MISSISSAUGA ROAD
CLASS ENVIRONMENTAL ASSESSMENT

QUEEN STREET WEST TO BOVAIRD DRIVE

AIR QUALITY ASSESSMENT REPORT

Submitted to:

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EXECUTIVE SUMMARY

The Regional Municipality of Peel (Peel Region) retained Wood Environment & Infrastructure Solutions (Wood) (formerly Amec Foster Wheeler), a Division of Wood Canada Limited to undertake an air quality assessment for the proposed widening of Mississauga Road from four (4) to six (6) through lanes between Queen Street West to Bovaird Drive West.

Mississauga Road is classified as an arterial roadway and is under the jurisdiction of the Region of Peel. It extends from Caledon in the north, through the City of Brampton, and to the City of Mississauga in the south. Mississauga Road study has various speed limits (ranging from 60 to 80 km/h), with auxiliary lanes at many intersections within the Study Area.

This air quality assessment has been based on design information, and traffic predictions up to year 2031. The total expected traffic in the 2031 horizon year is estimated as the sum of the foregoing Regional background traffic growth and the traffic related to the various developments within the study area.

This study contributes to the overall Municipal Class Environmental Assessment.

The purpose of this report is to:

- Provide estimates of the air emissions resulting from vehicular traffic;
- Predict the resulting air quality effects on ambient air, with consideration of existing background air quality; and
- Provide a qualitative discussion of the significance of potential effects and a quantitative comparison of the future air quality effects year 2031 to the current scenario (2015).

Modeling for the site was done using the CALRoads US EPA model, modelling package of Lakes Environmental Consultants Inc., version 6.5.0. CALRoads View is a dynamic and intuitive user-friendly interface for the three air dispersion modelling codes: CALINE4, CAL3QHC and CAL3QHCR. The modelling used the five-year meteorological data set for Toronto as recommended by the Ministry of Environment, Conservation and Parks (MECP). Concentrations of Sulphur dioxide (SO_2), Nitrogen dioxide (NO_2), Carbon Monoxide (CO) Inhalable particulate (PM_{10}), Respirable particulate ($PM_{2.5}$), and VOCs (Benzene, 1-3 Butadiene, Formaldehyde, Acetaldehyde, Acrolein) were modelled for all two mentioned above scenarios and included predicted concentration levels at the closest sensitive receptors. The emissions rates were developed based on MOVES 2014a US EPA software and traffic data was based on the 2017 study completed for the Class EA by Paradigm Transportation Solutions Limited.

The off-site effects were predicted using the CAL3QHCR dispersion model, using the Tier I approach utilizing peak hour traffic volume and emissions.

CAL3QHCR is considered the most appropriate model to predict pollutant concentrations from motor vehicles at roadway intersections. It can process up to one year of meteorological data and vehicular emissions, traffic volume, and signalization (ETS) data in one run using the basic algorithms from CAL3QHC.

The meteorological data used for the modelling was obtained from the Ministry of the Environment and Climate Change for the year 2000. This consisted of hourly surface data from a met station at Toronto Pearson Airport located approximately 15 kilometres to the east of the study area. The meteorological data incorporated into the model included wind speed, wind direction, stability category, air temperature, rural mixing height, and urban mixing height. For the CAL3HQCR modelling, each run considers one year of meteorological data.

The model was run for the target pollutants (PM_{10}, $PM_{2.5}$, NO_2, CO, SO_2, Benzene, 1-3 Butadiene, Formaldehyde, Acetaldehyde, and Acrolein) stipulated in the scope of work. Note that the model runs for NOx do not consider any atmospheric reactions or transformations.

The findings of the air quality study were as follow:

- In the case of Mississauga Road, it was noted that passenger vehicles comprise the majority of the traffic, with the average fleet profile consisting of 91% passenger cars and 9% heavy duty diesel vehicles (HDDV) based on the current scenario;
- The potential effect associated with air emissions is an increase in the airborne concentrations of the key pollutants NO_2, $PM_{2.5}$, PM_{10}, CO, SO_2, and VOCs (Benzene, 1-3 Butadiene, Formaldehyde, Acetaldehyde, and Acrolein) in the vicinity of the project;
- The incremental (project) effects for NO_2, $PM_{2.5}$, PM_{10}, CO, SO_2, and VOCs (Benzene, 1-3 Butadiene, Formaldehyde, Acetaldehyde, and Acrolein) predicted to be below the respective ambient air quality criteria;
- Highest effects located proximate to intersections, most significantly Mississauga Rd and Queen St W for current scenario;
- Small increment compared with existing baseline;
- MOVES model considers the gradual fleet replacement as the higher polluting vehicles are removed from service;
- The predicted effects for NO_2 were highest for the current scenario, but still in compliance with all air quality limits currently enforced in the province of Ontario. The current scenario is exceeding federal limits (CAAQS) for 1-hr averaging time. These limits are expected to be introduced in Canada in 2020. NO_2 is also exceeding the same federal limit for the future 2031 scenario. The exceedance for the future scenario is much less significant as the NO_2 emissions reduction is achieved as older vehicles are removed from service. The cleaner engines off-set the effect of increased traffic volumes for 2031. The emission factors for the other target pollutants ($PM_{2.5}$, PM_{10}, CO, SO_2) also decreased over time

and off-set the increase of traffic volume. This resulted in lower impacts on air quality in 2031 scenario of all contaminants except SO_2. SO_2 emissions demonstrate marginal increase in ambient concentrations but still being in compliance with ambient criteria limits;

- The cumulative effects of the roadway emissions of PM_{10}, CO, SO_2, Benzene, and 1-3 Butadiene within the study area plus the background concentrations were below the respective ambient air quality criteria for all averaging times under each scenario;
- The cumulative effect of the $PM_{2.5}$ emissions within the study area and the background concentrations were found to be marginally higher than the respective 2020 CAAQS criteria for the annual averaging time. $PM_{2.5}$ emissions are in compliance with all currently enforced provincial limits; and
- The cumulative effect of the NO_2 emissions within the study area plus the background concentrations were found to be higher than the respective ambient air quality criteria for the 1-hr, 24-hr, annual averaging times and above the 2020 CAAQS.

NO_2 emissions are assessed in the most conservative way, which can explain the above mentioned exceedances. The conservative approach in estimating and modelling of NO_2 emissions using the CALRoads model is unavoidable, as the model does not take into account the NOx/NO_2 conversion. All NOx emissions are considered to be in NO_2 form as this modelling package is not providing an algorithm to simulate NOx to NO_2 conversion. As per US EPA's NO_2/NOx In-Stack Ratio (ISR) Database, NO_2/NOx ratio is 0.1, so the lower levels of NO_2 can be expected at the receptors in the study area. For the future the above mentioned conservativism in modelling is increased by accepting the current (2015) background levels of NO_2, SO_2, and VOCs as applied for 2031 scenario. In Canada the ambient concentrations of these contaminants are lowered between the years 2002 to 2015 (as per ECCC website). NO_2 levels are reduced by 24.5% in that period. It is anticipated that that the same trend will continue between now and 2031. So the proposed project is not expected to have a negative impact on the air quality in the study area for the future 2031 scenario.

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1.0 INTRODUCTION

Wood Environment & Infrastructure Solutions (Wood) (formerly Amec Foster Wheeler) was retained to complete a study on the air quality for the proposed widening of Mississauga Road (between Queen Street West to Bovaird Drive West) in the City of Brampton, Ontario.

This study contributes to the overall Municipal Class Environmental Assessment.

The purposes of this report are to:

- Provide estimates of the air emissions resulting from vehicular traffic;
- Predict the resulting air quality effects on ambient air, with consideration of existing background air quality; and
- Provide a qualitative discussion of the significance of potential effects and a quantitative comparison of the future air quality effects 2031 to the current scenario.

The assessment addresses the potential for the site to have an effect on the air quality, discusses the likelihood of such air quality effects occurring, and the significance of any effects predicted.

1.1 Key Components of Study

The key components of the study include:

1. Development of a baseline scenario considering the current air quality;
2. Develop an emission scenario for the 2031 level of service along Mississauga Road;
3. Provide a qualitative and quantitative analysis of the effects on air quality; the quantitative analysis will include the use of modeling to predict off-site air concentrations that result from site activities; and
4. Provide a qualitative discussion of the significance of air quality effects.

1.2 Definition of Study Area

The study area comprised of approximately 2.3 kilometers of Mississauga Road. The southern extent of the study area was Queen Street West, and the Northern extent was the intersection of Bovaird Drive West.

The study area is presented in Figure 1.1 (Appendix A).

The main roadways within the Study Area include:

- **Mississauga Road (Peel Regional Road 1)** is a north-south Regional Arterial Road. Mississauga Road study has various speed limits (ranging from 60 to 80 km/h) within the study area and provides one (1) to three (3) travel lanes per direction, with auxiliary lanes at many intersections.

- **Williams Parkway** is a four (4) lane, east-west City of Brampton Minor Arterial road. Within the Study Area. It has a posted speed limit of 60 km/h.

- **Queen Street West (Peel Regional Road 6)** is a two (2) to four (4) lane, east-west Regional Arterial Road that runs east from Mississauga Road to Downtown Brampton. It has a posted speed limit of 60 km/h within the Study Area.

There are also several local roads and driveways that intersect with Mississauga Road within the Study Area:

- **Beacon Hill Drive** intersects with Mississauga Road further to the north at an unsignalized intersection. Beacon Hill Drive provides additional access to the residential lands.

- **Royal West Drive** will intersect with Mississauga Road north of Williams Parkway at an unsignalized intersection. Royal West Drive will be opening to traffic in the near term and will provide access to the new residential subdivision east of Mississauga Road.

2.0 IDENTIFICATION OF POTENTIAL AIR QUALITY EFFECTS

There is the potential for vehicular emissions to increase the ambient air concentrations of certain pollutants in the local study area.

The air quality effects of the airborne pollutants may be classified as health effects, environmental effects, or nuisance effects. The health and environmental effects are of significance in the ambient air in general. Nuisance effects are not generally expected to result in health or environmental effects and are considered at locations where people reside or frequent; such locations are deemed 'sensitive receptors' for the purposes of air quality studies. In Ontario, the Environmental Protection Act prohibits release of a contaminant into the natural environment, if the discharge causes or may cause an adverse effect, and encompasses potential health, environmental, and nuisance effects.

Nitrogen dioxide, carbon monoxide, sulphur dioxide, fine particulate matter, and VOCs (Benzene, 1-3 Butadiene, Formaldehyde, Acetaldehyde, Acrolein) have standards in Ontario that were set based upon health or environmental effects of exposure to these pollutants.

2.1 Particulate Matter

Particulate Matter, or more practically fugitive dust in the context of outdoor activities, is assessed and regulated in four forms:

- Total suspended particulate (TSP) which usually considers the particle size range of up to 44 micrometres (µm) in aerodynamic diameter, and includes the smaller particle size fractions PM_{10} and $PM_{2.5}$. The larger particles are more likely to settle quickly and proximate to the source; it is the particles that are less than 44 micrometres in diameter that are generally considered as TSP. Ambient TSP standards have become a surrogate for visibility effects, and the assessment of TSP effects is related to potential nuisance effects, and not health effects.

  The coarser particulate matter in road dusts has a standard based upon the nuisance effects that may result from site emissions. The potential exists for road dust generated to lead to reduced air quality, impaired visibility, and deposition in the surrounding area. The proximity of the site to residences increases the likelihood that, if unmitigated, dust may become a nuisance to residents in the community.
- Inhalable particulate (PM_{10}) which has a particle size range up to 10 µm in aerodynamic diameter. PM_{10} includes the smaller particles referred to as $PM_{2.5}$. In addition to the nuisance effects, there are possible health effects that may be attributed to PM_{10}.
- Respirable particulate ($PM_{2.5}$) with a particle size range up to 2.5 µm in aerodynamic diameter. $PM_{2.5}$ is considered to be the most important particle size range from a respiratory public health perspective.

- Settleable particulate, or dustfall, that falls to the ground due to gravity and may be visible on surfaces. The dust fall is comprised of the coarser fraction of TSP that is prone to settling within close proximity to the source rather than being transported any significant distances from the site. According to the U.S. EPA's emission factor document (AP-42 Section 13.2, 1995), for a typical wind speed of 4.4 m/s, particles larger than 100 µm typically settle out within 6 to 9 m of the source.

2.2 Nitrogen Oxides

Nitrogen oxides (NO_x) are a mixture of compounds of oxygen and nitrogen, including nitric oxide (NO), nitrous oxide (N_20), nitrogen dioxide (NO_2), and others. These compounds are formed during fuel combustion, and are emitted from vehicles, boilers, and diesel generators. Nitrogen oxides may contribute to the formation of smog, or may affect human health at higher concentrations.

NO_x from vehicle tailpipes were estimated and included in the modeling.

2.3 Carbon Monoxide

Carbon monoxide (CO) is a colourless, odourless, tasteless gas, which is produced primarily through the combustion of fossil fuels as a result of incomplete combustion. Over 75% of the CO produced in Ontario is from the transportation sector and 25% is due to the combined effect of power generation, buildings, heating and industrial operations. Exposures at 100 ppm or greater can be dangerous to human health, and larger exposures can lead to significant toxicity of the central nervous system and heart.

The Ontario Regulation 419/05 CO standard is for the ½ hour averaging time; AAQC exist for the 1 hour and 8 hour averaging times. The standards and AAQC for CO are all based upon potential health effects and are presented in Table 3.1.

2.4 Sulphur Dioxide

Sulphur oxides (SO_x) comprise sulphur dioxide (SO_2), sulphur trioxide (SO_3) and solid sulphate forms. Sulphur dioxide is a non-flammable, non-explosive colourless gas. In connection with fuel burning, where the majority is in the form of SO_2, SO_x is normally expressed in terms of the equivalent mass concentration of SO_2 and sometimes as total sulphur. Sulphur oxide has an odour threshold limit of 0.47 to 3.0 ppm and has pungent irritating odour above 3 ppm. SO_x compounds are significant contributors to acid rain and also precursors to the formation of secondary fine particulate matter.

SO_2 is irritating to the eyes and respiratory system above 5 ppm (exposure for 10 minutes), in the form of higher airway resistance. The effects of SO_2 on human health with respect to the short-term (acute) respiratory effects have been extensively studied. No clear evidence of long term or chronic effects is apparent.

