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Appendix S

Air Quality Impact Assessment Report

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Air Quality Impact Assessment Report Warden Avenue and Kennedy Road Environmental Assessment Between Major Mackenzie Drive and Elgin Mills Road

Regional Municipality of York

Air Quality Impact Assessment Report Warden Avenue and Kennedy Road Environmental Assessment Between Major Mackenzie Drive and Elgin Mills Road

Regional Municipality of York

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R.J. Burnside & Associates Limited

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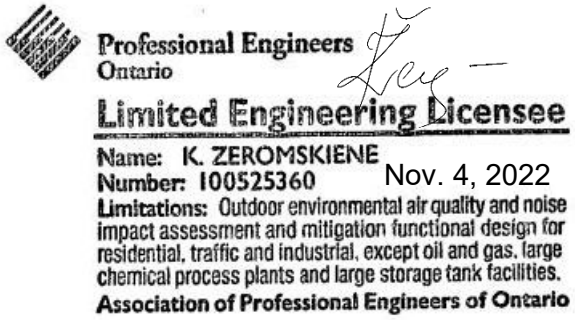

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Executive Summary

R.J. Burnside & Associates Limited has been retained by the Regional Municipality of York (York Region) to provide air quality impact assessment services in support of the Municipal Class Environmental Assessment (MCEA) Studies for the proposed improvements to Warden Avenue and Kennedy Road from Major Mackenzie Drive to Elgin Mills Road. This Air Quality Impact Assessment (AQIA) was completed as part of the MCEA Study in order to understand the impacts of the proposed road improvements on local air quality.

Based on the forecasted 2041 traffic volumes, future predicted air quality levels with and without road improvements were compared to the existing air quality levels to understand the impact of proposed improvements on local air quality. Typical contaminants from automobile exhaust were evaluated including Particulate Matter ($PM_{2.5}$ and PM_{10}), Total Suspended Particulates (TSP), Nitrogen Dioxide (NO_2), Carbon Monoxide (CO), 1,3-Butadiene, Benzene, Acrolein, Acetaldehyde, and Formaldehyde.

Air quality modelling was performed for the above contaminants for current and two future scenarios. The current scenario results show the current impact of the local roads on selected sensitive receptors. The Future No Build scenario shows emissions due to traffic in the vicinity of the Study Area in the future (2041) without the proposed road improvements. The Future Build scenario shows future (2041) emissions with the proposed road improvements. The impacts were assessed on 0.5-hour, 1-hour, 8-hour, 24-hour, and annual basis. Modelled impacts from the local roads were added to the background measurements recorded by the Ministry of Environment, Conservation and Parks (MECP) for all three scenarios in order to understand the total cumulative effects of the proposed road improvements on local air quality.

The future predicted air quality levels at sensitive receptor locations (residential properties and the Angus Glen Montessori School) with and without the proposed undertaking were below the MECP criteria; therefore, no negative impact is expected due to the proposed project.

A potential Greenhouse Gas emission effect from the proposed road improvement was determined to be insignificant on a regional scale. The total annual emissions are expected to be well below 0.01% of the provincial levels. Similarly, the local impact is negligible.

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Glossary of Terms and Acronyms

AAQC	Ambient Air Quality Criteria
AADT	Annual Average Daily Traffic
AQIA	Air Quality Impact Assessment
CAL3QHCR	Air Dispersion Model for Predicting Air Quality Impacts Near Roadways
Burnside	R.J. Burnside & Associates Limited
CAAQS	Canadian Ambient Air Quality Standards
CAC	Criteria Air Contaminant
CO	Carbon Monoxide
CO_2e	Carbon Dioxide equivalent
ECCC	Environmental and Climate Change Canada
EA	Environmental Assessment
GHG	Greenhouse Gas
MECP	Ministry of the Environment, Conservation, and Parks
MOVES	Motor Vehicle Emission Simulator
MTO	Ministry of Transportation
MTO Guide	Ministry of Transportation “Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects” (2012)
NAPS	National Air Pollution Surveillance
NO	Nitric Oxide
NO_2	Nitrogen Dioxide
NO_x	Nitrogen Oxides
O_3	Ozone
OTAQ	Office of Transportation and Air Quality
$PM_{2.5}$	Particulate Matter < 2.5 µm in diameter
PM_{10}	Particulate Matter < 10 µm in diameter
SO_2	Sulphur Dioxide
TSP	Total Suspended Particulate Matter
US EPA	United States Environmental Protection Agency
VOC	Volatile Organic Compounds
York Region	Regional Municipality of York

