are commonly referred to as “line sources”.

#### **4.5.1 CAL3QHCR**

CAL3QHCR is a model developed specifically to predict the changes in downwind air quality resulting from vehicle emissions from free flowing traffic conditions and near roadway intersections (U.S. EPA, 1995). The model combines the CALINE-3 (Benson, 1979) line source dispersion model and a traffic algorithm for estimating vehicular queue lengths at signalized intersections. The CALINE-3 line source dispersion model predicts more realistic concentrations immediately around roads because of the initial mixing in the wake zone of the vehicle. This initial mixing, combined with the traffic algorithm for queuing (added emissions from idling vehicles), provides improved model predictions of the impact of vehicle tailpipe emissions adjacent to roadways. CAL3QHCR includes additional calculations for approximating emissions near roadway intersections.

CAL3QHCR requires the input of roadway geometries, receptor locations, vehicular emission factors, signal timing, intersection configuration, and meteorological data.

CAL3QHCR model guidance documents recommend using a source release height of 0 m and all sources were assigned a release height of 0 m.

The CAL3QHCR model was originally designed to simulate dispersion of CO and PM<sub>2.5</sub> from roadways. However, it is applicable to all gaseous pollutants, provided that minor alterations to the model source code are made. To model NO<sub>2</sub>, SO<sub>2</sub> and VOC emissions, the model was modified to reflect the difference in the contaminant's molecular weight.

Since emission factors differ by vehicle class, the vehicle mix was used to calculate a composite emission factor for each pollutant for a given roadway based on the fraction of cars and trucks that travel on it. Typical hourly traffic profiles for weekdays were provided and were used to develop emission factors for each pollutant for each hour of the day.

#### **4.5.2 Meteorological Data**

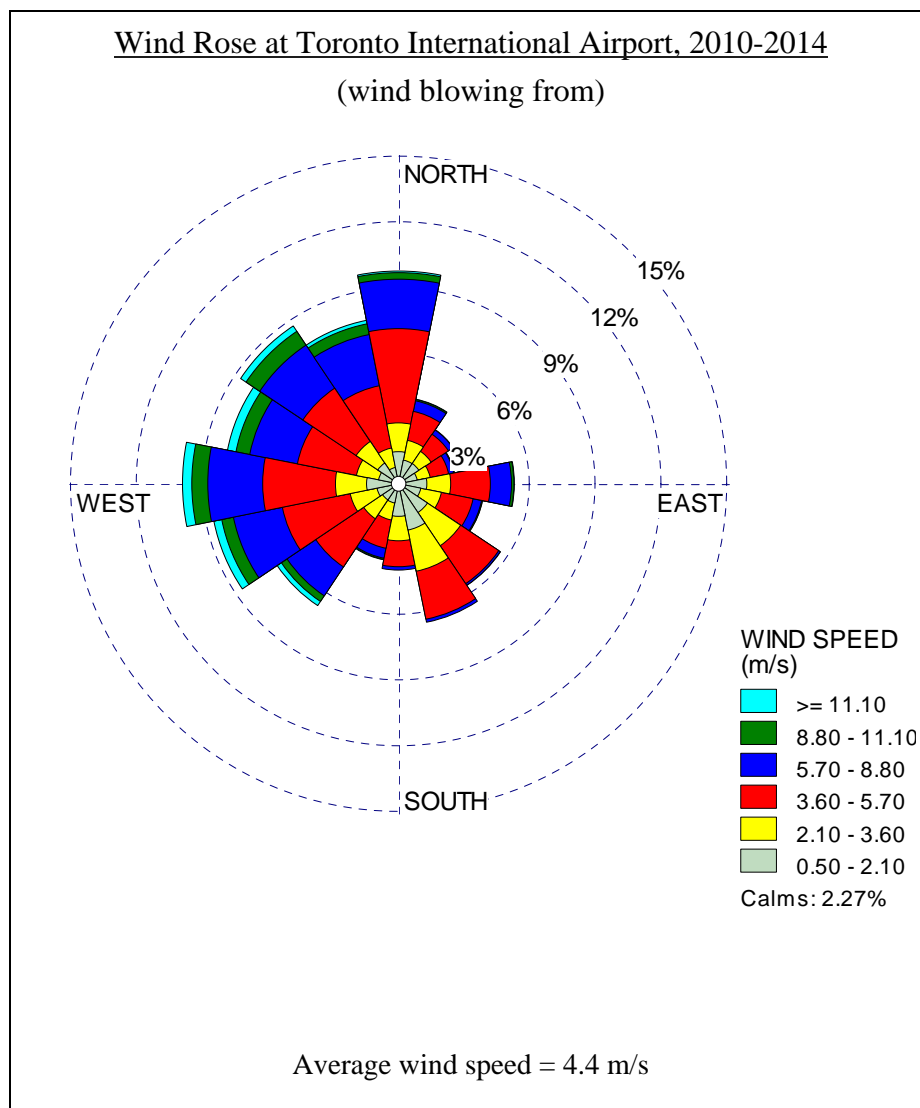
Two meteorological data sets are needed in order to perform a dispersion analysis with the CAL3QHCR model: upper air data and surface data. Hourly meteorological data is required, including: mixing height, temperature, cloud cover, cloud opacity, wind speed and wind direction. For calculating hourly mixing heights, upper air measurements are needed. Using upper air observations (twice daily), morning and afternoon mixing heights are calculated and, based on these measurements, hourly mixing heights are estimated using the U.S. EPA's regulatory meteorological pre-processor PCRAMMET for CAL3QHCR.

Upper air data was obtained from the Buffalo station and surface data was obtained from Toronto Pearson International Airport for the 5-year period 2010 to 2014. It is noted that in June 2013, the Toronto Pearson International Airport station changed equipment which resulted in a change in station name and climate ID. However, it was confirmed by the Ontario Climate Centre that the two data sets, 2010-May 2013 and June 2013- 2014, are consistent and therefore have been used for this assessment. Buffalo is the closest upper

air meteorological station to Toronto, and mixing heights (i.e. the upper air parameter) are a regional parameter and do not change significantly over moderate distances.

The frequency distribution of hourly surface wind speed and direction at the Toronto International Airport in the 5-year period from 2010 to 2014, in the form of a wind rose (i.e. a graphical representation of the frequency of winds from each direction) is presented on Figure 4.1. The average wind speed was 4.4 m/s, and calm wind conditions were observed approximately 2.3 % of the time. The prevailing winds were westerly (9.8% of the time) and from the north (9.7% of the time).

**Figure 4.1 Wind Rose Plot at Toronto Int'l Airport for the period 2010 to 2014**



Typically, five years of hourly meteorological data are used in dispersion modelling calculations, as recommended by the U.S. EPA in order to include all of the possible combinations of meteorological conditions expected to occur in the area to be modelled. The CAL3QHCR model can process only one year of data per model run, therefore the results for each year of meteorological data were compared to determine the maximum concentration for each contaminant. The models were run for five years of meteorological data to determine maximum contaminant concentrations at 24 sensitive receptor locations (see Section 3). To develop isopleths (i.e. lines of equal concentrations) for illustrative purposes, the worst-case meteorological year (i.e., the year that most often gave the highest maximum ground-level concentrations) was selected. The year 2012 was used to model concentrations at the full grid receptors (i.e. 1598 receptors along the 407 Transitway).

### **4.5.3 NO<sub>x</sub> to NO<sub>2</sub> Conversion**

As discussed previously, NO<sub>x</sub> emissions are composed of nitric oxide (NO) and nitrogen dioxide (NO<sub>2</sub>), with adverse health effects resulting from NO<sub>2</sub> at much lower concentrations than NO. Once NO is emitted to the atmosphere it begins to react with other contaminants (primarily ground-level ozone – O<sub>3</sub>) to produce NO<sub>2</sub>. Depending on the amount of ozone present, only a portion of NO<sub>x</sub> will be converted to NO<sub>2</sub>. However, for the purpose of this assessment, it has been conservatively assumed that all NO<sub>x</sub> will be converted to NO<sub>2</sub>.



## 5 AIR QUALITY IMPACT ASSESSMENT

### 5.1 CAL3QHCR Modelling Results

The output from CAL3QHCR is the predicted 1-hour average concentration at each of the modelled receptor points for the gaseous pollutants and 24-hour average concentrations for particulate matter. Hourly data is post-processed to determine maximum predicted 1-hour, 8-hour and 24-hour average concentrations, as well as annual average concentrations.

Tables B.1 through B.22 outline the maximum model-predicted concentrations of criteria air contaminants (i.e., including background) for the twenty-four (24) representative sensitive receptor locations. The ambient background concentrations established in Section 4.1 were added to maximum model-predicted concentrations to estimate worst-case ambient concentrations that could be realized as a result of the proposed Project.

As can be seen in the Tables provided in Appendix B, for each scenario assessed, all maximum model-predicted concentrations of TSP, PM<sub>10</sub>, PM<sub>2.5</sub>, NO<sub>2</sub>, SO<sub>2</sub>, and CO for all averaging periods are well below applicable ambient air quality criteria even with the addition of background. Furthermore, the maximum cumulative concentrations of SO<sub>2</sub> are well below the more stringent upcoming one-hour and annual CAAQS.

In addition, VOC compounds of acetaldehyde, acrolein, benzene, 1-3 butadiene, formaldehyde and benzo[a]pyrene were modelled and predicted results for the averaging periods with applicable air quality criteria are presented in Table B.13 through B.22 in Appendix B. Maximum predicted concentrations of VOCs for all averaging periods are well below applicable ambient air quality criteria when combined with their respective 90<sup>th</sup> percentile ambient background concentrations. The only exceptions are for benzo[a]pyrene and annual benzene, for which the background concentrations are already above their respective AAQC without any contribution from the modelled 407 Transitway.

Appendix B also provides Table B.23 through Table B.25 with the three maximum concentrations, the days (i.e. Julian day in 2012) and hour (when applicable) on which these concentrations occurred and locations (i.e. UTM coordinates in km) where these concentrations occurred, for each modelled contaminant for the Existing, Future No-Build and Future Build Scenarios, respectively. Maximum predicted concentrations of all pollutants of concern are below their corresponding ambient air quality criteria and standards, except 24-hour and annual benzo[a]pyrene and annual benzene which have background concentrations already above their respective AAQC limits.

## 5.2 Air Quality

### 5.2.1 Comparison of Existing Conditions (2015) to Future Scenarios (2031)

Model-predicted maximum concentrations for twelve contaminants and three scenarios were presented in Tables B.1 to B.22 in Appendix B. In each table, the percent change in contaminant concentrations for the Future Build and Future No-Build scenarios relative to the existing conditions scenario is also presented. As illustrated in Tables B.1 through Table B.5, predicted concentrations of TSP, PM<sub>2.5</sub> and PM<sub>10</sub> are shown to have insignificant changes at all receptors for the Future No-Build scenario relative to existing conditions, due to the emission factors staying relatively the same from 2015 to 2031. It shows a slight increase of TSP and PM<sub>10</sub> for the Future Build scenario relative to existing conditions at all receptors (except at the receptor R13 where percent change from Future Build predicted 24-hour TSP concentrations to existing conditions is 11%). Unlike gaseous pollutants, particulate matter emissions are made up of re-suspended road dust as well as tailpipe emissions. Since the road dust component dominates the total particulate matter emission factor, the expected net effect over time is an increase in emissions due to increase in future traffic volumes.

In contrast, CO, SO<sub>2</sub>, NO<sub>2</sub>, and benzo[a]pyrene concentrations decrease significantly for the Future Build and Future No-Build Scenarios relative to existing conditions (Tables B.6 to B.12, and B.21 and B.22). This is a result of the emission factors decreasing by almost a factor of 10 for every type of vehicle (cars, heavy truck and bus). The decrease in emission factors in 2031 is great enough to counteract the increase in traffic, which results in an overall decrease in emission for most receptors. The decrease in emission factors is due to the assumptions regarding the future improvements to vehicle combustion and exhaust control technology.

Tables B.13 through B.22 present the model-predicted concentrations for acrolein, acetaldehyde, benzene, 1,3-Butadiene, formaldehyde and benzo[a]pyrene showing insignificant changes for the Future Build and Future No-Build Scenarios relative to existing conditions. As mentioned before, insignificant changes can be expected despite the predicted increase in traffic volumes as a result of the improvements to engine technologies, as well as improved fuel standards.

### 5.2.2 Comparison of Future No-Build and Future Build Scenarios

When assessing the merits of the proposed 407 Transitway project compared to Future No-Build conditions, it is the incremental change in total model-predicted concentrations between the two future cases that is the true measure of the future impact of the Project. The same background concentrations are added to the modelled concentrations for the Future Build and Future No-Build scenarios, therefore, when assessing the incremental change in the combined concentrations, the background concentration cancels out.

The percent change in predicted concentrations for the Future Build Scenario relative to the Future No-Build Scenario is presented in Tables B.1 through B.22 in Appendix B. For most contaminants and most averaging periods, model-predicted concentrations are shown to stay fairly similar for the Future Build Scenario relative to Future No-Build conditions at all receptor locations. Benzo[a]pyrene is the only

contaminant that indicates a significant change between the No-Build and Future Build scenarios at two sensitive receptors. Since benzo[a]pyrene is assessed in significantly small quantities, any minor increase to emissions can result in a change in predicted concentrations that result in a significant change between the Future Build and No-Build scenarios. In addition, receptors R14 and R21 are in close proximity to the proposed Ninth Line and Whites Road stations, respectively, therefore impacting the concentrations at each of those receptors. The predicted 24-hour maximum concentrations of TSP and PM<sub>10</sub>, are shown to have a slight increase on average of 3%, for the Future Build scenario relative to the Future No-Build scenario at the sensitive receptors. The percentage change in the predicted concentration for the Future Build scenario relative to the Future No-Build scenario for the rest of modelled contaminants is up to 1% on average at all sensitive receptors. Table 5.1 below identifies the number of receptors significantly affected between the Future Build and Future No-Build scenarios.

**Table 5.1 Changes from Future Build and Future No-Build Scenarios**

	Change from Future Build and No-Build	Number of Receptors Significantly Affected
Benzo[a]pyrene	significant (>10%)	2
Formaldehyde	insignificant (<10%)	0
Acetaldehyde	insignificant (<10%)	0
Acrolein	insignificant (<10%)	0
1,3 Butadiene	insignificant (<10%)	0
Benzene	insignificant (<10%)	0
Carbon Monoxide	insignificant (<10%)	0
Nitrogen Dioxide	insignificant (<10%)	0
Sulphur Dioxide	insignificant (<10%)	0
TSP	insignificant (<10%)	0
PM <sub>10</sub>	insignificant (<10%)	0
PM <sub>2.5</sub>	insignificant (<10%)	0

The results from the air dispersion modelling have been presented in graphical format as contour plots of twelve modelled contaminants (averaging period depends on the contaminant of concern) for all three scenarios in Appendix C. As outlined in Section 4.5 2, a worst-case meteorological year (2012) was used to develop graphical isopleths for each contaminant. Figures 5.1 to 5.3 present the predicted 24-hour maximum NO<sub>2</sub> concentrations at Existing Conditions (2015), Future No-Build (2031) and Future Build (2031) scenarios, respectively. These maximum concentrations are the maximum 24-hour predicted concentrations that occur during a one-year period added to a conservative background concentration. A comparison of Figures 5.2 and 5.3 also illustrates negligible changes in NO<sub>2</sub> concentrations between the Future No-Build and Future with the 407 Transitway scenarios. Figures for all other gaseous compounds are provided in Appendix C and demonstrate results similar to those of NO<sub>2</sub>. Figures of predicted concentrations for particulate matter in Appendix C confirm the slight increase of TSP and PM<sub>10</sub> concentrations in the Future Build scenario relative to the Future No-Build scenario.

Highway 407 Transitway from East of Kennedy Road to East of Brock Road

Figure 5.1 24-hr NO<sub>2</sub> Concentrations (including background) in µg/m<sup>3</sup> - Existing Conditions (2015)

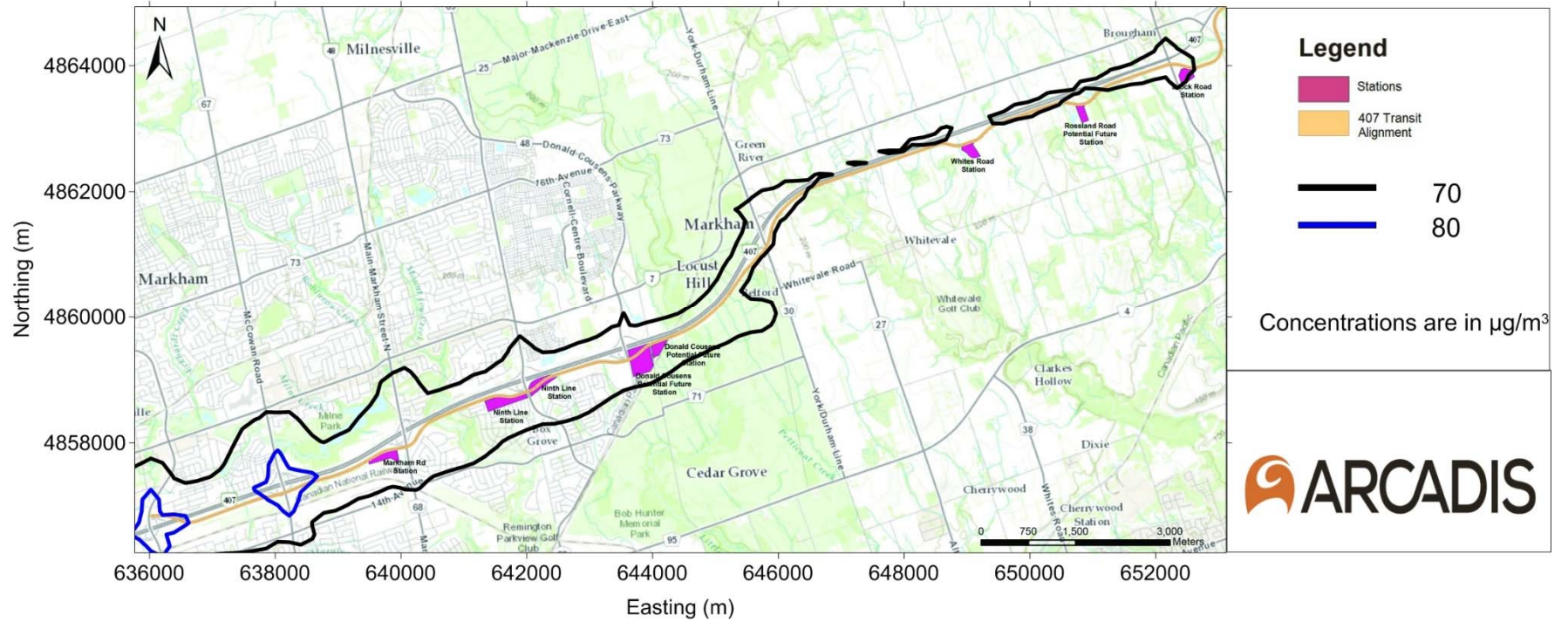


Figure 5.2 24-hr NO<sub>2</sub> Concentrations (including background) in µg/m<sup>3</sup> - Future No-Build Transitway (2031)

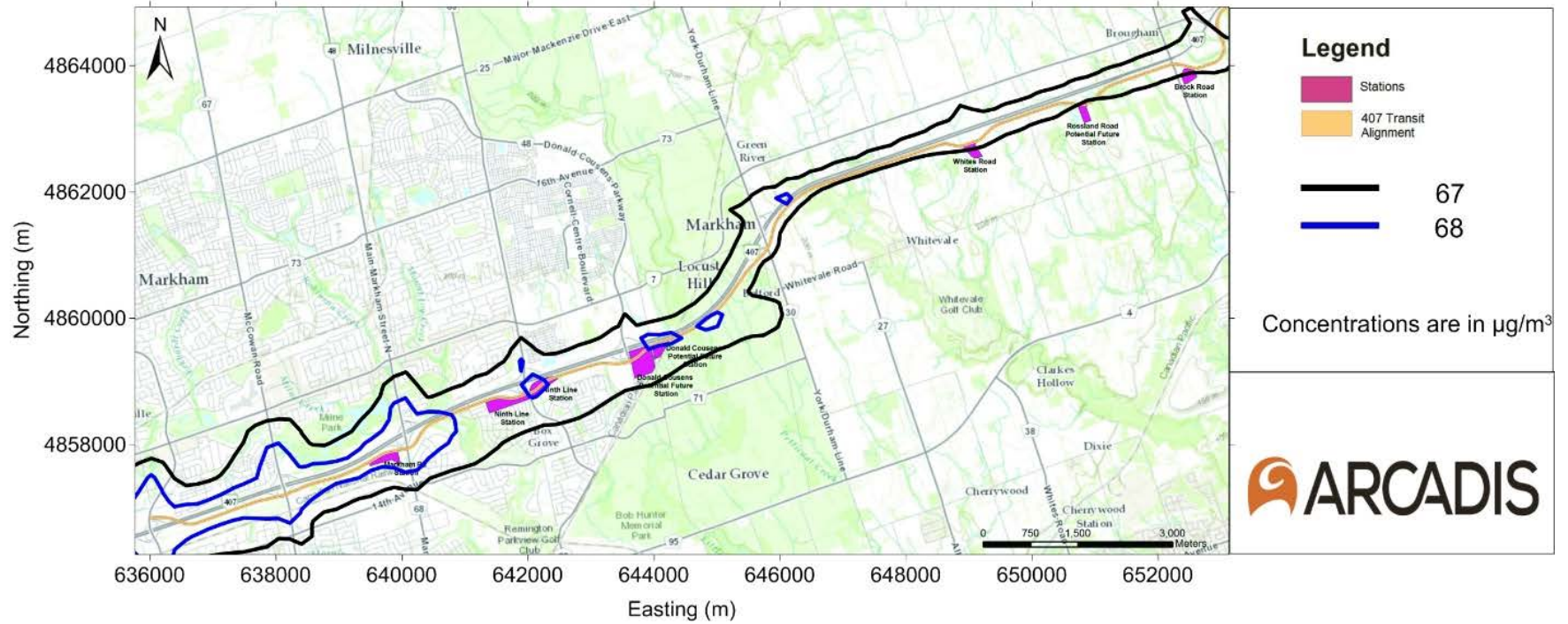
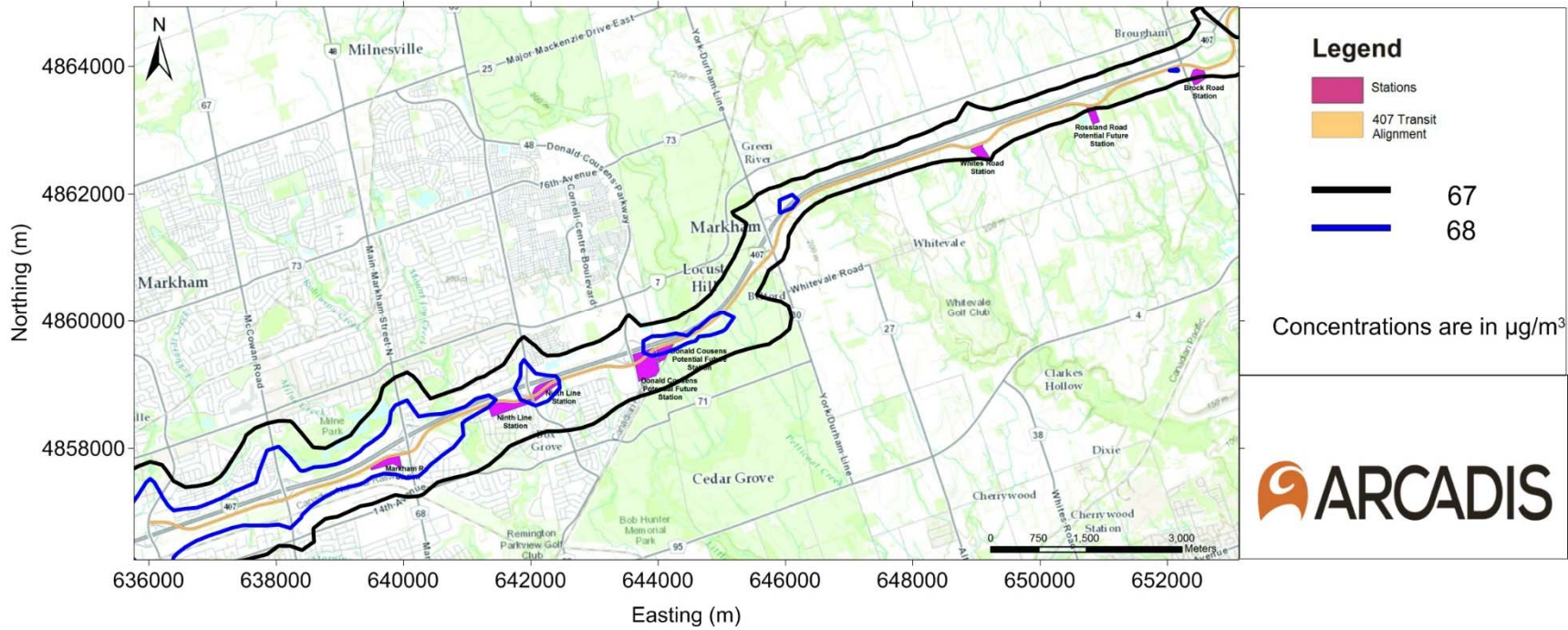


Figure 5.3 24-hr NO<sub>2</sub> Concentrations (including background) in µg/m<sup>3</sup> - Future Build Transitway (2031)



### 5.3 Greenhouse Gases

In addition to air quality pollutants, a GHG emissions inventory was also developed for the “Future with the 407 Transitway” (2031) scenario and compared to Existing Conditions (2015) and the “Future without the 407 Transitway” (2031) scenario. The total annual quantities of carbon dioxide equivalent (CO<sub>2</sub>e) released (in tonnes) for each assessment scenario are summarized in Table 5.2. The percent differences between the scenarios are shown in Table 5.3 and Table 5.4.

**Table 5.2 Annual Emissions of Greenhouse Gases**

Assessment Scenario	Annual Emissions (tonnes/year)
	CO <sub>2</sub> e
Existing Conditions (2015)	70,400
Future <b>without</b> 407 Transitway (2031)	68,488
Future <b>with</b> 407 Transitway (2031)	70,992

**Table 5.3 Percent Difference between “Future with the 407 Transitway” and “Future without the 407 Transitway”**

Assessment Scenario	% difference from the “Future without the 407 Transitway” (2031)
	CO <sub>2</sub> e
Future <b>with</b> 407 Transitway (2031)	3.70%

**Table 5.4 Percent Difference between Future (2031) and Existing Conditions (2015)**

Assessment Scenario	% difference between Future (2031) and Existing Conditions (2015)
	CO <sub>2</sub> e
Future <b>without</b> 407 Transitway (2031)	-2.70%
Future <b>with</b> 407 Transitway (2031)	0.80%

## Highway 407 Transitway from East of Kennedy Road to East of Brock Road

CO<sub>2</sub>e is shown to increase by 3.7% in the “Future with the 407 Transitway” scenario relative to the “Future without the 407 Transitway” (Table 5.3) and to increase by 0.8% in the “Future with the 407 Transitway” scenario relative to existing conditions (Table 5.4). The increase in GHG emissions occurs because the estimated number of vehicles removed from the 407 does not compensate for the predicted increase in emissions from diesel buses along the Transitway. Even though GHG emissions are expected to increase slightly for the specific Transitway Study Area, this is likely a worst-case (i.e., 100% diesel bus fleet) estimate of the project’s impact on GHG emissions.

According to Environment and Climate Change Canada’s 2016 National Inventory Report, Ontario’s GHG emissions were 182 and 170 million tonnes (Mt) in 1990 and 2014, respectively. The GHG emissions target in 2030 is therefore 115 Mt based on a 37% reduction below 1990 levels. Emissions therefore have to decrease by 55 Mt in 2030 relative to existing conditions. However, the project is estimated to increase GHG emissions by 2,500 tonnes (or 0.0025 Mt) in forecast year 2031 relative to the Future No-Build scenario (Table 5.2). Consequently, the project as designed will negatively affect progress towards the 2030 GHG target by approximately 0.0045%. This increase is the result of the worst-case scenario being evaluated, which included increased traffic volumes and diesel-fuelled buses.



## 6 MITIGATION

There are several ways that particulate emissions can be mitigated during the construction and operation phases of the Transitway. High temperatures and wind have the potential to cause the release and disbursement of particulate emissions. Therefore, it is recommended that, if possible, construction activities that are likely to cause the release of particulate be avoided under such conditions. If avoidance is not possible, it is recommended that residents within the immediate surrounding area be notified of the potential for particulate emissions during construction or high wind and high temperature scenarios. The Environment Canada publication “Best Practices for the Reduction of air Emissions from Construction and Demolition Activities” provides several mitigation measures for reducing emissions during construction activities. It is recommended that these best management practices be followed during construction of the road to reduce any adverse air quality impact that may occur. Mitigation of road dust, as recommended in the Environment Canada document, includes the use of wind barriers (i.e., solid barriers, or trees and shrubs), wetting or non-chloride dust suppressants, equipment washing, and limiting the exposed area which may be a source of dust.

For the operation phase, there are many fuel and technology pathways available to reduce the GHG intensity of Transitway buses. Switching from diesel to lower-carbon alternative fuels such as natural gas or dimethyl ether can reduce tailpipe emissions. Another option is blending biological-based fuels such as biodiesel or hydrogenation-derived renewable diesel with conventional petroleum-based diesel. Moreover, upgrading transit buses from conventional internal combustion engine technology to hybrid or electric technology can improve fuel economy or eliminate tailpipe emissions altogether. These pathways would simultaneously reduce air pollution and GHG emissions.

## 7 CONCLUSIONS

An air quality and GHG emissions inventory was completed for the future reference year 2031, with and without the proposed 407 Transitway. The air quality impacts of the proposed 407 Transitway were evaluated with detailed air dispersion modelling. Estimated concentrations of all pollutants of concern were shown to be below their corresponding ambient air quality criteria and standards, except benzo[a]pyrene and annual benzene which have background concentrations already above their respective AAQC limits. The project's contribution to the cumulative concentration of benzene for the annual averaging period is insignificant. Conversely, the project's contribution to the cumulative concentration of benzo[a]pyrene for the 24-hr and annual averaging periods is more substantial. However, since benzo[a]pyrene is assessed in significantly small quantities, model-predicted concentrations are very sensitive to even a minor increase in emissions.

Compared to existing conditions (2015), NO<sub>2</sub>, CO and SO<sub>2</sub> show a significant decrease in both Future Build and Future No-Build scenarios. All VOCs (i.e. acrolein, acetaldehyde, benzene, 1,3-butadiene, formaldehyde and benzo[a]pyrene) stay relatively constant in both Future Build and Future No-Build scenarios. Significant changes at two receptors are shown for 24-hour benzo[a]pyrene, which are in close proximity to the proposed nearby stations. However, it should be restated that benzo[a]pyrene is assessed in significantly small quantities and therefore model-predicted concentrations are very sensitive to even a minor increase in emissions. Moreover, despite future increases in traffic volumes within the Study Area, these gaseous tailpipe emissions decrease due to improved engine technologies and better fuel standards. As a result, the increase in gaseous air pollutants attributable to the Project is deemed to be insignificant.

Unlike gaseous air pollutants, TSP and PM<sub>10</sub> concentrations are predicted to increase in the "Future with the 407 Transitway" scenario relative to existing conditions. Although, the estimated increase in emissions of TSP and PM<sub>10</sub> are attributable to the Project, this increase is considered to be insignificant and the predicted concentrations are well below the applicable ambient air quality criteria, indicating no public health risk. The change in PM<sub>2.5</sub> concentrations in the Future Build scenario relative to the Existing Conditions and Future No-Build scenarios is insignificant.

Emissions of CO<sub>2e</sub> are also shown to increase in the "Future with the 407 Transitway" scenario relative to future conditions without the Project as well as existing conditions. However, the percent change is less than 10% in both cases, therefore, the increase is considered to be insignificant.

## 8 REFERENCES

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**APPENDIX A**  
**MOVES2014 Inputs**



## Summary of MOVES2014 Model Inputs

As noted in Section 4.3.4, vehicle emission factors developed for the purposes of this air quality assessment were based on the U.S. EPA's Motor Vehicle Emission Simulator (MOVES) model. The U.S. EPA introduced MOVES in 2010 as a replacement emission inventory tool to the MOBILE6.2 model.

For this assessment, emission factors were developed for cars, medium trucks, heavy trucks and buses using MOVES2014 and Niagara County, New York (NY) State as the geographic surrogate for exhaust emissions. Although there are small temperature and humidity effects on exhaust emissions, the geographic proximity of Niagara County, NY to the Study Area are not expected to affect emission estimates to a level that would materially impact results and conclusions of this report.