Air quality standards for SO_2 have been set for the 1-hour and 24-hour averaging times, with equivalent AAQCs, as shown in Table 3.1. In addition, Ontario has an annual AAQC of 55 µg/m^3 for SO_2. The standards and AAQC are based upon potential health effects of SO_2, as well as potential effects on vegetation.

2.5 Volatile Organic Compounds (VOCs)

Some of the VOCs emitted by transportation vehicles are deemed to have significant health impacts and are designated as "air toxics" (MTO Air Quality Guideline).

These are:

- benzene,
- 1, 3-butadiene,
- formaldehyde,
- acetaldehyde, and
- acrolein.

The VOCs released during the fuel combustion were estimated and modelled.

2.6 Greenhouse Gases

Greenhouse Gas (GHG) emissions, such as methane and carbon dioxide, are a potential contributor to long-term, global climate change effects. However, the offsite effects are not modelled because the ambient air quality criteria are intended to provide limits on short-term effects, with the longest averaging time being an annual average.

2.7 Other Pollutants

This study is intended to cover the substances that may be released to the atmosphere in quantities significant enough to affect the air quality. There may be a number of other pollutants released from the site as a result of the activities carried out, such as trace metals in the particulate matter; these other pollutants have not been considered in the modelling assessment due to the minor quantities, and the low potential for off-site effects.

3.0 PROJECT SETTING

3.1 Regulatory Framework and Assessment Criteria

The relevant air quality criteria for Ontario are listed in Table 3.1. This table lists the contaminants, the relevant averaging period for each standard and the standard as a numerical value (where appropriate).

Table 3.1: Air Quality Criteria used for Study

Contaminant	Averaging Time	Ontario Ambient Air Quality Criteria
NO_2	1 hr	400 µg/m^3 (0.2 ppm) 60 ppb (0.06 ppm) (2020 CAAQS*) 42 ppb (0.042 ppm) (2025 CAAQS*)
	24 hr	200 µg/m^3 (0.1 ppm)
	Annual	17 ppb (0.017 ppm) (2020 CAAQS*) 12 ppb (0.012 ppm) (2025 CAAQS*)
SO_2	1 hr	690 µg/m^3 (0.25 ppm) 70 ppb (0.07 ppm) (2020 CAAQS*) 65 ppb (0.065 ppm) (2025 CAAQS*)
	24 hr	275 µg/m^3 (0.10 ppm)
	Annual	55 µg/m^3 (0.02 ppm) 5 ppb (0.005 ppm) (2020 CAAQS*) 4 ppb (0.004 ppm) (2025 CAAQS*)
CO	1 hr	36,200 µg/m^3 (30 ppm)
	8 hr	15,700 µg/m^3 (13 ppm)
PM_{10} (<10µm)	24-hour	50 µg/m^3 (Interim)
$PM_{2.5}$ (<2.5 µm)	24-hour	27 µg/m^3 (2020 CAAQS*)
	Annual	8.8 µg/m^3 (2020 CAAQS*)
Benzene	24-hour	2.3 µg/m^3
	Annual	0.45 µg/m^3
1-3 Butadiene	24-hour	10 µg/m^3
	Annual	2 µg/m^3

Contaminant	Averaging Time	Ontario Ambient Air Quality Criteria
Formaldehyde	24-hour	65 µg/m^3
Acetaldehyde	24-hour ½ hr	500 µg/m^3
Acrolein	24-hour	0.4 µg/m^3
	1 hr	4.5 µg/m^3

*CAAQS - Canadian Ambient Air Quality Standards

TSP is the oldest and least used parameter for determining particulate related environmental effects. Ambient TSP standards have become a surrogate for visibility effects; the effects are not health related. The criteria of 50 µg/m^3 as a 24-hour average for PM_{10} is an interim ambient air quality criterion provided as a guide for decision making. For $PM_{2.5}$, the 24-hour Canadian Ambient Air Quality Standard of 27 µg/m^3; this level has been set for the protection of health and to reduce environmental risk.

3.2 Background Conditions

The background concentrations for pollutants CO, NO2, PM2.5, and select VOCs (benzene and 1-3 Butadiene) considered in this assessment were obtained from the Environment Canada National Air Pollution Surveillance (NAPS) air monitoring station located at 525 Main St. N. (Peel Manor) in Brampton, ON. This station is located approximately 5 kilometers northeast of the study area. A five-year data set was used (2012 to 2016). The background concentration for SO2 was obtained from air monitoring station located at 3359 Mississauga Rd. N., U of T Campus, Mississauga. A four-year data set was used (2012 to 2015) for SO2.

The background concentrations for pollutants CO considered in this assessment were obtained from the NAPS air monitoring station located at 125 Resources Road in Etobicoke, ON. This station is located approximately 22 kilometers east of the study area. A five-year data set was used (2012 to 2016).

Table 3.2: Background Concentrations

Parameter		Background Concentration, µg/m³ or ppm or ppb	Source of Criteria
CO	1 hr	0.4 ppm	125 Resources Rd. monitoring station
	8 hr	0.38 ppm	125 Resources Rd. monitoring station
SO_2	1 hr	2.15 ppb	3359 Mississauga Rd. N., U of T Campus, Mississauga monitoring station
	24 hr	2.5 ppb	3359 Mississauga Rd. N., U of T Campus, Mississauga monitoring station
	Annual	1.1 ppb	3359 Mississauga Rd. N., U of T Campus, Mississauga monitoring station
NO_2	1 hr	31.6 ppb	525 Main St. N. Brampton monitoring station
	24 hr	28.6 ppb	525 Main St. N. Brampton monitoring station
	Annual	10 ppb	525 Main St. N. Brampton monitoring station
$PM_{2.5}$	24 hr	14.2 µg/m³	525 Main St. N. Brampton monitoring station
	Annual	7 µg/m³	525 Main St. N. Brampton monitoring station
PM_{10}	24 hr	22.2 µg/m³	PM2.5/PM10 = 0.54 (Lall et. all, 2004)
Acetaldehyde	24 hr	1.152** µg/m³	200 College St. Toronto monitoring station
	½ hr	N/A	
Acrolein	24 hr	0.046** µg/m³	200 College St. Toronto monitoring station
	1 hr	N/A	
Benzene	24 hr	0.536* µg/m³	525 Main St. N. Brampton monitoring station
	Annual	N/A	
1,3-Butadiene	24 hr	0.045* µg/m³	525 Main St. N. Brampton monitoring station
	Annual	0.040 µg/m³	525 Main St. N. Brampton monitoring station
Formaldehyde	24 hr	2.248** µg/m³	200 College St. Toronto monitoring station

Note: Annual benzene and 1,3-butadiene values obtained from MECP air quality 2015 report
*Averages based on samples taken in 2014 and 2015

3.3 Regional Climate and Meteorology

Air quality is affected by both the emission sources that release pollutants into the air, and by the climate, or atmospheric conditions, such as wind speed, wind direction, and temperature. The climate in the Greater Toronto Area consists of fairly cold and windy winters and typically hot, humid summers.

For the air quality study, five years of surface meteorological data were obtained for Georgetown, Ontario; this station is located 5 kilometers west of the study area. The 5-year period of record for meteorological data is not considered a climate record, but rather a meteorological data set. The term climate normal is the arithmetic average of a meteorological parameter during a 30-year period.

3.3.1 Wind Speed and Direction

The wind rose depicted in Figure 3.1 for the nearest recent meteorological dataset (TORONTO INTL A; 15 km east of study area) details the distribution of wind directions and wind speeds for 2012 to 2016. A wind rose depicts the predominant wind patterns for a site by graphically illustrating the distribution of wind speed and wind direction. The wind rose is comprised of two parts: the frequency of winds from specified direction around the rose, and the distribution of wind speed indicated by the colours on each bar that represent wind speed ranges. Winds from the west and northwest wind directions were the most common.

The average wind speed for the five-year period was 4.44 m/s (16.0 km/h).

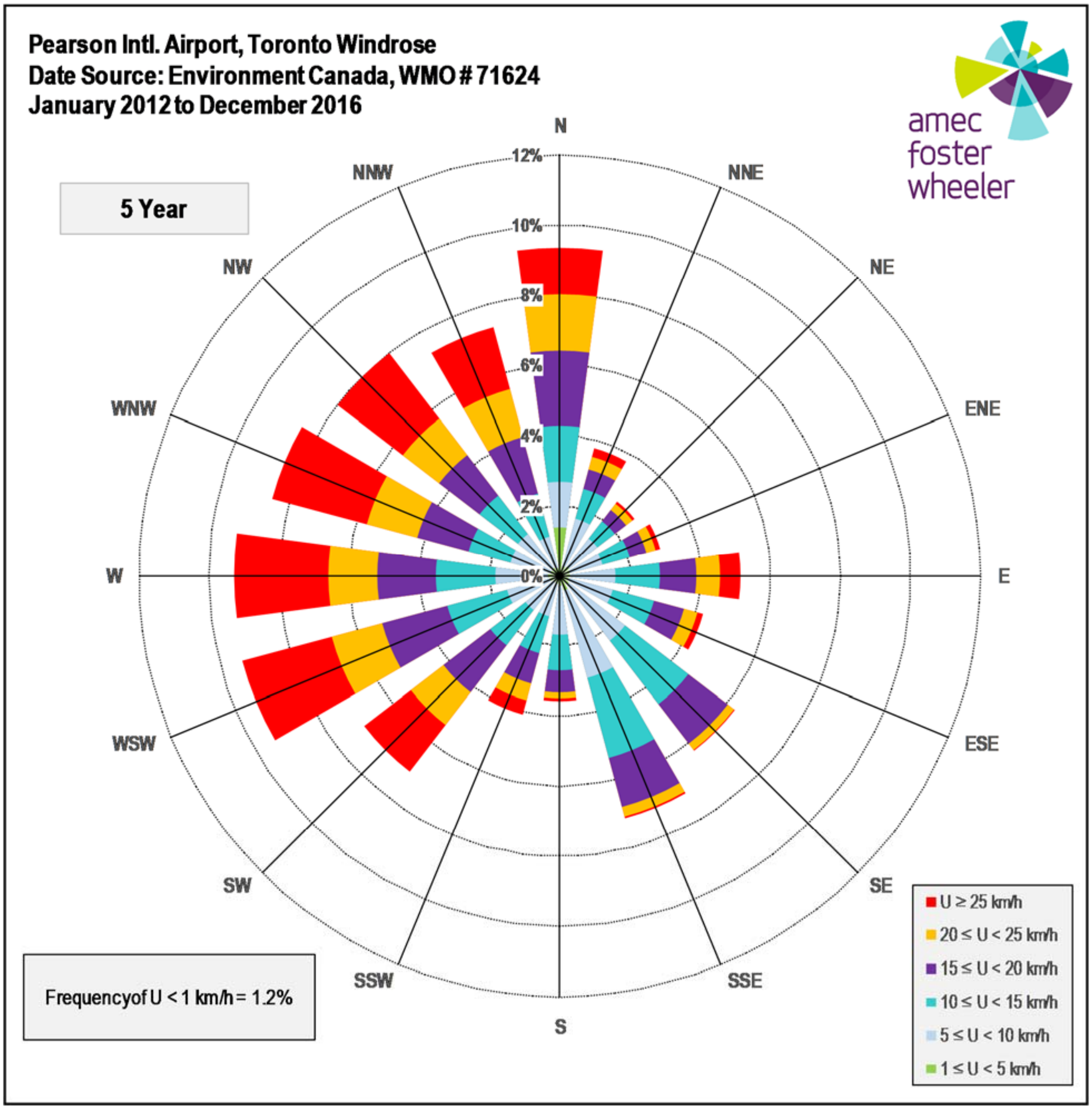

Figure 3.1: Pearson Intl. Airport 5 Year Windrose

3.3.2 Temperature

The temperature in the greater Toronto area fluctuates significantly with the seasons (Figure 3.2). The climate normal annual average temperature reported was 7.1°C; the January daily average was -6.3°C and a July average 20.0°C. The daily maximum and minimum temperatures are also demonstrative of the large fluctuations in temperature typical of this climate zone. In July, the daily average temperatures ranged from 13.0 to 26.9°C. In January, the range was -10.9 to -1.7°C.

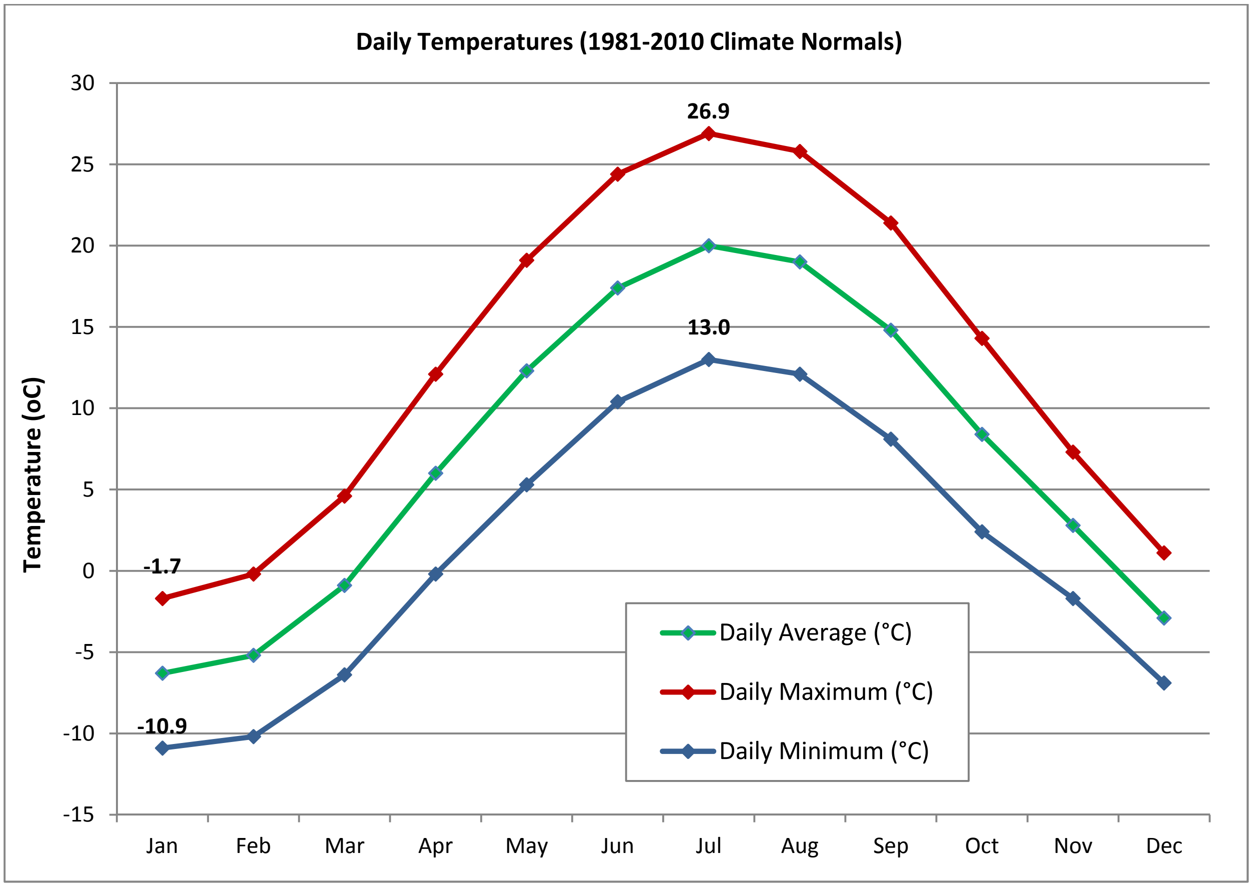

Figure 3.2: Daily Temperature Climate Normals (1981-2010)

3.3.3 Precipitation

Mean annual precipitation for the Project site is estimated at 877 mm (Figure 3.3), with the greatest precipitation contribution occurring as rainfall during the spring and summer.