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1.0 Introduction

R.J. Burnside & Associates Limited has been retained by the Regional Municipality of York (York Region) to provide air quality impact assessment services in support of the Municipal Class Environmental Assessment (MCEA) Studies for the proposed improvements to Warden Avenue and Kennedy Road from Major Mackenzie Drive to Elgin Mills Road.

This Air Quality Impact Assessment (AQIA) was completed as part of the MCEA Study to understand the impacts of the proposed road improvements on local air quality.

1.1 Study Area

The Study Area is an approximately 2 km stretch of Warden Avenue from Major Mackenzie Drive to Elgin Mills Road and a similar 2 km stretch of Kennedy Road from Major Mackenzie Drive to Elgin Mills Road. The Study Area covers residential areas as well as natural features. The Study Area is illustrated in Figure 1.

Figure 1: Study Area

1.2 Sensitive Receptors

The air quality effects due to the Warden Avenue and Kennedy Road improvements were predicted at selected sensitive receptors. Sensitive receptors are described by the Ministry of Transportation (MTO) in their Guide "Environmental Guide for Assessing and Mitigating the Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects" (MTO Guide) (MTO, 2012) as:

- Residences;
- Hospitals;
- Retirement homes;
- Childcare centres;
- Similar institutional buildings (like schools).

There are residences on both west and east side of Warden Avenue and Kennedy Road. In addition, Angus Glen Montessori School is located southwest of the intersection of Kennedy Road and Major Mackenzie Drive. Four residential properties and the school were selected as representative sensitive receptors within the Study Area. All sensitive receptor locations are summarized in Table 1 and shown in Figure 2.

Table 1: Sensitive Receptor Locations

ID	Address	Easting	Northing	Receptor Description
R1	10726 Warden Avenue, Markham	632623	4863077	Residential Dwelling
R2	3 Heritage Hill Drive, Markham	632964	4861457	Residential Dwelling
R3	4478 Elgin Mills Road East, Markham	634549	4863882	Residential Dwelling
R4	4510 Elgin Mills Road East, Markham	634612	4863892	Residential Dwelling
R5	10000 Kennedy Road, Markham	634997	4861834	School

Receptors above were selected to represent the group of receptors closest to Warden Avenue and Kennedy Road. Angus Glen Montessori School was selected as a sensitive receptor R5.

Figure 2: Sensitive Receptors

1.3 Potential Pollutants

Transportation related contaminants are emitted due to fuel combustion, brake wear, tire wear, and road dust. According to MTO Guide, the Criteria Air Contaminants (CAC) and Volatile Organic Compounds (VOC) most relevant to transportation are:

- Carbon Monoxide (CO);
- Nitrogen Dioxide (NO_2);
- Total Suspended Particulate Matter (TSP);
- Particulate Matter 10 µm or less in diameter (PM_{10});
- Particulate Matter 2.5 µm or less in diameter ($PM_{2.5}$);
- Selected VOCs (benzene, 1,3-butadiene, formaldehyde, acetaldehyde, and acrolein).

CACs are the common pollutants found in ambient air associated with environmental effects such as smog and acid rain and cause a variety of health effects. They include total suspended particulate matter (TSP), sulphur dioxide (SO_2), nitrogen dioxide (NO_2), carbon monoxide (CO), and ozone (O_3). CACs come from a variety of sources and are mainly the products of fossil fuel combustion and industrial processes.

VOCs are compounds that have a high vapour pressure and can easily evaporate into the air. They occur naturally and are also produced by human activities such as cleaning, painting, etc. They are common indoors, where concentrations are typically higher than outdoors.

1.4 Greenhouse Gas

Greenhouse Gases (GHGs) contribute to climate change by trapping heat within the earth's atmosphere. The major gases include carbon dioxide, methane, and nitrous oxide, although there are many other gases that behave in a similar way. Burning of fossil fuels is the major source of GHGs.