County-level MOVES runs were completed for the base year 2015, and the future horizon year 2031 using the "emission rates" calculation mode. In general, Chapter 5 of the MOVES2014 User Guide "*Generate Emission Rates for County Scale Analyses*" was followed. When running MOVES in the "emission rates" mode, many of the same inputs needed to run MOVES in "inventory" mode are required in order for the model to run in "emission rates" mode. However, not all inputs are actually used by the model in the calculation of emission rates. As a result, much of the default data available for Niagara County, NY could be used as input to MOVES without impacting the results. Default inputs used included:

- meteorology;
- average speed distribution;
- road type distribution;
- ramp fraction;
- fuels information; and
- hotelling.

Of this list, fuel supply information is the only data input that can directly affect the emission rates calculations. However, recent fuel supply data is not readily available for Ontario and as a result, default fuel information for Niagara County, NY was used as a surrogate. Since Canada's on-road vehicle and engine emissions regulations<sup>1</sup> are closely aligned with U.S. emissions regulations, the differences in fuel and engine characteristics are considered minor enough so as not to affect emission estimates to a level that would materially impact results and conclusions of this report. However, it should be noted that it was conservatively assumed that all buses were powered by diesel fuel. The AVFT (alternative vehicle fuels and technologies) input table was adjusted to reflect this. A summary of the primary MOVES input parameters is provided in Table A.1.

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<sup>1</sup> Government of Canada. On-Road Vehicle and Engine Emission Regulations SOR/2003-2. Available at: <http://laws-lois.justice.gc.ca/PDF/SOR-2003-2.pdf>. Accessed on: 18 September 2015.

**Table A.1 MOVES Input Parameters**

Parameter	Input
Scale	County Domain
Meteorology	Default temperature and humidity for Niagara County, NY
Years	2015, 2031
Geographical Bounds	Niagara County, NY
Fuels	Gasoline Fuels, Diesel Fuels
Source Use Types	Passenger Car, Passenger Truck, Bus, Single short-haul, Single long-haul truck, Combination short-haul truck, Combination long-haul truck
Road Type	4- Urban Restricted Access, 5 – Urban Unrestricted Access
Contaminants and Processes	All Processes for NO <sub>x</sub> , CO, PM <sub>2.5</sub> , PM <sub>10</sub> , Acetaldehyde, Acrolein, Benzene, 1,3-Butadiene, Formaldehyde, Benzo[a]Pyrene
Vehicle Age Distribution	30-year distribution from Age Distribution Projection Tool for MOVES2014

Source type population data and VMT (vehicle-miles travelled) data was based on data from Statistics Canada's 2009 Annual Canadian Vehicle Survey Report<sup>2</sup>. 2009 is the most recent year that data is published for. VMT information was then input to the AADVMT Converter Tool for MOVES2014 (available from the U.S. EPA) to generate the required inputs for MOVES: HPMSVTypeYear; and VMTFraction. The Statistics Canada vehicle categories were mapped into HPMSVTypeID categories as shown in Table A.2. The mapping was based on professional judgment.

**Table A.2 Statistics Canada Vehicle Categories Mapped Into MOVES Source Types**

Statistics Canada Vehicle Category	MOVES Source Type	HPMSVTypeID
<b><i>Vehicles up to 4.5 tonnes</i></b>		
Car	21	25
Station wagon	21	25
Van	21	25
Sport utility vehicle	21	25
Pickup	31	25
Straight truck	32	50
<b><i>Trucks 4.5 tonnes to 14.9 tonnes</i></b>		
Van	32	50
Pickup	32	50
Straight truck	52	50
Tractor trailer	53	50
Bus	42	40
<b><i>Trucks 15 tonnes and over</i></b>		
Straight truck	61	60
Tractor trailer	62	60

<sup>2</sup> Statistics Canada. 2010. Canadian Vehicle Survey: Annual, 2009. Catalogue no. 53-223-X. July.

Age distribution data was based on data available from Environment Canada for the year 2006, which was provided to Arcadis for a previous project. The Age Distribution Projection Tool for MOVES2014 (available from the U.S. EPA) was then used to project the age distributions out to 2015 and 2031. I/M program information was not used in this assessment.

Rate per distance tables were generated using MOVES2014 which provided emission factors for each pollutant by year, month, vehicle type, vehicle speed and road type. The emission factors generated were then applied to the traffic volume data described in Section 4.3.4 to calculate total annual emissions. Note that emission factors were not varied by time of year. Rather, winter emission factors were used to calculate emissions for an entire year as they were the most conservative. More specifically, January emission factors were used as this was considered the worst-case month. Cold weather promotes cold starts on vehicles, which consequently result in incomplete combustion and higher tailpipe emissions. Cold weather also diminishes dispersion of contaminants, resulting in higher ground-level concentrations.

The rate per distance tables provided emission factors for eight vehicle source types; however, the traffic volumes provided by IBI Group were only broken down into four categories (cars, medium trucks, heavy trucks and buses). As a result, the emission factors for the selected MOVES source types were averaged before being applied to the traffic volumes in Section 4.3.4. Table A.3 illustrates which MOVES source types were averaged together for the composite emission factor.

**Table A.3 Classification of MOVES Source Type Outputs for the Air Quality Assessment**

MOVES Source Type ID	MOVES Source Type Name	Assessment Source Type Classification*
21	Passenger Car	Cars <sup>1</sup>
31	Passenger truck	Cars <sup>1</sup>
32	Light commercial truck	Medium Trucks <sup>2,4</sup>
42	Bus	Bus
52	Single-unit short-haul truck	Medium Trucks <sup>2,4</sup>
53	Single-unit long-haul truck	Medium Trucks <sup>2,4</sup>
61	Combination short-haul truck	Heavy Trucks <sup>3,4</sup>
62	Combination long-haul truck	Heavy Trucks <sup>3,4</sup>

**Notes:**

- <sup>1</sup> The traffic volume for Cars includes all vehicles having designed primarily for the transportation of nine or fewer passengers or the transportation of cargo (e.g., vans and light trucks). Generally, the gross vehicle weight is less than 4,500 kg.
- <sup>2</sup> The traffic volume for Medium Trucks includes all vehicles designed for the transportation of cargo. Generally, the gross vehicle weight is greater than 4,500 kg but less than 12,000 kg.
- <sup>3</sup> The traffic volume for Heavy Trucks includes all vehicles designed for the transportation of cargo. Generally, the gross vehicle weight is greater than 12,000 kg.
- <sup>4</sup> Breakdown of medium vs. heavy trucks for Highway 407 mainline was not available. It was assumed that one-third of total trucks are medium trucks and two-thirds are heavy truck.

**APPENDIX B**  
**CAL3QHCR Model Results TABLES**





**Table B.1 24-hour Maximum TSP Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			24-hr Max Concentration (µg/m <sup>3</sup> )	24-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	24-hr Max Concentration µg/m <sup>3</sup>	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	56	60.51	61.52	2%	63.02	4%	2%	120	50%	51%	53%
R2	Kennedy Rd. to McCowan Rd.	56	64.60	66.80	3%	69.40	7%	4%	120	54%	56%	58%
R3	Kennedy Rd. to McCowan Rd.	56	65.12	67.40	3%	68.99	6%	2%	120	54%	56%	57%
R4	Kennedy Rd. to McCowan Rd.	56	59.14	59.75	1%	60.44	2%	1%	120	49%	50%	50%
R5	Kennedy Rd. to McCowan Rd.	56	64.53	66.62	3%	67.81	5%	2%	120	54%	56%	57%
R6	Kennedy Rd. to McCowan Rd.	56	59.01	59.60	1%	60.41	2%	1%	120	49%	50%	50%
R7	Markham Rd. to Ninth Line	56	63.06	64.79	3%	66.29	5%	2%	120	53%	54%	55%
R8	Markham Rd. to Ninth Line	56	64.83	67.15	4%	68.50	6%	2%	120	54%	56%	57%
R9	Markham Rd. to Ninth Line	56	60.95	62.14	2%	64.22	5%	3%	120	51%	52%	54%
R10	Markham Rd. to Ninth Line	56	61.61	63.00	2%	64.60	5%	3%	120	51%	52%	54%
R11	Markham Rd. to Ninth Line	56	60.58	61.62	2%	65.53	8%	6%	120	50%	51%	55%
R12	Markham Rd. to Ninth Line	56	63.87	66.14	4%	67.75	6%	2%	120	53%	55%	56%
R13	Markham Rd. to Ninth Line	56	61.60	62.98	2%	68.10	11%	8%	120	51%	52%	57%
R14	Markham Rd. to Ninth Line	56	60.69	62.03	2%	66.19	9%	7%	120	51%	52%	55%
R15	Ninth Line to Donald Cousens Pkwy.	56	60.26	61.48	2%	63.71	6%	4%	120	50%	51%	53%
R16	Ninth Line to Donald Cousens Pkwy.	56	60.77	62.04	2%	64.44	6%	4%	120	51%	52%	54%
R17	Ninth Line to Donald Cousens Pkwy.	56	59.14	59.87	1%	61.04	3%	2%	120	49%	50%	51%
R18	Donald Cousens Pkwy. to York-Durham Line	56	59.02	59.79	1%	61.35	4%	3%	120	49%	50%	51%
R19	Donald Cousens Pkwy. to York-Durham Line	56	60.27	60.59	1%	61.96	3%	2%	120	50%	50%	52%
R20	York-Durham Line to Whites Road	56	57.72	58.13	1%	58.80	2%	1%	120	48%	48%	49%
R21	York-Durham Line to Whites Road	56	57.76	59.17	2%	61.13	6%	3%	120	48%	49%	51%
R22	Whites Road to Brock Road	56	57.75	58.17	1%	58.86	2%	1%	120	48%	48%	49%
R23	Whites Road to Brock Road	56	57.77	58.19	1%	59.00	2%	1%	120	48%	48%	49%
R24	Whites Road to Brock Road	56	58.11	57.98	0%	59.47	2%	3%	120	48%	48%	50%

**Table B.2 Annual Average TSP Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			Annual Average Concentration (µg/m <sup>3</sup> )	Annual Average Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	Annual Average Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	30.5	31.99	32.38	1%	32.78	2%	1%	60	53%	54%	55%
R2	Kennedy Rd. to McCowan Rd.	30.5	33.31	34.09	2%	34.97	5%	3%	60	56%	57%	58%
R3	Kennedy Rd. to McCowan Rd.	30.5	33.66	34.52	3%	35.13	4%	2%	60	56%	58%	59%
R4	Kennedy Rd. to McCowan Rd.	30.5	31.15	31.32	1%	31.53	1%	1%	60	52%	52%	53%
R5	Kennedy Rd. to McCowan Rd.	30.5	33.19	33.91	2%	34.29	3%	1%	60	55%	57%	57%
R6	Kennedy Rd. to McCowan Rd.	30.5	31.13	31.30	1%	31.55	1%	1%	60	52%	52%	53%
R7	Markham Rd. to Ninth Line	30.5	33.35	34.13	2%	34.82	4%	2%	60	56%	57%	58%
R8	Markham Rd. to Ninth Line	30.5	33.63	34.53	3%	35.01	4%	1%	60	56%	58%	58%
R9	Markham Rd. to Ninth Line	30.5	32.02	32.45	1%	33.28	4%	3%	60	53%	54%	55%
R10	Markham Rd. to Ninth Line	30.5	32.11	32.57	1%	33.39	4%	3%	60	54%	54%	56%
R11	Markham Rd. to Ninth Line	30.5	32.03	32.45	1%	33.94	6%	5%	60	53%	54%	57%
R12	Markham Rd. to Ninth Line	30.5	32.46	33.03	2%	33.50	3%	1%	60	54%	55%	56%
R13	Markham Rd. to Ninth Line	30.5	32.32	32.83	2%	34.88	8%	6%	60	54%	55%	58%
R14	Markham Rd. to Ninth Line	30.5	31.51	31.83	1%	33.55	6%	5%	60	53%	53%	56%
R15	Ninth Line to Donald Cousens Pkwy.	30.5	31.66	32.06	1%	32.90	4%	3%	60	53%	53%	55%
R16	Ninth Line to Donald Cousens Pkwy.	30.5	31.82	32.23	1%	33.30	5%	3%	60	53%	54%	55%
R17	Ninth Line to Donald Cousens Pkwy.	30.5	31.24	31.46	1%	31.94	2%	2%	60	52%	52%	53%
R18	Donald Cousens Pkwy. to York-Durham Line	30.5	31.20	31.48	1%	32.00	3%	2%	60	52%	52%	53%
R19	Donald Cousens Pkwy. to York-Durham Line	30.5	31.70	31.86	0%	32.44	2%	2%	60	53%	53%	54%
R20	York-Durham Line to Whites Road	30.5	30.74	30.85	0%	31.03	1%	1%	60	51%	51%	52%
R21	York-Durham Line to Whites Road	30.5	30.75	31.24	2%	31.76	3%	2%	60	51%	52%	53%
R22	Whites Road to Brock Road	30.5	30.74	30.89	1%	31.11	1%	1%	60	51%	51%	52%
R23	Whites Road to Brock Road	30.5	30.73	30.85	0%	31.09	1%	1%	60	51%	51%	52%
R24	Whites Road to Brock Road	30.5	30.88	30.88	0%	31.44	2%	2%	60	51%	51%	52%

Table B.3 98<sup>th</sup> Percentile of PM<sub>2.5</sub> Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			98 % Concentration (µg/m <sup>3</sup> )	98 % Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	98 % Concentration µg/m <sup>3</sup>	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	14.2	14.72	14.72	0.0%	14.78	0%	0%	27	55%	55%	55%
R2	Kennedy Rd. to McCowan Rd.	14.2	15.02	15.02	0.0%	15.13	1%	1%	27	56%	56%	56%
R3	Kennedy Rd. to McCowan Rd.	14.2	15.11	15.10	-0.1%	15.17	0%	0%	27	56%	56%	56%
R4	Kennedy Rd. to McCowan Rd.	14.2	14.48	14.48	-0.1%	14.52	0%	0%	27	54%	54%	54%
R5	Kennedy Rd. to McCowan Rd.	14.2	15.05	15.04	-0.1%	15.08	0%	0%	27	56%	56%	56%
R6	Kennedy Rd. to McCowan Rd.	14.2	14.49	14.48	-0.1%	14.54	0%	0%	27	54%	54%	54%
R7	Markham Rd. to Ninth Line	14.2	14.97	14.94	-0.2%	15.05	1%	1%	27	55%	55%	56%
R8	Markham Rd. to Ninth Line	14.2	15.04	15.07	0.2%	15.16	1%	1%	27	56%	56%	56%
R9	Markham Rd. to Ninth Line	14.2	14.69	14.71	0.1%	14.83	1%	1%	27	54%	54%	55%
R10	Markham Rd. to Ninth Line	14.2	14.71	14.72	0.1%	14.85	1%	1%	27	54%	55%	55%
R11	Markham Rd. to Ninth Line	14.2	14.67	14.67	0.0%	14.92	2%	2%	27	54%	54%	55%
R12	Markham Rd. to Ninth Line	14.2	14.85	14.89	0.3%	14.99	1%	1%	27	55%	55%	56%
R13	Markham Rd. to Ninth Line	14.2	14.75	14.77	0.2%	15.08	2%	2%	27	55%	55%	56%
R14	Markham Rd. to Ninth Line	14.2	14.57	14.60	0.2%	15.03	3%	3%	27	54%	54%	56%
R15	Ninth Line to Donald Cousens Pkwy.	14.2	14.61	14.63	0.2%	14.79	1%	1%	27	54%	54%	55%
R16	Ninth Line to Donald Cousens Pkwy.	14.2	14.64	14.65	0.1%	14.84	1%	1%	27	54%	54%	55%
R17	Ninth Line to Donald Cousens Pkwy.	14.2	14.48	14.51	0.2%	14.60	1%	1%	27	54%	54%	54%
R18	Donald Cousens Pkwy. to York-Durham Line	14.2	14.47	14.51	0.3%	14.64	1%	1%	27	54%	54%	54%
R19	Donald Cousens Pkwy. to York-Durham Line	14.2	14.53	14.55	0.1%	14.64	1%	1%	27	54%	54%	54%
R20	York-Durham Line to Whites Road	14.2	14.30	14.32	0.1%	14.37	1%	0%	27	53%	53%	53%
R21	York-Durham Line to Whites Road	14.2	14.30	14.42	0.8%	14.56	2%	1%	27	53%	53%	54%
R22	Whites Road to Brock Road	14.2	14.29	14.33	0.3%	14.39	1%	0%	27	53%	53%	53%
R23	Whites Road to Brock Road	14.2	14.29	14.32	0.2%	14.37	1%	0%	27	53%	53%	53%
R24	Whites Road to Brock Road	14.2	14.34	14.31	-0.2%	14.47	1%	1%	27	53%	53%	54%

**Table B.4 Annual Average PM<sub>2.5</sub> Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			Annual Average Concentration (µg/m <sup>3</sup> )	Annual Average Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	Annual Average Concentration µg/m <sup>3</sup>	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	7.4	7.63	7.61	0%	7.64	0%	0%	8.8	87%	86%	87%
R2	Kennedy Rd. to McCowan Rd.	7.4	7.75	7.73	0%	7.80	1%	1%	8.8	88%	88%	89%
R3	Kennedy Rd. to McCowan Rd.	7.4	7.78	7.76	0%	7.81	0%	1%	8.8	88%	88%	89%
R4	Kennedy Rd. to McCowan Rd.	7.4	7.50	7.49	0%	7.51	0%	0%	8.8	85%	85%	85%
R5	Kennedy Rd. to McCowan Rd.	7.4	7.73	7.71	0%	7.74	0%	0%	8.8	88%	88%	88%
R6	Kennedy Rd. to McCowan Rd.	7.4	7.50	7.49	0%	7.52	0%	0%	8.8	85%	85%	85%
R7	Markham Rd. to Ninth Line	7.4	7.75	7.72	0%	7.78	0%	1%	8.8	88%	88%	88%
R8	Markham Rd. to Ninth Line	7.4	7.76	7.76	0%	7.80	1%	1%	8.8	88%	88%	89%
R9	Markham Rd. to Ninth Line	7.4	7.60	7.60	0%	7.66	1%	1%	8.8	86%	86%	87%
R10	Markham Rd. to Ninth Line	7.4	7.60	7.60	0%	7.66	1%	1%	8.8	86%	86%	87%
R11	Markham Rd. to Ninth Line	7.4	7.59	7.58	0%	7.69	1%	1%	8.8	86%	86%	87%
R12	Markham Rd. to Ninth Line	7.4	7.64	7.64	0%	7.69	1%	1%	8.8	87%	87%	87%
R13	Markham Rd. to Ninth Line	7.4	7.61	7.61	0%	7.75	2%	2%	8.8	87%	86%	88%
R14	Markham Rd. to Ninth Line	7.4	7.54	7.54	0%	7.71	2%	2%	8.8	86%	86%	88%
R15	Ninth Line to Donald Cousens Pkwy.	7.4	7.55	7.56	0%	7.63	1%	1%	8.8	86%	86%	87%
R16	Ninth Line to Donald Cousens Pkwy.	7.4	7.57	7.57	0%	7.65	1%	1%	8.8	86%	86%	87%
R17	Ninth Line to Donald Cousens Pkwy.	7.4	7.51	7.51	0%	7.55	1%	1%	8.8	85%	85%	86%
R18	Donald Cousens Pkwy. to York-Durham Line	7.4	7.50	7.51	0%	7.56	1%	1%	8.8	85%	85%	86%
R19	Donald Cousens Pkwy. to York-Durham Line	7.4	7.53	7.52	0%	7.57	1%	1%	8.8	86%	86%	86%
R20	York-Durham Line to Whites Road	7.4	7.44	7.44	0%	7.46	0%	0%	8.8	85%	85%	85%
R21	York-Durham Line to Whites Road	7.4	7.44	7.48	1%	7.53	1%	1%	8.8	85%	85%	86%
R22	Whites Road to Brock Road	7.4	7.43	7.45	0%	7.47	0%	0%	8.8	84%	85%	85%
R23	Whites Road to Brock Road	7.4	7.43	7.44	0%	7.46	0%	0%	8.8	84%	85%	85%
R24	Whites Road to Brock Road	7.4	7.45	7.44	0%	7.50	1%	1%	8.8	85%	85%	85%

Table B.5 24-hour Maximum PM<sub>10</sub> Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			24-hr Max Concentration (µg/m <sup>3</sup> )	24-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	24-hr Max Concentration µg/m <sup>3</sup>	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	28	30.38	30.73	1%	31.14	2%	1%	50	61%	61%	62%
R2	Kennedy Rd. to McCowan Rd.	28	31.50	32.12	2%	32.91	4%	2%	50	63%	64%	66%
R3	Kennedy Rd. to McCowan Rd.	28	31.82	32.47	2%	33.11	4%	2%	50	64%	65%	66%
R4	Kennedy Rd. to McCowan Rd.	28	29.38	29.59	1%	30.12	2%	2%	50	59%	59%	60%
R5	Kennedy Rd. to McCowan Rd.	28	31.66	32.26	2%	32.76	3%	2%	50	63%	65%	66%
R6	Kennedy Rd. to McCowan Rd.	28	29.48	29.67	1%	30.21	2%	2%	50	59%	59%	60%
R7	Markham Rd. to Ninth Line	28	31.24	31.72	2%	32.91	5%	4%	50	62%	63%	66%
R8	Markham Rd. to Ninth Line	28	31.92	32.72	3%	33.44	5%	2%	50	64%	65%	67%
R9	Markham Rd. to Ninth Line	28	31.08	31.64	2%	32.87	6%	4%	50	62%	63%	66%
R10	Markham Rd. to Ninth Line	28	30.65	31.14	2%	31.88	4%	2%	50	61%	62%	64%
R11	Markham Rd. to Ninth Line	28	30.15	30.54	1%	31.99	6%	5%	50	60%	61%	64%
R12	Markham Rd. to Ninth Line	28	30.73	31.34	2%	32.22	5%	3%	50	61%	63%	64%
R13	Markham Rd. to Ninth Line	28	30.63	31.20	2%	33.07	8%	6%	50	61%	62%	66%
R14	Markham Rd. to Ninth Line	28	29.97	30.46	2%	32.66	9%	7%	50	60%	61%	65%
R15	Ninth Line to Donald Cousens Pkwy.	28	30.13	30.67	2%	32.15	7%	5%	50	60%	61%	64%
R16	Ninth Line to Donald Cousens Pkwy.	28	30.11	30.59	2%	31.70	5%	4%	50	60%	61%	63%
R17	Ninth Line to Donald Cousens Pkwy.	28	29.38	29.67	1%	30.47	4%	3%	50	59%	59%	61%
R18	Donald Cousens Pkwy. to York-Durham Line	28	29.37	29.58	1%	30.75	5%	4%	50	59%	59%	62%
R19	Donald Cousens Pkwy. to York-Durham Line	28	29.56	29.64	0%	30.33	3%	2%	50	59%	59%	61%
R20	York-Durham Line to Whites Road	28	28.39	28.60	1%	29.00	2%	1%	50	57%	57%	58%
R21	York-Durham Line to Whites Road	28	28.39	29.30	3%	30.22	6%	3%	50	57%	59%	60%
R22	Whites Road to Brock Road	28	28.41	28.69	1%	29.11	2%	1%	50	57%	57%	58%
R23	Whites Road to Brock Road	28	28.37	28.54	1%	28.85	2%	1%	50	57%	57%	58%
R24	Whites Road to Brock Road	28	28.81	28.64	-1%	29.44	2%	3%	50	58%	57%	59%

**Table B.6 1-hour Maximum NO<sub>2</sub> Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			1-hr Max Concentration (µg/m <sup>3</sup> )	1-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	1-hr Max Concentration µg/m <sup>3</sup>	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	75.9	134.30	90.36	-33%	91.00	-32%	1%	400	34%	23%	23%
R2	Kennedy Rd. to McCowan Rd.	75.9	175.91	100.65	-43%	101.41	-42%	1%	400	44%	25%	25%
R3	Kennedy Rd. to McCowan Rd.	75.9	195.25	105.49	-46%	106.28	-46%	1%	400	49%	26%	27%
R4	Kennedy Rd. to McCowan Rd.	75.9	119.09	86.93	-27%	88.19	-26%	1%	400	30%	22%	22%
R5	Kennedy Rd. to McCowan Rd.	75.9	177.03	100.90	-43%	101.72	-43%	1%	400	44%	25%	25%
R6	Kennedy Rd. to McCowan Rd.	75.9	111.00	84.96	-23%	86.13	-22%	1%	400	28%	21%	22%
R7	Markham Rd. to Ninth Line	75.9	155.89	96.91	-38%	98.36	-37%	1%	400	39%	24%	25%
R8	Markham Rd. to Ninth Line	75.9	262.65	122.00	-54%	123.20	-53%	1%	400	66%	31%	31%
R9	Markham Rd. to Ninth Line	75.9	212.61	111.63	-47%	114.32	-46%	2%	400	53%	28%	29%
R10	Markham Rd. to Ninth Line	75.9	180.08	103.06	-43%	103.75	-42%	1%	400	45%	26%	26%
R11	Markham Rd. to Ninth Line	75.9	161.55	98.12	-39%	99.61	-38%	2%	400	40%	25%	25%
R12	Markham Rd. to Ninth Line	75.9	128.63	89.87	-30%	90.22	-30%	0%	400	32%	22%	23%
R13	Markham Rd. to Ninth Line	75.9	155.14	96.42	-38%	98.76	-36%	2%	400	39%	24%	25%
R14	Markham Rd. to Ninth Line	75.9	142.09	93.12	-34%	93.63	-34%	1%	400	36%	23%	23%
R15	Ninth Line to Donald Cousens Pkwy.	75.9	138.00	92.09	-33%	94.51	-32%	3%	400	35%	23%	24%
R16	Ninth Line to Donald Cousens Pkwy.	75.9	149.35	95.08	-36%	97.05	-35%	2%	400	37%	24%	24%
R17	Ninth Line to Donald Cousens Pkwy.	75.9	132.99	90.78	-32%	92.20	-31%	2%	400	33%	23%	23%
R18	Donald Cousens Pkwy. to York-Durham Line	75.9	127.95	89.47	-30%	90.41	-29%	1%	400	32%	22%	23%
R19	Donald Cousens Pkwy. to York-Durham Line	75.9	100.04	82.61	-17%	83.00	-17%	0%	400	25%	21%	21%
R20	York-Durham Line to Whites Road	75.9	87.95	79.48	-10%	79.73	-9%	0%	400	22%	20%	20%
R21	York-Durham Line to Whites Road	75.9	88.40	80.05	-9%	80.59	-9%	1%	400	22%	20%	20%
R22	Whites Road to Brock Road	75.9	88.08	79.67	-10%	79.93	-9%	0%	400	22%	20%	20%
R23	Whites Road to Brock Road	75.9	88.00	79.59	-10%	79.97	-9%	0%	400	22%	20%	20%
R24	Whites Road to Brock Road	75.9	99.34	82.66	-17%	83.42	-16%	1%	400	25%	21%	21%

**Table B.7 24-hour Maximum NO<sub>2</sub> Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			24-hr Max Concentration (µg/m <sup>3</sup> )	24-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	24-hr Max Concentration µg/m <sup>3</sup>	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	65.9	74.82	68.41	-9%	68.47	-8%	0.1%	200	37%	34%	34%
R2	Kennedy Rd. to McCowan Rd.	65.9	76.66	68.77	-10%	68.92	-10%	0.2%	200	38%	34%	34%
R3	Kennedy Rd. to McCowan Rd.	65.9	78.37	69.20	-12%	69.31	-12%	0.2%	200	39%	35%	35%
R4	Kennedy Rd. to McCowan Rd.	65.9	71.55	67.38	-6%	67.48	-6%	0.1%	200	36%	34%	34%
R5	Kennedy Rd. to McCowan Rd.	65.9	77.83	69.00	-11%	69.08	-11%	0.1%	200	39%	35%	35%
R6	Kennedy Rd. to McCowan Rd.	65.9	71.94	67.47	-6%	67.57	-6%	0.1%	200	36%	34%	34%
R7	Markham Rd. to Ninth Line	65.9	79.23	69.33	-12%	69.52	-12%	0.3%	200	40%	35%	35%
R8	Markham Rd. to Ninth Line	65.9	77.35	68.79	-11%	68.88	-11%	0.1%	200	39%	34%	34%
R9	Markham Rd. to Ninth Line	65.9	78.17	69.10	-12%	69.34	-11%	0.3%	200	39%	35%	35%
R10	Markham Rd. to Ninth Line	65.9	76.04	68.55	-10%	68.69	-10%	0.2%	200	38%	34%	34%
R11	Markham Rd. to Ninth Line	65.9	74.59	68.18	-9%	68.42	-8%	0.4%	200	37%	34%	34%
R12	Markham Rd. to Ninth Line	65.9	73.64	67.91	-8%	68.01	-8%	0.1%	200	37%	34%	34%
R13	Markham Rd. to Ninth Line	65.9	74.68	68.21	-9%	68.53	-8%	0.5%	200	37%	34%	34%
R14	Markham Rd. to Ninth Line	65.9	71.70	67.48	-6%	67.71	-6%	0.3%	200	36%	34%	34%
R15	Ninth Line to Donald Cousens Pkwy.	65.9	73.61	67.96	-8%	68.20	-7%	0.4%	200	37%	34%	34%
R16	Ninth Line to Donald Cousens Pkwy.	65.9	73.93	68.04	-8%	68.24	-8%	0.3%	200	37%	34%	34%
R17	Ninth Line to Donald Cousens Pkwy.	65.9	71.54	67.40	-6%	67.53	-6%	0.2%	200	36%	34%	34%
R18	Donald Cousens Pkwy. to York-Durham Line	65.9	71.15	67.31	-5%	67.48	-5%	0.3%	200	36%	34%	34%
R19	Donald Cousens Pkwy. to York-Durham Line	65.9	69.05	66.81	-3%	66.92	-3%	0.2%	200	35%	33%	33%
R20	York-Durham Line to Whites Road	65.9	67.55	66.45	-2%	66.52	-2%	0.1%	200	34%	33%	33%
R21	York-Durham Line to Whites Road	65.9	67.52	66.66	-1%	66.79	-1%	0.2%	200	34%	33%	33%
R22	Whites Road to Brock Road	65.9	67.57	66.47	-2%	66.54	-2%	0.1%	200	34%	33%	33%
R23	Whites Road to Brock Road	65.9	67.55	66.44	-2%	66.50	-2%	0.1%	200	34%	33%	33%
R24	Whites Road to Brock Road	65.9	69.14	66.64	-4%	66.73	-3%	0.1%	200	35%	33%	33%

**Table B.8 1-hour Maximum SO<sub>2</sub> Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			1-hr Max Concentration (µg/m <sup>3</sup> )	1-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	1-hr Max Concentration µg/m <sup>3</sup>	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	7.512	8.27	7.76	-6%	7.77	-6%	0%	690	1%	1%	1%
R2	Kennedy Rd. to McCowan Rd.	7.512	8.80	7.94	-10%	7.95	-10%	0%	690	1%	1%	1%
R3	Kennedy Rd. to McCowan Rd.	7.512	9.05	8.02	-11%	8.03	-11%	0%	690	1%	1%	1%
R4	Kennedy Rd. to McCowan Rd.	7.512	8.05	7.70	-4%	7.71	-4%	0%	690	1%	1%	1%
R5	Kennedy Rd. to McCowan Rd.	7.512	8.81	7.94	-10%	7.95	-10%	0%	690	1%	1%	1%
R6	Kennedy Rd. to McCowan Rd.	7.512	7.94	7.66	-4%	7.68	-3%	0%	690	1%	1%	1%
R7	Markham Rd. to Ninth Line	7.512	8.40	7.84	-7%	7.87	-6%	0%	690	1%	1%	1%
R8	Markham Rd. to Ninth Line	7.512	10.05	8.33	-17%	8.34	-17%	0%	690	1%	1%	1%
R9	Markham Rd. to Ninth Line	7.512	9.07	8.07	-11%	8.09	-11%	0%	690	1%	1%	1%
R10	Markham Rd. to Ninth Line	7.512	8.71	7.94	-9%	7.94	-9%	0%	690	1%	1%	1%
R11	Markham Rd. to Ninth Line	7.512	8.51	7.86	-8%	7.88	-7%	0%	690	1%	1%	1%
R12	Markham Rd. to Ninth Line	7.512	8.19	7.75	-5%	7.75	-5%	0%	690	1%	1%	1%
R13	Markham Rd. to Ninth Line	7.512	8.44	7.84	-7%	7.86	-7%	0%	690	1%	1%	1%
R14	Markham Rd. to Ninth Line	7.512	8.27	7.78	-6%	7.79	-6%	0%	690	1%	1%	1%
R15	Ninth Line to Donald Cousens Pkwy.	7.512	8.24	7.76	-6%	7.84	-5%	1%	690	1%	1%	1%
R16	Ninth Line to Donald Cousens Pkwy.	7.512	8.37	7.81	-7%	7.84	-6%	0%	690	1%	1%	1%
R17	Ninth Line to Donald Cousens Pkwy.	7.512	8.18	7.74	-5%	7.79	-5%	1%	690	1%	1%	1%
R18	Donald Cousens Pkwy. to York-Durham Line	7.512	8.11	7.72	-5%	7.75	-4%	0%	690	1%	1%	1%
R19	Donald Cousens Pkwy. to York-Durham Line	7.512	7.79	7.62	-2%	7.62	-2%	0%	690	1%	1%	1%
R20	York-Durham Line to Whites Road	7.512	7.65	7.56	-1%	7.57	-1%	0%	690	1%	1%	1%
R21	York-Durham Line to Whites Road	7.512	7.64	7.57	-1%	7.59	-1%	0%	690	1%	1%	1%
R22	Whites Road to Brock Road	7.512	7.64	7.57	-1%	7.57	-1%	0%	690	1%	1%	1%
R23	Whites Road to Brock Road	7.512	7.64	7.57	-1%	7.57	-1%	0%	690	1%	1%	1%
R24	Whites Road to Brock Road	7.512	7.76	7.61	-2%	7.62	-2%	0%	690	1%	1%	1%