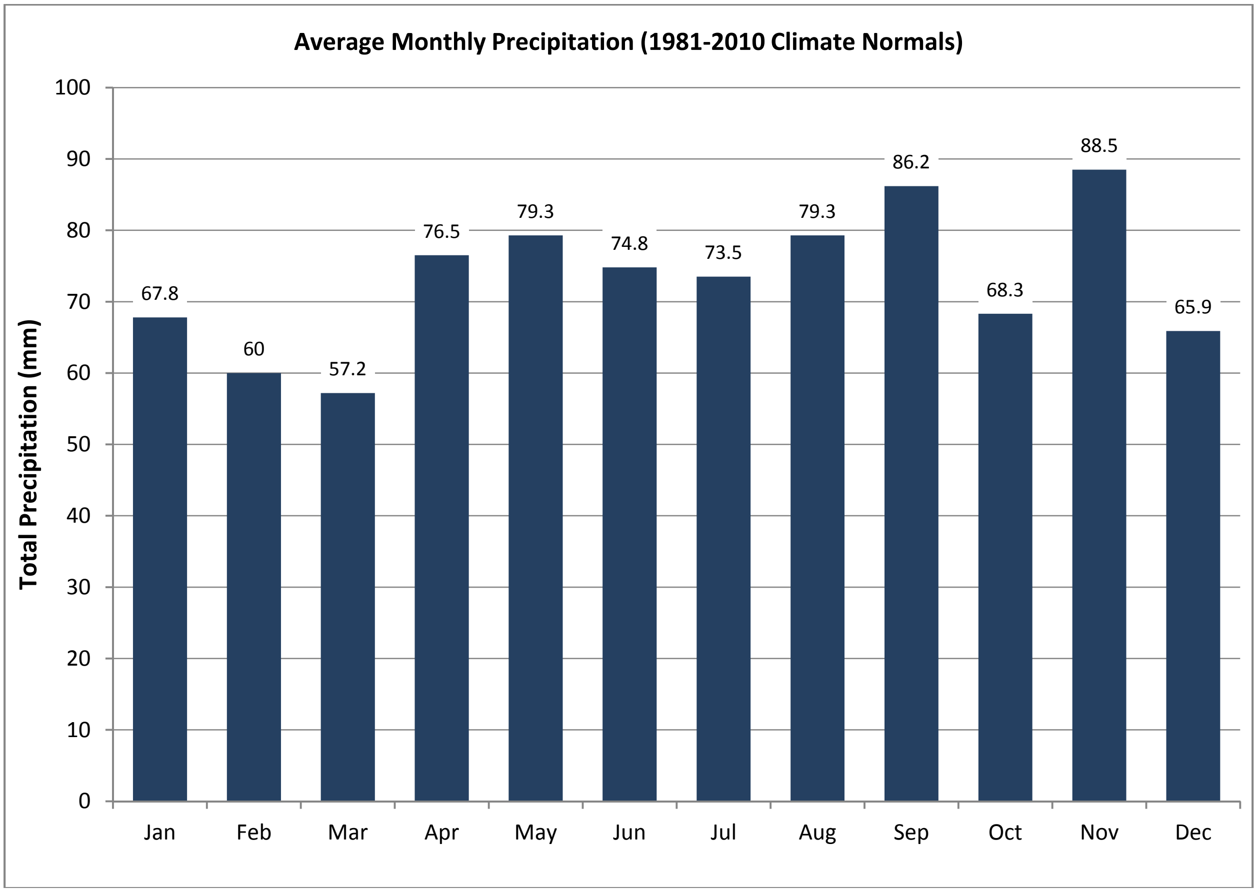

Figure 3.3: Precipitation Climate Normals (1981-2010)

3.4 Surrounding Land Uses

The existing land uses in the study area are a mix of office/business park, agricultural as well as residential type land uses, with some pockets of commercial.

4.0 IDENTIFICATION OF FLEET PROFILES AND EMISSION RATE ESTIMATION

Identification of fleet profiles and emission rate estimation were done based on the following software, traffic study and US EPA guideline:

- MOVES software, estimates g/mile emissions for passenger cars and HDDV.
- MOVES considers the gradual fleet replacement as the higher polluting vehicles are removed from service.
- Fleet profile averaged from Paradigm study, predominantly passenger vehicles.
- Idling emission factors are calculated using MOVES with the vehicle volume of the link as per one (1) vehicle and assign an average speed of 0 mile per hour (recommended practice).

4.1 Description of Scenarios

Two scenarios were considered as part of the air quality assessment:

1. Current Conditions (2015);
2. Future conditions (2031).

2015 - Consists of a four-lane cross-section from Queen Street West to Bovaird Drive West.

2031 - (Mississauga road - six Lanes expansion with Auxiliary Lanes): Consists of a six-lane cross-section from Queen Street West to Bovaird Drive West with existing and additional turn lanes.

The traffic volumes, intersection data, and traffic profile (passenger cars, trucks), detailed in the Mississauga Road Environmental Assessment: Traffic Study Report (by Paradigm, 2017) were used for the dispersion modelling assessment and the discussion of the air quality effects of traffic along Mississauga Road and along the cross-streets in the study area (Queen St W, Ostrander Boulevard/Adamsville Road, Beacon Hill Drive, Commercial Dwy, Williams Parkway, and Royal West Drive).

The traffic profile, or the distribution of vehicles by passenger car and truck, was tabulated by traffic counts in 2015; the distribution was assumed to be applicable to the future years considered in the assessment (2031).

Emission scenarios and emission rates estimate are presented in Appendix B.

4.2 Emission Rate Estimation

The tailpipe emissions, and particulate emissions from brake and tire wear, for passenger vehicles and heavy-duty diesel vehicles were estimated using the Motor Vehicle Emission Simulator (MOVES) 2014a model. This model is the EPA's official model for estimating emissions from highway vehicles and has replaced the Mobile6.2C model emission factor database used previously.

This model provides estimates of emissions for current and future years, with consideration for gradual fleet replacement as the higher polluting vehicles are removed from service.

Idling emission factors are calculated using MOVES with the vehicle volume of the link as per one (1) vehicle and assign an average speed of 0 mile per hour (recommended practice).

MOVES Input parameters are provided in Table 4.2.

Table 4.2: MOVES (v2014a) Input Parameters

Parameter	Input
Scale Panel	Model Type: Onroad Domain/Scale: Project Calculation type: Emission Rates
Time Spans	Years: 2015 (existing) and 2031 (future build)
Geographic Bounds Panel	Region: Zone & Link - Michigan Washtenaw County
Vehicles/Equipment - Onroad vehicles	Fuels: Gasoline/diesel fuel
	Source Use types: Passenger car/combination long-haul truck
Road type	Rural Unrestricted Access
Pollutants and Processes	PM_{10}/$PM_{2.5}$/NO_2/CO/SO_2/ Benzene/ 1-3 Butadiene/Formaldehyde/Acetaldehyde/Acrolein
Input Database Meteorology	Temperature and relative humidity were obtained from meteorological data from Environment Canada and Climate Change station
Age Distribution	Used MOVES default data based on the years, 2015 (existing), and 2031 (future build) Age fractions of fleet by age and source type

The emissions calculations and a summary of the raw traffic data is provided in Appendix B and Appendix C respectively.

Re-entrainment of dust from paved roads is considered and added to the particulate matter emissions for this project. $PM_{2.5}$ and PM_{10} emission factors are calculated based on US EPA AP-42, Section 13.2.1.

The equation is used to calculate the emission factor:

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

Where:

E = particulate emission factor (g/VKT)
K = particle size multiplier
sL= road surface silt loading factor (g/m2)
W = average vehicle weight (assumed 3 tons)

Sample calculations of emission factors for re-entrainment particulate matter.

Contaminant	**AADT**	**K**	**sL**	**W**	**E**	**E**
		g/VMT	g/m2	Tons	g/VKT	g/VMT
PM_{10}	>10,000	0.62	0.03	3	0.078	0.049
$PM_{2.5}$		0.15	0.03	3	0.019	0.012

Notes: k and sL values are from AP-42, Section 13.2.1.3

5.0 DISPERSION MODELLING

The off-site effects were predicted using the CAL3QHCR dispersion model, using the Tier I approach. In this approach, only one hour (peak hour) of ETS data (Emissions, Traffic and Signalization) are input into the CAL3QHCR model.

CALINE-3 is designed to predict air pollutant concentrations near highways and arterial streets due to emissions from motor vehicles operating under free flow conditions. However, it does not permit the direct estimation of the contribution of emissions from idling vehicles. CAL3QHC enhances CALINE-3 by incorporating methods for estimating queue lengths and the contribution of emissions from idling vehicles, to allow for total air pollution concentrations from both moving and idling vehicles. CAL3QHCR further enhances the model by incorporating local meteorological data rather than the default wind speed and wind directions used by CAL3QHC.

The meteorological data used for the modelling was obtained from the Ministry of the Environment and Climate Change for year 2000. This consisted of hourly surface data from a met station at Toronto Pearson Airport located approximately 15 kilometres to the east of the study area. The meteorological data incorporated into the model included wind speed, wind direction, stability category, air temperature, rural mixing height, and urban mixing height. For the CAL3HQCR modelling, each run considers one year of meteorological data.

1,273 discrete receptors were selected for the modelling based on site analysis.

The CAL3QHCR modelling input summary table is provided below.

Table 5.1: CAL3QHCR Modelling Input Summary Table

Parameters	Input
Job options	
Run information	Pollutant type: PM/CO Approach: Tier I
Job parameters	Settling velocity: NO_2, CO, and VOCs = 0 cm/s Deposition velocity: NO_2, CO, and VOCs = 0 cm/s Setting: Rural Surface Roughness Length: 50cm
Met Options	
Meteorological data	1996-2000 data from Toronto Pearson International Airport Model can process only one year of met data. The model was run separately for each year (1996, 1997, 1998, 1999, and 2000). Out of all five individual runs the modelling based on year 2000 data predicted the highest POI concentrations at the receptors. This year meteorological data was selected for all subsequent modelling runs as the most conservative.

Parameters	Input
Link and Group Link Options Free flow link Queue link	The traffic volumes (vph), and intersection data are obtained from Traffic Study Report (by Paradigm, 2017). The emission factors (g/v-mi) are obtained from MOVES.
Receptors	Receptors are placed (based on the residential locations) along the Mississauga Road

The model was run for the target pollutants (PM_{10}, $PM_{2.5}$, NO_2, CO, SO_2, Benzene, 1-3 Butadiene, Formaldehyde, Acetaldehyde, and Acrolein). Note that the model runs for NOx do not take into account any atmospheric reactions or transformations. The CALRoads Version 6.5.0 model is designed to model the effects of particulate matter or carbon monoxide; NOx, SO_2, Benzene, 1-3 Butadiene, Formaldehyde, Acetaldehyde, and Acrolein were modeled as "pollutant type - inert gases" with appropriate molecular weight as recommended by Lakes Environmental technical support.

For this study, the highest predicted concentration is reported in Table 6.1 and portrayed in the sample isopleths (Figures 6.1 to 6.2, Appendix A).

6.0 CONSTRUCTION EMISSIONS

Due to a short term duration of the construction phase of the project in comparison with the operational phase, the impacts of the construction activities were not added to the overall project assessment. Dust generated from the construction activities (pavement removal, overburden excavation, material movement, etc.) will be addressed over the construction period. The Best Management Practice (BMP) plan will be developed to manage fugitive dust emissions from the construction phase of the project. Emissions of NO_2, SO_2, and VOCs are also expected to emit from the heavy duty construction equipment at the project area. Environment Canada and Climate Change (ECCC) and Ministry of the Environment, Conservation and Parks (MECP) guidelines will be followed for mitigation techniques of dust and engines emissions.

7.0 ASSESSMENT FINDINGS / RESULTS

Modelling Results are presented in Table 6.1. Combined effect of modelled effects plus background Concentrations is presented in Table 6.2.