A GHG impact assessment on a regional scale was completed as part of this AQIA. Total annual emissions were based on the annual vehicle kilometres travelled within the Study Area for the reference year 2041. Annual emissions were compared to the total provincial emissions due to transportation sector to estimate the magnitude of the effect of improvements. Provincial emissions were taken from the most recent Environment Canada National Inventory Report on Greenhouse Gases (Environment and Climate Change Canada, 2022-1 and 2022-2) for the 2020 calendar year.

2.0 Existing Ambient Air Quality Conditions

2.1 Climate

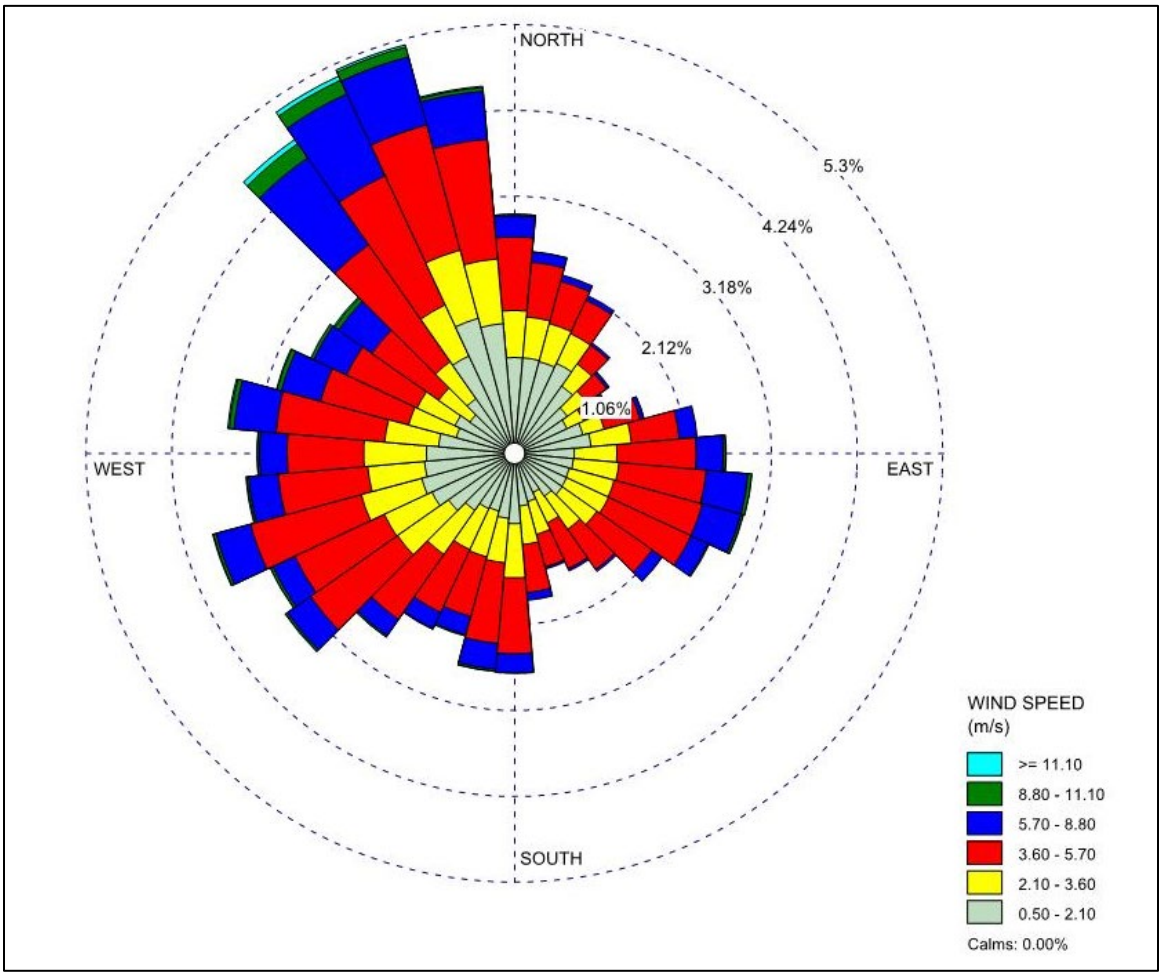
The nearest ambient air monitoring station in Markham was used to assess the climate in the vicinity of the Study Area. The Study Area is located within the City of Markham which has a humid continental climate characterized with warm and humid summers and cool winters. Local climate conditions were obtained from Environment and Climate Change Canada's (ECCC) Toronto Buttonville A meteorological station (Station ID 615HMAK, Latitude 43°51'44.000" N, Longitude 79°22'12.000" W, see Figure 4). According to the Canadian Climate Normals (calendar years 1981 to 2010) for this station, the mean annual temperature is estimated at 7.7°C. The warmest month of the year is July with an average temperature of 21.2°C and the coldest month is January with an average temperature of -5.8°C. The Toronto Buttonville A meteorological station recorded a total average annual precipitation (snow and rain) of 853 mm, 717 mm of which was rain. Precipitation is distributed throughout the year, with most of the rain occurring between April and November. The maximum mean monthly rainfall is 82.8 mm and occurs in June. Climate Normals for the Toronto Buttonville A station are summarized in Table 2.