**Table B.9 24-hour Maximum SO<sub>2</sub> Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			24-hr Max Concentration (µg/m <sup>3</sup> )	24-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	24-hr Max Concentration µg/m <sup>3</sup>	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	6.91	6.996	6.95	-1%	6.95	-1%	0%	275	3%	3%	3%
R2	Kennedy Rd. to McCowan Rd.	6.91	7.034	6.95	-1%	6.96	-1%	0%	275	3%	3%	3%
R3	Kennedy Rd. to McCowan Rd.	6.91	7.050	6.96	-1%	6.96	-1%	0%	275	3%	3%	3%
R4	Kennedy Rd. to McCowan Rd.	6.91	6.972	6.93	-1%	6.93	-1%	0%	275	3%	3%	3%
R5	Kennedy Rd. to McCowan Rd.	6.91	7.047	6.96	-1%	6.96	-1%	0%	275	3%	3%	3%
R6	Kennedy Rd. to McCowan Rd.	6.91	6.975	6.93	-1%	6.94	-1%	0%	275	3%	3%	3%
R7	Markham Rd. to Ninth Line	6.91	7.070	6.97	-1%	6.97	-1%	0%	275	3%	3%	3%
R8	Markham Rd. to Ninth Line	6.91	7.056	6.96	-1%	6.96	-1%	0%	275	3%	3%	3%
R9	Markham Rd. to Ninth Line	6.91	7.052	6.96	-1%	6.96	-1%	0%	275	3%	3%	3%
R10	Markham Rd. to Ninth Line	6.91	7.026	6.95	-1%	6.95	-1%	0%	275	3%	3%	3%
R11	Markham Rd. to Ninth Line	6.91	7.009	6.95	-1%	6.95	-1%	0%	275	3%	3%	3%
R12	Markham Rd. to Ninth Line	6.91	7.003	6.94	-1%	6.94	-1%	0%	275	3%	3%	3%
R13	Markham Rd. to Ninth Line	6.91	7.010	6.95	-1%	6.95	-1%	0%	275	3%	3%	3%
R14	Markham Rd. to Ninth Line	6.91	6.977	6.93	-1%	6.94	-1%	0%	275	3%	3%	3%
R15	Ninth Line to Donald Cousens Pkwy.	6.91	6.999	6.94	-1%	6.95	-1%	0%	275	3%	3%	3%
R16	Ninth Line to Donald Cousens Pkwy.	6.91	7.001	6.94	-1%	6.95	-1%	0%	275	3%	3%	3%
R17	Ninth Line to Donald Cousens Pkwy.	6.91	6.974	6.93	-1%	6.94	-1%	0%	275	3%	3%	3%
R18	Donald Cousens Pkwy. to York-Durham Line	6.91	6.969	6.93	-1%	6.93	-1%	0%	275	3%	3%	3%
R19	Donald Cousens Pkwy. to York-Durham Line	6.91	6.946	6.92	0%	6.93	0%	0%	275	3%	3%	3%
R20	York-Durham Line to Whites Road	6.91	6.927	6.92	0%	6.92	0%	0%	275	3%	3%	3%
R21	York-Durham Line to Whites Road	6.91	6.927	6.92	0%	6.92	0%	0%	275	3%	3%	3%
R22	Whites Road to Brock Road	6.91	6.927	6.92	0%	6.92	0%	0%	275	3%	3%	3%
R23	Whites Road to Brock Road	6.91	6.927	6.92	0%	6.92	0%	0%	275	3%	3%	3%
R24	Whites Road to Brock Road	6.91	6.945	6.92	0%	6.92	0%	0%	275	3%	3%	3%

**Table B.10 Annual Average SO<sub>2</sub> Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			Annual Average Concentration (µg/m <sup>3</sup> )	Annual Average Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	Annual Average Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	2.74	2.76	2.75	-1%	2.75	-1%	0%	55	5%	5%	5%
R2	Kennedy Rd. to McCowan Rd.	2.74	2.78	2.75	-1%	2.76	-1%	0%	55	5%	5%	5%
R3	Kennedy Rd. to McCowan Rd.	2.74	2.78	2.76	-1%	2.76	-1%	0%	55	5%	5%	5%
R4	Kennedy Rd. to McCowan Rd.	2.74	2.75	2.74	0%	2.75	0%	0%	55	5%	5%	5%
R5	Kennedy Rd. to McCowan Rd.	2.74	2.78	2.75	-1%	2.76	-1%	0%	55	5%	5%	5%
R6	Kennedy Rd. to McCowan Rd.	2.74	2.75	2.74	0%	2.75	0%	0%	55	5%	5%	5%
R7	Markham Rd. to Ninth Line	2.74	2.78	2.76	-1%	2.76	-1%	0%	55	5%	5%	5%
R8	Markham Rd. to Ninth Line	2.74	2.78	2.75	-1%	2.75	-1%	0%	55	5%	5%	5%
R9	Markham Rd. to Ninth Line	2.74	2.76	2.75	-1%	2.75	-1%	0%	55	5%	5%	5%
R10	Markham Rd. to Ninth Line	2.74	2.76	2.75	-1%	2.75	-1%	0%	55	5%	5%	5%
R11	Markham Rd. to Ninth Line	2.74	2.76	2.75	-1%	2.75	-1%	0%	55	5%	5%	5%
R12	Markham Rd. to Ninth Line	2.74	2.77	2.75	-1%	2.75	-1%	0%	55	5%	5%	5%
R13	Markham Rd. to Ninth Line	2.74	2.77	2.75	-1%	2.75	-1%	0%	55	5%	5%	5%
R14	Markham Rd. to Ninth Line	2.74	2.76	2.75	0%	2.75	0%	0%	55	5%	5%	5%
R15	Ninth Line to Donald Cousens Pkwy.	2.74	2.76	2.75	0%	2.75	0%	0%	55	5%	5%	5%
R16	Ninth Line to Donald Cousens Pkwy.	2.74	2.76	2.75	0%	2.75	0%	0%	55	5%	5%	5%
R17	Ninth Line to Donald Cousens Pkwy.	2.74	2.75	2.74	0%	2.75	0%	0%	55	5%	5%	5%
R18	Donald Cousens Pkwy. to York-Durham Line	2.74	2.75	2.74	0%	2.74	0%	0%	55	5%	5%	5%
R19	Donald Cousens Pkwy. to York-Durham Line	2.74	2.75	2.75	0%	2.75	0%	0%	55	5%	5%	5%
R20	York-Durham Line to Whites Road	2.74	2.74	2.74	0%	2.74	0%	0%	55	5%	5%	5%
R21	York-Durham Line to Whites Road	2.74	2.74	2.74	0%	2.74	0%	0%	55	5%	5%	5%
R22	Whites Road to Brock Road	2.74	2.74	2.74	0%	2.74	0%	0%	55	5%	5%	5%
R23	Whites Road to Brock Road	2.74	2.74	2.74	0%	2.74	0%	0%	55	5%	5%	5%
R24	Whites Road to Brock Road	2.74	2.75	2.74	0%	2.74	0%	0%	55	5%	5%	5%

**Table B.11 1-hr Maximum CO Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			1-hr Max Concentration (µg/m <sup>3</sup> )	1-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	1-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	278.2	585.09	456.53	-22%	456.53	-22%	0%	36,200	2%	1%	1%
R2	Kennedy Rd. to McCowan Rd.	278.2	804.05	581.07	-28%	581.07	-28%	0%	36,200	2%	2%	2%
R3	Kennedy Rd. to McCowan Rd.	278.2	904.32	638.22	-29%	638.22	-29%	0%	36,200	2%	2%	2%
R4	Kennedy Rd. to McCowan Rd.	278.2	493.42	405.76	-18%	405.76	-18%	0%	36,200	1%	1%	1%
R5	Kennedy Rd. to McCowan Rd.	278.2	803.99	580.54	-28%	580.54	-28%	0%	36,200	2%	2%	2%
R6	Kennedy Rd. to McCowan Rd.	278.2	448.89	380.98	-15%	380.98	-15%	0%	36,200	1%	1%	1%
R7	Markham Rd. to Ninth Line	278.2	620.52	481.33	-22%	481.33	-22%	0%	36,200	2%	1%	1%
R8	Markham Rd. to Ninth Line	278.2	1321.08	882.66	-33%	882.66	-33%	0%	36,200	4%	2%	2%
R9	Markham Rd. to Ninth Line	278.2	892.64	627.34	-30%	627.34	-30%	0%	36,200	2%	2%	2%
R10	Markham Rd. to Ninth Line	278.2	748.40	544.34	-27%	544.34	-27%	0%	36,200	2%	2%	2%
R11	Markham Rd. to Ninth Line	278.2	674.41	503.48	-25%	503.48	-25%	0%	36,200	2%	1%	1%
R12	Markham Rd. to Ninth Line	278.2	551.14	443.30	-20%	443.30	-20%	0%	36,200	2%	1%	1%
R13	Markham Rd. to Ninth Line	278.2	648.34	489.40	-25%	489.40	-25%	0%	36,200	2%	1%	1%
R14	Markham Rd. to Ninth Line	278.2	578.99	450.30	-22%	450.30	-22%	0%	36,200	2%	1%	1%
R15	Ninth Line to Donald Cousens Pkwy.	278.2	565.04	463.41	-18%	463.41	-18%	0%	36,200	2%	1%	1%
R16	Ninth Line to Donald Cousens Pkwy.	278.2	618.07	475.32	-23%	475.32	-23%	0%	36,200	2%	1%	1%
R17	Ninth Line to Donald Cousens Pkwy.	278.2	540.69	440.38	-19%	440.38	-19%	0%	36,200	1%	1%	1%
R18	Donald Cousens Pkwy. to York-Durham Line	278.2	515.11	422.80	-18%	422.80	-18%	0%	36,200	1%	1%	1%
R19	Donald Cousens Pkwy. to York-Durham Line	278.2	389.92	346.34	-11%	346.34	-11%	0%	36,200	1%	1%	1%
R20	York-Durham Line to Whites Road	278.2	333.93	311.55	-7%	311.55	-7%	0%	36,200	1%	1%	1%
R21	York-Durham Line to Whites Road	278.2	329.30	320.54	-3%	320.54	-3%	0%	36,200	1%	1%	1%
R22	Whites Road to Brock Road	278.2	328.00	310.67	-5%	310.67	-5%	0%	36,200	1%	1%	1%
R23	Whites Road to Brock Road	278.2	328.24	310.40	-5%	310.40	-5%	0%	36,200	1%	1%	1%
R24	Whites Road to Brock Road	278.2	374.68	337.50	-10%	337.50	-10%	0%	36,200	1%	1%	1%

**Table B.12 8-hr Maximum CO Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			8-hr Max Concentration (µg/m <sup>3</sup> )	8-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	8-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	396.4	452.71	428.11	-5%	428.26	-5%	0%	15700	3%	3%	3%
R2	Kennedy Rd. to McCowan Rd.	396.4	482.96	445.61	-8%	446.12	-8%	0%	15700	3%	3%	3%
R3	Kennedy Rd. to McCowan Rd.	396.4	498.71	454.57	-9%	455.10	-9%	0%	15700	3%	3%	3%
R4	Kennedy Rd. to McCowan Rd.	396.4	438.25	419.43	-4%	419.69	-4%	0%	15700	3%	3%	3%
R5	Kennedy Rd. to McCowan Rd.	396.4	493.93	450.91	-9%	451.14	-9%	0%	15700	3%	3%	3%
R6	Kennedy Rd. to McCowan Rd.	396.4	444.97	422.91	-5%	423.09	-5%	0%	15700	3%	3%	3%
R7	Markham Rd. to Ninth Line	396.4	508.65	457.98	-10%	463.00	-9%	1%	15700	3%	3%	3%
R8	Markham Rd. to Ninth Line	396.4	542.36	480.49	-11%	480.95	-11%	0%	15700	3%	3%	3%
R9	Markham Rd. to Ninth Line	396.4	510.87	460.40	-10%	461.95	-10%	0%	15700	3%	3%	3%
R10	Markham Rd. to Ninth Line	396.4	479.34	442.84	-8%	443.54	-7%	0%	15700	3%	3%	3%
R11	Markham Rd. to Ninth Line	396.4	461.56	433.16	-6%	433.63	-6%	0%	15700	3%	3%	3%
R12	Markham Rd. to Ninth Line	396.4	461.77	433.73	-6%	434.82	-6%	0%	15700	3%	3%	3%
R13	Markham Rd. to Ninth Line	396.4	468.27	437.70	-7%	438.33	-6%	0%	15700	3%	3%	3%
R14	Markham Rd. to Ninth Line	396.4	446.19	425.03	-5%	430.82	-3%	1%	15700	3%	3%	3%
R15	Ninth Line to Donald Cousens Pkwy.	396.4	458.60	431.68	-6%	435.88	-5%	1%	15700	3%	3%	3%
R16	Ninth Line to Donald Cousens Pkwy.	396.4	457.90	431.30	-6%	432.54	-6%	0%	15700	3%	3%	3%
R17	Ninth Line to Donald Cousens Pkwy.	396.4	442.51	422.50	-5%	424.65	-4%	1%	15700	3%	3%	3%
R18	Donald Cousens Pkwy. to York-Durham Line	396.4	441.71	422.01	-4%	423.90	-4%	0%	15700	3%	3%	3%
R19	Donald Cousens Pkwy. to York-Durham Line	396.4	420.53	410.12	-2%	410.36	-2%	0%	15700	3%	3%	3%
R20	York-Durham Line to Whites Road	396.4	408.43	404.92	-1%	406.10	-1%	0%	15700	3%	3%	3%
R21	York-Durham Line to Whites Road	396.4	408.59	406.75	0%	409.42	0%	1%	15700	3%	3%	3%
R22	Whites Road to Brock Road	396.4	407.79	404.85	-1%	405.01	-1%	0%	15700	3%	3%	3%
R23	Whites Road to Brock Road	396.4	406.95	403.32	-1%	403.76	-1%	0%	15700	3%	3%	3%
R24	Whites Road to Brock Road	396.4	421.02	407.10	-3%	407.70	-3%	0%	15700	3%	3%	3%

**Table B.13 24-hr Maximum Acetaldehyde Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration ( $\mu\text{g}/\text{m}^3$ )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria ( $\mu\text{g}/\text{m}^3$ )	% of the AAQC		
			24-hr Max Concentration ( $\mu\text{g}/\text{m}^3$ )	24-hr Max Concentration ( $\mu\text{g}/\text{m}^3$ )	% change from Existing Conditions	24-hr Max Concentration ( $\mu\text{g}/\text{m}^3$ )	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	2.95	2.965	2.96	0%	2.96	0%	0%	500	1%	1%	1%
R2	Kennedy Rd. to McCowan Rd.	2.95	2.966	2.96	0%	2.96	0%	0%	500	1%	1%	1%
R3	Kennedy Rd. to McCowan Rd.	2.95	2.969	2.96	0%	2.96	0%	0%	500	1%	1%	1%
R4	Kennedy Rd. to McCowan Rd.	2.95	2.958	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R5	Kennedy Rd. to McCowan Rd.	2.95	2.967	2.96	0%	2.96	0%	0%	500	1%	1%	1%
R6	Kennedy Rd. to McCowan Rd.	2.95	2.959	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R7	Markham Rd. to Ninth Line	2.95	2.972	2.96	-1%	2.96	-1%	0%	500	1%	1%	1%
R8	Markham Rd. to Ninth Line	2.95	2.966	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R9	Markham Rd. to Ninth Line	2.95	2.969	2.96	0%	2.96	0%	0%	500	1%	1%	1%
R10	Markham Rd. to Ninth Line	2.95	2.965	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R11	Markham Rd. to Ninth Line	2.95	2.963	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R12	Markham Rd. to Ninth Line	2.95	2.961	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R13	Markham Rd. to Ninth Line	2.95	2.963	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R14	Markham Rd. to Ninth Line	2.95	2.959	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R15	Ninth Line to Donald Cousens Pkwy.	2.95	2.962	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R16	Ninth Line to Donald Cousens Pkwy.	2.95	2.962	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R17	Ninth Line to Donald Cousens Pkwy.	2.95	2.958	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R18	Donald Cousens Pkwy. to York-Durham Line	2.95	2.958	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R19	Donald Cousens Pkwy. to York-Durham Line	2.95	2.955	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R20	York-Durham Line to Whites Road	2.95	2.952	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R21	York-Durham Line to Whites Road	2.95	2.952	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R22	Whites Road to Brock Road	2.95	2.952	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R23	Whites Road to Brock Road	2.95	2.952	2.95	0%	2.95	0%	0%	500	1%	1%	1%
R24	Whites Road to Brock Road	2.95	2.955	2.95	0%	2.95	0%	0%	500	1%	1%	1%

**Table B.14 1-hr Maximum Acrolein Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m³)	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m³)	% of the AAQC		
			1-hr Max Concentration (µg/m³)	1-hr Max Concentration (µg/m³)	% change from Existing Conditions	1-hr Max Concentration (µg/m³)	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	0.22	0.229	0.223	-3%	0.223	-3%	0%	4.5	5%	5%	5%
R2	Kennedy Rd. to McCowan Rd.	0.22	0.236	0.225	-5%	0.225	-5%	0%	4.5	5%	5%	5%
R3	Kennedy Rd. to McCowan Rd.	0.22	0.239	0.226	-5%	0.226	-5%	0%	4.5	5%	5%	5%
R4	Kennedy Rd. to McCowan Rd.	0.22	0.228	0.222	-3%	0.223	-2%	0%	4.5	5%	5%	5%
R5	Kennedy Rd. to McCowan Rd.	0.22	0.236	0.225	-5%	0.225	-5%	0%	4.5	5%	5%	5%
R6	Kennedy Rd. to McCowan Rd.	0.22	0.226	0.222	-2%	0.222	-2%	0%	4.5	5%	5%	5%
R7	Markham Rd. to Ninth Line	0.22	0.235	0.225	-4%	0.225	-4%	0%	4.5	5%	5%	5%
R8	Markham Rd. to Ninth Line	0.22	0.247	0.228	-8%	0.229	-7%	0%	4.5	5%	5%	5%
R9	Markham Rd. to Ninth Line	0.22	0.244	0.227	-7%	0.228	-7%	0%	4.5	5%	5%	5%
R10	Markham Rd. to Ninth Line	0.22	0.238	0.225	-5%	0.226	-5%	0%	4.5	5%	5%	5%
R11	Markham Rd. to Ninth Line	0.22	0.234	0.224	-4%	0.225	-4%	0%	4.5	5%	5%	5%
R12	Markham Rd. to Ninth Line	0.22	0.228	0.223	-2%	0.223	-2%	0%	4.5	5%	5%	5%
R13	Markham Rd. to Ninth Line	0.22	0.233	0.224	-4%	0.225	-3%	0%	4.5	5%	5%	5%
R14	Markham Rd. to Ninth Line	0.22	0.231	0.223	-3%	0.224	-3%	0%	4.5	5%	5%	5%
R15	Ninth Line to Donald Cousens Pkwy.	0.22	0.231	0.223	-3%	0.224	-3%	0%	4.5	5%	5%	5%
R16	Ninth Line to Donald Cousens Pkwy.	0.22	0.233	0.224	-4%	0.224	-4%	0%	4.5	5%	5%	5%
R17	Ninth Line to Donald Cousens Pkwy.	0.22	0.230	0.223	-3%	0.223	-3%	0%	4.5	5%	5%	5%
R18	Donald Cousens Pkwy. to York-Durham Line	0.22	0.229	0.223	-3%	0.223	-3%	0%	4.5	5%	5%	5%
R19	Donald Cousens Pkwy. to York-Durham Line	0.22	0.224	0.223	0%	0.221	-1%	-1%	4.5	5%	5%	5%
R20	York-Durham Line to Whites Road	0.22	0.222	0.221	0%	0.221	0%	0%	4.5	5%	5%	5%
R21	York-Durham Line to Whites Road	0.22	0.222	0.221	0%	0.221	0%	0%	4.5	5%	5%	5%
R22	Whites Road to Brock Road	0.22	0.222	0.221	0%	0.221	0%	0%	4.5	5%	5%	5%
R23	Whites Road to Brock Road	0.22	0.222	0.221	0%	0.221	0%	0%	4.5	5%	5%	5%
R24	Whites Road to Brock Road	0.22	0.224	0.221	-1%	0.222	-1%	0%	4.5	5%	5%	5%

**Table B.15 24-hr Maximum Acrolein Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			24-hr Max Concentration (µg/m <sup>3</sup> )	24-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	24-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	0.22	0.222	0.221	0%	0.221	0%	0%	0.4	56%	55%	55%
R2	Kennedy Rd. to McCowan Rd.	0.22	0.222	0.221	0%	0.221	0%	0%	0.4	56%	55%	55%
R3	Kennedy Rd. to McCowan Rd.	0.22	0.222	0.221	0%	0.221	0%	0%	0.4	56%	55%	55%
R4	Kennedy Rd. to McCowan Rd.	0.22	0.221	0.220	0%	0.220	0%	0%	0.4	55%	55%	55%
R5	Kennedy Rd. to McCowan Rd.	0.22	0.222	0.221	0%	0.221	0%	0%	0.4	56%	55%	55%
R6	Kennedy Rd. to McCowan Rd.	0.22	0.221	0.220	0%	0.220	0%	0%	0.4	55%	55%	55%
R7	Markham Rd. to Ninth Line	0.22	0.223	0.221	-1%	0.221	-1%	0%	0.4	56%	55%	55%
R8	Markham Rd. to Ninth Line	0.22	0.222	0.221	0%	0.221	0%	0%	0.4	56%	55%	55%
R9	Markham Rd. to Ninth Line	0.22	0.222	0.221	0%	0.221	0%	0%	0.4	56%	55%	55%
R10	Markham Rd. to Ninth Line	0.22	0.222	0.221	0%	0.221	0%	0%	0.4	56%	55%	55%
R11	Markham Rd. to Ninth Line	0.22	0.221	0.220	0%	0.221	0%	0%	0.4	55%	55%	55%
R12	Markham Rd. to Ninth Line	0.22	0.221	0.220	0%	0.220	0%	0%	0.4	55%	55%	55%
R13	Markham Rd. to Ninth Line	0.22	0.221	0.220	0%	0.221	0%	0%	0.4	55%	55%	55%
R14	Markham Rd. to Ninth Line	0.22	0.221	0.220	0%	0.220	0%	0%	0.4	55%	55%	55%
R15	Ninth Line to Donald Cousens Pkwy.	0.22	0.221	0.220	0%	0.221	0%	0%	0.4	55%	55%	55%
R16	Ninth Line to Donald Cousens Pkwy.	0.22	0.221	0.220	0%	0.221	0%	0%	0.4	55%	55%	55%
R17	Ninth Line to Donald Cousens Pkwy.	0.22	0.221	0.220	0%	0.220	0%	0%	0.4	55%	55%	55%
R18	Donald Cousens Pkwy. to York-Durham Line	0.22	0.221	0.220	0%	0.220	0%	0%	0.4	55%	55%	55%
R19	Donald Cousens Pkwy. to York-Durham Line	0.22	0.221	0.221	0%	0.220	0%	0%	0.4	55%	55%	55%
R20	York-Durham Line to Whites Road	0.22	0.220	0.220	0%	0.220	0%	0%	0.4	55%	55%	55%
R21	York-Durham Line to Whites Road	0.22	0.220	0.220	0%	0.220	0%	0%	0.4	55%	55%	55%
R22	Whites Road to Brock Road	0.22	0.220	0.220	0%	0.220	0%	0%	0.4	55%	55%	55%
R23	Whites Road to Brock Road	0.22	0.220	0.220	0%	0.220	0%	0%	0.4	55%	55%	55%
R24	Whites Road to Brock Road	0.22	0.221	0.220	0%	0.220	0%	0%	0.4	55%	55%	55%

**Table B.16 24-hr Maximum Benzene Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			24-hr Max Concentration (µg/m <sup>3</sup> )	24-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	24-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	1.03	1.032	1.037	0%	1.037	0%	0%	2.3	45%	45%	45%
R2	Kennedy Rd. to McCowan Rd.	1.03	1.033	1.040	1%	1.040	1%	0%	2.3	45%	45%	45%
R3	Kennedy Rd. to McCowan Rd.	1.03	1.034	1.042	1%	1.042	1%	0%	2.3	45%	45%	45%
R4	Kennedy Rd. to McCowan Rd.	1.03	1.032	1.035	0%	1.035	0%	0%	2.3	45%	45%	45%
R5	Kennedy Rd. to McCowan Rd.	1.03	1.034	1.041	1%	1.041	1%	0%	2.3	45%	45%	45%
R6	Kennedy Rd. to McCowan Rd.	1.03	1.032	1.035	0%	1.035	0%	0%	2.3	45%	45%	45%
R7	Markham Rd. to Ninth Line	1.03	1.034	1.042	1%	1.043	1%	0%	2.3	45%	45%	45%
R8	Markham Rd. to Ninth Line	1.03	1.034	1.042	1%	1.043	1%	0%	2.3	45%	45%	45%
R9	Markham Rd. to Ninth Line	1.03	1.034	1.041	1%	1.042	1%	0%	2.3	45%	45%	45%
R10	Markham Rd. to Ninth Line	1.03	1.033	1.039	1%	1.040	1%	0%	2.3	45%	45%	45%
R11	Markham Rd. to Ninth Line	1.03	1.033	1.038	0%	1.038	0%	0%	2.3	45%	45%	45%
R12	Markham Rd. to Ninth Line	1.03	1.032	1.038	1%	1.038	1%	0%	2.3	45%	45%	45%
R13	Markham Rd. to Ninth Line	1.03	1.033	1.038	0%	1.038	0%	0%	2.3	45%	45%	45%
R14	Markham Rd. to Ninth Line	1.03	1.032	1.035	0%	1.036	0%	0%	2.3	45%	45%	45%
R15	Ninth Line to Donald Cousens Pkwy.	1.03	1.032	1.037	0%	1.038	1%	0%	2.3	45%	45%	45%
R16	Ninth Line to Donald Cousens Pkwy.	1.03	1.032	1.037	0%	1.038	1%	0%	2.3	45%	45%	45%
R17	Ninth Line to Donald Cousens Pkwy.	1.03	1.032	1.035	0%	1.036	0%	0%	2.3	45%	45%	45%
R18	Donald Cousens Pkwy. to York-Durham Line	1.03	1.032	1.035	0%	1.035	0%	0%	2.3	45%	45%	45%
R19	Donald Cousens Pkwy. to York-Durham Line	1.03	1.031	1.033	0%	1.033	0%	0%	2.3	45%	45%	45%
R20	York-Durham Line to Whites Road	1.03	1.030	1.032	0%	1.032	0%	0%	2.3	45%	45%	45%
R21	York-Durham Line to Whites Road	1.03	1.030	1.032	0%	1.033	0%	0%	2.3	45%	45%	45%
R22	Whites Road to Brock Road	1.03	1.030	1.032	0%	1.032	0%	0%	2.3	45%	45%	45%
R23	Whites Road to Brock Road	1.03	1.030	1.032	0%	1.032	0%	0%	2.3	45%	45%	45%
R24	Whites Road to Brock Road	1.03	1.031	1.032	0%	1.032	0%	0%	2.3	45%	45%	45%



**Table B.17 Annual Average Benzene Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration ( $\mu\text{g}/\text{m}^3$ )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria ( $\mu\text{g}/\text{m}^3$ )	% of the AAQC		
			Annual Average Concentration ( $\mu\text{g}/\text{m}^3$ )	Annual Average Concentration ( $\mu\text{g}/\text{m}^3$ )	% change from Existing Conditions	Annual Average Concentration ( $\mu\text{g}/\text{m}^3$ )	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	0.61	0.611	0.612	0%	0.612	0%	0%	0.45	136%	136%	136%
R2	Kennedy Rd. to McCowan Rd.	0.61	0.611	0.613	0%	0.613	0%	0%	0.45	136%	136%	136%
R3	Kennedy Rd. to McCowan Rd.	0.61	0.611	0.614	0%	0.614	0%	0%	0.45	136%	136%	136%
R4	Kennedy Rd. to McCowan Rd.	0.61	0.610	0.611	0%	0.611	0%	0%	0.45	136%	136%	136%
R5	Kennedy Rd. to McCowan Rd.	0.61	0.611	0.613	0%	0.613	0%	0%	0.45	136%	136%	136%
R6	Kennedy Rd. to McCowan Rd.	0.61	0.610	0.611	0%	0.611	0%	0%	0.45	136%	136%	136%
R7	Markham Rd. to Ninth Line	0.61	0.611	0.613	0%	0.613	0%	0%	0.45	136%	136%	136%
R8	Markham Rd. to Ninth Line	0.61	0.611	0.613	0%	0.613	0%	0%	0.45	136%	136%	136%
R9	Markham Rd. to Ninth Line	0.61	0.611	0.612	0%	0.612	0%	0%	0.45	136%	136%	136%
R10	Markham Rd. to Ninth Line	0.61	0.611	0.612	0%	0.612	0%	0%	0.45	136%	136%	136%
R11	Markham Rd. to Ninth Line	0.61	0.611	0.612	0%	0.612	0%	0%	0.45	136%	136%	136%
R12	Markham Rd. to Ninth Line	0.61	0.611	0.612	0%	0.612	0%	0%	0.45	136%	136%	136%
R13	Markham Rd. to Ninth Line	0.61	0.611	0.612	0%	0.612	0%	0%	0.45	136%	136%	136%
R14	Markham Rd. to Ninth Line	0.61	0.610	0.611	0%	0.612	0%	0%	0.45	136%	136%	136%
R15	Ninth Line to Donald Cousens Pkwy.	0.61	0.610	0.611	0%	0.611	0%	0%	0.45	136%	136%	136%
R16	Ninth Line to Donald Cousens Pkwy.	0.61	0.610	0.611	0%	0.612	0%	0%	0.45	136%	136%	136%
R17	Ninth Line to Donald Cousens Pkwy.	0.61	0.610	0.611	0%	0.611	0%	0%	0.45	136%	136%	136%
R18	Donald Cousens Pkwy. to York-Durham Line	0.61	0.610	0.611	0%	0.611	0%	0%	0.45	136%	136%	136%
R19	Donald Cousens Pkwy. to York-Durham Line	0.61	0.610	0.611	0%	0.611	0%	0%	0.45	136%	136%	136%
R20	York-Durham Line to Whites Road	0.61	0.610	0.610	0%	0.610	0%	0%	0.45	136%	136%	136%
R21	York-Durham Line to Whites Road	0.61	0.610	0.611	0%	0.611	0%	0%	0.45	136%	136%	136%
R22	Whites Road to Brock Road	0.61	0.610	0.610	0%	0.610	0%	0%	0.45	136%	136%	136%
R23	Whites Road to Brock Road	0.61	0.610	0.610	0%	0.610	0%	0%	0.45	136%	136%	136%
R24	Whites Road to Brock Road	0.61	0.610	0.610	0%	0.611	0%	0%	0.45	136%	136%	136%