Table 6.1: Results of Dispersion Modelling

			Scenario											
			2015 (Current)						2031					
Pollutant	**Averaging Time**	**Unit**	**Max Concentration**	**AAQC**	**2020 CAAQS**	**Percentage of AAQC**	**Percentage of CAAQS**	**Location of Max**	**Max Concentration**	**AAQC**	**2025 CAAQS**	**Percentage of AAQC**	**Percentage of CAAQS**	**Location of Max**
$PM_{2.5}$	24 hr	$\mu g/m^3$	8.44	30	27	28.14%	31.27%	Mississauga Rd + Queen St W	2.57	30	27	8.58%	9.53%	Mississauga Rd + Queen St W
	Annual	$\mu g/m^3$	2.24	-	8.8	25.45%	25.45%	-	0.68	-	8.8	-	7.73%	-
PM_{10}	24 hr	$\mu g/m^3$	14.96	50	-	29.93%	-	Mississauga Rd + Queen St W	9.58	50	-	19.16%	-	Mississauga Rd + Williams Parkway
NO_2	1 hr	ppm	0.19	0.2	0.06	97.25%	324.17%	Mississauga Rd + Queen St W	0.080	0.2	0.042	39.95%	190.24%	Mississauga Rd + Royal West Drive
	24 hr	ppm	0.08	0.1	-	77.80%	-	-	0.032	0.1	-	31.96%	-	-
	Annual	ppm	0.02	-	0.017	91.53%	91.53%	-	0.006	-	0.012	53.27%	53.27%	-
SO_2	1 hr	ppm	0.0008	0.25	0.07	0.32%	1.14%	Mississauga Rd + Queen St W	0.0013	0.25	0.065	0.52%	2.00%	Mississauga Rd + Royal West Drive
	24 hr	ppm	0.0003	0.1	-	0.32%	-	-	0.0005	0.1	-	0.52%	-	-
	Annual	ppm	0.00006	0.02	0.005	1.28%	1.28%	-	0.0001	0.02	0.004	2.60%	2.60%	-
CO	1 hr	ppm	0.54	30	-	1.81%	-	Mississauga Rd + Queen St W	0.44	30	-	1.46%	-	Mississauga Rd + Beacon Hill Drive
	8 hr	ppm	0.34	13	-	2.62%	-	-	0.27	13	-	2.08%	-	-
Benzene	24 hr	$\mu g/m^3$	0.52	2.3	-	22.56%	-	Mississauga Rd + Queen St W	0.13	2.3	-	5.63%	-	Mississauga Rd + Queen St W
	Annual	$\mu g/m^3$	0.10	0.45	-	23.06%	-	-	0.03	0.45	-	5.76%	-	-
1-3 Butadiene	24 hr	$\mu g/m^3$	0.09	10	-	0.90%	-	Mississauga Rd + Queen St W	-	10	-	-	-	-
	Annual	$\mu g/m^3$	0.02	2	-	0.90%	-	-	-	2	-	-	-	-
Formaldehyde	24 hr	$\mu g/m^3$	0.70	65	-	1.07%	-	Mississauga Rd + Queen St W	0.30	65	-	0.46%	-	Mississauga Rd + Royal West Drive
Acetaldehyde	24 hr	$\mu g/m^3$	0.37	500	-	0.07%	-	Mississauga Rd + Queen St W	0.15	500	-	0.03%	-	Mississauga Rd + Royal West Drive
	1/2-hr	$\mu g/m^3$	1.10	500	-	0.22%	-	Mississauga Rd + Queen St W	0.44	500	-	0.09%	-	Mississauga Rd + Royal West Drive
Acrolein	24 hr	$\mu g/m^3$	0.09	0.4	-	23.20%	-	Mississauga Rd + Queen St W	-	0.4	-	-	-	-
	1 hr	$\mu g/m^3$	0.23	4.5	-	5.16%	-	Mississauga Rd + Queen St W	-	4.5	-	-	-	-

Note: As can be seen from the above Table 6.1, all compounds are predicted to be below the ambient air quality criteria. The maximum percent of criteria is 324.17% of the 1 hour CAAQS criteria for NO2.
" - " Not available criteria or below modelling threshold results
NOx emissions - expressed as NO_2
CAAQS - Canadian Ambient Air Quality Standards
AAQC - Ontario Ambient Air Quality Criteria

Table 6.2: Combined Effect of Modelled Effects and Background Air Concentrations

			Scenario															
			2015 (Current)								2031							
Pollutant	Averaging Time	Unit	Max Concentration	Background Concentration	Cumulative = project + Background	AAQC	2020 CAAQS	Percentage of AAQC	Percentage of CAAQS	Location of Max	Max Concentration	Background Concentration	Cumulative = project + Background	Ambient Air Quality Criteria	2025 CAAQS	Percentage of AAQC	Percentage of CAAQS	Location of Max
$PM_{2.5}$	24 hr	µg/m³	8.44	14.20	22.64	30.00	27	75.48%	83.86%	Mississauga Rd + Queen St W	2.57	14.20	16.77	30	27	55.91%	62.12%	Mississauga Rd + Queen St W
	Annual	µg/m³	2.24	7	9.24	-	8.8		105.00%	-	0.68	7	7.68	-	8.8	-	87.27%	-
PM_{10}	24 hr	µg/m³	14.96	26.3	41.26	50	-	82.53%	-	-	9.58	26.3	35.88	50	-	71.76%	-	-
NO_2	1 hr	ppm	0.19	31.6 ppb	0.2261	0.2	0.06	113.05%	376.83%	Mississauga Rd + Queen St W	0.08	31.6 ppb	0.1115	0.2	0.042	55.75%	265.48%	Mississauga Rd + Royal West Drive
	24 hr	ppm	0.08	28.6 ppb	0.1064	0.1	-	106.40%	-	-	0.03	28.6 ppb	0.06056	0.1	-	60.56%	-	-
	Annual	ppm	0.02	10 ppb	0.02556	-	0.017	150.35%	150.35%	-	0.01	10 ppb	0.016392	-	0.012	136.60%	136.60%	-
SO_2	1 hr	ppm	0.0008	2.15 ppb	0.00295	0.25	0.07	1.18%	4.21%	Mississauga Rd + Queen St W	0.0013	2.15 ppb	0.00345	0.25	0.065	1.38%	5.31%	Mississauga Rd + Royal West Drive
	24 hr	ppm	0.00032	2.5 ppb	0.00282	0.1	-	2.82%	-	-	0.00052	2.5 ppb	0.00302	0.1	-	3.02%	-	-
	Annual	ppm	0.00006	1.1 ppb	0.001164	0.02	0.005	23.28%	23.28%	-	0.00010	1.1 ppb	0.001204	0.02	0.004	30.10%	30.10%	-
CO	1 hr	ppm	0.54	0.4	0.9438	30	-	3.15%	-	Mississauga Rd + Queen St W	0.44	0.4	0.8392	30	-	2.80%	-	Mississauga Rd + Beacon Hill Drive
	8 hr	ppm	0.34	0.38	0.72	13	-	5.54%	-	-	0.27	0.38	0.65	13	-	5.00%	-	-
Benzene	24 hr	µg/m³	0.52	0.522	1.04	2.30	-	45.25%	-	Mississauga Rd + Queen St W	0.13	0.522	0.65	2.30	-	28.33%	-	Mississauga Rd + Queen St W
	Annual	µg/m³	0.10	-	-	0.45	-	-	-	-	0.03	-	-	0.45	-	-	-	-
1-3 Butadiene	24 hr	µg/m³	0.09	0.0425	0.13	10	-	1.32%	-	Mississauga Rd + Queen St W	-	0.0425	-	10	-	-	-	-
	Annual	µg/m³	0.02	0.04	0.06	2	-	2.90%	-	-	-	0.04	-	2	-	-	-	-
Formaldehyde	24 hr	µg/m³	0.70	2.248	2.95	65	-	4.53%	-	-	0.30	2.248	2.55	65	-	3.92%	-	-
Acetaldehyde	24 hr	µg/m³	0.37	1.152	1.52	500	-	0.30%	-	-	0.15	1.152	1.30	500	-	0.26%	-	-
	1/2-hr	µg/m³	1.10	-	-	500	-	-	-	-	0.44	-	-	500	-	-	-	-
Acrolein	24 hr	µg/m³	0.09	0.046	0.14	0.4	-	34.70%	-	-	-	0.046	-	0.4	-	-	-	-
	1 hr	µg/m³	0.23	-	-	4.5	-	-	-	-	-	-	-	4.5	-	-	-	-

Note: " - " Not available criteria or below modelling threshold results
NOx emissions - expressed as NO_2
CAAQS - Canadian Ambient Air Quality Standards
AAQC - Ontario Ambient Air Quality Criteria

The findings of the air quality study were as follow:

- In the case of Mississauga Road, it was noted that passenger vehicles comprise the majority of the traffic, with the average fleet profile consisting of 91% passenger cars and 9% heavy duty diesel vehicles (HDDV) based on the current scenario;
- The potential effect associated with air emissions is an increase in the airborne concentrations of the key pollutants NOx, $PM_{2.5}$, PM_{10}, CO, SO_2, and VOCs (Benzene, 1-3 Butadiene, Formaldehyde, Acetaldehyde, and Acrolein) in the vicinity of the project;
- The incremental (project) effects for NOx, $PM_{2.5}$, PM_{10}, CO, SO_2, and VOCs (Benzene, 1-3 Butadiene, Formaldehyde, Acetaldehyde, and Acrolein) predicted to be below the respective ambient air quality criteria;
- Highest effects located proximate to intersections, most significantly Mississauga Rd and Queen St W for current scenario;
- Small increment compared with existing baseline;
- MOVES model considers the gradual fleet replacement as the higher polluting vehicles are removed from service;
- The predicted effects for NO_2 were highest for the current scenario, but still in compliance with all air quality limits currently enforced in the province of Ontario. The current scenario is exceeding federal limits (CAAQS) for 1-hr averaging time. These limits are expected to be introduced in Canada in 2020. NO_2 is also exceeding the same federal limit for the future 2031 scenario. The exceedance for the future scenario is much less significant as the NO_2 emissions reduction is achieved as older vehicles are removed from service. The cleaner engines off-set the effect of increased traffic volumes for 2031. The emission factors for the other target pollutants ($PM_{2.5}$, PM_{10}, CO, SO_2) also decreased over time and off-set the increase of traffic volume. This resulted in lower impacts on air quality in 2031 scenario of all contaminants except SO_2. SO_2 emissions demonstrate marginal increase in ambient concentrations but still being in compliance with ambient criteria limits;
- The cumulative effects of the roadway emissions of PM_{10}, CO, SO_2, Benzene, and 1-3 Butadiene within the study area plus the background concentrations were below the respective ambient air quality criteria for all averaging times under each scenario;
- The cumulative effect of the $PM_{2.5}$ emissions within the study area and the background concentrations were found to be marginally higher than the respective 2020 CAAQS criteria for the annual averaging time. $PM_{2.5}$ emissions are in compliance with all currently enforced provincial limits; and
- The cumulative effect of the NO_2 emissions within the study area plus the background concentrations were found to be higher than the respective ambient air quality criteria for the 1-hr, 24-hr, annual averaging times and above the 2020 CAAQS.

7.1 Predicted Effect Levels

The isopleths plots (Figures 6.1 to 6.2, Appendix A) for NOx illustrate how localized the areas are where the maximum predicted concentrations lay, and that all concentrations are below the regulatory criteria.

The predicted concentrations presented in Table 6.1 are conservative, as they represent the highest hour or day over the year of meteorological data used for the modelling.

8.0 CONCLUSIONS

The predicted effects for NO_2 were highest for the current scenario, but still in compliance with all air quality limits currently enforced in the province of Ontario.

NO_2 emissions are assessed in the most conservative way, which can explain the above mentioned exceedances. The conservative approach in estimating and modelling of NO_2 emissions using the CALRoads model is unavoidable, as the model does not take into account the NOx/NO_2 conversion. All NOx emissions are considered to be in NO_2 form as this modelling package is not providing an algorithm to simulate NOx to NO_2 conversion. As per US EPA's NO_2/NOx In-Stack Ratio (ISR) Database, NO_2/NOx ratio is 0.1, so the lower levels of NO_2 can be expected at the receptors in the study area. For the future the above mentioned conservativism in modelling is increased by accepting the current (2015) background levels of NO_2, SO_2, and VOCs as applied for 2031 scenario. In Canada the ambient concentrations of these contaminants are lowered between the years 2002 to 2015 (as per ECCC website). NO_2 levels are reduced by 24.5% in that period. It is anticipated that that the same trend will continue between now and 2031. So the proposed project is not expected to have a negative impact on the air quality in the study area for the future 2031 scenario.

9.0 REFERENCES

Paradigm Transportation Solutions Limited 2017 Traffic Study Report Mississauga Road Class Environmental Assessment.

US EPA MOVES 2014a (Nov 2015) User's Guide, EPA-420-B-15-095.

US EPA CALROAD model (Lakes Environmental version 6.5.0)

Ministry of Transportation (MTO) Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects, June 2012.

Ontario's Ambient Air Quality Criteria, PIBS # 6570e01, April 2012.