Table 2: Toronto Buttonville A Meteorological Station Climate Normals (1981-2010)

Meteorological Parameter	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Daily Average Temperature (°C)	-5.8	-5.6	-0.4	6.7	13	18.6	21.2	20.2	15.7	8.9	3.1	-2.9	7.7
Daily Maximum Temperature (°C)	-1.5	-0.9	4.5	12.1	19.1	24.6	27.1	26	21.5	14.1	7.2	0.9	12.9
Daily Minimum Temperature (°C)	-10.1	-10.2	-5.3	1.2	6.8	12.6	15.2	14.3	9.9	3.6	-1.1	-6.8	2.5
Rainfall (mm)	26	22.9	33.6	66.7	79.5	82.8	78.8	76.2	81.8	66.7	68.3	34.2	717.4
Snowfall (cm)	38.9	29.9	19.3	7.5	0.1	0	0	0	0	0.6	12.1	34.2	142.6
Precipitation (mm)	62.1	50.5	53.2	74.1	79.6	82.8	79	76.2	81.8	68	80	65.7	852.9
Station Climate ID: 615HMAK; Latitude: 43°51'44.000" N, Longitude: 79°22'12.000" W Elevation: 198.10 m													
Source: https://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?searchType=stnProx&txtRadius=25&selCity=&selPark=&optProxType=custom&txtCentralLatDeg=43&txtCentralLatMin=54&txtCentralLatSec=6.67&txtCentralLongDeg=79&txtCentralLongMin=20&txtCentralLongSec=44.84&txtLatDecDeg=&txtLongDecDeg=&stnID=4841&dispBack=0													

The MECP provided the meteorological data set (Station ID 61584) used in this AQIA. This data set covers the 2016 to 2020 calendar years. Based on the provided data, the average wind speed at the station is 3.56 m/s. The dominant wind direction is from the northwest. A wind rose depicting the relative frequency of wind directions including wind speeds is provided in Figure 3. The meteorological data set was used in the dispersion model (CAL3QHCR) to predict the concentration levels at various places.