**Table B.18 24-hr Maximum 1,3-Butadiene Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m³)	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m³)	% of the AAQC		
			24-hr Max Concentration (µg/m³)	24-hr Max Concentration (µg/m³)	% change from Existing Conditions	24-hr Max Concentration (µg/m³)	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	0.11	0.1123	0.1101	-2%	0.1101	-2%	0%	10	1%	1%	1%
R2	Kennedy Rd. to McCowan Rd.	0.11	0.1128	0.1101	-2%	0.1101	-2%	0%	10	1%	1%	1%
R3	Kennedy Rd. to McCowan Rd.	0.11	0.1133	0.1101	-3%	0.1101	-3%	0%	10	1%	1%	1%
R4	Kennedy Rd. to McCowan Rd.	0.11	0.1115	0.1100	-1%	0.1100	-1%	0%	10	1%	1%	1%
R5	Kennedy Rd. to McCowan Rd.	0.11	0.1132	0.1101	-3%	0.1101	-3%	0%	10	1%	1%	1%
R6	Kennedy Rd. to McCowan Rd.	0.11	0.1116	0.1100	-1%	0.1100	-1%	0%	10	1%	1%	1%
R7	Markham Rd. to Ninth Line	0.11	0.1140	0.1101	-3%	0.1101	-3%	0%	10	1%	1%	1%
R8	Markham Rd. to Ninth Line	0.11	0.1133	0.1101	-3%	0.1101	-3%	0%	10	1%	1%	1%
R9	Markham Rd. to Ninth Line	0.11	0.1134	0.1101	-3%	0.1101	-3%	0%	10	1%	1%	1%
R10	Markham Rd. to Ninth Line	0.11	0.1128	0.1101	-2%	0.1101	-2%	0%	10	1%	1%	1%
R11	Markham Rd. to Ninth Line	0.11	0.1123	0.1101	-2%	0.1101	-2%	0%	10	1%	1%	1%
R12	Markham Rd. to Ninth Line	0.11	0.1121	0.1100	-2%	0.1100	-2%	0%	10	1%	1%	1%
R13	Markham Rd. to Ninth Line	0.11	0.1123	0.1101	-2%	0.1101	-2%	0%	10	1%	1%	1%
R14	Markham Rd. to Ninth Line	0.11	0.1116	0.1100	-1%	0.1100	-1%	0%	10	1%	1%	1%
R15	Ninth Line to Donald Cousens Pkwy.	0.11	0.1121	0.1101	-2%	0.1101	-2%	0%	10	1%	1%	1%
R16	Ninth Line to Donald Cousens Pkwy.	0.11	0.1122	0.1101	-2%	0.1101	-2%	0%	10	1%	1%	1%
R17	Ninth Line to Donald Cousens Pkwy.	0.11	0.1115	0.1100	-1%	0.1100	-1%	0%	10	1%	1%	1%
R18	Donald Cousens Pkwy. to York-Durham Line	0.11	0.1114	0.1100	-1%	0.1100	-1%	0%	10	1%	1%	1%
R19	Donald Cousens Pkwy. to York-Durham Line	0.11	0.1109	0.1100	-1%	0.1100	-1%	0%	10	1%	1%	1%
R20	York-Durham Line to Whites Road	0.11	0.1104	0.1100	0%	0.1100	0%	0%	10	1%	1%	1%
R21	York-Durham Line to Whites Road	0.11	0.1104	0.1100	0%	0.1100	0%	0%	10	1%	1%	1%
R22	Whites Road to Brock Road	0.11	0.1104	0.1100	0%	0.1100	0%	0%	10	1%	1%	1%
R23	Whites Road to Brock Road	0.11	0.1104	0.1100	0%	0.1100	0%	0%	10	1%	1%	1%
R24	Whites Road to Brock Road	0.11	0.1108	0.1100	-1%	0.1100	-1%	0%	10	1%	1%	1%

**Table B.19 Annual Average 1,3-Butadiene Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			Annual Average Concentration (µg/m <sup>3</sup> )	Annual Average Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	Annual Average Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	0.058	0.059	0.058	-1%	0.058	-1%	0.000%	2	3%	3%	3%
R2	Kennedy Rd. to McCowan Rd.	0.058	0.059	0.058	-2%	0.058	-2%	0.017%	2	3%	3%	3%
R3	Kennedy Rd. to McCowan Rd.	0.058	0.059	0.058	-2%	0.058	-2%	0.017%	2	3%	3%	3%
R4	Kennedy Rd. to McCowan Rd.	0.058	0.058	0.058	0%	0.058	0%	0.000%	2	3%	3%	3%
R5	Kennedy Rd. to McCowan Rd.	0.058	0.059	0.058	-2%	0.058	-2%	0.000%	2	3%	3%	3%
R6	Kennedy Rd. to McCowan Rd.	0.058	0.058	0.058	0%	0.058	0%	0.000%	2	3%	3%	3%
R7	Markham Rd. to Ninth Line	0.058	0.059	0.058	-2%	0.058	-2%	0.017%	2	3%	3%	3%
R8	Markham Rd. to Ninth Line	0.058	0.059	0.058	-2%	0.058	-2%	0.000%	2	3%	3%	3%
R9	Markham Rd. to Ninth Line	0.058	0.059	0.058	-1%	0.058	-1%	0.000%	2	3%	3%	3%
R10	Markham Rd. to Ninth Line	0.058	0.059	0.058	-1%	0.058	-1%	0.000%	2	3%	3%	3%
R11	Markham Rd. to Ninth Line	0.058	0.059	0.058	-1%	0.058	-1%	0.000%	2	3%	3%	3%
R12	Markham Rd. to Ninth Line	0.058	0.059	0.058	-1%	0.058	-1%	0.000%	2	3%	3%	3%
R13	Markham Rd. to Ninth Line	0.058	0.059	0.058	-1%	0.058	-1%	0.000%	2	3%	3%	3%
R14	Markham Rd. to Ninth Line	0.058	0.058	0.058	-1%	0.058	-1%	0.000%	2	3%	3%	3%
R15	Ninth Line to Donald Cousens Pkwy.	0.058	0.058	0.058	-1%	0.058	-1%	0.000%	2	3%	3%	3%
R16	Ninth Line to Donald Cousens Pkwy.	0.058	0.058	0.058	-1%	0.058	-1%	0.000%	2	3%	3%	3%
R17	Ninth Line to Donald Cousens Pkwy.	0.058	0.058	0.058	0%	0.058	0%	0.000%	2	3%	3%	3%
R18	Donald Cousens Pkwy. to York-Durham Line	0.058	0.058	0.058	0%	0.058	0%	0.000%	2	3%	3%	3%
R19	Donald Cousens Pkwy. to York-Durham Line	0.058	0.058	0.058	0%	0.058	0%	0.000%	2	3%	3%	3%
R20	York-Durham Line to Whites Road	0.058	0.058	0.058	0%	0.058	0%	0.000%	2	3%	3%	3%
R21	York-Durham Line to Whites Road	0.058	0.058	0.058	0%	0.058	0%	0.017%	2	3%	3%	3%
R22	Whites Road to Brock Road	0.058	0.058	0.058	0%	0.058	0%	0.000%	2	3%	3%	3%
R23	Whites Road to Brock Road	0.058	0.058	0.058	0%	0.058	0%	0.000%	2	3%	3%	3%
R24	Whites Road to Brock Road	0.058	0.058	0.058	0%	0.058	0%	0.000%	2	3%	3%	3%

**Table B.20 24-hr Maximum Formaldehyde Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			24-hr Max Concentration (µg/m <sup>3</sup> )	24-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	24-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	6.47	6.473	6.483	0%	6.484	0%	0%	65	10%	10%	10%
R2	Kennedy Rd. to McCowan Rd.	6.47	6.473	6.483	0%	6.484	0%	0%	65	10%	10%	10%
R3	Kennedy Rd. to McCowan Rd.	6.47	6.473	6.484	0%	6.485	0%	0%	65	10%	10%	10%
R4	Kennedy Rd. to McCowan Rd.	6.47	6.472	6.476	0%	6.477	0%	0%	65	10%	10%	10%
R5	Kennedy Rd. to McCowan Rd.	6.47	6.473	6.482	0%	6.483	0%	0%	65	10%	10%	10%
R6	Kennedy Rd. to McCowan Rd.	6.47	6.472	6.477	0%	6.477	0%	0%	65	10%	10%	10%
R7	Markham Rd. to Ninth Line	6.47	6.474	6.487	0%	6.488	0%	0%	65	10%	10%	10%
R8	Markham Rd. to Ninth Line	6.47	6.473	6.481	0%	6.481	0%	0%	65	10%	10%	10%
R9	Markham Rd. to Ninth Line	6.47	6.474	6.484	0%	6.485	0%	0%	65	10%	10%	10%
R10	Markham Rd. to Ninth Line	6.47	6.473	6.481	0%	6.482	0%	0%	65	10%	10%	10%
R11	Markham Rd. to Ninth Line	6.47	6.472	6.479	0%	6.481	0%	0%	65	10%	10%	10%
R12	Markham Rd. to Ninth Line	6.47	6.472	6.478	0%	6.479	0%	0%	65	10%	10%	10%
R13	Markham Rd. to Ninth Line	6.47	6.472	6.479	0%	6.481	0%	0%	65	10%	10%	10%
R14	Markham Rd. to Ninth Line	6.47	6.472	6.477	0%	6.479	0%	0%	65	10%	10%	10%
R15	Ninth Line to Donald Cousens Pkwy.	6.47	6.472	6.479	0%	6.481	0%	0%	65	10%	10%	10%
R16	Ninth Line to Donald Cousens Pkwy.	6.47	6.472	6.479	0%	6.480	0%	0%	65	10%	10%	10%
R17	Ninth Line to Donald Cousens Pkwy.	6.47	6.472	6.476	0%	6.477	0%	0%	65	10%	10%	10%
R18	Donald Cousens Pkwy. to York-Durham Line	6.47	6.471	6.476	0%	6.477	0%	0%	65	10%	10%	10%
R19	Donald Cousens Pkwy. to York-Durham Line	6.47	6.471	6.474	0%	6.475	0%	0%	65	10%	10%	10%
R20	York-Durham Line to Whites Road	6.47	6.470	6.472	0%	6.473	0%	0%	65	10%	10%	10%
R21	York-Durham Line to Whites Road	6.47	6.470	6.473	0%	6.474	0%	0%	65	10%	10%	10%
R22	Whites Road to Brock Road	6.47	6.470	6.472	0%	6.473	0%	0%	65	10%	10%	10%
R23	Whites Road to Brock Road	6.47	6.470	6.472	0%	6.473	0%	0%	65	10%	10%	10%
R24	Whites Road to Brock Road	6.47	6.471	6.473	0%	6.474	0%	0%	65	10%	10%	10%

Table B.21 24-hr Maximum B[a]P Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			24-hr Max Concentration	24-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	24-hr Max Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	1.60E-04	2.07E-03	7.12E-04	-66%	7.14E-04	-66%	0%	0.00005	4148%	1423%	1427%
R2	Kennedy Rd. to McCowan Rd.	1.60E-04	2.57E-03	9.76E-04	-62%	9.80E-04	-62%	0%	5E-05	5133%	1952%	1960%
R3	Kennedy Rd. to McCowan Rd.	1.60E-04	2.95E-03	1.08E-03	-63%	1.08E-03	-63%	0%	5E-05	5905%	2162%	2168%
R4	Kennedy Rd. to McCowan Rd.	1.60E-04	1.40E-03	5.63E-04	-60%	5.69E-04	-59%	1%	5E-05	2790%	1126%	1138%
R5	Kennedy Rd. to McCowan Rd.	1.60E-04	2.85E-03	1.06E-03	-63%	1.06E-03	-63%	0%	5E-05	5691%	2115%	2122%
R6	Kennedy Rd. to McCowan Rd.	1.60E-04	1.47E-03	5.75E-04	-61%	5.82E-04	-60%	1%	5E-05	2940%	1150%	1164%
R7	Markham Rd. to Ninth Line	1.60E-04	3.53E-03	1.23E-03	-65%	1.33E-03	-62%	8%	5E-05	7062%	2463%	2664%
R8	Markham Rd. to Ninth Line	1.60E-04	2.99E-03	1.15E-03	-61%	1.16E-03	-61%	1%	5E-05	5975%	2303%	2320%
R9	Markham Rd. to Ninth Line	1.60E-04	3.05E-03	1.10E-03	-64%	1.13E-03	-63%	3%	5E-05	6092%	2207%	2267%
R10	Markham Rd. to Ninth Line	1.60E-04	2.49E-03	9.27E-04	-63%	9.44E-04	-62%	2%	5E-05	4980%	1854%	1887%
R11	Markham Rd. to Ninth Line	1.60E-04	2.11E-03	8.13E-04	-62%	8.27E-04	-61%	2%	5E-05	4229%	1626%	1655%
R12	Markham Rd. to Ninth Line	1.60E-04	1.98E-03	7.80E-04	-61%	8.00E-04	-60%	3%	5E-05	3969%	1561%	1600%
R13	Markham Rd. to Ninth Line	1.60E-04	2.11E-03	8.17E-04	-61%	8.32E-04	-61%	2%	5E-05	4225%	1634%	1663%
R14	Markham Rd. to Ninth Line	1.60E-04	1.53E-03	6.15E-04	-60%	7.07E-04	-54%	15%	5E-05	3055%	1231%	1414%
R15	Ninth Line to Donald Cousens Pkwy.	1.60E-04	1.97E-03	7.56E-04	-62%	8.29E-04	-58%	10%	5E-05	3933%	1513%	1657%
R16	Ninth Line to Donald Cousens Pkwy.	1.60E-04	1.98E-03	7.67E-04	-61%	7.94E-04	-60%	4%	5E-05	3962%	1533%	1588%
R17	Ninth Line to Donald Cousens Pkwy.	1.60E-04	1.43E-03	5.82E-04	-59%	6.15E-04	-57%	6%	5E-05	2858%	1163%	1230%
R18	Donald Cousens Pkwy. to York-Durham Line	1.60E-04	1.35E-03	5.53E-04	-59%	5.87E-04	-57%	6%	5E-05	2710%	1106%	1174%
R19	Donald Cousens Pkwy. to York-Durham Line	1.60E-04	9.10E-04	4.01E-04	-56%	4.04E-04	-56%	1%	5E-05	1820%	802%	809%
R20	York-Durham Line to Whites Road	1.60E-04	4.82E-04	2.91E-04	-40%	2.99E-04	-38%	3%	5E-05	965%	583%	598%
R21	York-Durham Line to Whites Road	1.60E-04	4.81E-04	3.58E-04	-26%	4.09E-04	-15%	14%	5E-05	963%	716%	818%
R22	Whites Road to Brock Road	1.60E-04	4.89E-04	2.96E-04	-39%	3.11E-04	-36%	5%	5E-05	977%	592%	622%
R23	Whites Road to Brock Road	1.60E-04	4.81E-04	2.88E-04	-40%	2.96E-04	-38%	3%	5E-05	963%	576%	592%
R24	Whites Road to Brock Road	1.60E-04	8.60E-04	3.34E-04	-61%	3.51E-04	-59%	5%	5E-05	1721%	669%	702%

**Table B.22 Annual Average B[a]P Concentrations for Existing Conditions, Future No-Build and Future Build Scenarios**

Receptor ID	Receptor Name	Background Concentration (µg/m <sup>3</sup> )	Existing Conditions (2015)	Future No-Build (2031)		2031 Future Build (2031)			Ambient Air Quality Criteria (µg/m <sup>3</sup> )	% of the AAQC		
			Annual Average Concentration (µg/m <sup>3</sup> )	Annual Average Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	Annual Average Concentration (µg/m <sup>3</sup> )	% change from Existing Conditions	% change from No-Build		Existing Conditions (2015)	Future No-Build (2031)	Future Build (2031)
R1	Kennedy Rd. to McCowan Rd.	9E-05	6.04E-04	2.49E-04	-59%	2.50E-04	-59%	0%	1E-05	6035%	2485%	2495%
R2	Kennedy Rd. to McCowan Rd.	9E-05	8.76E-04	3.45E-04	-61%	3.47E-04	-60%	0%	1E-05	8761%	3450%	3465%
R3	Kennedy Rd. to McCowan Rd.	9E-05	9.72E-04	3.81E-04	-61%	3.82E-04	-61%	0%	1E-05	9717%	3810%	3822%
R4	Kennedy Rd. to McCowan Rd.	9E-05	3.36E-04	1.70E-04	-49%	1.70E-04	-49%	0%	1E-05	3356%	1695%	1701%
R5	Kennedy Rd. to McCowan Rd.	9E-05	8.81E-04	3.56E-04	-60%	3.57E-04	-59%	0%	1E-05	8809%	3562%	3572%
R6	Kennedy Rd. to McCowan Rd.	9E-05	3.38E-04	1.71E-04	-49%	1.72E-04	-49%	0%	1E-05	3375%	1714%	1721%
R7	Markham Rd. to Ninth Line	9E-05	1.02E-03	3.90E-04	-62%	4.15E-04	-59%	6%	1E-05	10236%	3902%	4150%
R8	Markham Rd. to Ninth Line	9E-05	8.64E-04	3.52E-04	-59%	3.58E-04	-59%	1%	1E-05	8640%	3524%	3575%
R9	Markham Rd. to Ninth Line	9E-05	5.75E-04	2.51E-04	-56%	2.59E-04	-55%	3%	1E-05	5748%	2512%	2590%
R10	Markham Rd. to Ninth Line	9E-05	5.67E-04	2.51E-04	-56%	2.56E-04	-55%	2%	1E-05	5667%	2509%	2563%
R11	Markham Rd. to Ninth Line	9E-05	5.41E-04	2.45E-04	-55%	2.50E-04	-54%	2%	1E-05	5414%	2451%	2498%
R12	Markham Rd. to Ninth Line	9E-05	6.11E-04	2.70E-04	-56%	2.74E-04	-55%	2%	1E-05	6108%	2695%	2736%
R13	Markham Rd. to Ninth Line	9E-05	5.84E-04	2.60E-04	-56%	2.67E-04	-54%	3%	1E-05	5841%	2599%	2670%
R14	Markham Rd. to Ninth Line	9E-05	3.93E-04	1.94E-04	-51%	2.23E-04	-43%	15%	1E-05	3934%	1937%	2225%
R15	Ninth Line to Donald Cousens Pkwy.	9E-05	4.30E-04	2.06E-04	-52%	2.15E-04	-50%	4%	1E-05	4298%	2058%	2146%
R16	Ninth Line to Donald Cousens Pkwy.	9E-05	4.52E-04	2.14E-04	-53%	2.20E-04	-51%	3%	1E-05	4515%	2138%	2201%
R17	Ninth Line to Donald Cousens Pkwy.	9E-05	3.26E-04	1.72E-04	-47%	1.75E-04	-46%	2%	1E-05	3255%	1720%	1752%
R18	Donald Cousens Pkwy. to York-Durham Line	9E-05	2.92E-04	1.64E-04	-44%	1.69E-04	-42%	3%	1E-05	2915%	1640%	1688%
R19	Donald Cousens Pkwy. to York-Durham Line	9E-05	3.38E-04	1.75E-04	-48%	1.76E-04	-48%	1%	1E-05	3376%	1748%	1761%
R20	York-Durham Line to Whites Road	9E-05	1.76E-04	1.26E-04	-29%	1.27E-04	-28%	1%	1E-05	1757%	1256%	1266%
R21	York-Durham Line to Whites Road	9E-05	1.77E-04	1.40E-04	-21%	1.52E-04	-14%	8%	1E-05	1769%	1401%	1515%
R22	Whites Road to Brock Road	9E-05	1.73E-04	1.27E-04	-26%	1.29E-04	-25%	2%	1E-05	1726%	1269%	1290%
R23	Whites Road to Brock Road	9E-05	1.70E-04	1.24E-04	-27%	1.26E-04	-26%	1%	1E-05	1700%	1243%	1256%
R24	Whites Road to Brock Road	9E-05	1.97E-04	1.28E-04	-35%	1.37E-04	-31%	7%	1E-05	1972%	1281%	1367%

**Table B.23 Maximum Concentrations for Existing Condition Scenario**

Contaminant	Averaging Period	Threshold (AAQC or CAAQS)	Highest Concentration ( $\mu\text{g}/\text{m}^3$ )	Julian Day (2012) / Hour	Location (UTM km)	2 <sup>nd</sup> Highest Concentration ( $\mu\text{g}/\text{m}^3$ )	Julian Day (2012) / Hour	Location (UTM km)	3 <sup>rd</sup> Highest Concentration ( $\mu\text{g}/\text{m}^3$ )	Julian Day (2012) / Hour	Location (UTM km)
CO	1-hr	36,200	2,036.69	320/18	636.4, 4856.7	1,854.95	320/18	635.9, 4856.6	1,710.80	320/18	635.7, 4856.5
CO	8-hr	15,700	705.13	321/1	636.4, 4856.7	637.93	322/6	636.2, 4856.3	632.89	32/ 24	635.9, 4856.6
NO <sub>2</sub>	1-hr	400	386.29	320/18	636.4, 4856.7	367.89	320/18	635.9, 4856.6	342.14	320/18	635.7, 4856.5
NO <sub>2</sub>	24-hr	200	107.71	327	636.0, 4857.0	104.59	322	638.2, 4857.1	101.64	272	636.2, 4856.3
SO <sub>2</sub>	1-hr	690	11.78	320/18	636.4, 4856.7	11.37	320/18	635.9, 4856.6	11.02	320/18	635.7, 4856.5
SO <sub>2</sub>	24-hr	275	7.26	320	636.4, 4856.7	7.26	327	636.0, 4857.0	7.24	322	638.2, 4857.1
SO <sub>2</sub>	Annual	55	2.83	n/a	637.1, 4856.8	2.83	n/a	647.8, 4862.0	2.82	n/a	646.3, 4861.1
Acetaldehyde	24-hr	500	3.03	327	636.0, 4857.0	3.02	322	638.2, 4857.1	3.02	272	636.2, 4856.3
Benzene	24-hr	2.3	1.04	327	636.0, 4857.0	1.04	320	636.4, 4856.7	1.04	322	638.2, 4857.1
Benzene	Annual	0.5	0.61	n/a	636.9, 4857.1	0.61	n/a	638.0, 4857.4	0.61	n/a	642.1, 4859.7
Acrolein	1-hr	4.5	0.29	251/ 6	636.2, 4856.3	0.28	251/6	638.2, 4857.0	0.27	320/18	635.9, 4856.6
Acrolein	24-hr	0.4	0.23	327	636.0, 4857.0	0.23	322	636.0, 4857.0	0.23	272	636.2, 4856.3
1-3 Butadiene	24-hr	10	0.12	327	636.0, 4857.0	0.12	322	638.2, 4857.1	0.12	272	636.2, 4856.3
1-3 Butadiene	Annual	2	0.06	n/a	638.2, 4857.1	0.06	n/a	638.0, 4857.5	0.06	n/a	638.2, 4857.4
Formaldehyde	24-hr	65	6.49	327	636.0, 4857.0	6.49	322	638.2, 4857.1	6.48	272	636.2, 4856.3
Benzo[a]pyrene	24-hr	5.00E-05	8.55E-03	327	636.0, 4857.0	8.03E-03	322	638.2, 4857.1	7.32E-03	272	636.2, 4856.3
Benzo[a]pyrene	Annual	1.00E-05	2.09E-03	n/a	638.2, 4857.1	1.98E-03	n/a	638.0, 4857.5	1.88E-03	n/a	638.2, 4857.4
PM <sub>2.5</sub>	24-hr	27	16.75	n/a*	636.8, 4856.5	16.67	n/a*	635.9, 4856.3	16.25	n/a*	642.9, 4858.9
PM <sub>2.5</sub>	Annual	8.8	8.31	n/a	638.2, 4857.1	8.26	n/a	638.0, 4857.5	8.16	n/a	638.2, 4857.4
PM <sub>10</sub>	24-hr	50	37.95	322	638.2, 4857.1	37.46	327	636.0, 4857.0	36.96	322	636.2, 4856.3
TSP	24-hr	120	78.52	320	638.2, 4857.1	78.19	363	636.4, 4856.7	77.12	316	636.0, 4857.0
TSP	Annual	60	37.91	n/a	636.4, 4856.7	37.68	n/a	638.2, 4857.1	37.17	n/a	638.2, 4857.4

Note: \* 98 percentile averaged over three consecutive years (2012-2014)

**Table B.24 Maximum Concentrations for Future No-Build Scenario**

Contaminant	Averaging Period	Threshold (AAQC or CAAQS)	Highest Concentration (µg/m <sup>3</sup> )	Julian Day (2012) / Hour	Location (UTM km)	2 <sup>nd</sup> Highest Concentration (µg/m <sup>3</sup> )	Julian Day (2012) / Hour	Location (UTM km)	3 <sup>rd</sup> Highest Concentration (µg/m <sup>3</sup> )	Julian Day (2012) / Hour	Location (UTM km)
CO	1-hr	36,200	1,285.80	320/18	636.4, 4856.7	1,178.83	320/18	635.9, 4856.6	1,097.32	320/18	635.7, 4856.5
CO	8-hr	15,700	572.49	321/ 1	636.4, 4856.7	529.19	320/24	635.9, 4856.6	523.95	322/ 6	636.2, 4856.3
NO <sub>2</sub>	1-hr	400	150.83	320/18	636.4, 4856.7	147.89	320/18	635.9, 4856.6	146.20	251/ 6	636.2, 4856.3
NO <sub>2</sub>	24-hr	200	78.28	327	636.0, 4857.0	76.41	272	636.2, 4856.3	75.07	322	638.2, 4857.1
SO <sub>2</sub>	1-hr	690	8.85	320/18	636.4, 4856.7	8.76	320/18	635.9, 4856.6	8.65	320/18	635.7, 4856.5
SO <sub>2</sub>	24-hr	275	7.07	327	636.0, 4857.0	7.05	272	636.2, 4856.3	7.03	35	636.4, 4856.7
SO <sub>2</sub>	Annual	55	2.77	n/a	647.8, 4862.0	2.77	n/a	637.1, 4856.8	2.77	n/a	646.3, 4861.1
Acetaldehyde	24-hr	500	2.98	327	636.0, 4857.0	2.97	272	636.2, 4856.3	2.97	322	638.2, 4857.1
Benzene	24-hr	2.3	1.06	320	636.4, 4856.7	1.05	327	636.0, 4857.0	1.05	319	635.9 4856.6
Benzene	Annual	0.5	0.62	n/a	636.9, 4857.1	0.62	n/a	640.1, 4857.3	0.62	n/a	642.1, 4859.7
Acrolein	1-hr	4.5	0.24	251/ 6	636.2, 4856.3	0.23	76/ 7	638.2, 4857.0	0.23	251/ 6	635.9, 4856.6
Acrolein	24-hr	0.4	0.22	327	636.0, 4857.0	0.22	322	638.2, 4857.1	0.22	272	636.2, 4856.3
1-3 Butadiene	24-hr	10	0.11	327	636.0, 4857.0	0.11	272	636.2, 4856.3	0.11	322	638.2, 4857.1
1-3 Butadiene	Annual	2	0.06	n/a	638.2, 4857.1	0.06	n/a	638.0, 4857.5	0.06	n/a	636.0, 4857.0
Formaldehyde	24-hr	65	6.54	327	636.0, 4857.0	6.53	272	636.2, 4856.3	6.52	322	636.0, 4857.1
Benzo[a]pyrene	24-hr	5.00E-05	2.49E-03	320	636.4, 4856.7	2.32E-03	327	636.0, 4857.0	2.04E-03	322	636.2, 4856.3
Benzo[a]pyrene	Annual	1.00E-05	6.58E-04	n/a	636.4, 4856.7	6.35E-04	n/a	638.2, 4857.4	5.40E-04	n/a	638.4, 4857.5
PM <sub>2.5</sub>	24-hr	27	16.06	n/a*	645.2, 4860.8	15.91	n/a*	642.9, 4858.9	15.90	n/a*	635.9, 4856.3
PM <sub>2.5</sub>	Annual	8.8	8.09	n/a	636.4, 4856.7	8.05	n/a	638.2, 4857.4	7.99	n/a	638.2, 4857.1
PM <sub>10</sub>	24-hr	50	38.26	327	636.0, 4857.0	38.06	320	636.4, 4856.7	37.73	322	636.2, 4856.3
TSP	24-hr	120	84.04	320	636.4, 4856.7	82.04	363	636.0, 4857.0	81.26	316	636.2, 4856.3
TSP	Annual	60	39.94	n/a	636.4, 4856.7	38.56	n/a	638.2, 4857.4	37.72	n/a	638.2, 4857.1

Note: \* 98 percentile averaged over three consecutive years (2012-2014)



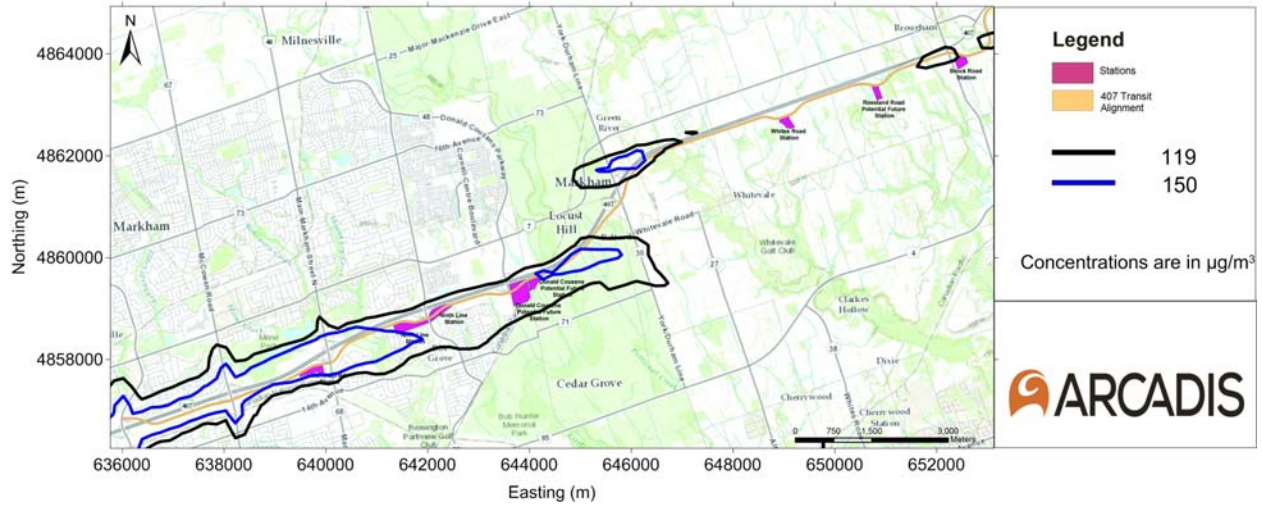
**Table B.25 Maximum Concentrations for Future Build Scenario**

Contaminant	Averaging Period	Threshold (AAQC or CAAQS)	Highest Concentration ( $\mu\text{g}/\text{m}^3$ )	Julian Day (2012) / Hour	Location (UTM km)	2 <sup>nd</sup> Highest Concentration ( $\mu\text{g}/\text{m}^3$ )	Julian Day (2012) / Hour	Location (UTM km)	3 <sup>rd</sup> Highest Concentration ( $\mu\text{g}/\text{m}^3$ )	Julian Day (2012) / Hour	Location (UTM km)
CO	1-hr	36,200	1,285.85	320/18	636.4, 4856.7	1,178.83	320/18	635.9, 4856.6	1,097.32	320/18	635.7, 4856.5
CO	8-hr	15,700	573.21	321/ 1	636.4, 4856.7	529.76	320/24	635.9, 4856.6	523.96	322/ 6	636.2, 4856.3
NO <sub>2</sub>	1-hr	400	152.96	320/18	636.4, 4856.7	149.61	320/18	635.9, 4856.6	146.21	251/ 6	636.2, 4856.3
NO <sub>2</sub>	24-hr	200	78.33	327	636.0, 4857.1	76.43	272	636.2, 4856.3	75.23	322	638.2, 4857.1
SO <sub>2</sub>	1-hr	690	8.88	320/18	636.4, 4856.7	8.78	320/18	635.9, 4856.6	8.67	320/18	635.7, 4856.5
SO <sub>2</sub>	24-hr	275	7.07	327	636.0, 4857.0	7.05	272	636.2, 4856.3	7.03	322	636.4, 4856.7
SO <sub>2</sub>	Annual	55	2.77	n/a	647.8, 4862.0	2.77	n/a	637.1, 4856.8	2.77	n/a	646.3, 4861.1
Acetaldehyde	24-hr	500	2.98	327	636.0, 4857.0	2.97	272	636.2, 4856.3	2.97	322	638.2, 4857.1
Benzene	24-hr	2.3	1.06	320	636.4, 4856.7	1.05	327	636.0, 4857.0	1.05	320	635.9, 4856.6
Benzene	Annual	0.5	0.62	n/a	636.9, 4857.1	0.62	n/a	640.1, 4857.3	0.62	n/a	642.1, 4859.7
Acrolein	1-hr	4.5	0.24	251/ 6	636.2, 4856.3	0.23	76/ 7	638.2, 4857.0	0.23	251/ 6	635.9, 4856.6
Acrolein	24-hr	0.4	0.22	327	636.0, 4857.0	0.22	322	638.2, 4857.1	0.22	272	636.2, 4856.3
1-3 Butadiene	24-hr	10	0.11	327	636.0, 4857.0	0.11	272	636.2, 4856.3	0.11	322	638.2, 4857.1
1-3 Butadiene	Annual	2	0.06	n/a	638.2, 4857.1	0.06	n/a	638.0, 4857.5	0.06	n/a	636.0, 4857.0
Formaldehyde	24-hr	65	6.54	327	636.0, 4857.0	6.53	272	636.2, 4856.3	6.52	322	636.0, 4857.1
Benzo[a]pyrene	24-hr	5.00E-05	2.51E-03	320	636.4, 4856.7	2.32E-03	327	636.0, 4857.0	2.05E-03	322	636.2, 4856.3
Benzo[a]pyrene	Annual	1.00E-05	6.60E-04	n/a	636.4, 4856.7	6.36E-04	n/a	638.2, 4857.4	5.42E-04	n/a	638.4, 4857.5
PM <sub>2.5</sub>	24-hr	27	16.04	n/a*	645.2, 4860.8	15.94	n/a*	642.9, 4858.9	15.91	n/a*	635.9, 4856.3
PM <sub>2.5</sub>	Annual	8.8	8.16	n/a	636.4, 4856.7	8.09	n/a	638.2, 4857.4	8.05	n/a	638.2, 4857.1
PM <sub>10</sub>	24-hr	50	39.56	320	636.4, 4856.7	38.52	327	636.0, 4857.0	38.12	322	636.2, 4856.3
TSP	24-hr	120	86.08	320	636.4, 4856.7	82.91	363	636.0, 4857.0	81.44	316	636.2, 4856.3
TSP	Annual	60	40.81	n/a	636.4, 4856.7	39.07	n/a	638.2, 4857.4	38.35	n/a	638.2, 4857.1