Yours truly,
Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

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Senior Engineer – Air Quality

Signature: ______________________ Date: December 20, 2018

Reviewed by: Alex Breido Ph.D., P.Eng
Associate Engineer – Air Quality

Signature: ______________________ Date: December 20, 2018

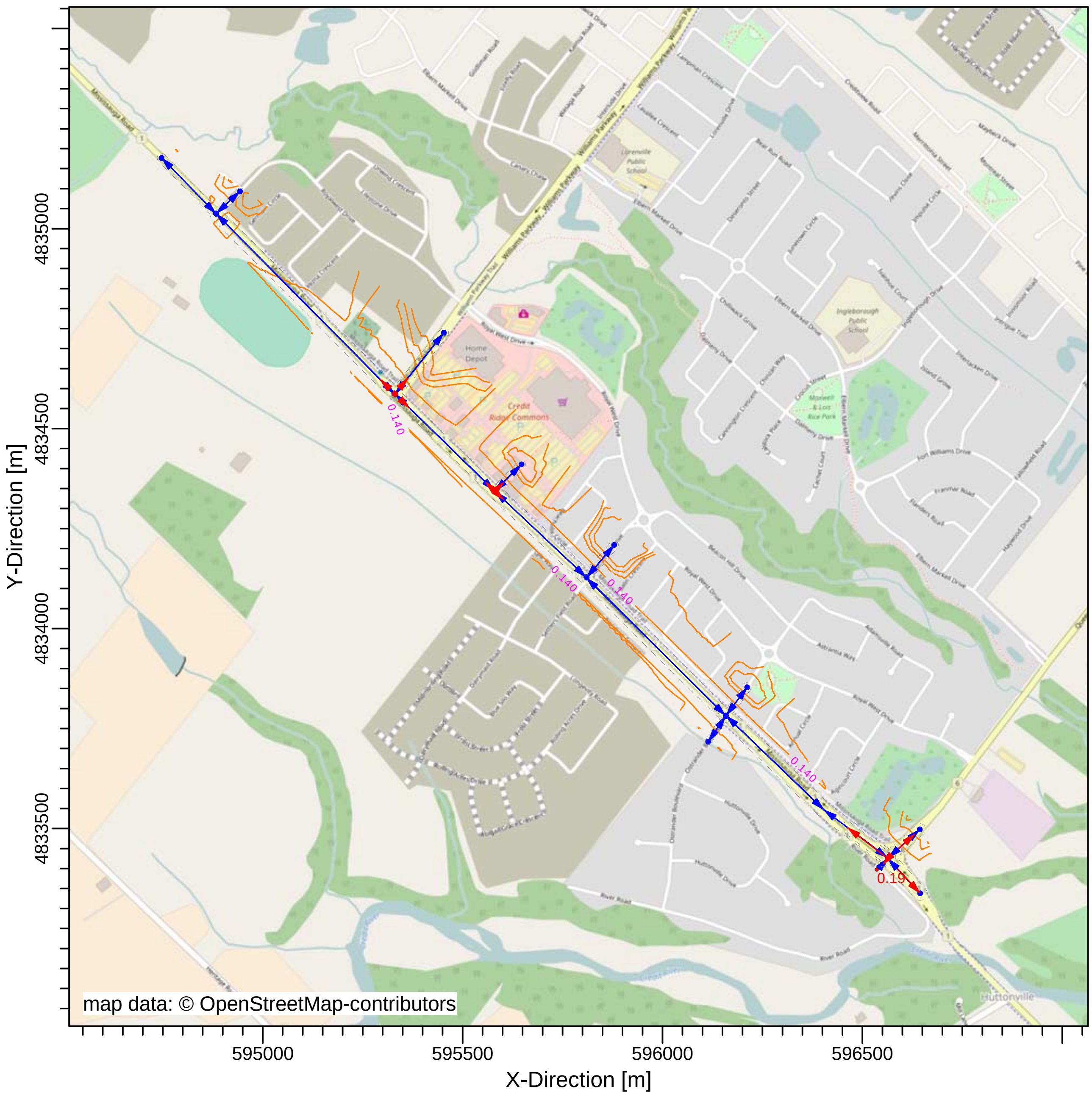
APPENDIX A

FIGURES

Figure 1.1: Study Area

PROJECT TITLE:

C:\CALRoads Modelling Files\Mississauga



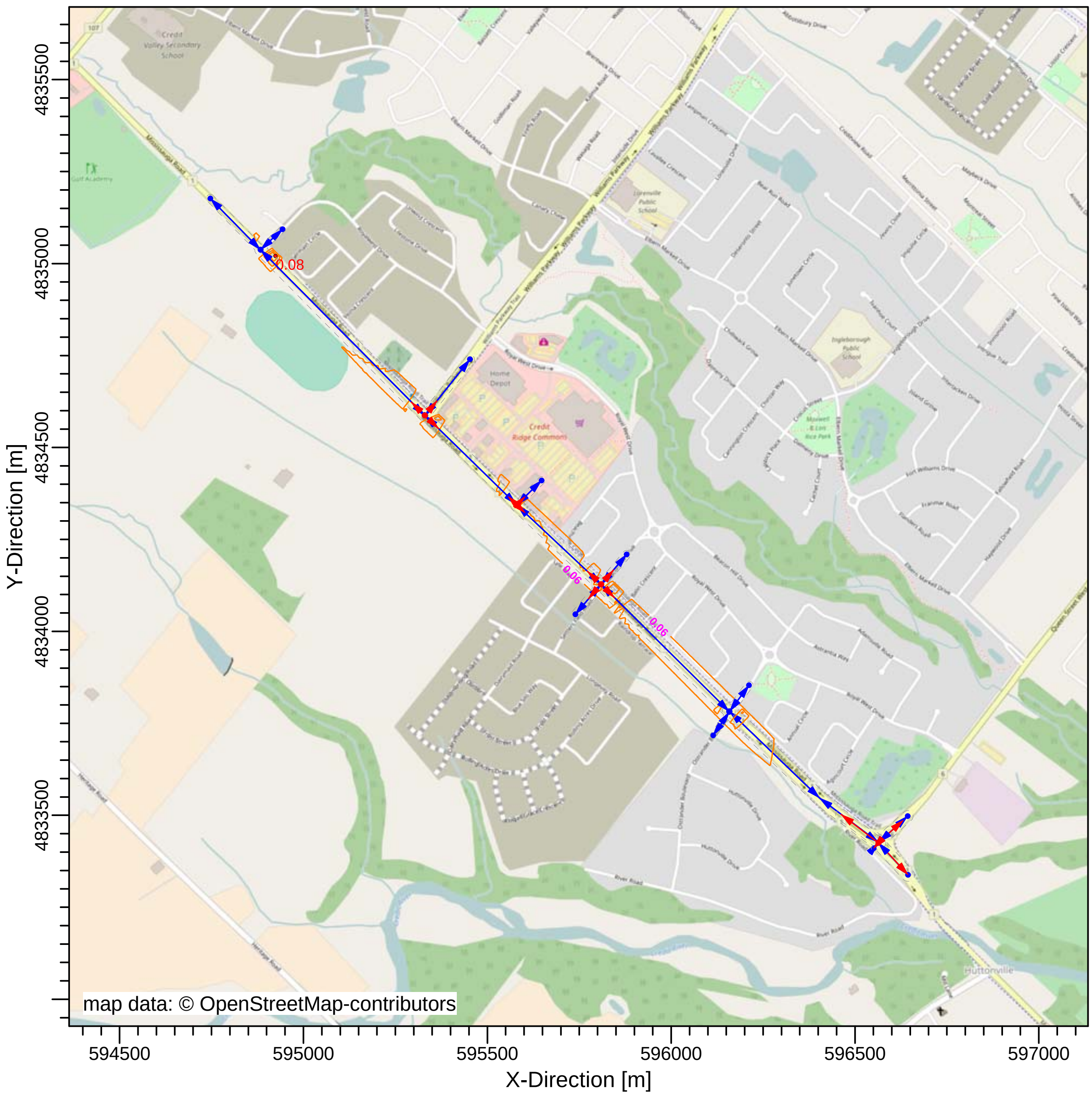
COMMENTS:	MODEL:	POLLUTANT:	COMPANY NAME:	
Existing Road and Traffic Condition (2015) NOX emissions 1-hr average	**CAL3QHCR**	**NOx**	**Region of Peel**	
	MAX: **0.19**	UNITS: **ppm**	MODELER: **AI**	
	LINKS: **42**	RECEPTORS: **1273**		
	SCALE: 1:16,021 0 — 0.5 m		DATE: **05/05/2017**	PROJECT / PLOT NO.: **TP115085**

CALRoads View - Lakes Environmental Software

Figure 6.1 (2015 scenario) : NOx modelling (1-hr avg.)

PROJECT TITLE:

C:\CALRoads Modelling Files\Mississauga



COMMENTS:	MODEL:	POLLUTANT:	COMPANY NAME:	
Road and Traffic Condition based on year 2031 NOx Emissions 1-hr Average	**CAL3QHCR**	**NOx**	**Region of Peel**	
	MAX: **0.08**	UNITS: **ppm**	MODELER: **AI**	
	LINKS: **48**	RECEPTORS: **1273**		
	SCALE: 1:17,418 0 — 0.5 m		DATE: **05/05/2017**	PROJECT / PLOT NO.: **TP115085**

CALRoads View - Lakes Environmental Software

Figure 6.2 (2031 scenario) : NOx modelling (1-hr avg.)

APPENDIX B

EMISSION CALCULATIONS

Fleet Profile

2015 Annual Average Daily Traffic (AADT)					
Intersection	**Direction**	**Total vehicles**	**Cars**	**Trucks**	**% Cars**
Mississauga Rd & Williams Parkway	Northbound	3,903	3,565	338	91%
	Southbound	4,159	3,887	270	93%
Mississauga Rd & Credit Ridge Commons Driveway	Northbound	4,043	3,774	269	93%
	Southbound	3,607	3,332	275	92%
Mississauga Rd & Beacon Hill Drive	Northbound	7,340	6,306	1,034	86%
	Southbound	7,121	6,067	1,054	85%
Mississauga Rd & Ostrander Boulevard/Adamsville Road	Northbound	6392	6031	361	94%
	Southbound	6498	6096	402	94%
Mississauga Rd & Queen St W	Northbound	6413	5927	486	92%
	Southbound	6237	5780	457	93%
	Total	**55,713**	**50,765**	**4,946**	**91%**

MOVES 2014a Emission Factors

Emission Factors - 2015

ID	Description	Direction	Speed (km/h)	Speed (mph)	% Cars - AM/PM Peak	$PM_{2.5}$	PM_{10}	NOx	SO_2	CO	Benzene	1-3 Butadiene	Formaldehyde	Acetaldehyde	Acrolein
						Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)
M1N	Mississauga Rd South of Queen St W	North	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0034	0.0004	0.0049	0.0026	0.0004
M1S	Mississauga Rd South of Queen St W	South	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0034	0.0004	0.0049	0.0026	0.0004
M2N	Mississauga Rd North of Queen St W	North	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0026	0.0004	0.0049	0.0026	0.0004
M2S	Mississauga Rd North of Queen St W	South	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0026	0.0004	0.0049	0.0026	0.0004
Q1E	Queen St W East of Mississauga Rd	East	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0035	0.0004	0.0049	0.0026	0.0004
Q1W	Queen St W East of Mississauga Rd	West	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0035	0.0004	0.0049	0.0026	0.0004
R1E	River Rd West of Mississauga Rd	East	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0084	0.0004	0.0049	0.0026	0.0004
R1W	River Rd West of Mississauga Rd	West	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0084	0.0004	0.0049	0.0026	0.0004
M3N	Mississauga Rd North of Ostrander Boulevard/Adamsville Road	North	80	50	91%	0.05	0.08	1.421	0.0068	2.118	0.0023	0.0003	0.0042	0.0022	0.0003
M3S	Mississauga Rd North of Ostrander Boulevard/Adamsville Road	South	80	50	91%	0.05	0.08	1.421	0.0068	2.118	0.0023	0.0003	0.0042	0.0022	0.0003
A1E	Adamsville Road East of Mississauga Rd	East	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0037	0.0004	0.0049	0.0026	0.0004
A1W	Adamsville Road East of Mississauga Rd	West	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0037	0.0004	0.0049	0.0026	0.0004
O1E	Ostrander Boulevard West of Mississauga Rd	East	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0039	0.0004	0.0049	0.0026	0.0004
O1W	Ostrander Boulevard West of Mississauga Rd	West	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0039	0.0004	0.0049	0.0026	0.0004
M4N	Mississauga Rd North of Beacon Hill Drive	North	80	50	91%	0.05	0.08	1.421	0.0068	2.118	0.0024	0.0003	0.0042	0.0022	0.0003
M4S	Mississauga Rd North of Beacon Hill Drive	South	80	50	91%	0.05	0.08	1.421	0.0068	2.118	0.0024	0.0003	0.0042	0.0022	0.0003
B1E	Beacon Hill Drive East of Mississauga Rd	East	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0035	0.0004	0.0049	0.0026	0.0004
B1W	Beacon Hill Drive East of Mississauga Rd	West	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0035	0.0004	0.0049	0.0026	0.0004
M5N	Mississauga Rd North of Commercial Dwy	North	80	50	91%	0.05	0.08	1.421	0.0068	2.118	0.0024	0.0003	0.0042	0.0022	0.0003
M5S	Mississauga Rd North of Commercial Dwy	South	80	50	91%	0.05	0.08	1.421	0.0068	2.118	0.0024	0.0003	0.0042	0.0022	0.0003
C1E	Commercial Dwy East of Mississauga Rd	East	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0036	0.0004	0.0049	0.0026	0.0004
C1W	Commercial Dwy East of Mississauga Rd	West	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0036	0.0004	0.0049	0.0026	0.0004
M6N	Mississauga Rd North of Williams Parkway	North	80	50	91%	0.05	0.08	1.421	0.0068	2.118	0.0022	0.0003	0.0042	0.0022	0.0003
M6S	Mississauga Rd North of Williams Parkway	South	80	50	91%	0.05	0.08	1.421	0.0068	2.118	0.0022	0.0003	0.0042	0.0022	0.0003
W1E	Williams Parkway East of Mississauga Rd	East	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0030	0.0004	0.0049	0.0026	0.0004
W1W	Williams Parkway East of Mississauga Rd	West	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0030	0.0004	0.0049	0.0026	0.0004
M7N	Mississauga Rd North of Royal West Drive	North	80	50	91%	0.05	0.08	1.421	0.0068	2.118	0.0026	0.0003	0.0042	0.0022	0.0003
M7S	Mississauga Rd North of Royal West Drive	South	80	50	91%	0.05	0.08	1.421	0.0068	2.118	0.0026	0.0003	0.0042	0.0022	0.0003
RW1E	Royal West Drive East of Mississauga Rd	East	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0038	0.0004	0.0049	0.0026	0.0004
RW1W	Royal West Drive East of Mississauga Rd	West	60	37	91%	0.07	0.12	1.479	0.0073	2.528	0.0038	0.0004	0.0049	0.0026	0.0004

MOVES 2014a Emission Factors
Emission Factors - 2015

Idle Emission Rate

% Cars - AM/PM Peak	$PM_{2.5}$			PM_{10}			NOx			SO_2			CO			Benzene			1-3 Butadiene			Formaldehyde			Acetaldehyde			Acrolein		
	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)
91%	0.1004	4.8958	0.526	0.1135	5.3215	0.576	0.9884	74.8615	7.549	0.0596	0.0675	0.060	12.4431	19.9983	13.114	0.0323	0.0668	0.0354	0.0044	0.0234	0.0061	0.0133	0.7012	0.0744	0.0139	0.3074	0.0400	0.0006	0.0561	0.0056