Figure 3: Wind Rose



2.2 Air Quality

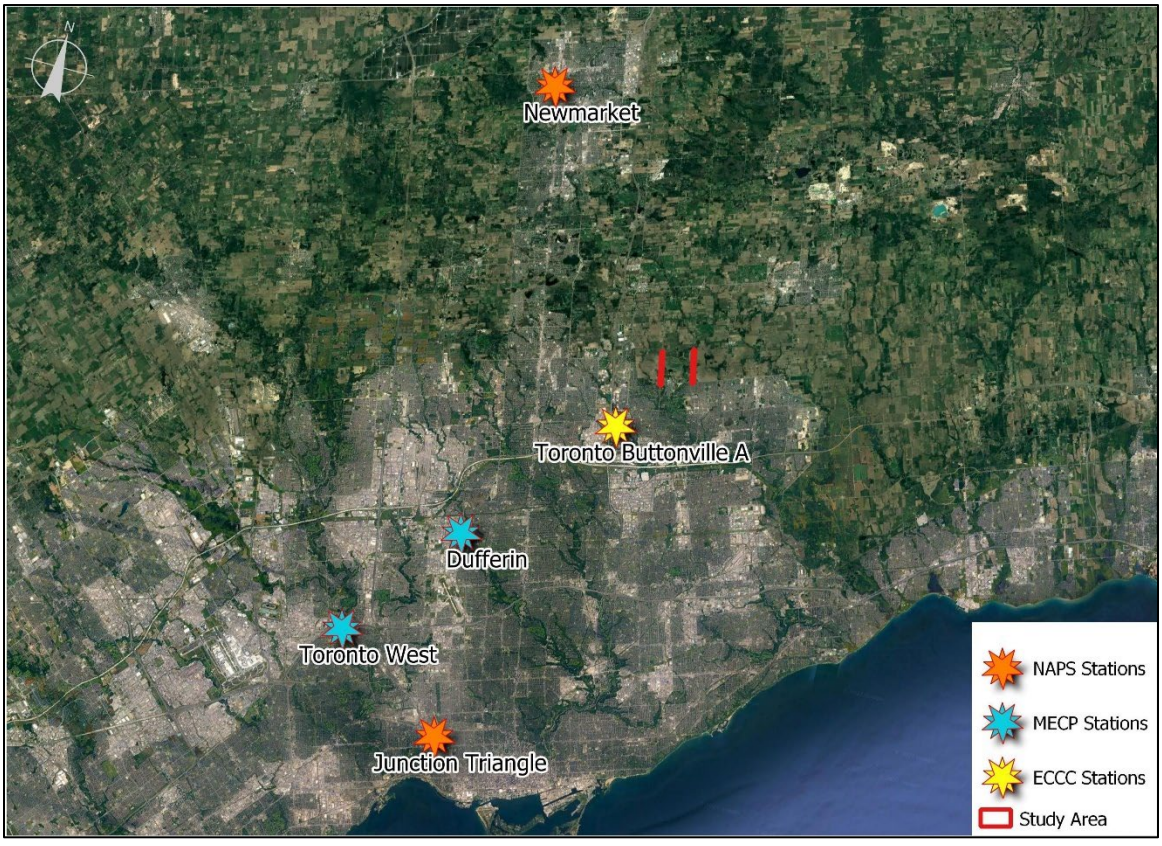
The MECP and National Air Pollution Surveillance (NAPS) stations in closest proximity to the Study Area were reviewed to ensure the most representative background concentration would be selected. Not all contaminant concentrations are available at every station; therefore, a total of four stations were selected to fully characterize the background concentrations in the vicinity of the Study Area. One MECP station was selected to represent $PM_{2.5}$, NO_2, and one was selected to represent CO. Two NAPS

stations were selected to represent background concentrations for 1,3-butadiene, benzene, acetaldehyde, acrolein, and formaldehyde. The stations and the most recent five years of data are summarized in Table 3. The locations of the selected stations are shown in Figure 4.

Table 3: Ambient Monitoring Stations Summary

Contaminant	Station ID	Station Location	Year
$PM_{2.5}$	MECP 34021	4905 Dufferin Street, Toronto, ON	2017-2021
NO_2	MECP 34021	4905 Dufferin Street, Toronto, ON	2017-2021
CO	MECP 35125	125 Resources Road, Toronto, ON	2017-2021
1,3-Butadiene	NAPS 65101	Eagle Street & McCaffrey Road, Newmarket, ON	2015-2019
Benzene	NAPS 65101	Eagle Street & McCaffrey Road, Newmarket, ON	2015-2019
Acetaldehyde	NAPS 60418	Toronto Perth/Ruskin (Junction Triangle)	2001-2005
Acrolein	NAPS 60418	Toronto Perth/Ruskin (Junction Triangle)	2001-2005
Formaldehyde	NAPS 60418	Toronto Perth/Ruskin (Junction Triangle)	2001-2005

Figure 4: MECP, NAPS, and ECCC Air Quality and Meteorological Stations



The ambient monitoring station nearest to the Study Area is located in Toronto, Dufferin station (ID 34021) (approximately 16 km) southwest of the proposed improvements. $PM_{2.5}$ and NO_2 background concentrations were taken from this station. CO concentrations were not available at the same station and were taken from the next closest station – Toronto West station (ID 35125). A summary of background concentrations 90th percentile[1], maximum and average values for all contaminants is provided in Table 4.