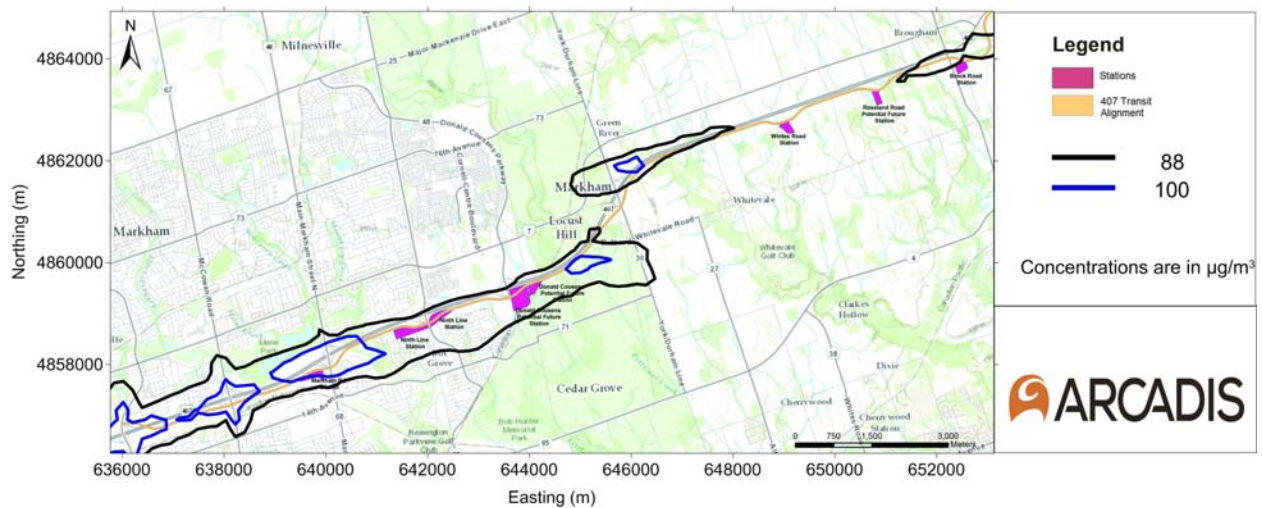
Note: \* 98 percentile averaged over three consecutive years (2012-2014)

**APPENDIX C**  
**CAL3QHCR Model Results FIGURES**

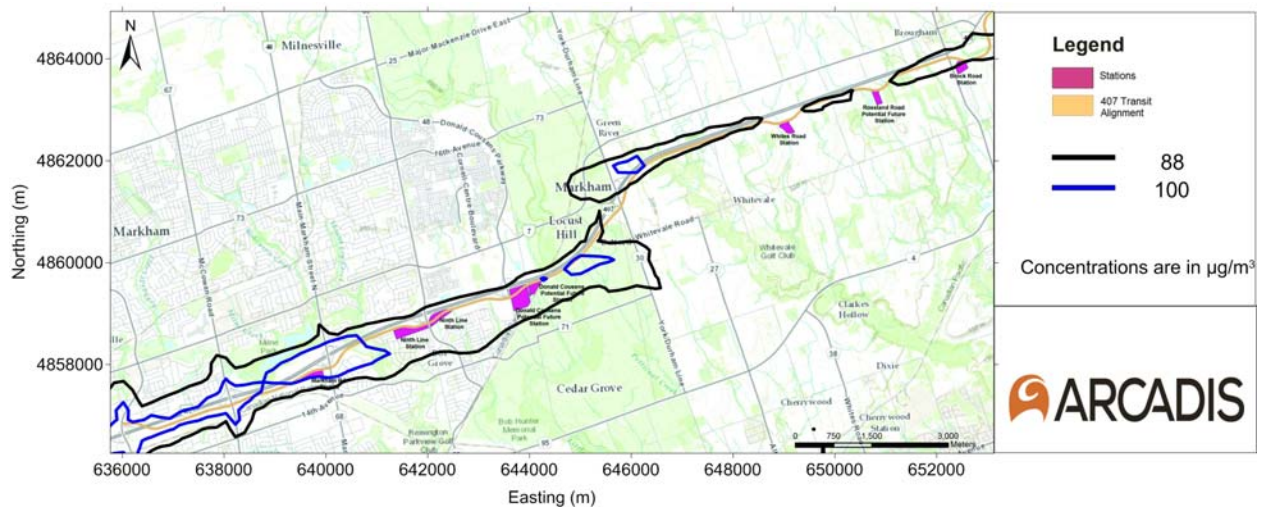




**Figure C.1** 1-hr  $\text{NO}_2$  Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)



**Figure C.2** 1-hr  $\text{NO}_2$  Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)



**Figure C.3** 1-hr  $\text{NO}_2$  Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)

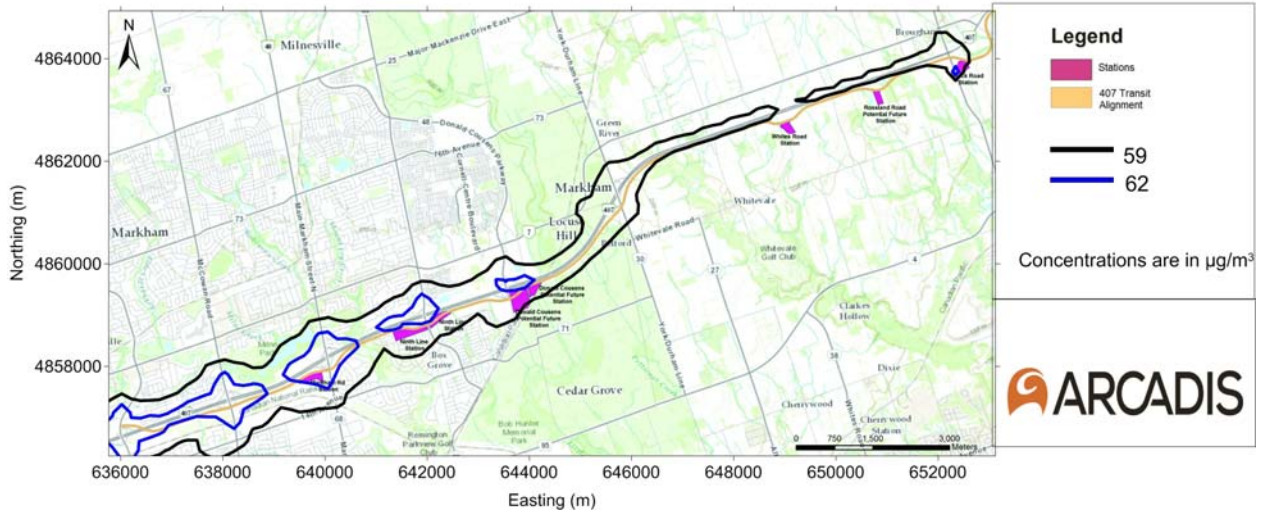


Figure C.4 24-hr TSP Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)

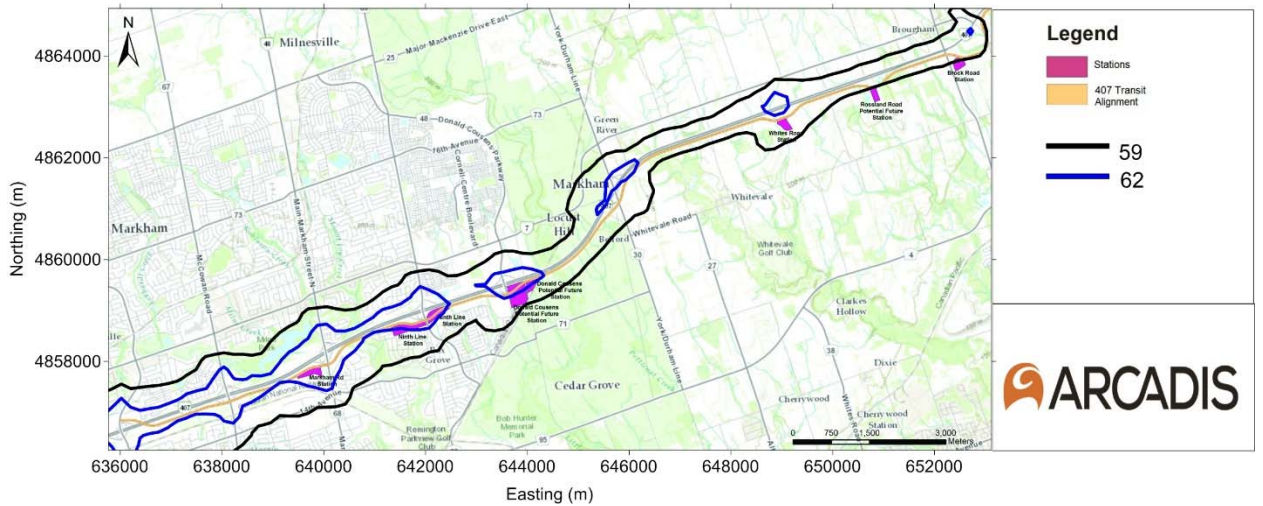


Figure C.5 24-hr TSP Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)

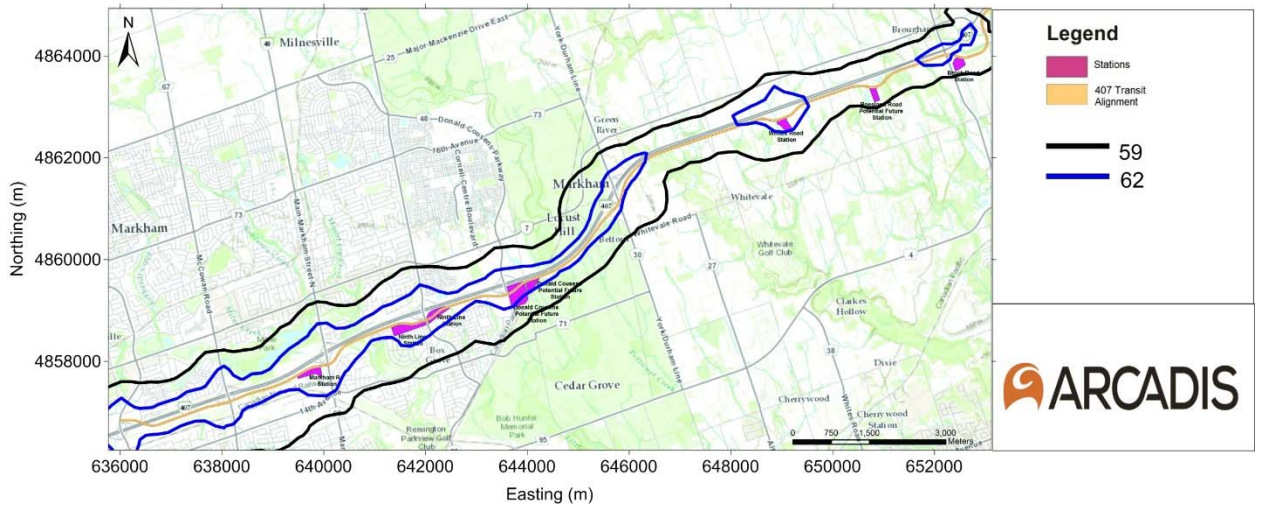


Figure C.6 24-hr TSP Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)

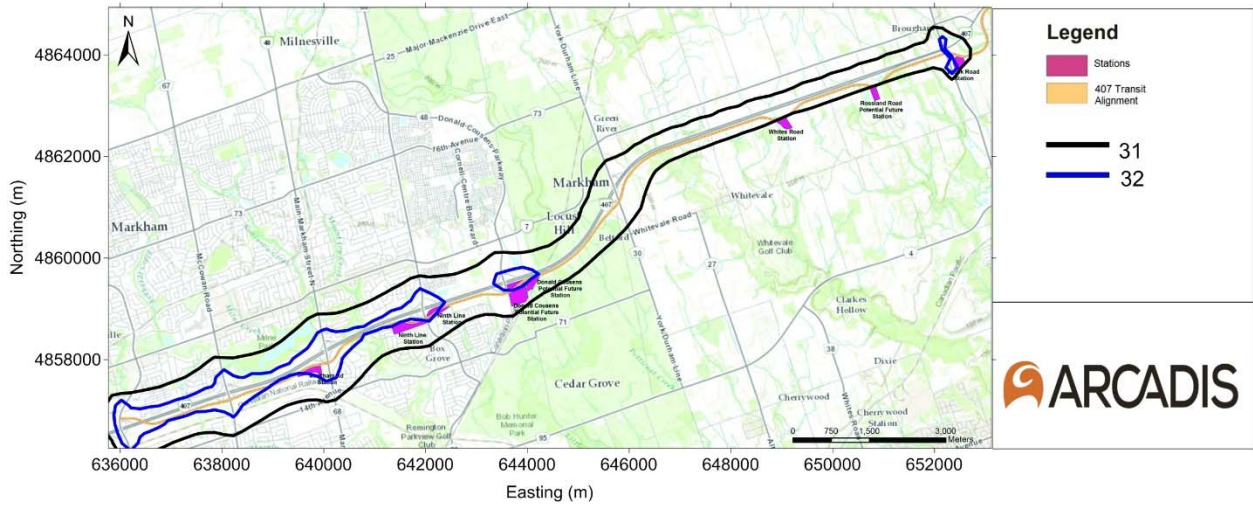


Figure C.7 Annual TSP Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)

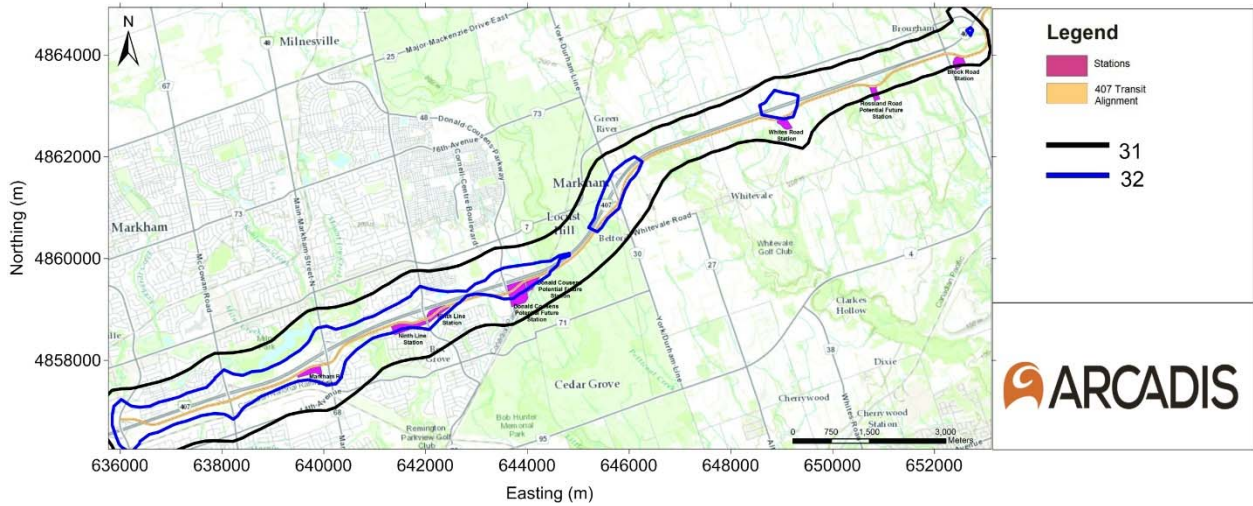


Figure C.8 Annual TSP Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)

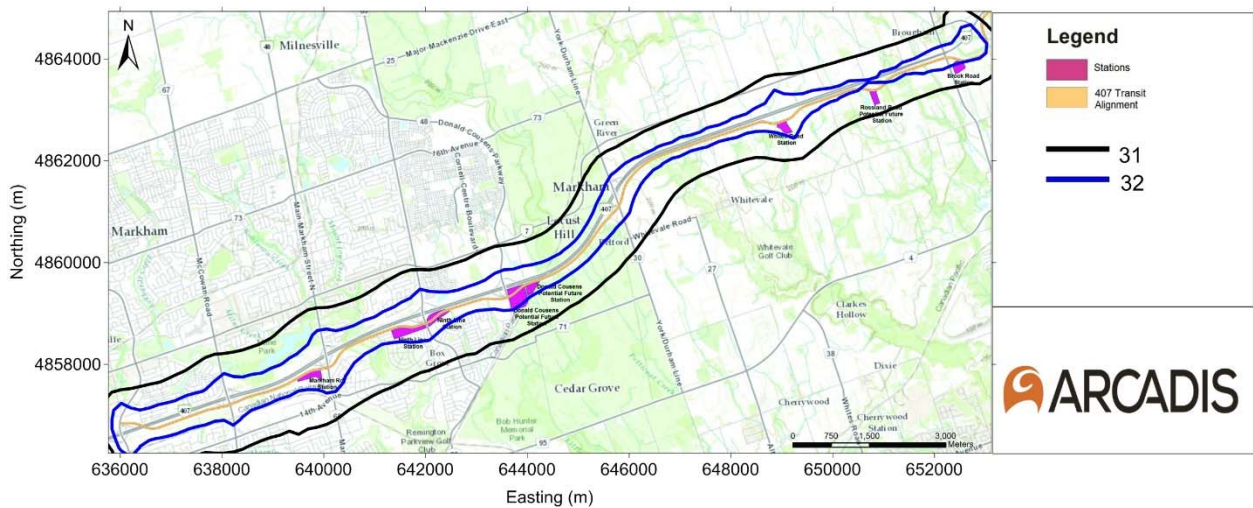
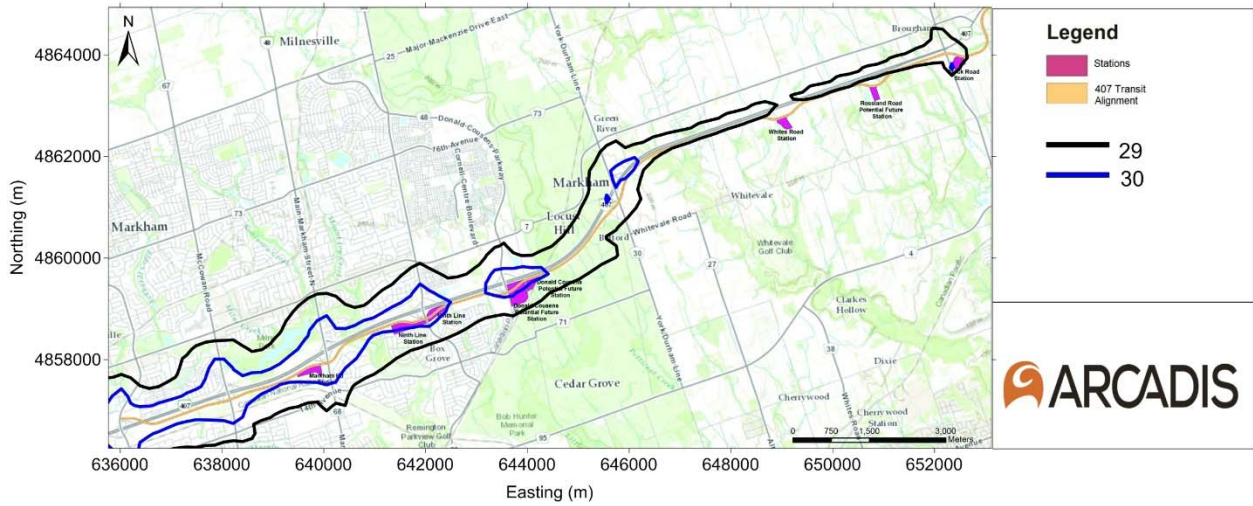
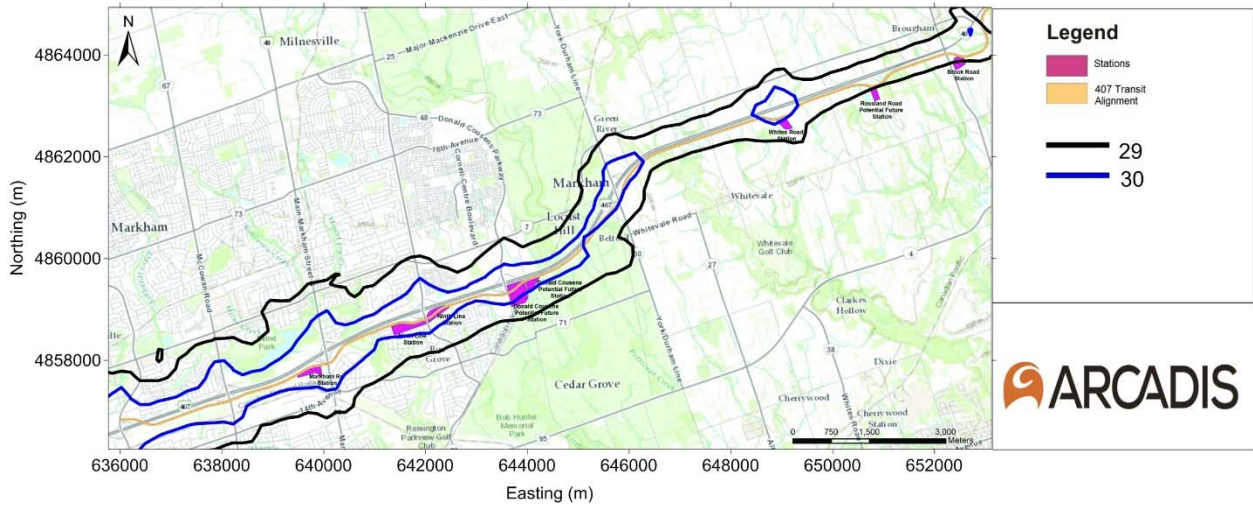


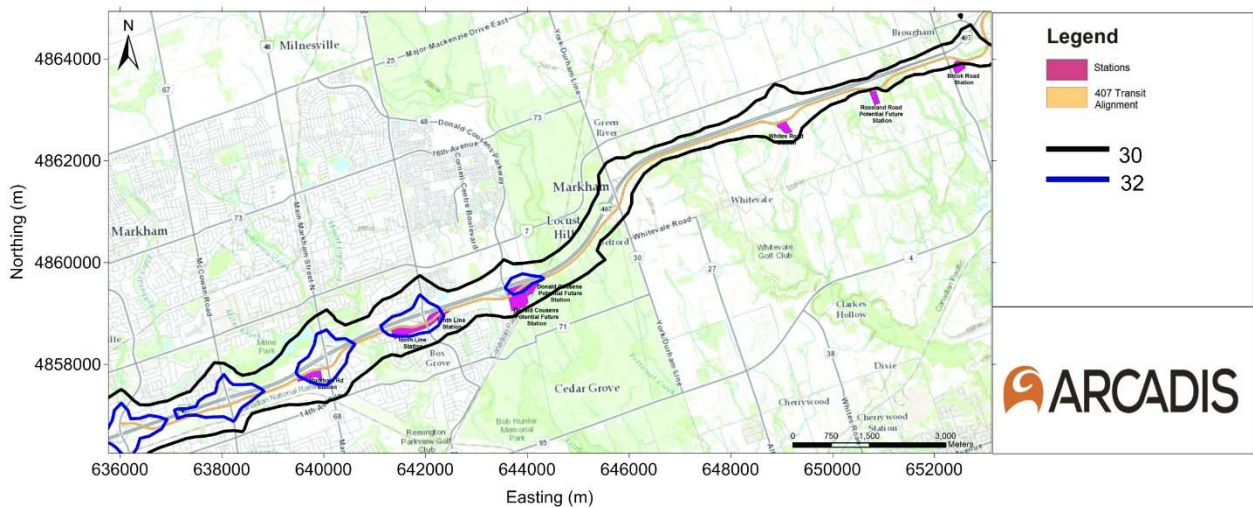
Figure C.9 Annual TSP Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)



**Figure C.10 24-hr PM<sub>10</sub> Concentrations (including background) in µg/m<sup>3</sup> - Existing Conditions (2015)**



**Figure C.11 24-hr PM<sub>10</sub> Concentrations (including background) in µg/m<sup>3</sup> - Future No Build Transitway (2031)**



**Figure C.12 24-hr PM<sub>10</sub> Concentrations (including background) in µg/m<sup>3</sup> - Future Build Transitway (2031)**

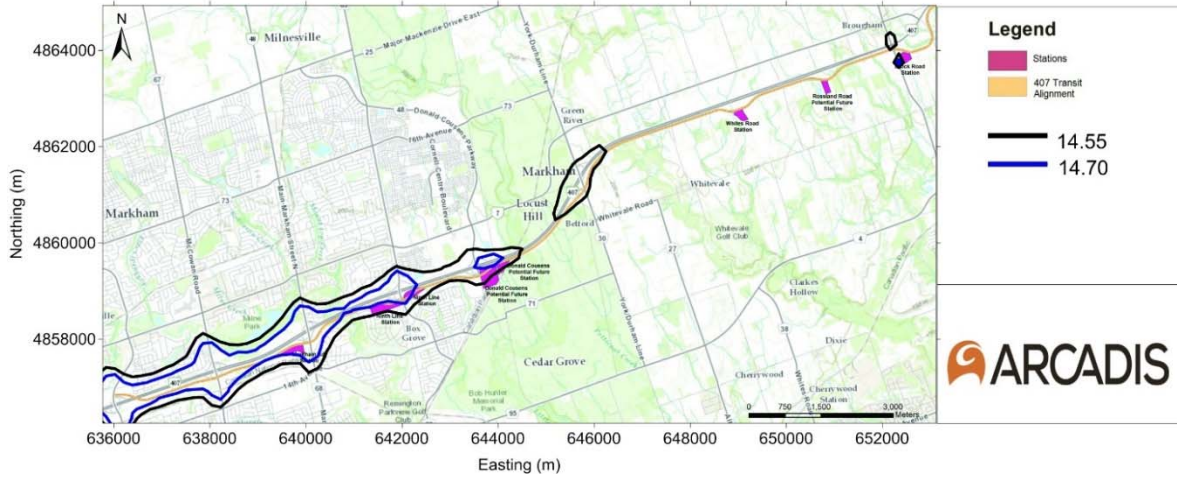


Figure C.13 24-hr<sup>1</sup> PM<sub>2.5</sub> Concentrations (including background) in µg/m<sup>3</sup> - Existing Conditions (2015)

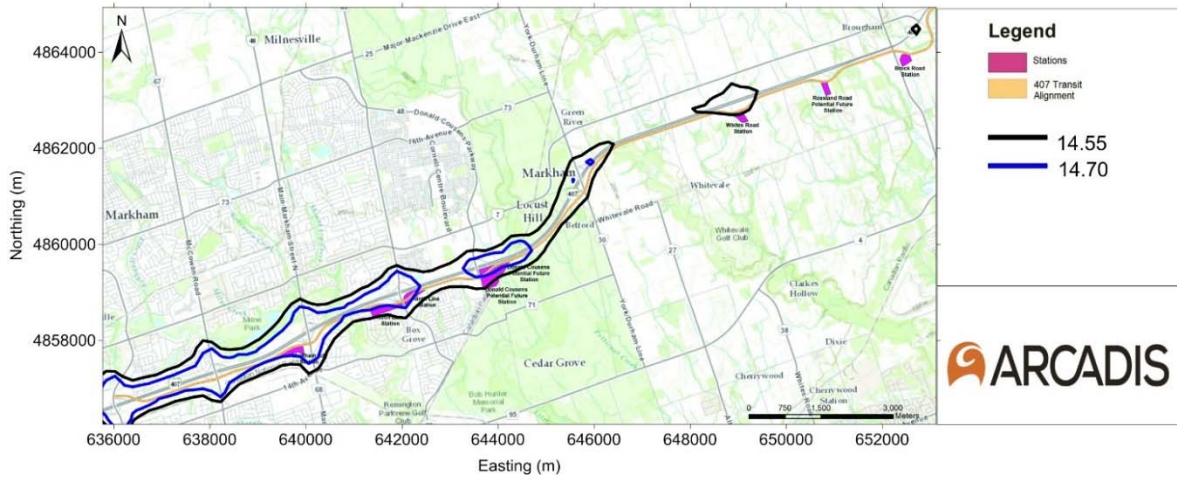


Figure C.14 24-hr<sup>1</sup> PM<sub>2.5</sub> Concentrations (including background) in µg/m<sup>3</sup> - Future No Build Transitway (2031)

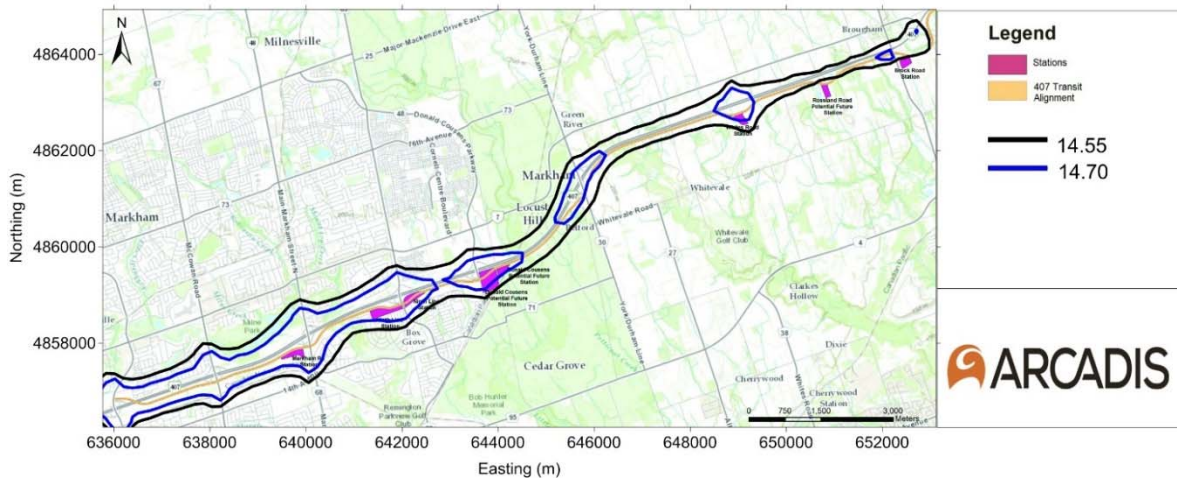


Figure C.15 24-hr<sup>1</sup> PM<sub>2.5</sub> Concentrations (including background) in µg/m<sup>3</sup> - Future Build Transitway (2031)

Note:<sup>1</sup> 97 percentile averaged over 2012 to 2014

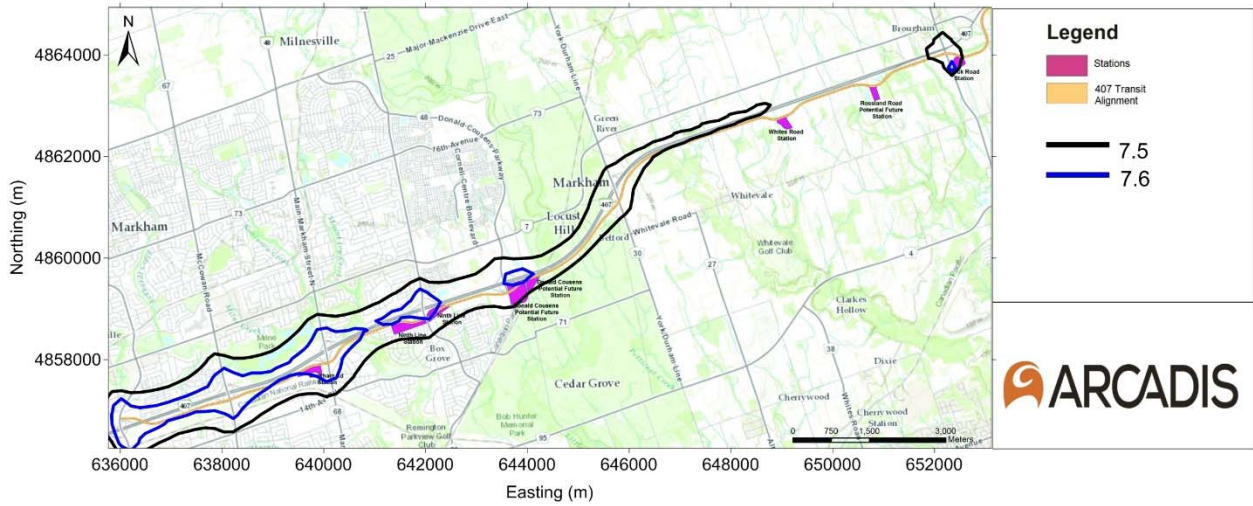


Figure C.16 Annual PM<sub>2.5</sub> Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)