MOVES 2014a Emission Factors

Emission Factors - 2031

ID	Description	Direction	Speed (km/h)	Speed (mph)	% Cars - AM/PM Peak	$PM_{2.5}$	PM_{10}	NOx	SO_2	CO	Benzene	1-3 Butadiene	Formaldehyde	Acetaldehyde	Acrolein
						Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)	Emission Factor AM/PM (g/veh-mile)
M1N	Mississauga Rd South of Queen St W	North	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00118	0.00001	0.00128	0.00045	0.00006
M1S	Mississauga Rd South of Queen St W	South	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00118	0.00001	0.00128	0.00045	0.00006
M2N	Mississauga Rd North of Queen St W	North	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00061	0.00001	0.00128	0.00045	0.00006
M2S	Mississauga Rd North of Queen St W	South	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00061	0.00001	0.00128	0.00045	0.00006
Q1E	Queen St W East of Mississauga Rd	East	60	37	91%	0.013	0.059	0.2306	0.0051	0.871	0.00127	0.00001	0.00128	0.00045	0.00006
Q1W	Queen St W East of Mississauga Rd	West	60	37	91%	0.013	0.059	0.2306	0.0051	0.871	0.00127	0.00001	0.00128	0.00045	0.00006
R1E	River Rd West of Mississauga Rd	East	60	37	91%	0.013	0.059	0.2306	0.0051	0.871	0.00497	0.00001	0.00128	0.00045	0.00006
R1W	River Rd West of Mississauga Rd	West	60	37	91%	0.013	0.059	0.2306	0.0051	0.871	0.00497	0.00001	0.00128	0.00045	0.00006
M3N	Mississauga Rd North of Ostrander Boulevard/Adamsville Road	North	80	50	91%	0.009	0.032	0.2181	0.0047	0.731	0.00058	0.00001	0.00102	0.00036	0.00005
M3S	Mississauga Rd North of Ostrander Boulevard/Adamsville Road	South	80	50	91%	0.009	0.032	0.2181	0.0047	0.731	0.00058	0.00001	0.00102	0.00036	0.00005
A1E	Adamsville Road East of Mississauga Rd	East	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00143	0.00001	0.00128	0.00045	0.00006
A1W	Adamsville Road East of Mississauga Rd	West	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00143	0.00001	0.00128	0.00045	0.00006
O1E	Ostrander Boulevard West of Mississauga Rd	East	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00158	0.00001	0.00128	0.00045	0.00006
O1W	Ostrander Boulevard West of Mississauga Rd	West	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00158	0.00001	0.00128	0.00045	0.00006
M4N	Mississauga Rd North of Beacon Hill Drive	North	80	50	91%	0.009	0.032	0.2181	0.0047	0.731	0.00069	0.00001	0.00102	0.00036	0.00005
M4S	Mississauga Rd North of Beacon Hill Drive	South	80	50	91%	0.009	0.032	0.2181	0.0047	0.731	0.00068	0.00001	0.00102	0.00036	0.00005
B1E	Beacon Hill Drive East of Mississauga Rd	East	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00127	0.00001	0.00128	0.00045	0.00006
B1W	Beacon Hill Drive East of Mississauga Rd	West	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00126	0.00001	0.00128	0.00045	0.00006
B2E	Beacon Hill Drive West of Mississauga Rd	East	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00127	0.00001	0.00128	0.00045	0.00006
B2W	Beacon Hill Drive West of Mississauga Rd	West	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00127	0.00001	0.00128	0.00045	0.00006
M5N	Mississauga Rd North of Commercial Dwy	North	80	50	91%	0.009	0.032	0.2181	0.0047	0.731	0.00066	0.00001	0.00102	0.00036	0.00005
M5S	Mississauga Rd North of Commercial Dwy	South	80	50	91%	0.009	0.032	0.2181	0.0047	0.731	0.00066	0.00001	0.00102	0.00036	0.00005
C1E	Commercial Dwy East of Mississauga Rd	East	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00137	0.00001	0.00128	0.00045	0.00006
C1W	Commercial Dwy East of Mississauga Rd	West	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00137	0.00001	0.00128	0.00045	0.00006
M6N	Mississauga Rd North of Williams Parkway	North	80	50	91%	0.009	0.032	0.2181	0.0047	0.731	0.00054	0.00001	0.00102	0.00036	0.00005
M6S	Mississauga Rd North of Williams Parkway	South	80	50	91%	0.009	0.032	0.2181	0.0047	0.731	0.00054	0.00001	0.00102	0.00036	0.00005
W1E	Williams Parkway East of Mississauga Rd	East	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00090	0.00001	0.00128	0.00045	0.00006
W1W	Williams Parkway East of Mississauga Rd	West	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00089	0.00001	0.00128	0.00045	0.00006
M7N	Mississauga Rd North of Royal West Drive	North	80	50	91%	0.009	0.032	0.2181	0.0047	0.731	0.00085	0.00001	0.00102	0.00036	0.00005
M7S	Mississauga Rd North of Royal West Drive	South	80	50	91%	0.009	0.032	0.2181	0.0047	0.731	0.00085	0.00001	0.00102	0.00036	0.00005
RW1E	Royal West Drive East of Mississauga Rd	East	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00151	0.00001	0.00128	0.00045	0.00006
RW1W	Royal West Drive East of Mississauga Rd	West	60	37	91%	0.013	0.059	0.2306	0.0051	0.872	0.00151	0.00001	0.00128	0.00045	0.00006

MOVES 2014a Emission Factors
Emission Factors - 2031

Idle Emission Rate

% Cars - AM/PM Peak	$PM_{2.5}$			PM_{10}			NOx			SO_2			CO			Benzene			1-3 Butadiene			Formaldehyde			Acetaldehyde			Acrolein		
	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - AM/PM (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - (g/hr)	Idle Emission Factor - Car (g/hr)	Idle Emission Factor - Truck (g/hr)	Effective Idle Emission Factor - (g/hr)
91%	0.0248	0.4204	0.060	0.0281	0.4570	0.066	0.0405	11.4575	1.054	0.0376	0.0621	0.040	0.5190	4.4363	0.867	0.002203	0.010199	0.002914	0.000000	0.001155	0.000103	0.000636	0.160321	0.014818	0.000291	0.053388	0.005007	0.000021	0.008024	0.000732

APPENDIX C

DISPERSION MODELLING INPUT DATA AND ASSUMPTIONS

Raw Traffic Data - Current (2015)

ID	Description	Direction	Link Type	Length (m)	Mixing Zone Width (m)	AM Peak	PM Peak
						Cars/Trucks	Cars/Trucks
M1N	Mississauga Rd South of Queen St W	North	At-Grade	118.83	35.37	1091	2130
M1S	Mississauga Rd South of Queen St W	South	At-Grade	118.61	35.37	2147	991
M2N	Mississauga Rd North of Queen St W	North	At-Grade	540.19	39.58	785	1646
M2S	Mississauga Rd North of Queen St W	South	At-Grade	540.19	39.58	1612	737
Q1E	Queen St W East of Mississauga Rd	East	At-Grade	106.03	29.81	460	677
Q1W	Queen St W East of Mississauga Rd	West	At-Grade	106.06	29.81	669	447
R1E	River Rd West of Mississauga Rd	East	At-Grade	19.01	12.82	25	6
R1W	River Rd West of Mississauga Rd	West	At-Grade	19.09	12.82	5	6
M3N	Mississauga Rd North of Ostrander Boulevard/Adamsville Road	North	At-Grade	489.88	32.89	802	1616
M3S	Mississauga Rd North of Ostrander Boulevard/Adamsville Road	South	At-Grade	490.29	32.89	1584	738
A1E	Adamsville Road East of Mississauga Rd	East	At-Grade	88.83	21.36	7	36
A1W	Adamsville Road East of Mississauga Rd	West	At-Grade	88.57	21.36	31	12
O1E	Ostrander Boulevard West of Mississauga Rd	East	At-Grade	77.48	16.41	30	15
O1W	Ostrander Boulevard West of Mississauga Rd	West	At-Grade	77.38	16.41	9	22
M4N	Mississauga Rd North of Beacon Hill Drive	North	At-Grade	312.95	34.55	801	1602
M4S	Mississauga Rd North of Beacon Hill Drive	South	At-Grade	313.51	34.55	1521	739
B1E	Beacon Hill Drive East of Mississauga Rd	East	At-Grade	106.8	21.65	8	21
B1W	Beacon Hill Drive East of Mississauga Rd	West	At-Grade	107.25	21.65	70	6
M5N	Mississauga Rd North of Commercial Dwy	North	At-Grade	346.36	27.75	745	1298
M5S	Mississauga Rd North of Commercial Dwy	South	At-Grade	346.46	27.75	1497	665
C1E	Commercial Dwy East of Mississauga Rd	East	At-Grade	94.86	19.9	347	409
C1W	Commercial Dwy East of Mississauga Rd	West	At-Grade	95.14	19.9	315	179
M6N	Mississauga Rd North of Williams Parkway	North	At-Grade	632.83	31.6	610	747
M6S	Mississauga Rd North of Williams Parkway	South	At-Grade	633.77	31.6	1031	584
W1E	Williams Parkway East of Mississauga Rd	East	At-Grade	195.02	24.1	305	720
W1W	Williams Parkway East of Mississauga Rd	West	At-Grade	195.65	24.1	636	250
M7N	Mississauga Rd North of Royal West Drive	North	At-Grade	194.6	22.27	610	747
M7S	Mississauga Rd North of Royal West Drive	South	At-Grade	194.87	22.27	1031	584
RW1E	Royal West Drive East of Mississauga Rd	East	At-Grade	81.79	16.55	70	70
RW1W	Royal West Drive East of Mississauga Rd	West	At-Grade	81.89	16.55	70	70

Raw Traffic Data - Current (2015)

Queue Links

					AM Peak								PM Peak							
ID	Segment Details	Link Type	Number of Lanes	Direction	Average Signal Cycle Length (s)	Green Time (s)	Average Red Time Length (s)	Clearance Lost Time (s)	Approach Traffic Volume (vph)	Saturation Flow Rate (v/hr/lane)	Signal Type	Arrival Type	Average Signal Cycle Length (s)	Green Time (s)	Average Red Time Length (s)	Clearance Lost Time (s)	Approach Traffic Volume (vph)	Saturation Flow Rate (v/hr/lane)	Signal Type	Arrival Type
M1NQ	Mississauga Rd South of Queen St W	At-Grade	3	North	130	58.5	60	6.5	1091	3832	Actuated	Above Avg. Progression	130	83.5	35.0	6.5	2130	1931	Actuated	Best Progression
M2SQ	Mississauga Rd North of Queen St W	At-Grade	2	South	130	54.1	64.4	6.5	1612	2259	Actuated	Worst Progression	130	79.1	39.4	6.5	717	1822	Actuated	Above Avg. Progression
Q1WQ	Queen St W East of Mississauga Rd	At-Grade	3	West	130	57.6	60	7.4	669	3406	Actuated	Average Progression	130	32.6	85	7.4	447	1630	Actuated	Below Average Progression
R1EQ	River Rd West of Mississauga Rd	At-Grade	1	East	130	57.6	60	7.4	25	1674	Actuated	Average Progression	130	32.6	85	7.4	6	1835	Actuated	Below Average Progression
M5NQ	Mississauga Rd North of Commercial Dwy	At-Grade	2	North	130	82.8	35.6	6.6	801	4179	Actuated	Best Progression	130	89.6	28.8	6.6	1602	2571	Actuated	Above Avg. Progression
M5SQ	Mississauga Rd North of Commercial Dwy	At-Grade	2	South	130	95.4	23	6.6	1497	2369	Actuated	Best Progression	130	99.7	18.7	6.6	665	1933	Actuated	Best Progression
C1WQ	Commercial Dwy East of Mississauga Rd	At-Grade	2	West	130	21.7	97	6.3	315	2568	Actuated	Below Average Progression	130	17.4	101.3	6.3	179	1691	Actuated	Worst Progression
M6NQ	Mississauga Rd North of Williams Parkway	At-Grade	2	North	130	74	46.3	6.7	745	4086	Actuated	Best Progression	130	90.8	27.5	6.7	1298	2505	Actuated	Best Progression
M6SQ	Mississauga Rd North of Williams Parkway	At-Grade	2	South	130	74	46.3	6.7	1031	2466	Actuated	Above Avg. Progression	130	90.8	29.5	6.7	584	2076	Actuated	Best Progression
W1WQ	Williams Parkway East of Mississauga Rd	At-Grade	2	West	130	43.1	77.7	6.2	636	2504.5	Actuated	Worst Progression	130	26.3	94.5	6.2	250	1691	Actuated	Below Avg. Progression

Raw Traffic Data - Future (2031)

ID	Description	Direction	Link Type	Length (m)	Mixing Zone Width (m)	AM Peak	PM Peak
						Cars/Trucks	Cars/Trucks
M1N	Mississauga Rd South of Queen St W	North	At-Grade	118.83	35.37	2231	4742
M1S	Mississauga Rd South of Queen St W	South	At-Grade	118.61	35.37	4599	2647
M2N	Mississauga Rd North of Queen St W	North	At-Grade	540.19	39.58	1851	4153
M2S	Mississauga Rd North of Queen St W	South	At-Grade	540.19	39.58	3945	2339
Q1E	Queen St W East of Mississauga Rd	East	At-Grade	106.03	29.81	588	856
Q1W	Queen St W East of Mississauga Rd	West	At-Grade	106.06	29.81	843	577
R1E	River Rd West of Mississauga Rd	East	At-Grade	19.01	12.82	20	5
R1W	River Rd West of Mississauga Rd	West	At-Grade	19.09	12.82	7	8
M3N	Mississauga Rd North of Ostrander Boulevard/Adamsville Road	North	At-Grade	489.88	32.89	1866	4114
M3S	Mississauga Rd North of Ostrander Boulevard/Adamsville Road	South	At-Grade	490.29	32.89	3905	2332
A1E	Adamsville Road East of Mississauga Rd	East	At-Grade	88.83	21.36	6	30
A1W	Adamsville Road East of Mississauga Rd	West	At-Grade	88.57	21.36	25	25
O1E	Ostrander Boulevard West of Mississauga Rd	East	At-Grade	77.48	16.41	23	14
O1W	Ostrander Boulevard West of Mississauga Rd	West	At-Grade	77.38	16.41	8	17
M4N	Mississauga Rd North of Beacon Hill Drive	North	At-Grade	312.95	34.55	1840	3936
M4S	Mississauga Rd North of Beacon Hill Drive	South	At-Grade	313.51	34.55	3682	2237
B1E	Beacon Hill Drive East of Mississauga Rd	East	At-Grade	106.8	21.65	7	16
B1W	Beacon Hill Drive East of Mississauga Rd	West	At-Grade	107.25	21.65	55	6
B2E	Beacon Hill Drive West of Mississauga Rd	East	At-Grade	106.83	21.65	176	116
B2W	Beacon Hill Drive West of Mississauga Rd	West	At-Grade	106.83	21.65	7	0
M5N	Mississauga Rd North of Commercial Dwy	North	At-Grade	346.36	27.75	1719	3539
M5S	Mississauga Rd North of Commercial Dwy	South	At-Grade	346.46	27.75	3570	2139
C1E	Commercial Dwy East of Mississauga Rd	East	At-Grade	94.86	19.9	271	318
C1W	Commercial Dwy East of Mississauga Rd	West	At-Grade	95.14	19.9	246	140
M6N	Mississauga Rd North of Williams Parkway	North	At-Grade	632.83	31.6	1590	2782
M6S	Mississauga Rd North of Williams Parkway	South	At-Grade	633.77	31.6	2971	2016
W1E	Williams Parkway East of Mississauga Rd	East	At-Grade	195.02	24.1	414	1010
W1W	Williams Parkway East of Mississauga Rd	West	At-Grade	195.65	24.1	912	389
M7N	Mississauga Rd North of Royal West Drive	North	At-Grade	194.6	22.27	1571	2771
M7S	Mississauga Rd North of Royal West Drive	South	At-Grade	194.87	22.27	2906	1983
RW1E	Royal West Drive East of Mississauga Rd	East	At-Grade	81.79	16.55	87	87
RW1W	Royal West Drive East of Mississauga Rd	West	At-Grade	81.89	16.55	87	87