Table 4: Background Data Summary

Contaminant	CAS #	Averaging period	90th Percentile (µg/m^3)	Maximum (µg/m^3)	Average (µg/m^3)
CO	630-08-0	1-hr	389	1,775	272
		8-hr	361	673	273
NO_2	11104-93-1	1-hr	39.5	131.8	18.7
		24-hr	33.4	62.9	18.6
		Annual	n/a	10.6	9.9
$PM_{2.5}$	-	24-hr	12.6	34.0	7.1
		Annual	n/a	7.6	7.1
PM_{10}	-	24-hr	23.3	63.0	13.1
TS	-	24-hr	42.0	113.5	23.7
		Annual	n/a	25.3	23.7
1,3-Butadiene	106-99-0	24-hr	0.04	0.11	0.02
		Annual	n/a	0.03	0.02
Acetaldehyde	75-07-0	0.5-hr	n/a	n/a	n/a
		24-hr	3.30	5.58	1.95
Acrolein	107-02-8	1-hr	n/a	n/a	n/a
		24-hr	0.20	1.17	0.12
Benzene	71-43-2	24-hr	0.57	2.48	0.32
		Annual	n/a	0.43	0.32
Formaldehyde	50-00-0	24-hr	6.48	11.24	3.66

Notes:
-Acrolein concentrations are provided on a daily basis so hourly values cannot be determined.
-Five annual values are insufficient to calculate an annual 90th percentile value so the average value was used.
-PM_{10} concentrations based on $PM_{2.5}/PM_{10}$ ratio of 0.54 (Lall, 2004).
-TSP concentrations based on $PM_{2.5}$/TSP ratio of 0.30 (Lall, 2004).

Fine particulate matter is associated with major health effects compared to larger particles. Due to their small size, they can penetrate deep into lungs. MECP monitoring

[1] 90th percentile of monitoring data is typically considered a conservative estimate of background air quality. 90th percentile is the level below which 90% of all the observed values occur.

stations record only background concentrations of $PM_{2.5}$. Since PM_{10} and TSP Background concentrations were not available; values were calculated based on monitored $PM_{2.5}$ concentrations. Mean ratios of $PM_{2.5}/PM_{10}$=0.54±0.14, and $PM_{2.5}$/TSP=0.30±0.11 derived by Lall et al. (2004) were used to calculate 90th percentile, maximum and average concentrations of PM_{10} and TSP. This method is used throughout the province to predict PM_{10} and TSP concentrations when the only measured values are for $PM_{2.5}$. The MECP considers this method to be acceptable.

2.3 Air Quality Assessment Criteria

Ontario regulates contaminants released into the environment to limit and even reduce concentrations of harmful substances in the atmosphere and to protect the environment and human health. As a part of this regulation, the MECP has developed several sources of criteria as described below.

Ambient air criteria for contaminants associated with road traffic emissions were taken from Ontario's Ambient Air Quality Criteria (AAQC) developed by the MECP and is summarized in Table 5. According to the MECP "an AAQC is a desirable concentration of a contaminant in air, based on protection against adverse effects on health or the environment". The Canadian Ambient Air Quality Standards (CAAQS) were used for nitrogen dioxide and $PM_{2.5}$ criteria (CCME, 2021).

Table 5: Representative Contaminants and Air Quality Criteria

Contaminant	CAS #	Averaging Period	AAQC[1] (μg/m^3)	CAAQS 2020[2] (μg/m^3)	CAAQS 2025 (μg/m^3)	Limiting Effect
CO	630-08-0	1-hr	36,200			Heath
		8-hr	15,700			Heath
NO_2	10102-44-0	1-hr		113 (60 ppb)	79 (42 ppb)	Heath
		24-hr	200			Heath
		Annual		32 (17 ppb)	23 (12 ppb)	Heath
$PM_{2.5}$	-	24-hr		27		Heath
		Annual		8.8		Heath
PM_{10}	-	24-hr	50			Heath
TSP	-	24-hr	120			Visibility
		Annual	60			Visibility
1,3-Butadiene	106-99-0	24-hr	10			Health
		Annual	2			Health
Acetaldehyde	75-07-0	0.5-hr	500			Health
		24-hr	500			Health
Acrolein	107-02-8	1-hr	4.5			Health
		24-hr	0.4			Heath
Benzene	71-43-2	24-hr	2.3			Heath