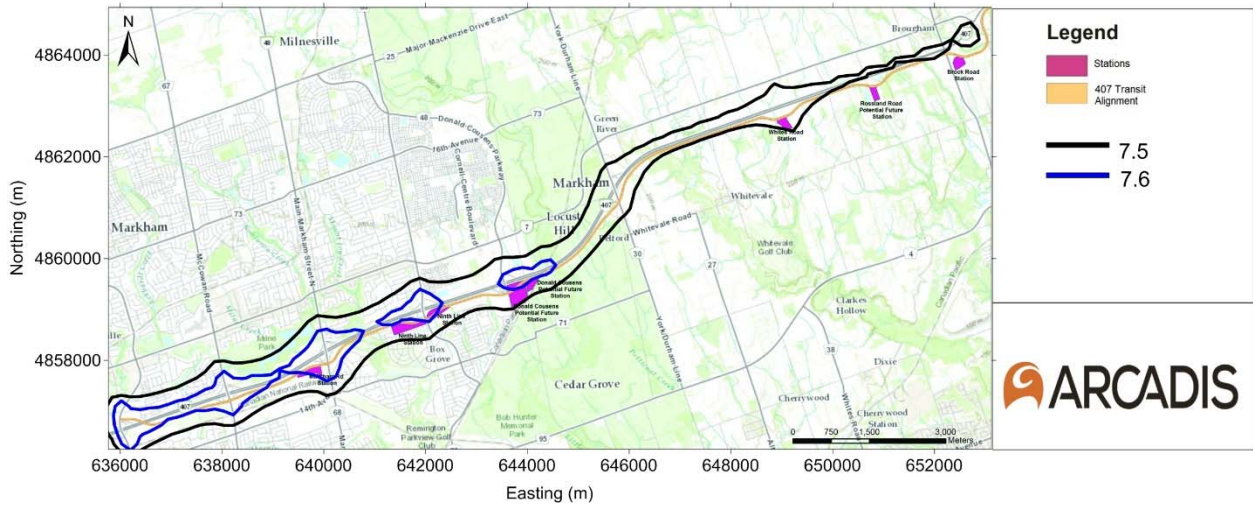


Figure C.17 Annual PM<sub>2.5</sub> Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)

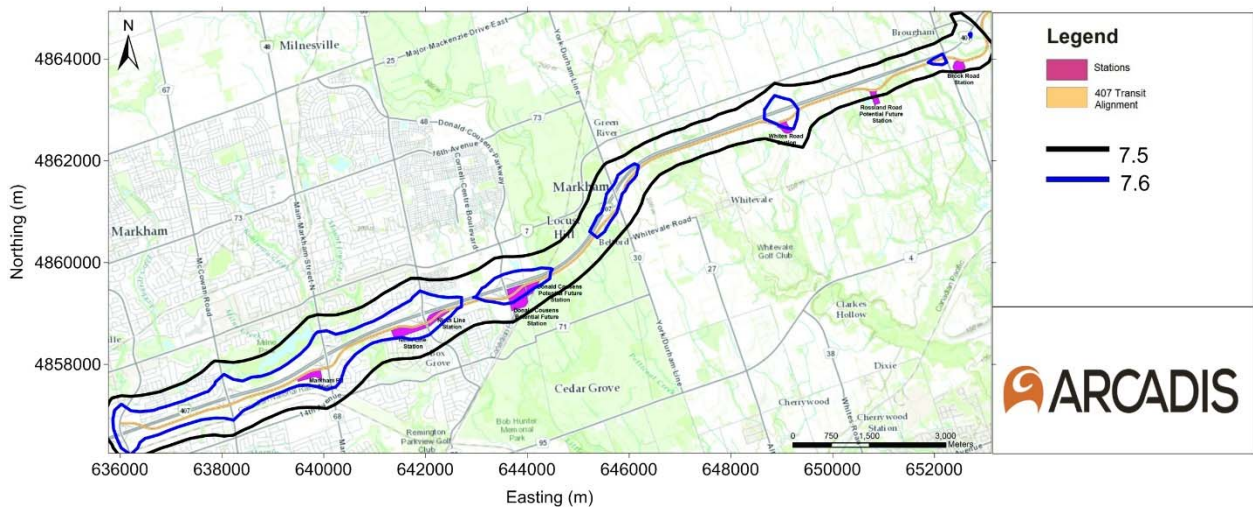
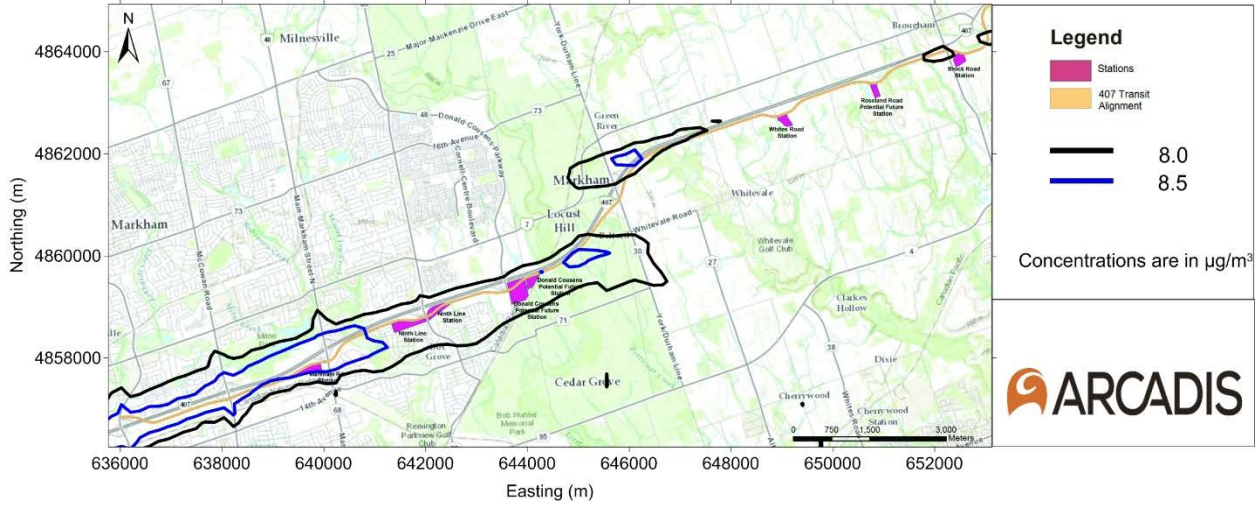
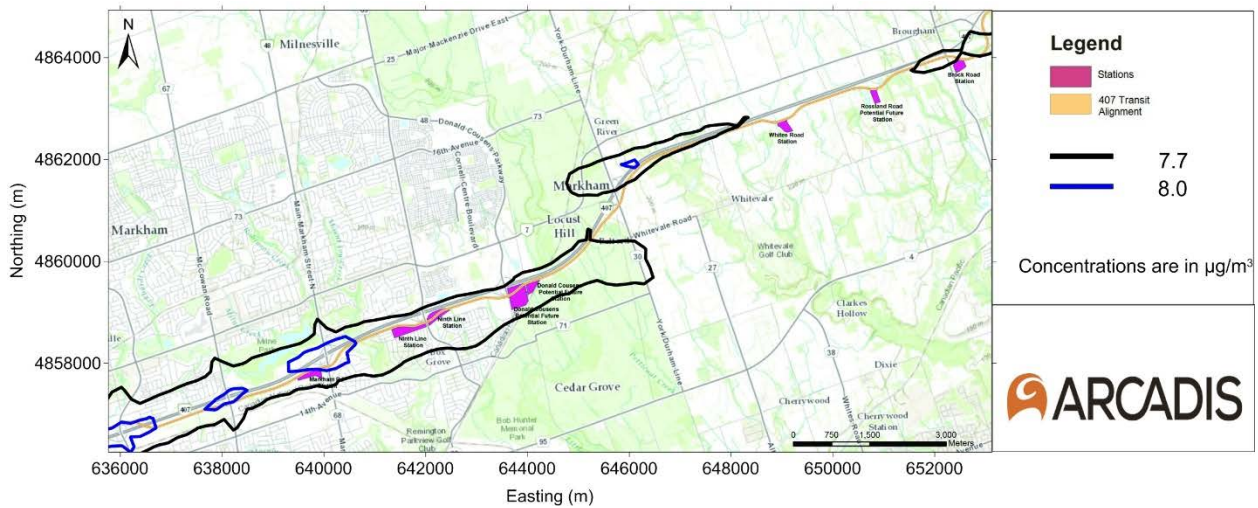


Figure C.18 Annual PM<sub>2.5</sub> Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)

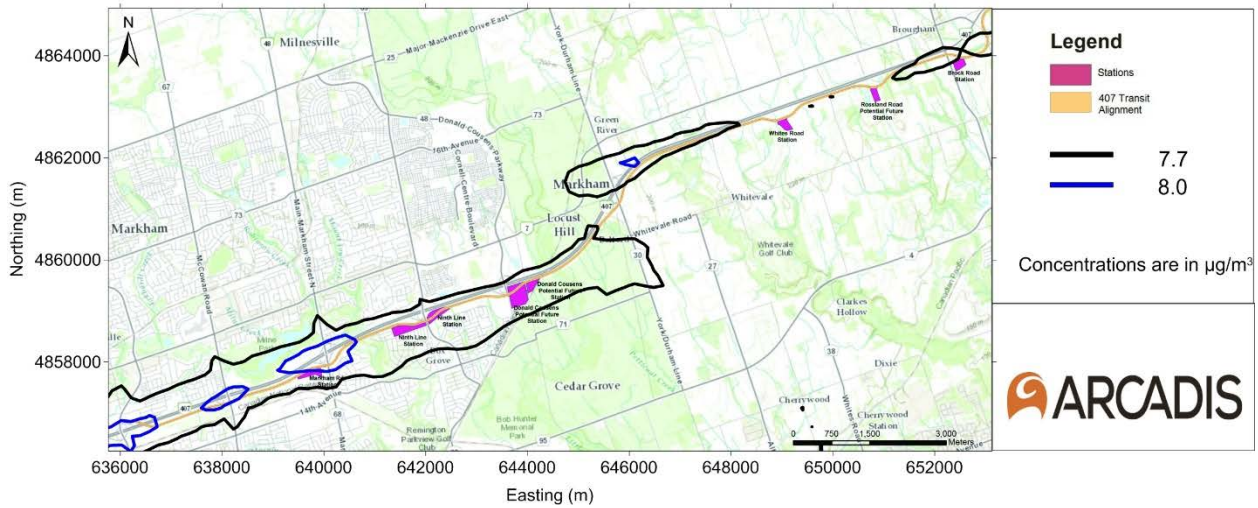




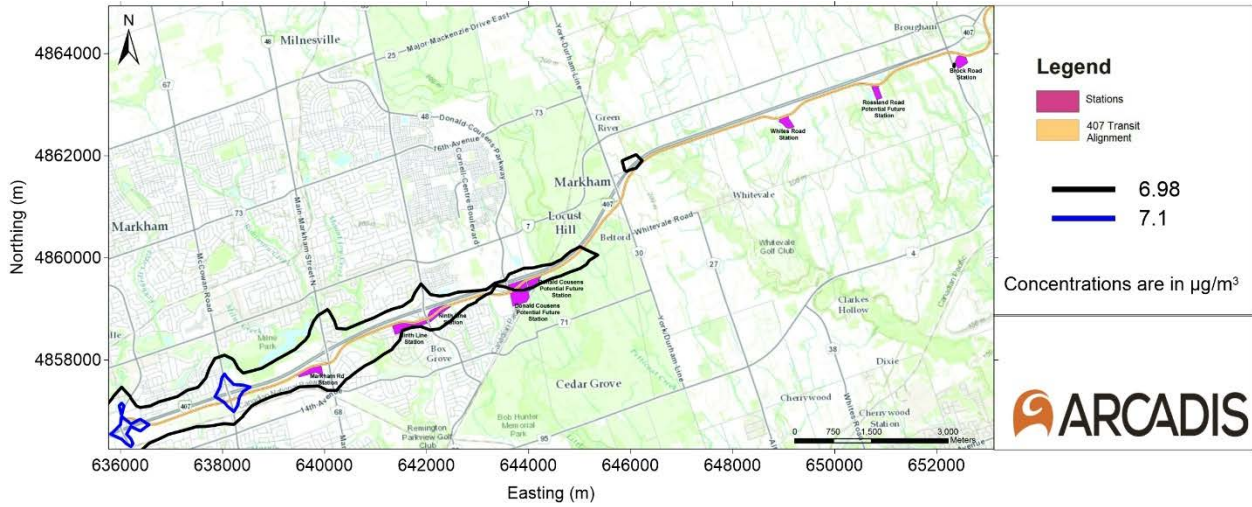
**Figure C.19** 1-hr SO<sub>2</sub> Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)



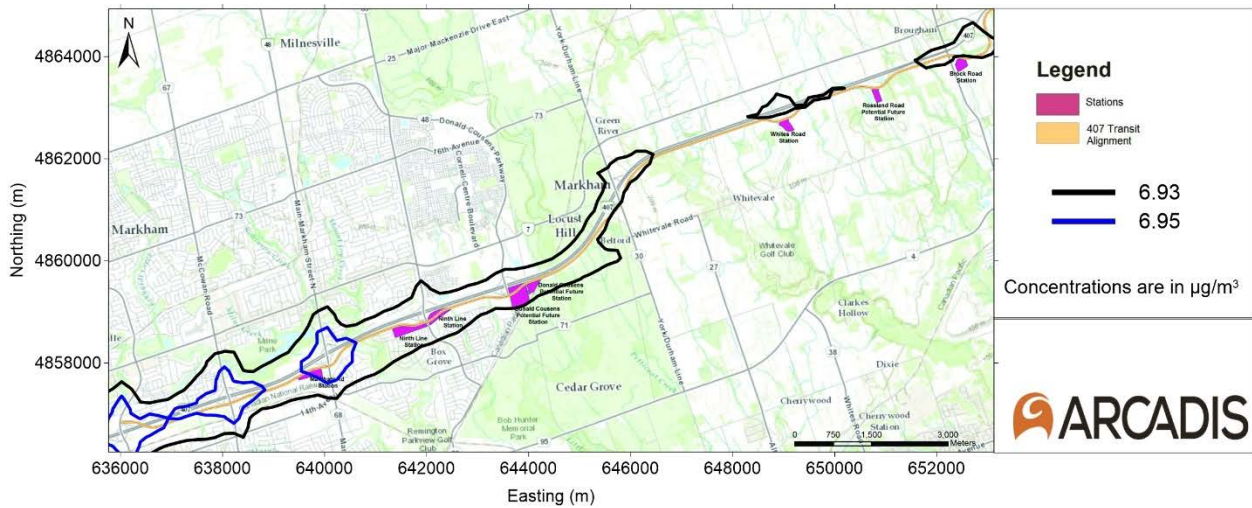
**Figure C.20** 1-hr SO<sub>2</sub> Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)



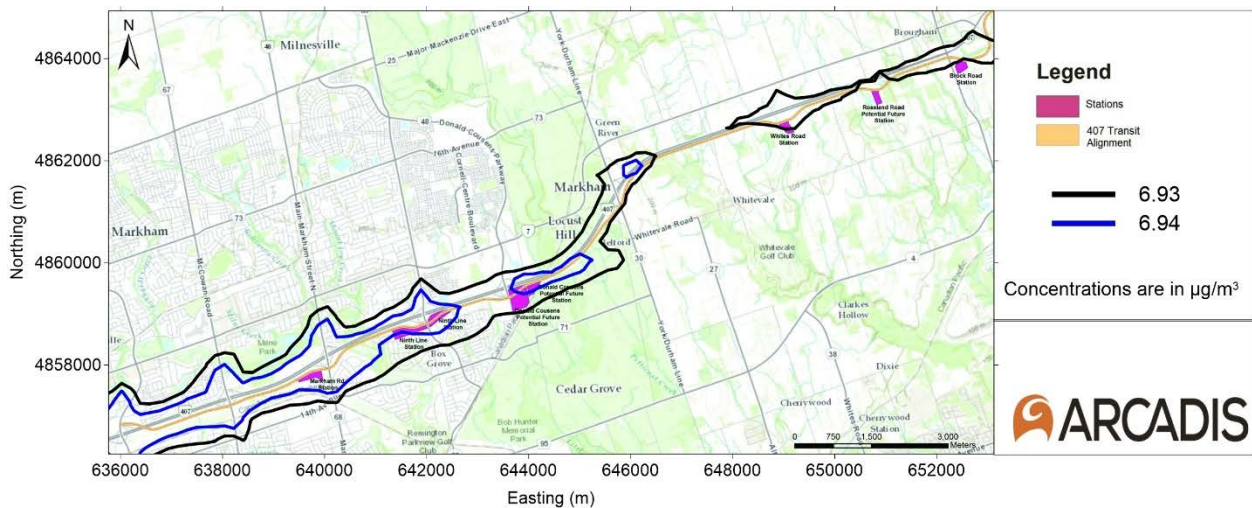
**Figure C.21** 1-hr SO<sub>2</sub> Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)



**Figure C.22** 24-hr SO<sub>2</sub> Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  – Existing Conditions (2015)



**Figure C.23** 24-hr SO<sub>2</sub> Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  – Future No Build Transitway (2031)



**Figure C.24** 24-hr SO<sub>2</sub> Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  – Future Build Transitway (2031)

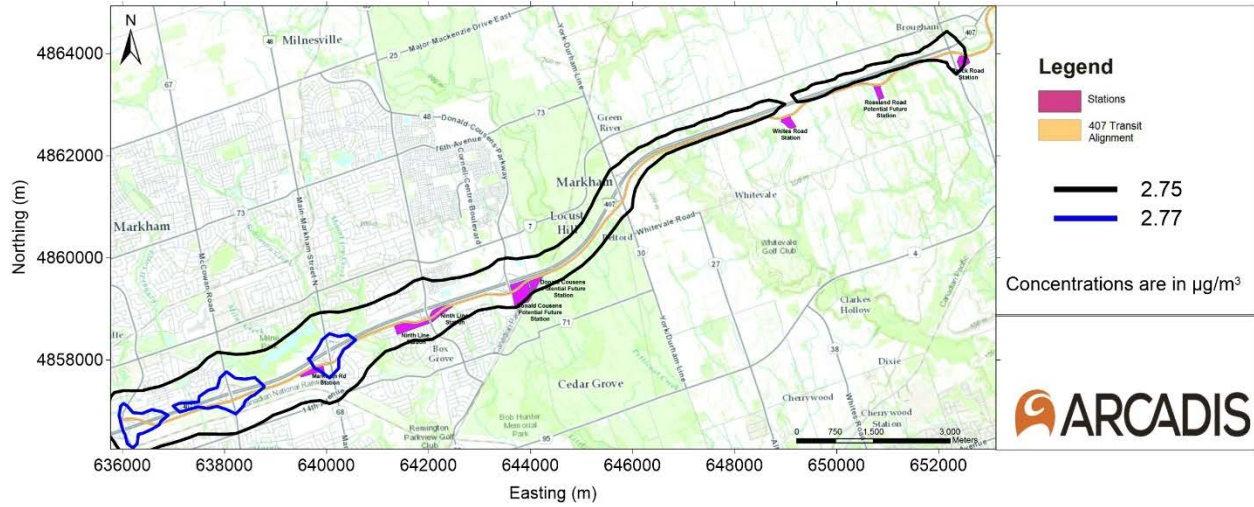


Figure C.25 Annual SO<sub>2</sub> Concentrations (including background) in µg/m<sup>3</sup> - Existing Conditions (2015)

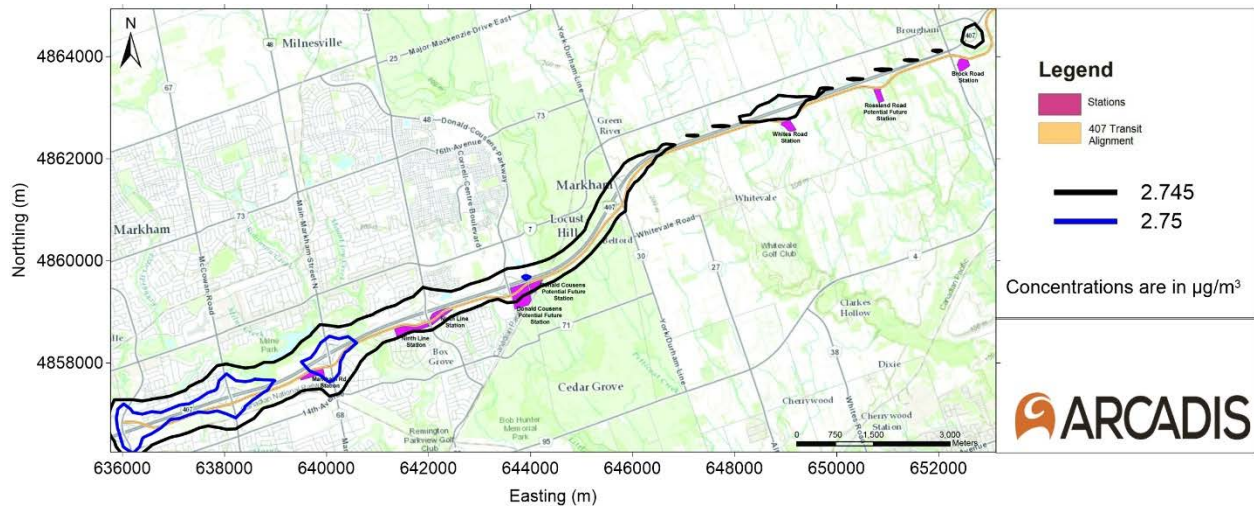


Figure C.26 Annual SO<sub>2</sub> Concentrations (including background) in µg/m<sup>3</sup> - Future No Build Transitway (2031)

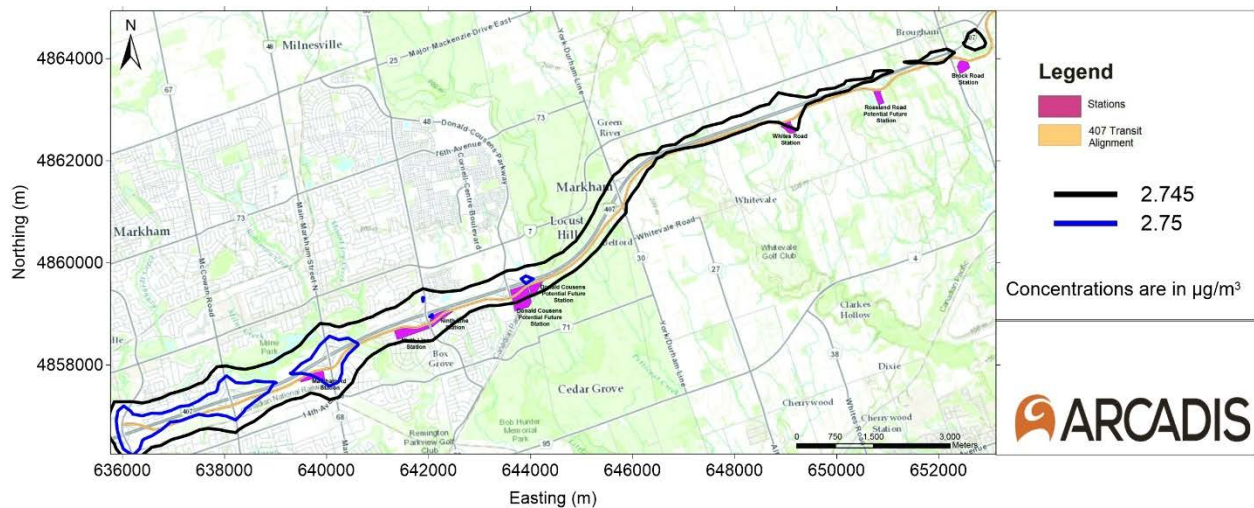


Figure C.27 Annual SO<sub>2</sub> Concentrations (including background) in µg/m<sup>3</sup> - Future Build Transitway (2031)

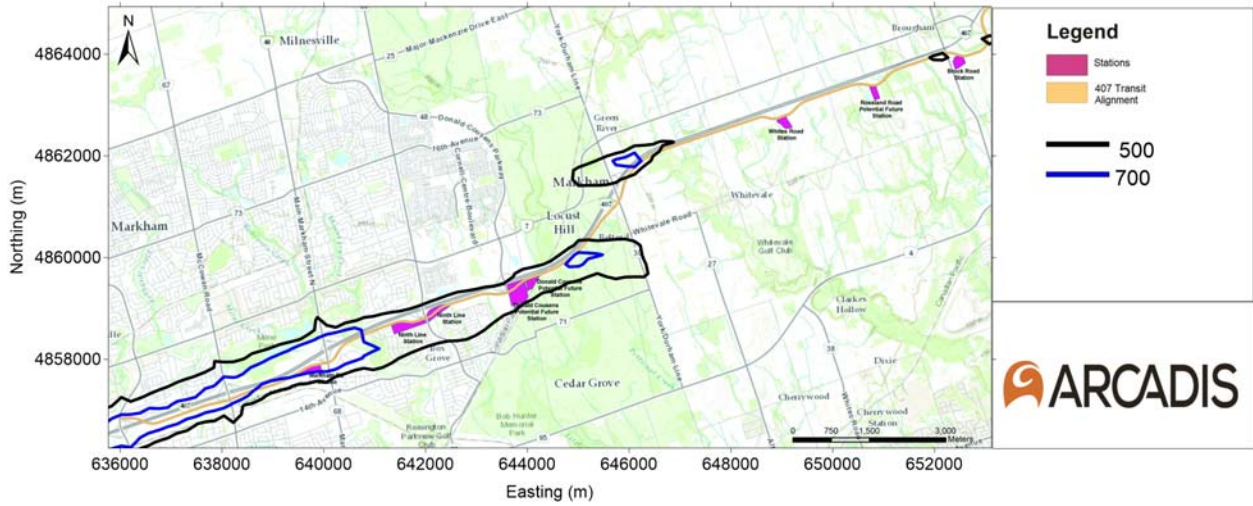


Figure C.28 1-hr CO Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)

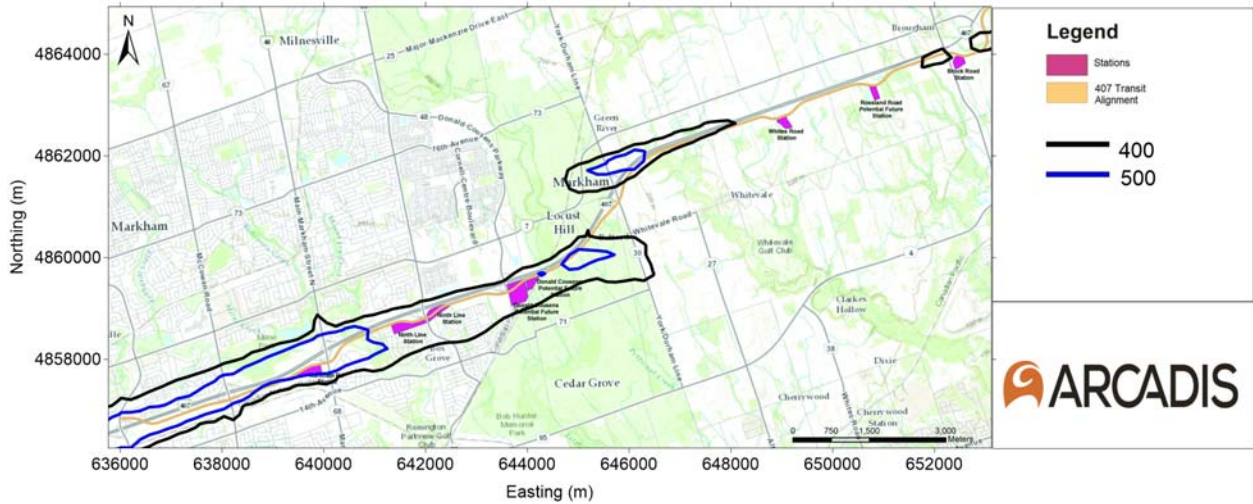


Figure C.29 1-hr CO Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)

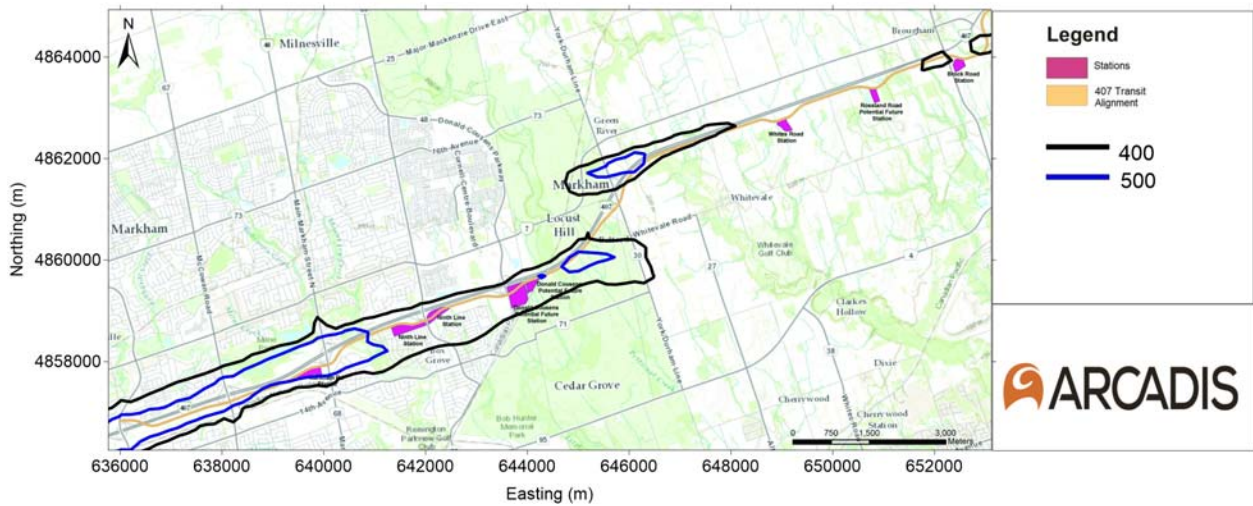
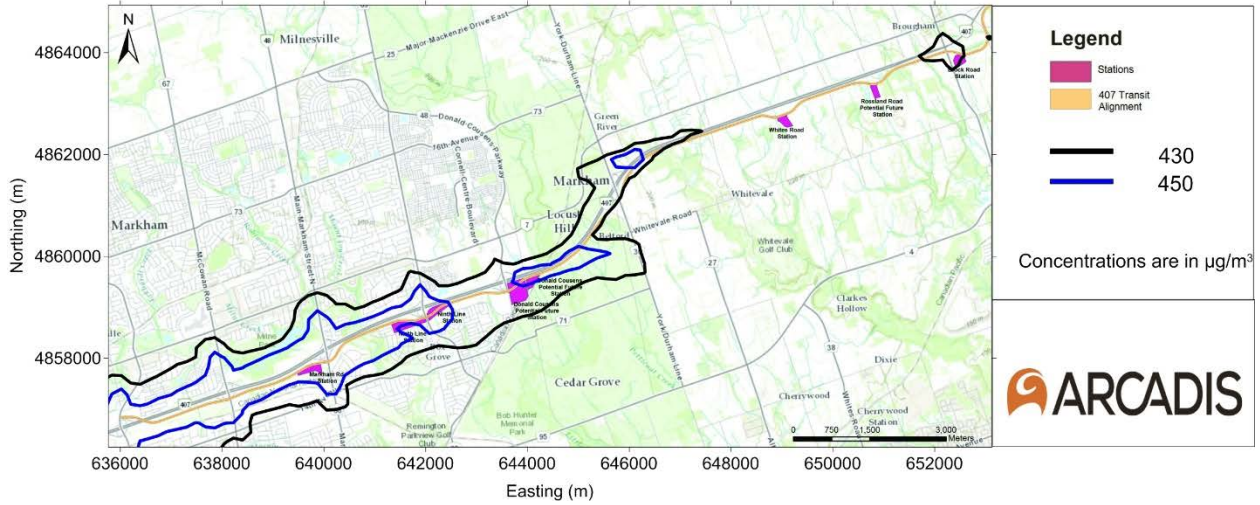
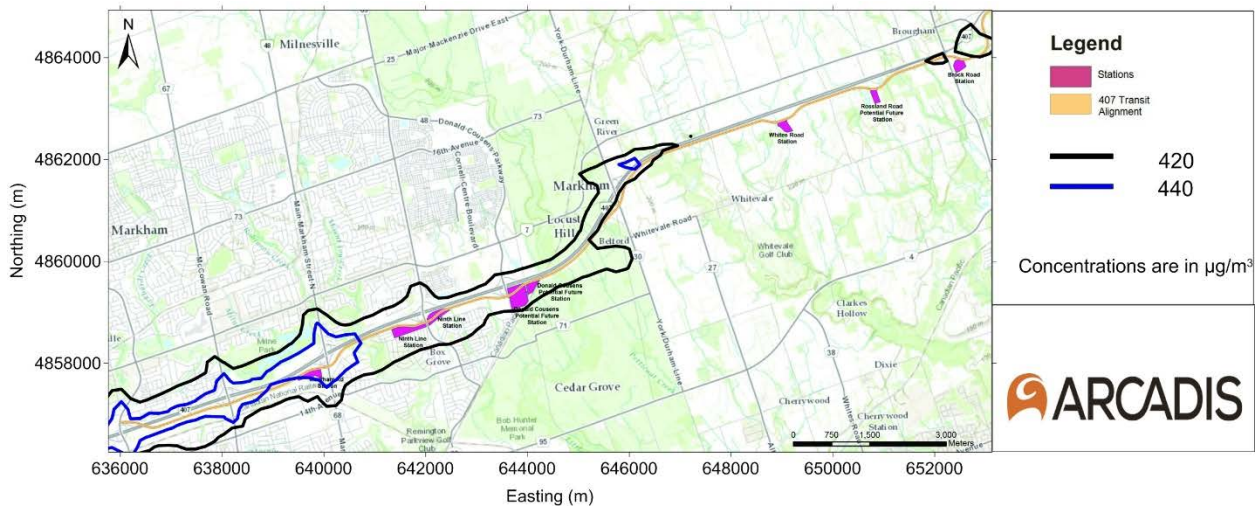