Raw Traffic Data - Future (2031)

Queue Links

					AM Peak								PM Peak							
ID	Segment Details	Link Type	Number of Lanes	Direction	Average Signal Cycle Length (s)	Green Time (s)	Average Red Time Length (s)	Clearance Lost Time (s)	Approach Traffic Volume (vph)	Saturation Flow Rate (v/hr/lane)	Signal Type	Arrival Type	Average Signal Cycle Length (s)	Green Time (s)	Average Red Time Length (s)	Clearance Lost Time (s)	Approach Traffic Volume (vph)	Saturation Flow Rate (v/hr/lane)	Signal Type	Arrival Type
M1NQ	Mississauga Rd South of Queen St W	At-Grade	3	North	140	57.5	71	6.5	2231	2089.67	Actuated	Below Average Progression	120	65.0	43.5	6.5	4743	2258	Actuated	Worst Progression
M2SQ	Mississauga Rd North of Queen St W	At-Grade	2	South	140	71.5	57	6.5	3945	2549	Actuated	Worst Progression	120	70.2	38.3	6.5	2339	2527	Actuated	Average Progression
Q1WQ	Queen St W East of Mississauga Rd	At-Grade	3	West	140	54.6	73	7.4	843	1482	Actuated	Worst Progression	120	31.6	76	7.4	577	1630	Actuated	Worst Progression
R1EQ	River Rd West of Mississauga Rd	At-Grade	1	East	140	54.6	73	7.4	20	1681	Actuated	Average Progression	120	31.6	76	7.4	6	1798	Actuated	Average Progression
M4NQ	Mississauga Rd North of Beacon Hill Drive	At-Grade	2	North	120	91	18	6	1820	3040	Actuated	Best Progression	110	80.7	18.3	6	3933	3273	Actuated	Worst Progression
M4SQ	Mississauga Rd North of Beacon Hill Drive	At-Grade	2	South	120	91	18	6	3682	3156	Actuated	Below Average Progression	110	80.7	18.3	6	2237	2327	Actuated	Best Progression
B1WQ	Beacon Hill Drive East of Mississauga Rd	At-Grade	2	West	120	17	92	6	55	1211.5	Actuated	Below Average Progression	110	17.3	81.7	6	6	1256	Actuated	Below Average Progression
B2EQ	Beacon Hill Drive West of Mississauga Rd	At-Grade	2	East	120	17	92	6	176	1495	Actuated	Below Average Progression	110	17.3	81.7	6	233	2991	Actuated	Below Average Progression
M5NQ	Mississauga Rd North of Commercial Dwy	At-Grade	2	North	110	69.5	28.9	6.6	1763	3226.5	Actuated	Average Progression	110	76.3	22.1	6.6	3775	3345	Actuated	Above Avg. Progression
M5SQ	Mississauga Rd North of Commercial Dwy	At-Grade	2	South	110	81.4	17	6.6	3570	2486.5	Actuated	Above Avg. Progression	110	83.3	15.1	6.6	2139	2593	Actuated	Best Progression
C1WQ	Commercial Dwy East of Mississauga Rd	At-Grade	2	West	110	15.7	83	6.3	246	1675.5	Actuated	Below Average Progression	110	13.8	84.9	6.3	140	1691	Actuated	Below Average Progression
M6NQ	Mississauga Rd North of Williams Parkway	At-Grade	2	North	120	58.9	49.4	6.7	1774	3152	Actuated	Average Progression	130	72.2	46.1	6.7	3557	3257	Actuated	Above Avg. Progression
M6SQ	Mississauga Rd North of Williams Parkway	At-Grade	2	South	120	73.3	35	6.7	2971	2479.5	Actuated	Average Progression	130	87.7	30.6	6.7	2016	2523	Actuated	Below Average Progression
W1WQ	Williams Parkway East of Mississauga Rd	At-Grade	2	West	120	33.8	75	6.2	912	1612	Actuated	Worst Progression	130	29.4	89.4	6.2	389	1691	Actuated	Below Average Progression

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January 10, 2019
Our File: TP115085
Your File: EA 01-06-05

Ministry of the Environment, Conservation and Parks
Central Region
5775 Yonge Street, 8th Floor
North York, ON M2M 4J1

Attention: Trevor Bell, Regional Environmental Assessment Coordinator

Dear Mr. Bell:

Re: Mississauga Road from Queen Street West to Bovaird Drive West
Region of Peel
Schedule C Municipal Class Environmental Assessment
Draft Addendum to the Environmental Study Report, October 2018

Wood is pleased to provide the following responses to the comments received from the Ministry of the Environment, Conservation and Parks (MECP) on November 16, 2018 via email. The following provides the original comment followed by our response:

First paragraph of MECP letter

"We understand that the draft Addendum addresses the change in the preferred solution from the 2016 Environmental Study Report to widen the section of Mississauga Road from Queen Street West to Bovaird Drive West from four to six lanes."

Response: *Please note that the Addendum report addresses the change to the preferred solution from the 2006 Environmental Study Report.*

Air Quality Comments

1. Air quality assessments typically use five years of meteorological data to account for varying meteorological conditions. Please provide a justification for why only one year of meteorological data was used and why the year 2000 was selected.

   Air quality assessments also typically use five years of background data to capture representative background conditions. Please provide a justification for why only one year of background data was used.

   Future air quality assessments should use five years of both meteorological and background data.

Response: *The CAL3QHCR dispersion model can process only one year of meteorological data per model run. The model was run separately for each year (1996, 1997, 1998, 1999, and 2000) using the MECP approved regional meteorological data for the project area. Out of all five individual runs the modelling based on year 2000 data predicted the highest POI concentrations at the receptors. This year meteorological data was selected for all subsequent modelling runs as the most conservative.*

The 2015 background data was selected based on the following reasons.:

- *When the project started in 2015, the 2015 data was the newest complete annual set of data for the project area;*
- *The comparison with previous years data it was found that the ambient air shed in the area is pretty stable with minimal or no change in year to year observations;*
- *The latest year was selected as the most representative data to reflect the current status of industrial and transportation sources of air emissions pertaining to the study area.*
- *This background data was used in the modelling assessments to account for the cumulative impact effect.*

2. The AQA Report should clarify the assumption that NO_2 concentrations were equal to those of NOx. Since this assumption is conservative, typically NO_2 concentrations are estimated using the Ozone Limiting Method.

   Since the Ambient Air Quality Criteria and the Canadian Ambient Air Quality Criteria have been established for NO_2, modelled concentrations should be stated in terms of NO_2 rather than NOx. Furthermore, measured background concentrations should be provided for NO_2 rather than NOx.

   Response: *CALRoads modelling was done considering all NOx emissions to be in NO_2 form as this modelling package is not providing an algorithm to simulate NOx to NO_2 conversion Ozone Limiting Method. We are considering this approach to be more conservative and so acceptable for the purpose of the assessment. Tables 6-1, 6-2, and 3-2 are updated to show NO_2 instead of NOx. The footnote is added to clarify this approach.*

3. Since NAPS stations measure VOC concentrations every six days, the AQA Report should clarify what VOC concentrations were used for days where samples were not collected.

   Response: *A 1:6 day sampling schedule is appropriate unless concentrations are high. Specifically at the concentrations of Benzene and 1-3 Butadiene seen in the AQA report, the annual average relative error go from 6% to 3% and 6% to 4% respectively between a 6:1 and 1:1 sampling schedules (Bortnick and Stetzer, 2002). This sampling schedule is common across North America for measuring ambient air concentrations.*

4. The AQA Report should include the MOVES and CAL3QHCR input parameters.

   Response: *MOVES and CAL3QHCR input parameters are provided in the final AQA report.*

5. Although roads will be paved, re-entrainment of particulates still contributes to total emissions. Since this source of particulates was not assessed, the AQA Report currently underestimates particulate emissions.

   Response: *Re-entrainment of dust from paved roads is calculated and added to particulate emissions. Please see the revised tables 6-1 and 6-2. Background concentration PM_{10} is calculated based on the ratio of PM2.5 / PM10 = 0.54 (Lall et. all, 2004) and revised Table 6-2 accordingly. These two PM fractions were remodelled and showing the compliance with the applicable limits.*

6. The following changes should be made to Table 3.1 *Air Quality Criteria used for Study*:

    a. The NO_2 and SO_2 one-hour and annual CAAQS should be included;
    b. Since the year 2031 was assessed for the full build scenario, the 2020 $PM_{2.5}$ 24 hour CAAQS of 27 ug/m^3 should be used rather than the 2015 24 hour CAAQS of 28 ug/m^3;
    c. The annual PM2.5 CAAQS should be included; and
    d. The annual AAQCs for benzene and 1,3-butadiene should be included.

    Response: *Table 3-1 is updated based on the above mentioned comments.*

7. The following changes should be made to Table 3.2 *Background Concentrations* and Table 6.2 *Combined Effect of Modelled Effects and Background Air Concentrations*:

    a. 24 hour and annual SO_2 and NO_2 background, modelled and cumulative concentrations should be included for comparison against the 24 hour AAQCs and annual 2025 CAAQS;
    b. $PM_{2.5}$ annual background and cumulative concentrations should be included for comparison against 2020 annual CAAQS;
    c. PM_{10} & TSP 24 hour background, modelled and cumulative concentrations should be included for comparison against the 24 hour AAQCs. These concentrations are typically estimated from $PM_{2.5}$ measurements by applying a ratio of $PM_{2.5}/PM_{10} = 0.54$ (Lall et. all, 2004);
    d. Annual background, modelled and cumulative concentrations for benzene and 1,3- butadiene should be included for comparison against annual AAQCs;
    e. Background and cumulative concentrations for formaldehyde, acetaldehyde and acrolein should be included for all averaging periods for which there is an AAQC. NAPS stations including Newmarket, Etobicoke North, Etobicoke South and Windsor are often used for this background data.

    Response: *Tables 3-2, and 6-2 are updated based on the above mentioned comments.*

8. Eight-hour NO_2 and SO_2 concentrations should be removed from Tables 6.1 and 6.2 since the ministry does not have eight-hour average guidelines for these contaminants.

    Response: *Tables 6.1 and 6.2 are revised accordingly.*

9. The AQA Report should clarify what is meant by a "Tier 1 approach" mentioned in section 5.0 Dispersion Modelling.

    Response: *In Tier 1 approach, only one hour (peak hour) of ETS data (Emissions, Traffic and Signalization) are input into the CAL3QHCR model.*

10. The AQA Report should clarify the scale of the study area that was modelled. Typically a distance of between 300 m and 500 m is assessed on either side of the roadway.

    Response: *The AQA report assessed the impacts of the roadway widening at nearby sensitive receptors (residential). Residences are located within 20m – 40m each side of the Mississauga Road in the study area, considering that further away located receptors will experience less impacts from the type of sources of air emissions under assessment.*

    In future assessments the study area will be increased for completeness, but it will not likely change the findings of the report.

11. The AQA Report did not discuss potential impacts during construction in relation to air quality. During construction, please apply best management practices to mitigate any air quality impacts caused by construction dust. Please note that the ministry recommends that non-chloride dust suppressants be applied.

    For a comprehensive list of fugitive dust prevention and control measures, please refer to Cheminfo Services Inc. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities. Report prepared for Environment Canada. March 2005.

    Response: *BMP will be developed to manage fugitive dust emissions from the construction phase of the project. Environment Canada and Climate Change (ECCC) and Ministry of the Environment, Conservation and Parks (MECP) guidelines will be followed for mitigation techniques of dust.*

Surface Water Comments

1. It is recommended that the Addendum include a description of the current status of the project, indicating whether the originally proposed road project/stormwater management and the residential/subdivision stormwater facilities/ponds (H3/W1) have been constructed, and weather any performance review was or will be conducted for these stormwater ponds. In addition, for the stormwater requirement analysis, it is recommended that the project baseline be set at the pre-development condition rather than the existing condition, since this is an addendum to the original Class EA.

   Response: *The details regarding the existing conditions of the study area, including existing stormwater management (SWM) infrastructure, are outlined in Section 2.0. Details pertaining to SWM Facilities W1 & H3 can be found in Section 2.1. It is unknown if a performance review was or will be completed for these SWM Facilities. It should be noted that these SWM Facilities are under the ownership of either the land developer or the City of Brampton. It is understood that a performance assessment would be the responsibility of the SWM Facility owner.*

   Please note that a pre-development condition was assessed for lands within the study area draining to Culvert C4 (ref. Section 2.4 of the EA Addendum SWM Report). A pre-development condition was not assessed for lands draining to SWM Facilities W1 & H3 as this was addressed by the SWM reports prepared for the respective SWM Facilities. Sections 4.1, 6.2 and 6.3 of the EA Addendum SWM Report outline that the future conditions drainage areas/impervious coverages do not exceed the amounts accounted for in the detailed design of the SWM Facilities, and as such, no further assessment is considered warranted.