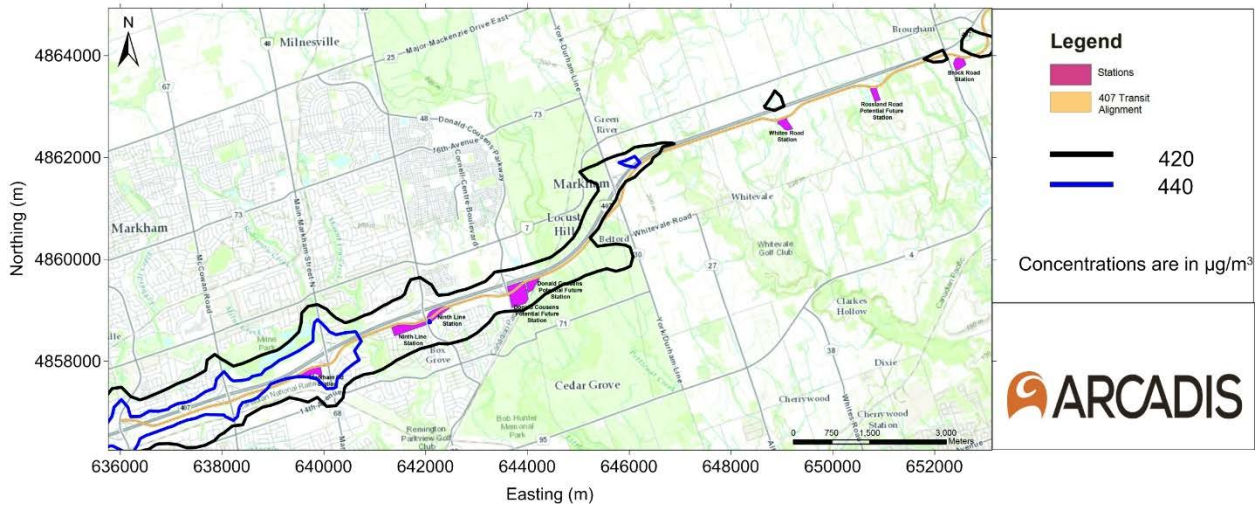
Figure C.30 1-hr CO Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)



**Figure C.31 8-hr CO Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)**



**Figure C.32 8-hr CO Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)**



**Figure C.33 8-hr CO Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)**

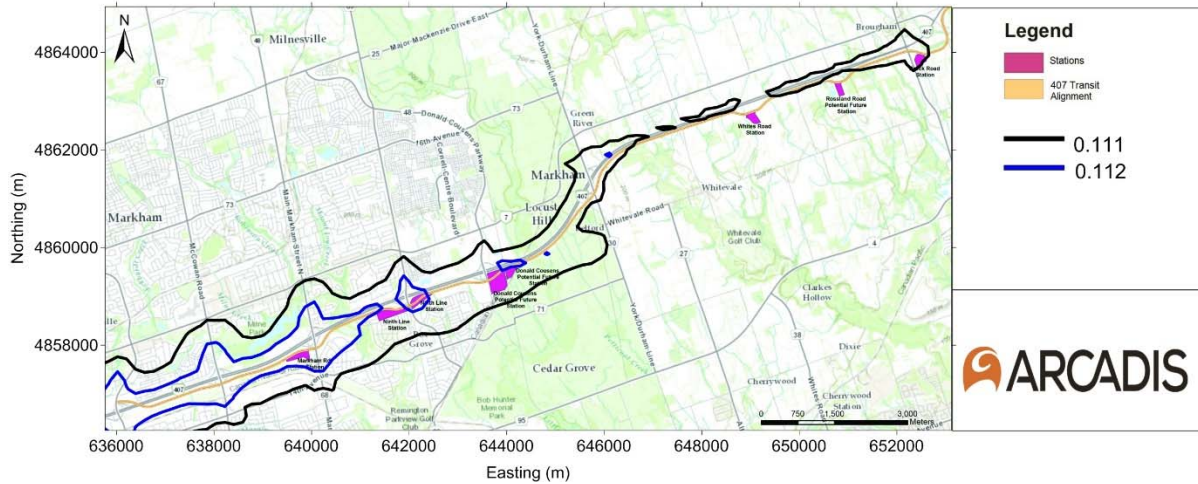


Figure C.34 24-Hour 1,3 Butadiene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)

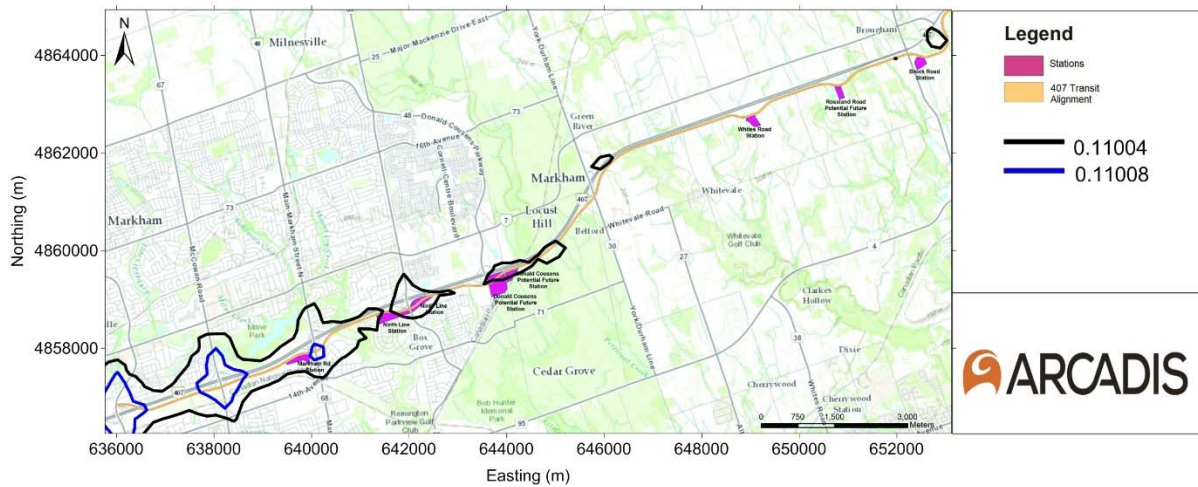


Figure C.35 24-Hour 1,3 Butadiene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)

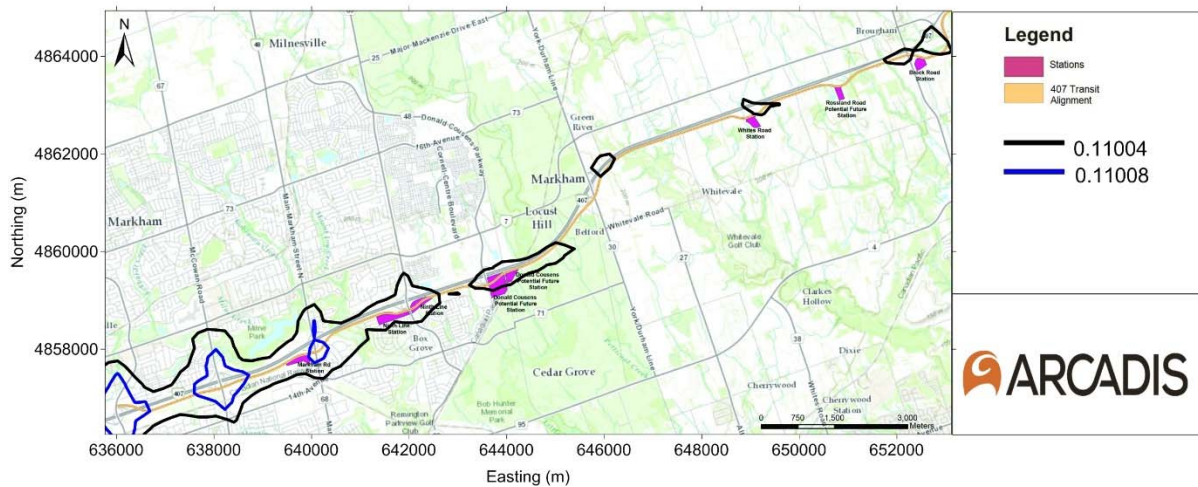


Figure C.36 24-Hour 1,3 Butadiene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)

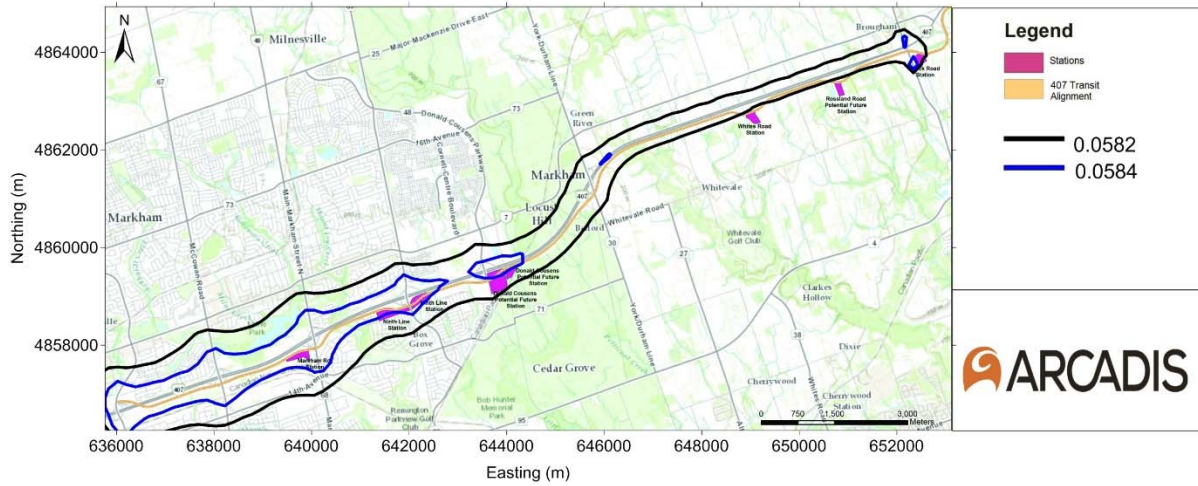


Figure C.37 Annual 1,3 Butadiene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)

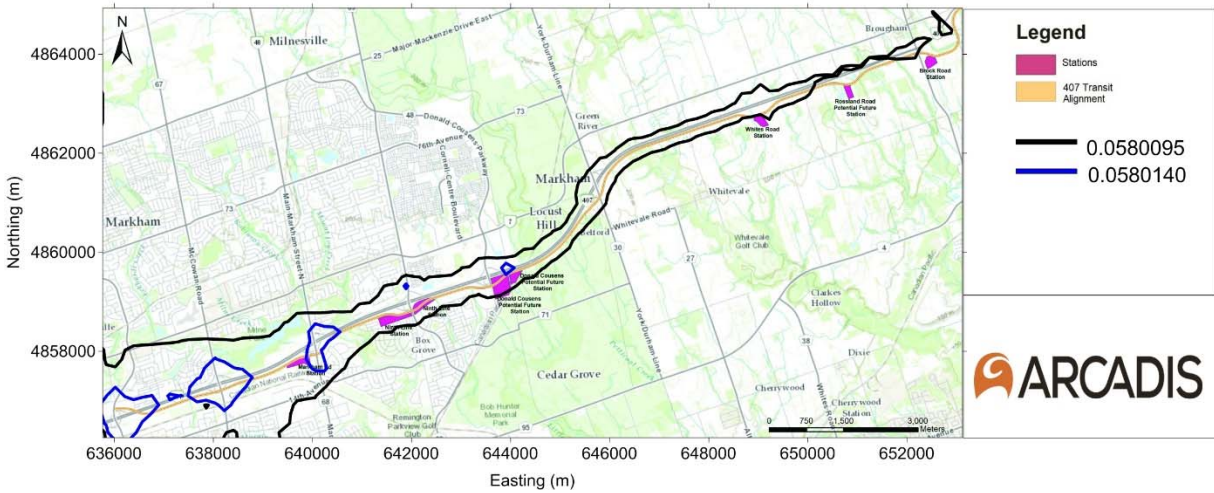


Figure C.38 Annual 1,3 Butadiene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)

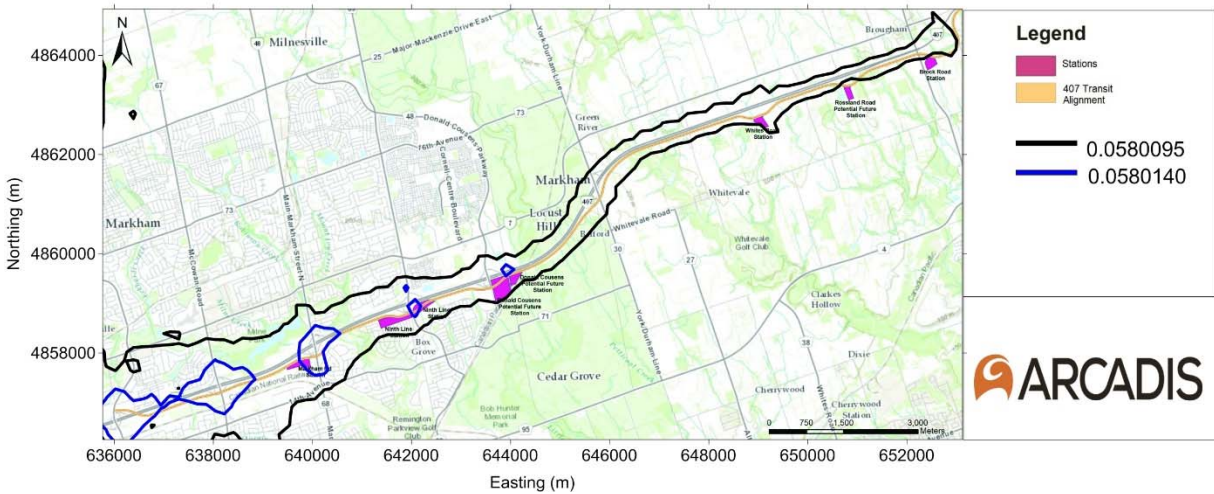
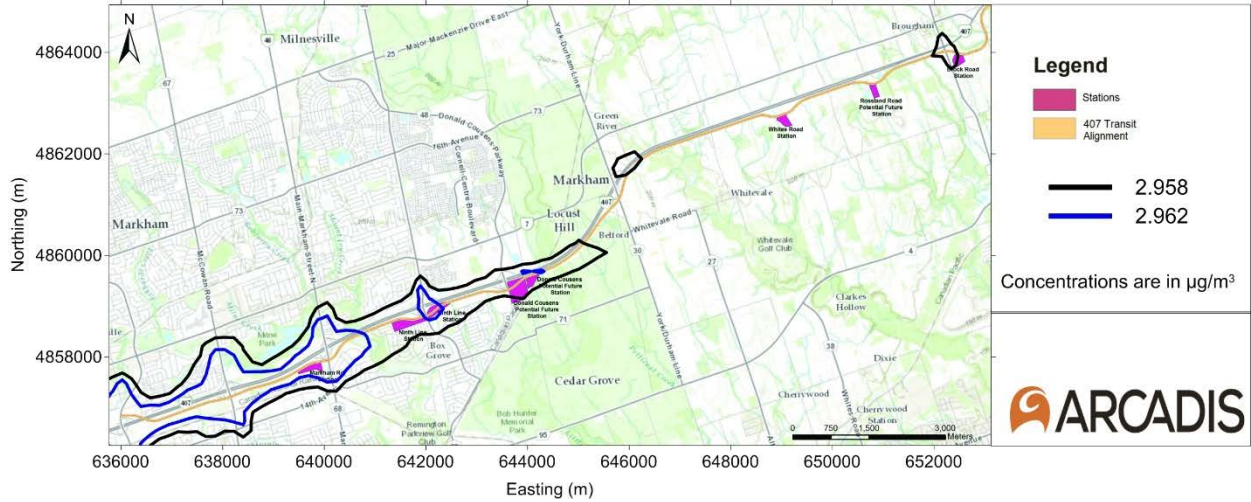
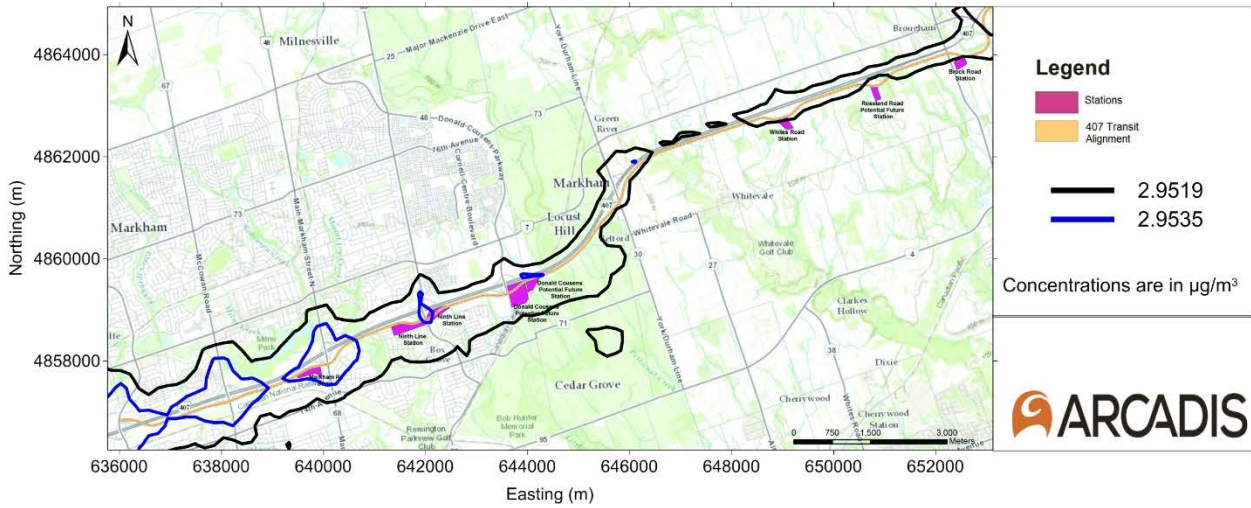


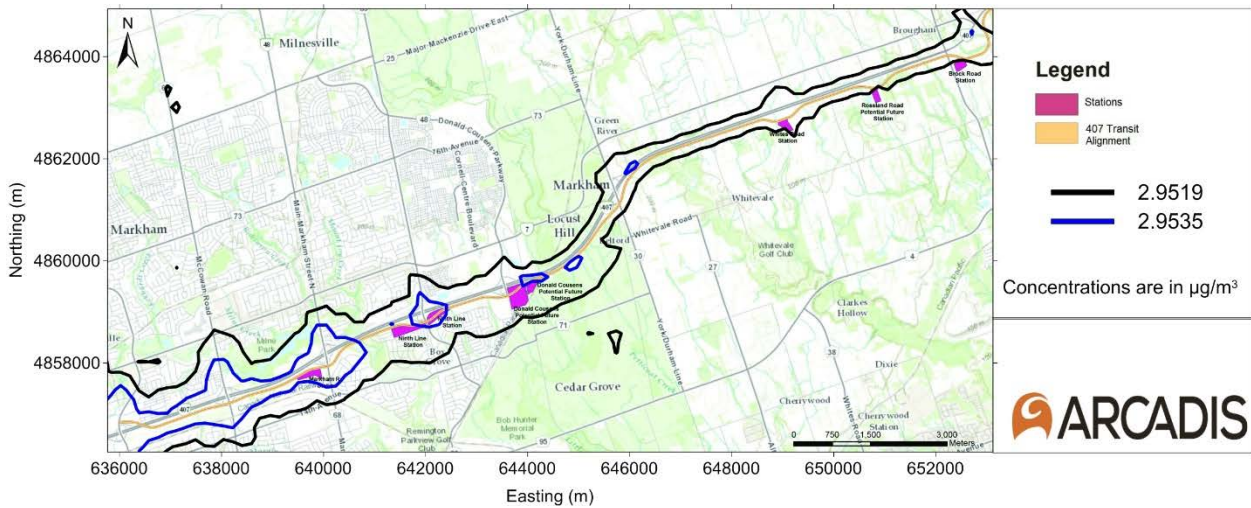
Figure C.39 Annual 1,3 Butadiene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)



**Figure C.43** 24-hr Acetaldehyde Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)



**Figure C.44** 24-hr Acetaldehyde Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)



**Figure C.45** 24-hr Acetaldehyde Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)



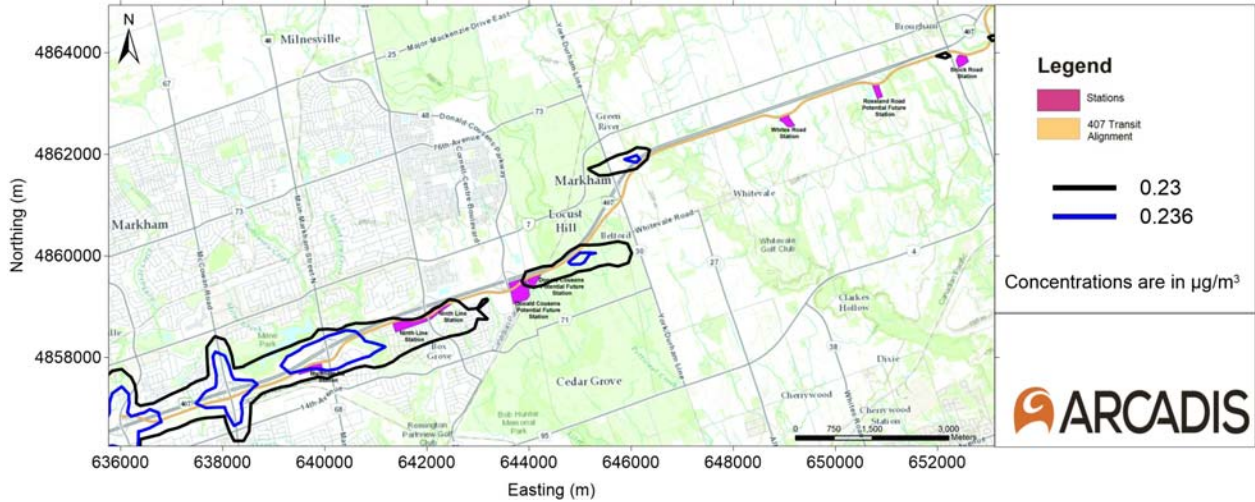


Figure C.46 1-hr Acrolein Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)

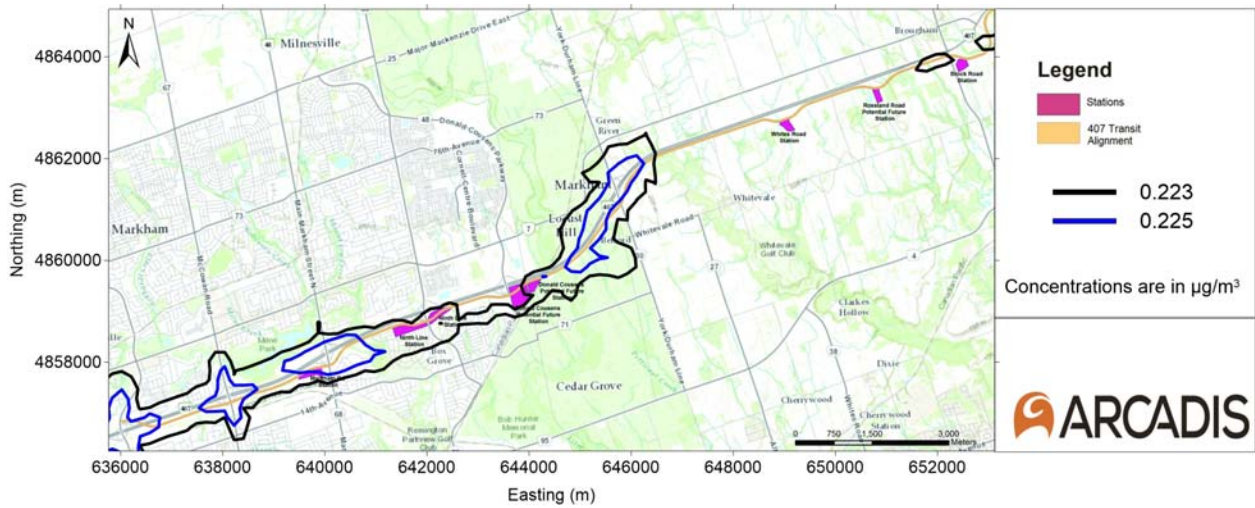


Figure C.47 1-hr Acrolein Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)

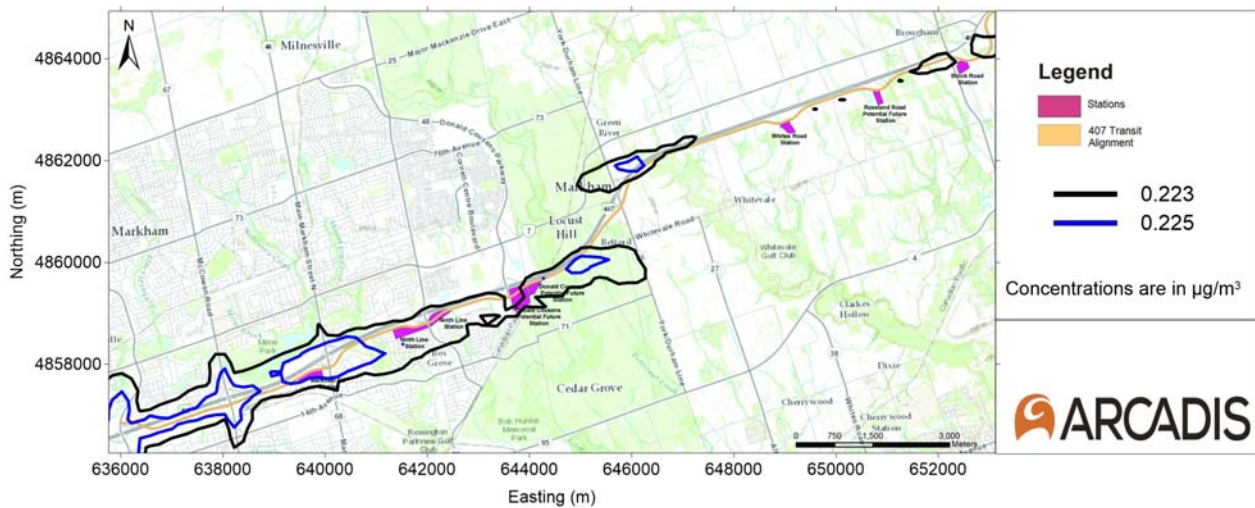
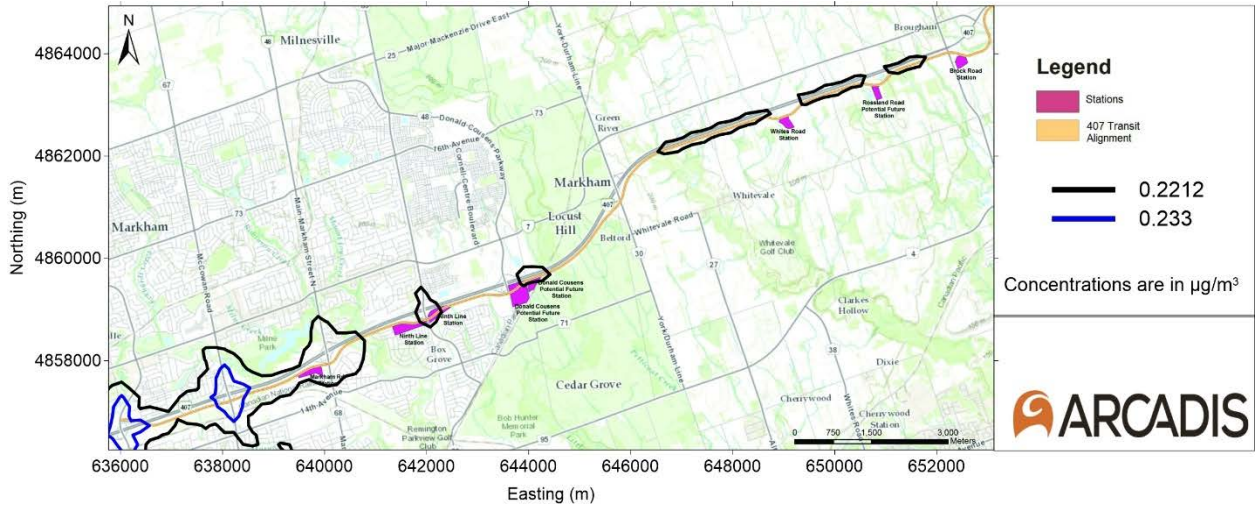
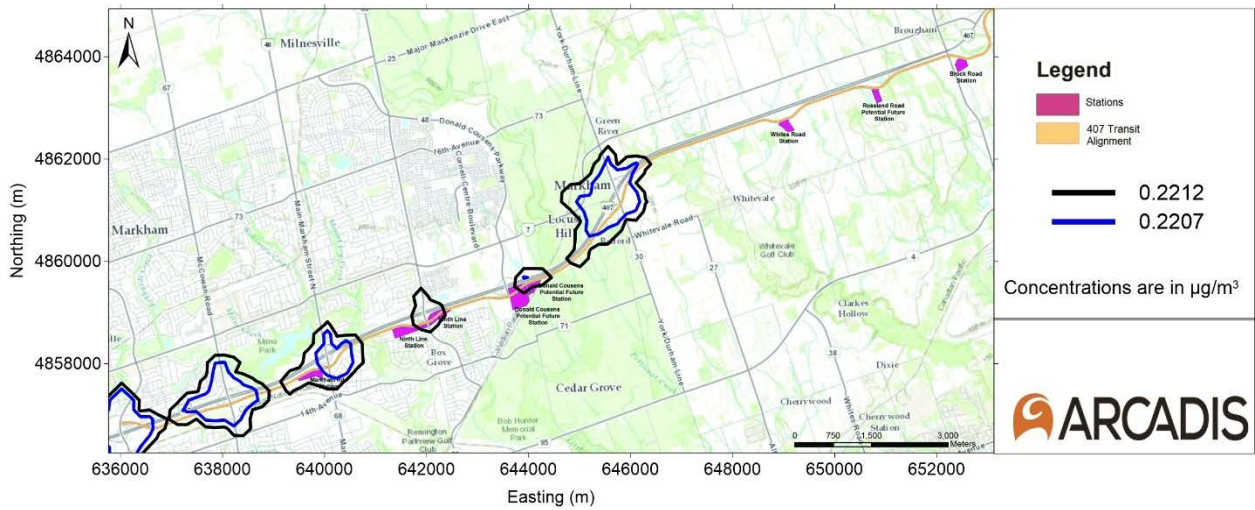


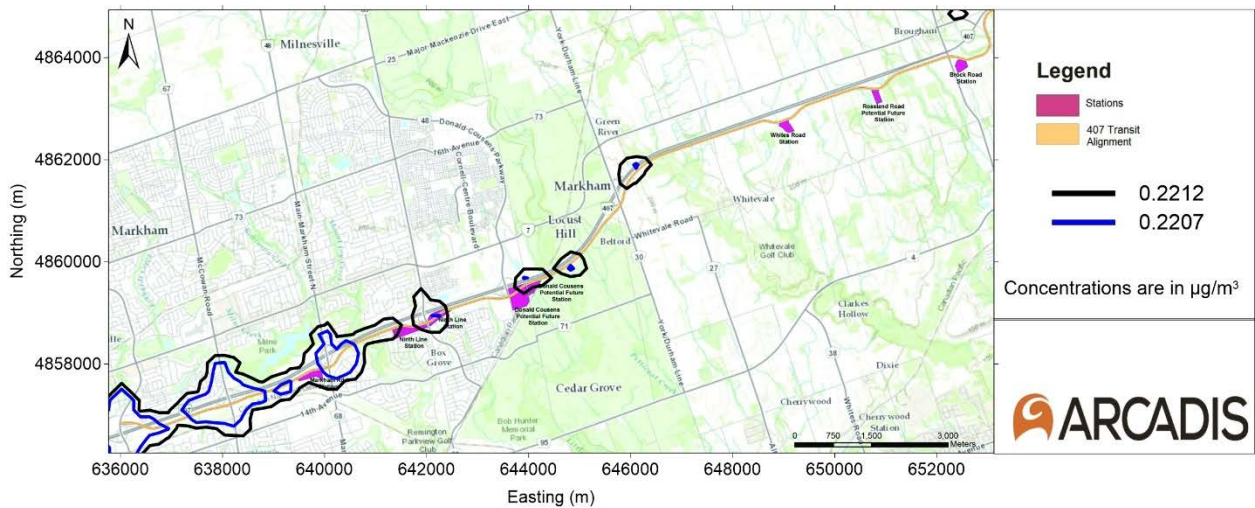
Figure C.48 1-hr Acrolein Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)



**Figure C.49** 24-hr Acrolein Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)



**Figure C.50** 24-hr Acrolein Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)



**Figure C.51** 24-hr Acrolein Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)

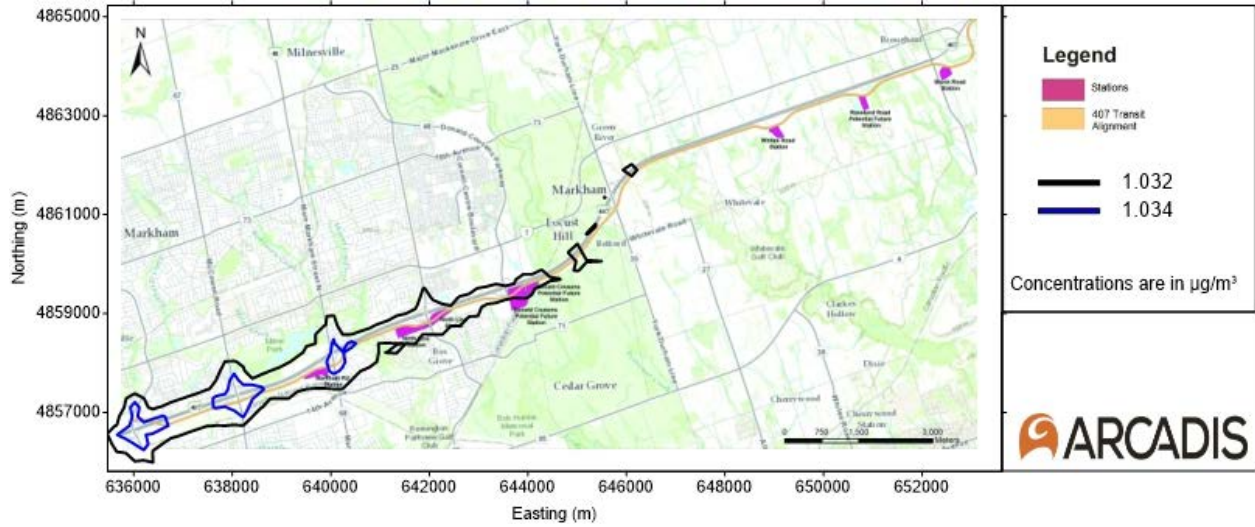


Figure C.52 24-hr Benzene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)

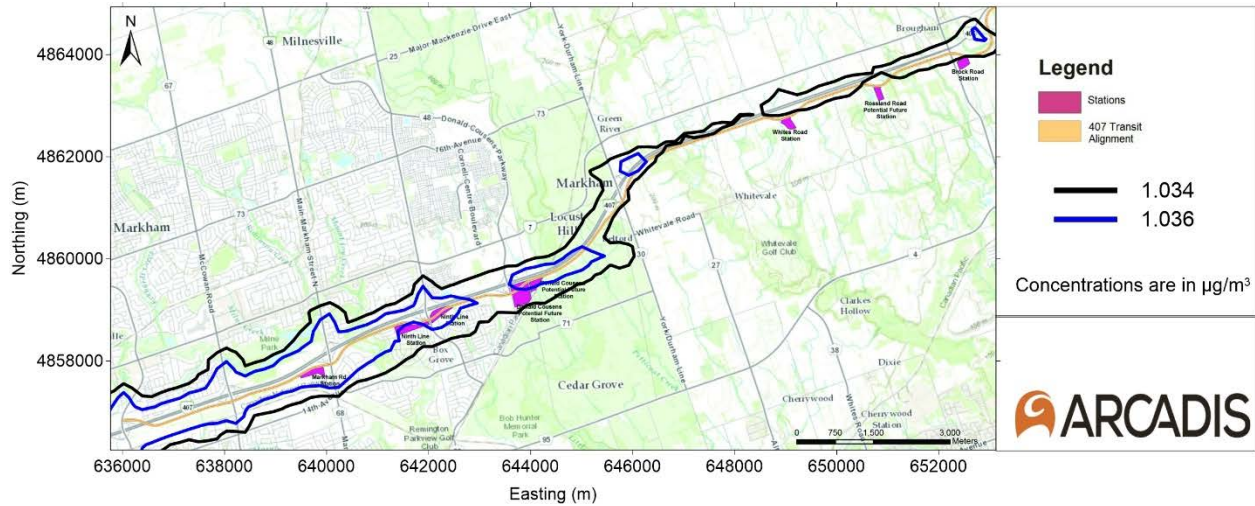


Figure C.53 24-hr Benzene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)

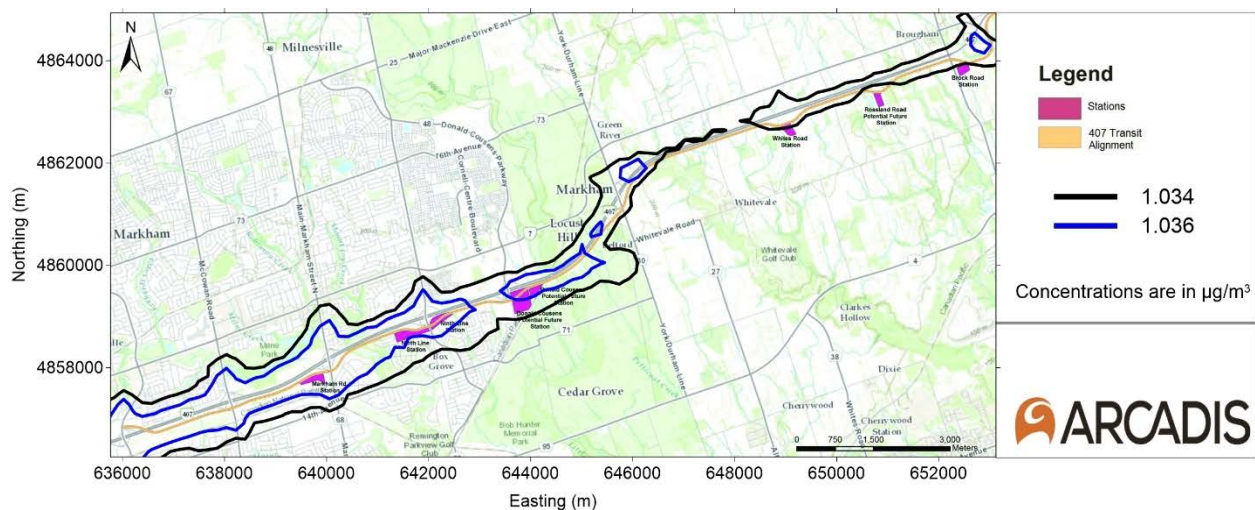


Figure C.54 24-hr Benzene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)

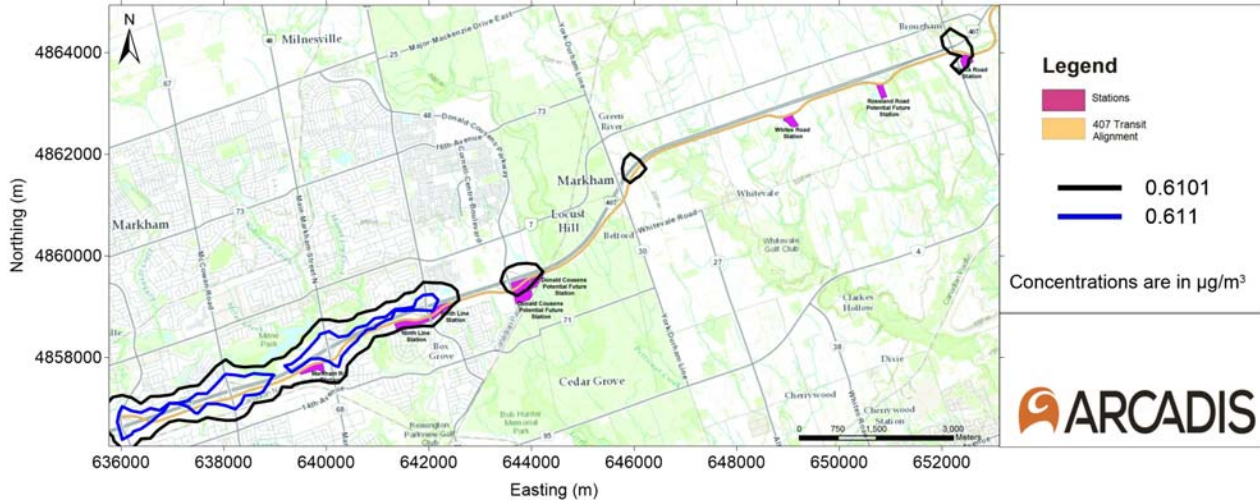


Figure C.55 Annual Benzene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)

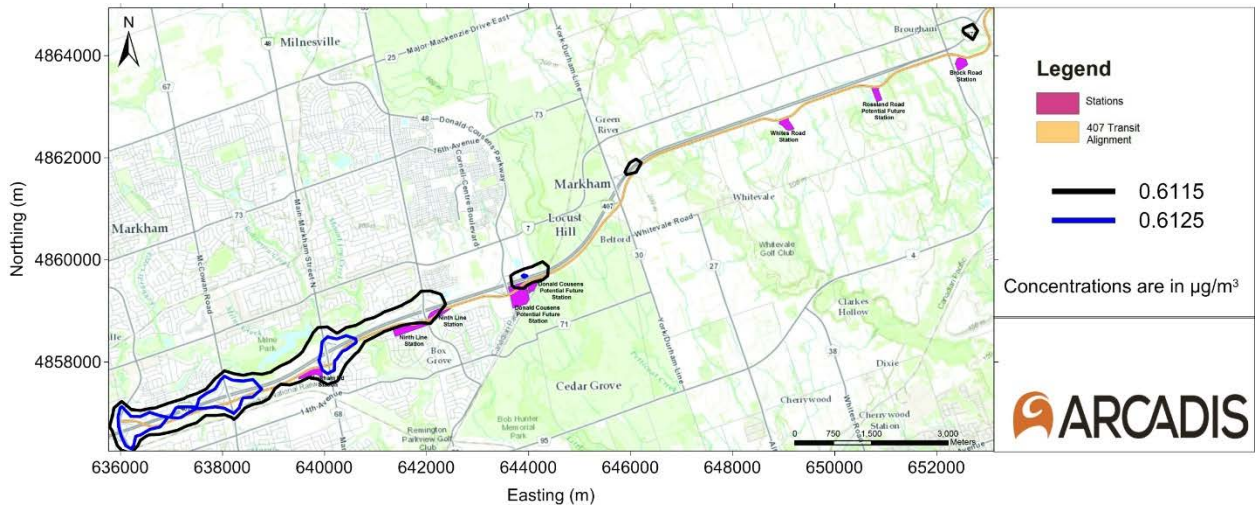


Figure C.56 Annual Benzene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)

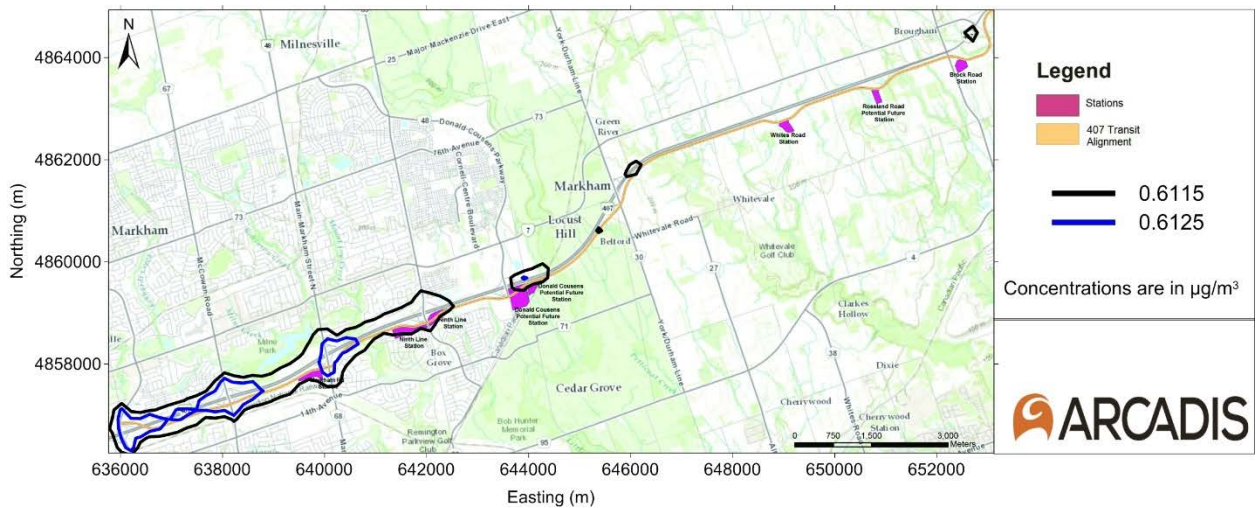


Figure C.57 Annual Benzene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)

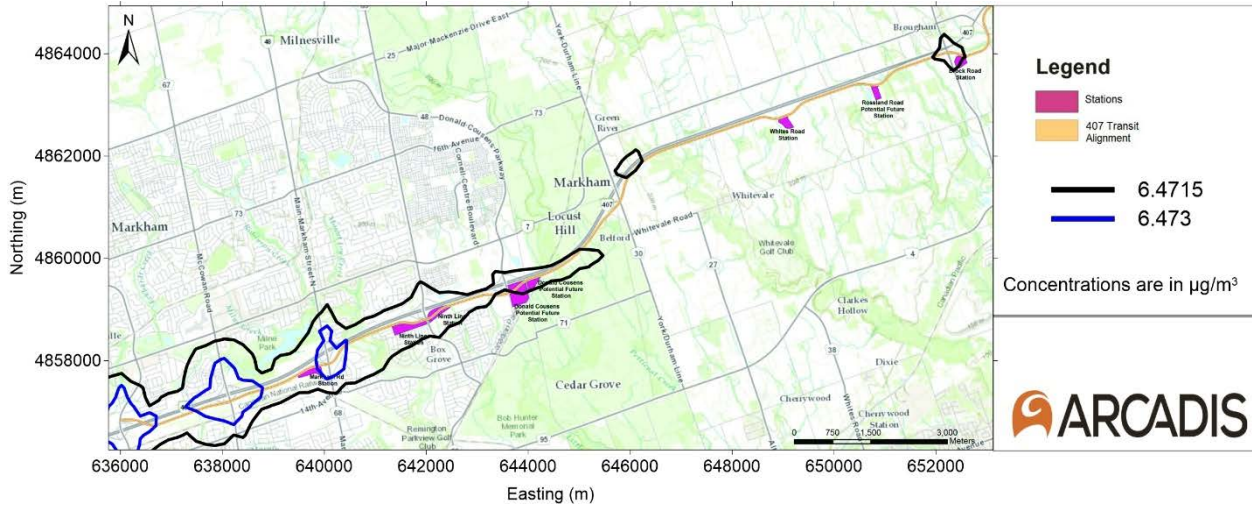


Figure C.58 24-hr Formaldehyde Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)

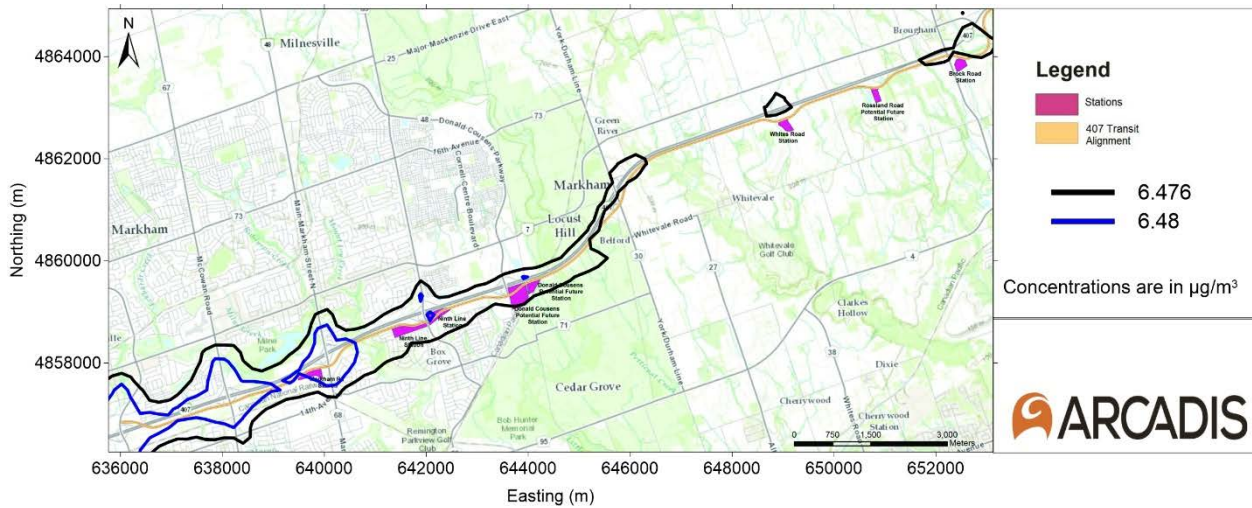


Figure C.59 24-hr Formaldehyde Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)

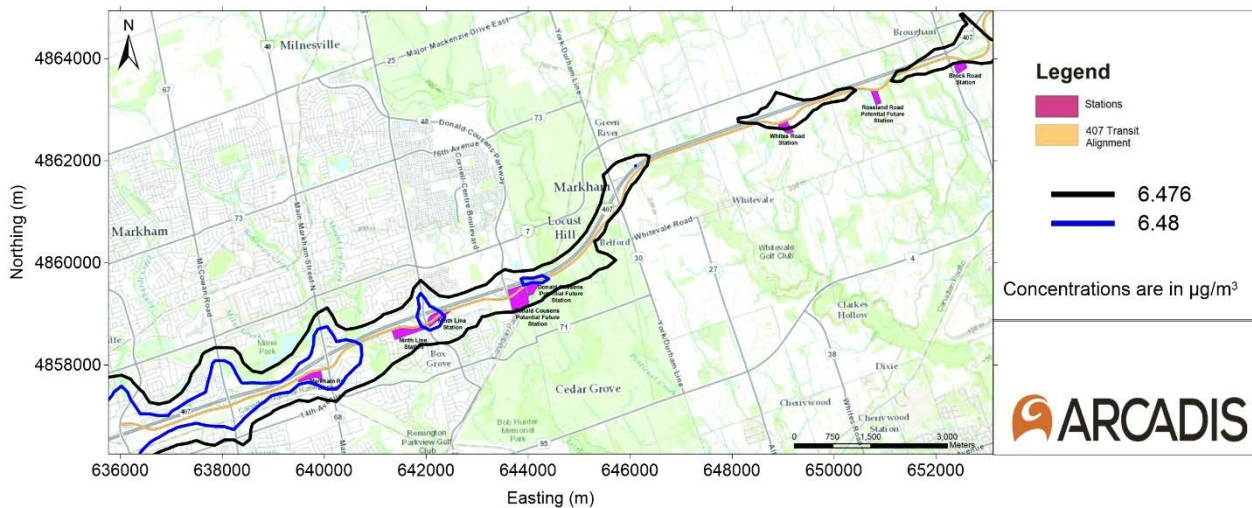
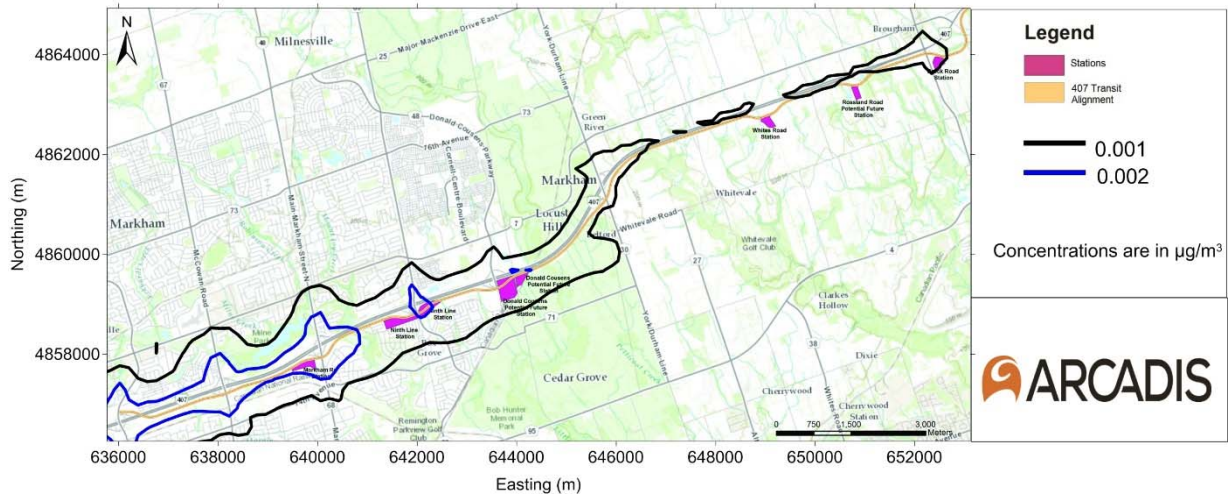
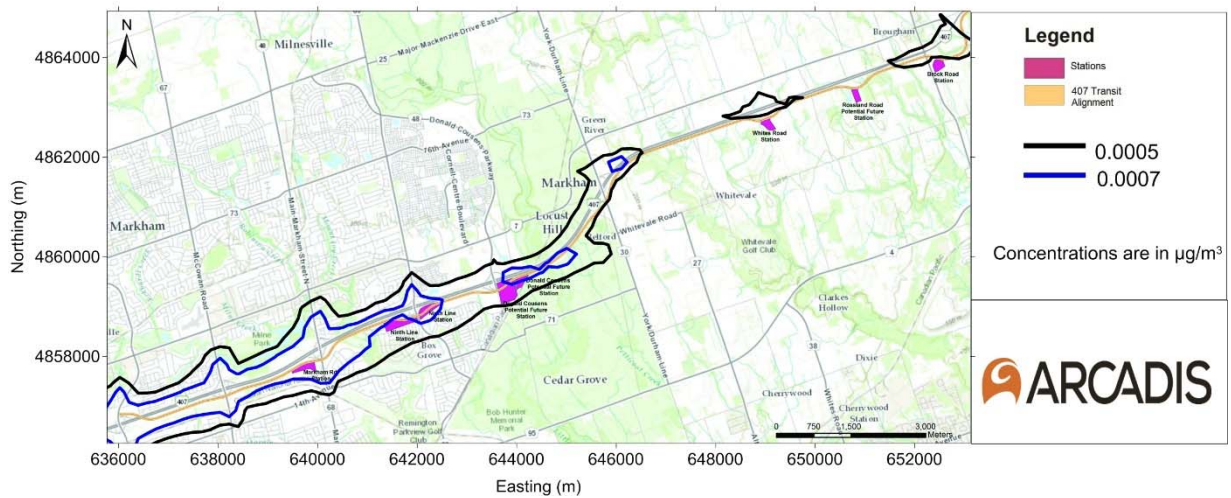


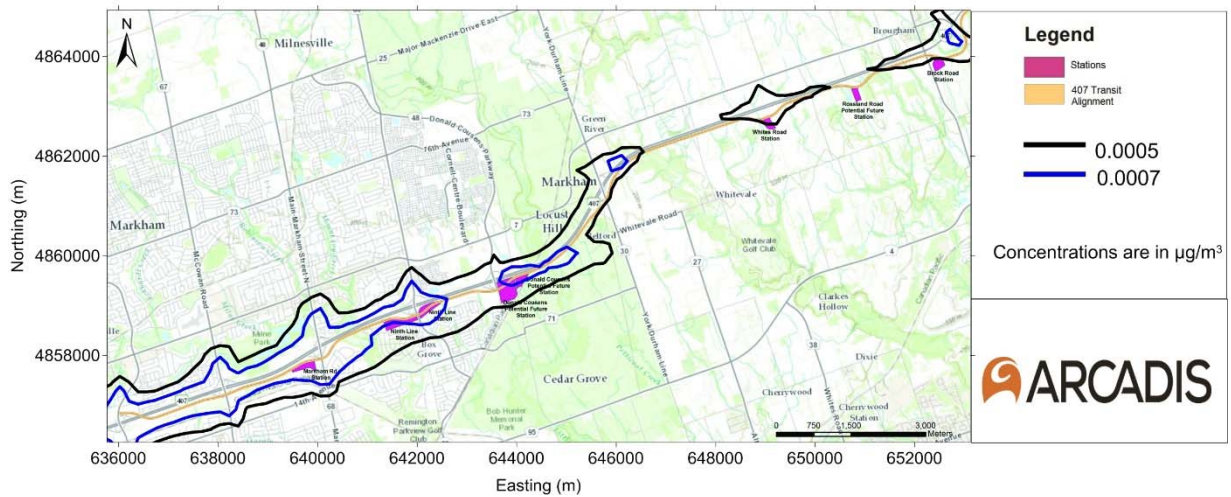
Figure C.60 24-hr Formaldehyde Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)



**Figure C.61** 24-hr Benzo[a]pyrene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)



**Figure C.62** 24-hr Benzo[a]pyrene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)



**Figure C.63** 24-hr Benzo[a]pyrene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)

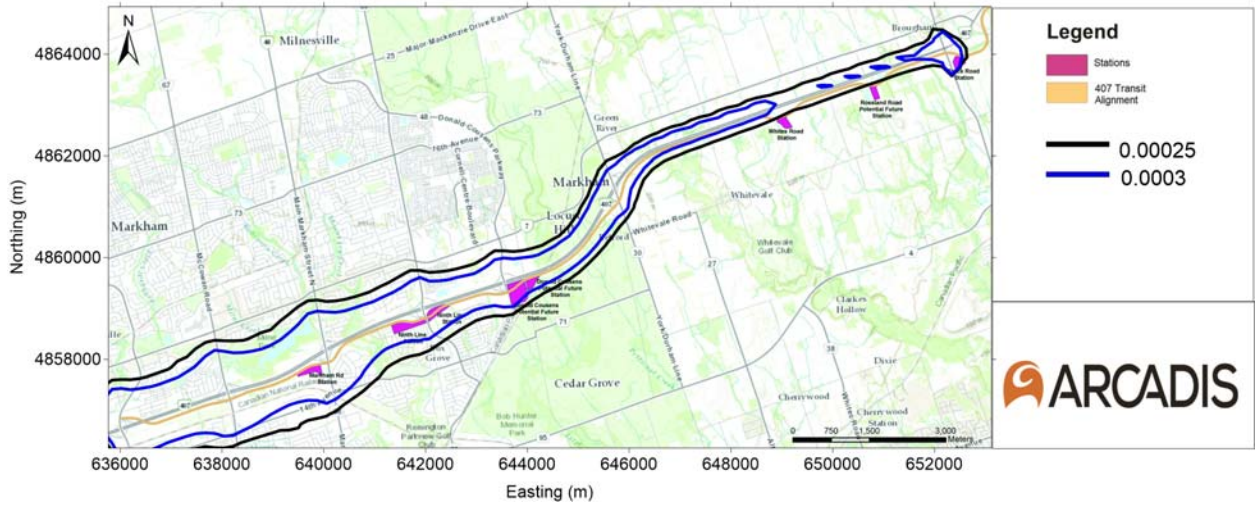


Figure C.64 Annual Benzo[a]pyrene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Existing Conditions (2015)

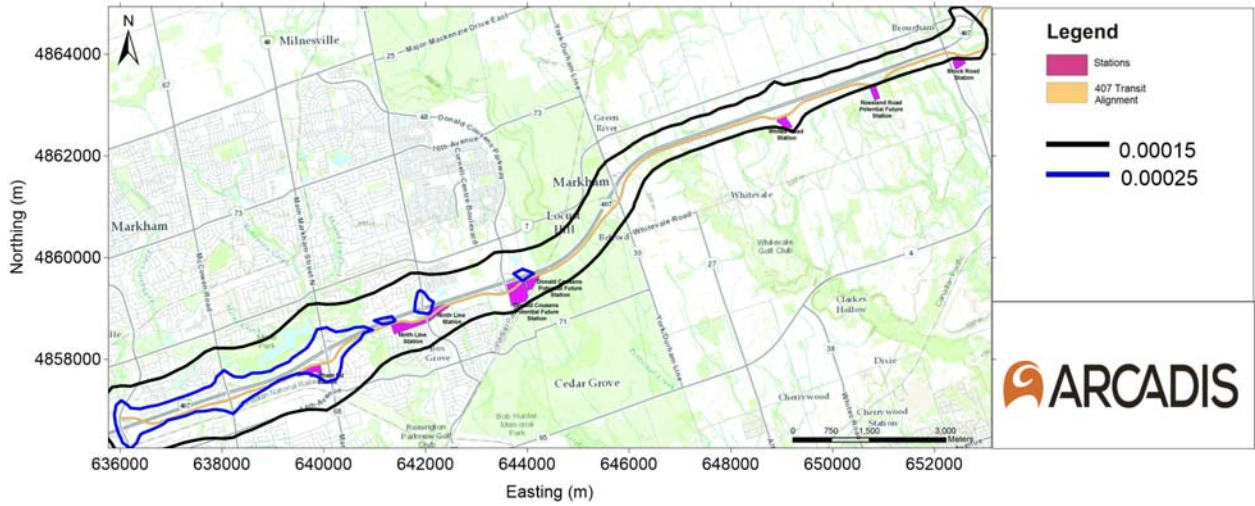


Figure C.65 Annual Benzo[a]pyrene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future No Build Transitway (2031)

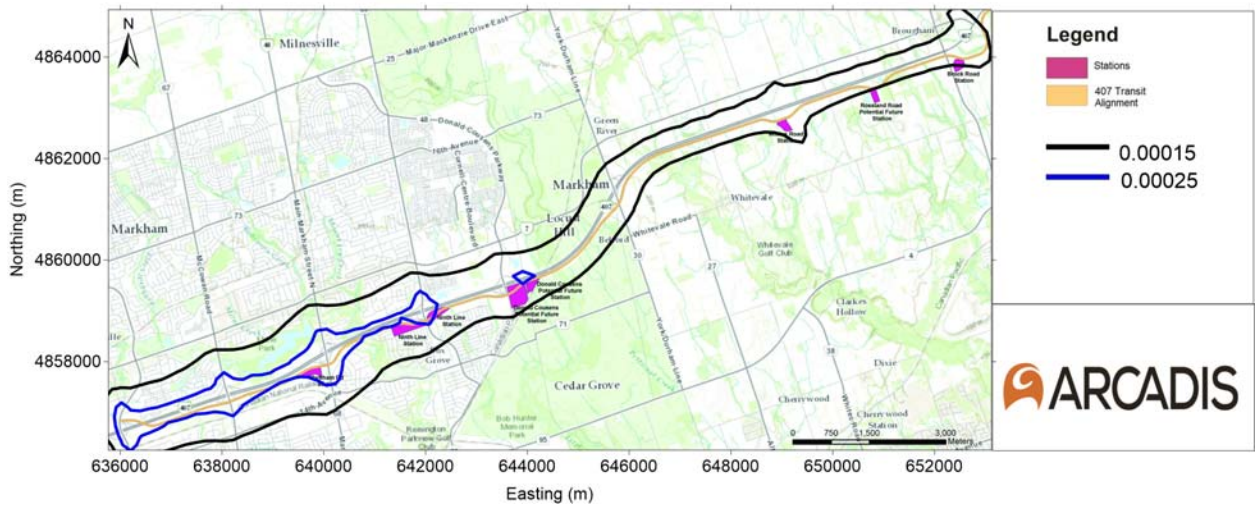


Figure C.66 Annual Benzo[a]pyrene Concentrations (including background) in  $\mu\text{g}/\text{m}^3$  - Future Build Transitway (2031)

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