2. It is acknowledged that the "Enhanced Level" of water quality protection has been adopted in the stormwater management plan. Based on the Stormwater Management Report (SWM Report), infiltration trenches will be installed to treat the increased stormwater runoff. The infiltration trenches will be designed to infiltrate the runoff volume generated from 27 mm storm event. In general, MECP has no concerns to apply Low Impact Development (LID) BMPs to treat the stormwater for this project. However, as the detailed design of the infiltration trenches has not been started, how to effectively use the proposed LID BMPs to achieve the enhanced water quality protection level is still unknown. It is recommended that further MECP review be required during the detailed design when all details about the preferred stormwater management plan are finalized.

   The SWM Report also recommended that part of the increased stormwater be directed into the residential/subdivision stormwater ponds, which based on the SWM Report, were designed to receive the stormwater from the proposed road section. In this regard, the originally proposed stormwater pond designs and their service areas should be more clearly described in the SWM Report.

Response: *The preliminary quality control solution is outlined within the SWM report (Appendix E of the ESR). A rather intensive investigation was completed to determine the suitability of the recommended LID BMPs, including review of; soil types and groundwater levels (ref. Section 2.3), geometric constraints based on available right-of-way space, and volumetric sizing completed in PCSWMM (ref. Section 6.0). The volumetric sizing completed in PCSWMM demonstrated that the LID BMPs can be sufficiently sized to capture and infiltrate the runoff volume from the 27 mm storm event. PCSWMM modelling can be made available for review if required.*

It is understood that the MECP will require soil infiltration rates to be confirmed within the areas of the proposed infiltration trenches, prior to providing an Environmental Compliance Approval (ECA). It should be noted that the infiltration rate testing will be completed at the detailed design stage as part of other geotechnical works. The infiltration rates will be used to ensure that the LID BMPs can be effectively used to achieve the required level of water quality protection. The locations and the configuration of the proposed infiltrations trenches can be adjusted and refined based on the soil infiltration rates determined within the detailed design process. Also, an ECA application will be submitted at the detailed design stage, which would include documentation of how the design of the infiltration trenches has incorporated the determined infiltration rates determined by the geotechnical assessment.

Sections 1.2.1 and 2.1 of the EA Addendum SWM Report outline details of the service areas for SWM Facilities W1 and H3. Drainage areas to the SWM facilities are also represented on the report figures. If additional details pertaining to the SWM Facilities are required, we recommend reviewing Certificate of Approval 6664-7GCQHL and Amended Certificate of Approval 3636-7UNP62.

3. The SWM Report concludes that the proposed stormwater management plan is able to achieve the target peak flow rates under designed 2-100 year storm events based on the modeling results. Given that a) the groundwater table is unusually high in the project area and would be further raised during a large storm event; and b) the permeable soil may become fully saturated during a large storm event, the designed infiltration/percolation rates can be significantly reduced under these scenarios. The reviewer needs to know how the model was used to simulate the infiltration trench performance to validate the conclusion. For the purpose of LID design, it is recommended that during the detailed design, a performance assessment/monitoring plan be included to verify that the proposed LID is able to capture/infiltrate the required runoff volumes.

   Response: *As outlined in the EA Addendum SWM Report, the SWM assessment was completed using PCSWMM. The infiltration trenches were incorporated into the PCSWMM model as storage elements representing the preliminary storage volumes physically provided by the infiltration trenches. Exfiltration into subsurface soils was not accounted for in the PCSWMM model, which is considered to be conservative. At the detailed design stage, a more detailed assessment of the infiltration rates and infiltration trench design will be completed. A performance assessment/monitoring plan will also be completed at this time.*

4. It is noted that the Credit River and its tributaries may support Redside Dace fish species. There is a concern regarding increased dissolved road salts entering the Credit River and its tributaries through the river crossing/bridge or sewer system as the road widening implies an increase in salt load during snowmelt seasons. The Addendum should review the current practice on road salt management in the project area and evaluate/discuss the potential impacts on the watercourses and fish habitats from the salt load.

Response: Environment Canada has produced a document titled "Five-year Review of Progress: Code of Practice for the Environmental Management of Road Salts (EC, 2012) which reviews the progress achieved in reducing salt use. The *Code of Practice for the Environmental Management of Road* Salts (EC, 2004) was developed to provide 'Best Practices' to help minimize its use. Environment Canada is continuing studies to reduce the amount of salt used. Region of Peel records since 2011 – 2018 list the amount of salt used has ranged from 11.09 tonnes /1 km lane to 28.60 tonnes / 1km lane, with an average weight of 14.8 tonnes/1km lane of salt per year. The roadway work for this project has provided two additional lanes.

Studies have shown that chloride concentrations continue to surpass levels that are harmful to aquatic organisms, especially in urban areas. Chloride does not degrade after application and will continue to migrate through surface and ground water, however, studies have also shown that reducing salt does lead to significantly less chloride in the soil and groundwater.

Most research for the toxicology of chloride impacts is based on aquatic ecosystems including streams, lakes and rivers, and has been studied since the 1960 and 1970's (EC, 2012). Salt can effect fish, invertebrates, and amphibians, and effect the species survival, growth and reproduction (ES, 2018) Studies have indicated chloride concentrations of less than 230 mg/l posed negligible risks to most aquatic organisms over a long term exposure of four days or less, while concentrations of 860 mg/l posed negligible risk to organisms in exposures of one hour or less (EC. 2012, ES, 2018). Natural background concentrations typically range from 1-10 mg/l (ES, 2018,). Some streams in Toronto which have had decades of salt use can have concentrations exceeding 1000 mg/l.

EC, 2012. Five-year Review of Progress: Code of Practice for the Environmental Management of Road Salts. Environment Canada, March 31, 2012. ISBN: 978-1-100-19681-7

ES. 2018. Environmental Services, New Hampshire Development of Environmental Services. Environmental, Health and Economic Impacts of Road Salt.

https://www.des.nh.gov/organization/divisions/water/wmb/was/salt-reduction-initiative/impacts.htm. 2018

The Region of Peel Council Endorsed Level of Service for winter operations on Regional Roads.

> *Level of Service*
>
> *Immediate after becoming aware of snow accumulation of 2.5 cm depth response. 4 hour route cycle time. Bare pavement* achieved within 4 hours after the end of precipitation.*
>
> **Bare pavement means in winter conditions, the pavement surface is maintained as bare as possible throughout winter precipitation event and returning pavement to bare condition within 4 hours once the precipitation has stopped. Peel aims to proactively achieve a bare pavement by utilizing anti-icing technique, monitoring weather conditions and use the snow fencing in areas of drifting snow.*

The Region of Peel developed its Salt Management Plan that established a framework for winter maintenance operations for salt storage, application of salts on roads, and disposal of snow containing road salts which may release salt to the environment. The Plan which recommends practices and outlines initiatives that can be adopted by the Region and each one plays a role in best practices for salt control. Efficiently using and handling salt "the right amount of material, at the right time, in the right place".

5. Please be advised that during construction, a Permit to Take Water (PTTW) for dewatering is required for taking/pumping water in excess of 400,000 litres per day. A guideline document and the Permit to Take Water application package can be downloaded directly from the MECP website. If the construction includes the discharge of any collected water from the dewatering activities into a surface watercourse, or a stormwater sewer that directly discharges into a surface watercourse, appropriate treatment and control/mitigation measures shall be provided to ensure that the proposed discharge will not result in any adverse impacts on the receiving waters. In such a case, further detailed review of the construction monitoring and mitigation plan by MECP will be required during the PTTW application process, when all the

detailed information, including the dewatering and discharge plan, and the monitoring, contingency, and erosion and sediment control plans developed for the proposed construction, becomes available. In addition, MECP emphasizes that every measure should be considered to prevent any contaminants from entering the watercourses both during and after construction.

Response: *Should a permit-to-take-water be required, it will be properly obtained at the detailed design stage*

General Comments

1. 1. The title of the draft Addendum reads "DRAFT ADDENDUM to the Class Environmental Assessment for the 2 to 4 lane widening on Mississauga Road from Queen Street West to Bovaird Drive East". This should be changed to "…Bovaird Drive West".

   Response: *This is revised.*

2. Please include a Table of Contents in the final Addendum report.

   Response: *This is included.*

3. Section 5.2 of the draft Addendum entitled Indigenous Consultation indicates that the Haudenosaunee Development Institute (HDI) wanted to meet to discuss the project, and have environmental field monitors present during field investigations, but several attempts to meet were unsuccessful. Please elaborate on this to identify why meeting attempts were unsuccessful and whether consultation efforts with HDI are ongoing.

   Response: In a separate email, you were provided a complete timeline between February 26, 2016 and January 24, 2017 of the engagement efforts by phone / email that occurred between the Region (and its consultant, Wood) and HDI. Meetings were arranged with HDI and cancelled by HDI as identified below; HDI informed Wood they would identify other meeting dates, but no dates were shared. The Region, through its consultant, continued to communicate with HDI in good faith towards reaching agreement for HDI to participate in field activities. No agreement was finalized. Notice of Completion and Letter will be mailed out on January 7, 2019.

   The following has been added to the Addendum report:

   *"**Follow-up consultation – March 30, 2016 to January 2019**: Continued correspondence to HDI was issued throughout the study. A letter and Notice of Filing Addendum was mailed to HDI in January 2019."*

4. Section 4.1 of the draft Addendum entitled Summary of the Potential Effects and Recommended Mitigation Measures indicates that there is some concern regarding the protection of Redside Dace and their habitat in the project area. Please include in this section a description of the mitigation measures for this species and its protected habitat that are found in Appendix B.

   Response: Specific mitigation measures have been developed to minimize and/or avoid significant short-term and long-term adverse environmental effects on fish and fish habitat. Principal mitigation measures for construction activities in or near to a watercourse include:

   - Prior to commencement of works, design and implement standard Erosion and Sediment Control (ESC) measures, consistent with Ontario Provincial Standards and Specifications (OPSS) and maintained ESC measures through all phases of the Project until vegetation is re-established, all disturbed ground is permanently stabilized. The ESC measures should be installed and meet the following requirements:

- Installation of silt fencing consisting of geotextile and wooden stakes. Fencing is installed such that a minimum of 600 mm of geotextile is above ground and a minimum of 300 mm is buried;
- Dewatering stations shall be located a minimum of 30 m from the channel edge in a vegetated area;
- Note that more stringent measures, e.g., double-row non-woven, wire-backed silt fencing and the installation of staked straw bales between the silt fences, may be necessary adjacent to drainage feature C1 to prevent silt from entering downstream Redside Dace habitat;
- All ESC measures should be inspected at least weekly and during and immediately following rainfall events to ensure that they are functioning properly and are maintained and/or upgraded as required. If the sediment and erosion control measures are not functioning properly, no further work would occur until the sediment and/or erosion problem is addressed.
- The ESC silt fencing should be installed around the Project footprint, allowing vehicle and construction staff access to the Project footprint only at designated areas.

Additional ESC measures relative to mitigating impacts of the aquatic ecosystem include:

- Soil sediment and other impurities must be prevented from entering the watercourse located immediately downstream of the site.
- Stockpiles and embankments are to be protected whenever there is potential for soil erosion to impact to the river.

- All materials and equipment used for the purpose of site preparation and Project construction should be operated and stored in a manner that prevents any deleterious substance (e.g., petroleum products, silt, etc.) from entering the watercourses present on site:
  - Any stockpiled materials should be stored and stabilized at least 30 m away from the drainages.
  - Refuelling and maintenance of construction equipment should occur a minimum of 30 m from the drainage features draining into a watercourse.
  - Any part of equipment entering the water would be free of fluid leaks and externally cleaned / degreased to prevent any deleterious substance from entering the watercourse.
  - Only clean material, free of fine particulate matter would be placed in the water.

- A protocol to minimize spills/leaks and their impact to the environment should be provided in the Emergency Response Plan. Routine inspection of the Project construction site should be conducted to ensure continued use and function of best management practices, mitigation measures and spill control and prevention measures. As appropriate, spills should be reported to the MOECC Spills Action Centre;
  - Scheduling work within drainage ditches to avoid wet, windy and rainy periods that may increase erosion and sedimentation.

- Materials such as sand bags, straw bales, geotextile filters, and/or pumps should be readily available on-site in case of unexpected stream flow during construction activities;

- Staging of the Project should limit vegetation disturbance and minimize the amount of time disturbed soil is exposed;

- Temporarily store, handle and dispose of all materials used or generated (e.g., organics, soils, construction waste and debris, etc.) during site preparation, construction, and clean-up in a manner that prevents their entry to the watercourse located downstream of the site;

- Concrete wash water must never be released into a watercourse, catch basin, ditch, or any other part of a land drainage system. Mitigation measures should include:
    - o Wash-out facilities should be available on site, with waterproof lining to prevent soil and groundwater contamination. These wash-out facilities should be situated away from watercourses or drains;
    - o Liquid and solid concrete waste is disposed of lawfully using licensed haulers and licensed receiving facilities; and
- Land drainage systems, whether naturally occurring or man-made are not to be used as receptors for any substance or material other than clean water complying with local municipal bylaws or storm water as intended.

Offset protection is already provided adjacent to Huttonville Creek in the reach that runs parallel to Mississauga Road and is ongoing construction in 2016/2017. A slope retention structure was designed and constructed on the east slope of Mississauga Road during the 2016 to 2018 roadway construction works. Significant impacts to aquatic habitat in the vicinity of Mississauga Road are not anticipated as a result of scheduled project works. There is potential for localized changes in hydrology and water quality due to the increase in impervious surfaces; however, mitigation measures and best management practices are expected to prevent these changes from impacting aquatic habitat.

Should you have any questions or require additional information, please feel free to contact the undersigned.

Yours truly,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Per: Matthew Britton, E.I.T.
Water Resources E.I.T.

Per: Steve Chipps, P.Eng.
Senior Engineer, Water Resources

Per: Akhter Iqbal, P.Eng.
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