Contaminant	CAS #	Averaging Period	AAQC[1] (μg/m^3)	CAAQS 2020[2] (μg/m^3)	CAAQS 2025 (μg/m^3)	Limiting Effect
		Annual	0.45			Heath
Formaldehyde	50-00-0	24-hr	65			Heath

Notes:

[1] AAQC – Ontario's Ambient Air Quality Criteria

[2] CAAQS – Canadian Ambient Air Quality Standards

NO_x is the sum of nitrogen dioxide (NO_2) and nitric oxide (NO). Emissions of NO_x consist mainly of NO; however, NO is converted to NO_2 in the ambient air. NO_2 has an adverse effect at much lower concentrations than NO according to Ontario's Ambient Air Quality Criteria publication. Therefore, the AAQC is based on the NO_2 concentration. As a conservative assumption for this assessment, it was assumed that all NO is converted to NO_2.

3.0 Local Air Quality Assessment

Transportation is one of the largest sources of air pollution in Canada according to Environment and Climate Change Canada (ECCC).

The exhaust from the vehicles due to fuel combustion contains pollutants that might be harmful to human health and the environment. The main contaminants include particulate matter, nitrogen oxides, and carbon monoxide. However, there are many more contaminants associated with transportation. The magnitude of the emissions and the predicted change of those emission due to proposed road improvements were also evaluated in this AQIA.

3.1 Methodology

Following the MTO Guide, three scenarios were assessed for Warden Avenue and Kennedy Road improvements, namely the Current, Future No Build, and Future Build scenarios. These scenarios provide the existing air quality levels and assess the future impact without the improvement and future impact with the improvements. These three scenarios are referred to as “Current”, “Future Build”, and “Future No Build”. The future date used in the assessment is 2041. The scenarios use the following information:

- Current Scenario:
  - Existing traffic volumes;
  - Warden Avenue and Kennedy Road without improvements.
- Future No Build (2041) Scenario:
  - Projected 2041 traffic volumes;
  - Warden Avenue and Kennedy Road without improvements.
- Future Build (2041) Scenario:
  - Projected 2041 traffic volumes;
  - Warden Avenue and Kennedy Road with improvements.

Ground level contaminant concentrations were predicted for all contaminants of interest for the three scenarios. Predicted values were added to the existing background concentrations. The resulting cumulative concentrations were compared to the applicable criteria and the magnitude of the impact of the proposed road improvements was determined.

For the future 2041 scenarios, background concentrations were assumed to remain the same. Based on data collected at the MECP ambient monitoring stations, concentrations of the key pollutants such as NO_2, $PM_{2.5}$, and some VOCs such as benzene, 1,3-butadiene decreased over the last 10 years between 22% and 55% (MECP, 2021). Assuming this trend will continue in the future, using current background values for the Future scenario is a conservative approach.

3.2 Emission Factors

Transportation related emissions are associated with fuel combustion, brake wear, tire wear, as well as re-suspended road dust.

Emission factors for fuel combustion, brake wear and tire wear were estimated using Motor Vehicle Emission Simulator (MOVES3) developed by the United States Environmental Protection Agency (US EPA) Office of Transportation and Air Quality (OTAQ) (US EPA, 2021). This emission modeling system estimates emissions for mobile sources covering a broad range of pollutants and conditions including the variety of vehicles (cars versus trucks), ambient temperature, and vehicle speed. The summary of emission factors is provided in Appendix A. Weighted emission factors were derived based on the speed limit and vehicle type distribution for each road segment.

MOVES3 does not provide an emission factor for TSP. An exhaust emission factor for PM_{10} was used for TSP as, according to the US EPA, based on emissions test results, more than 97% of tailpipe particulate matter is PM_{10} or less.

Particulate emissions due to re-suspended road dust was estimated using the US EPA methodology for paved roads (US EPA, 2011). As a result, the total emission factors for particulate matter were a sum of tail pipe and road dust emission factors.

3.3 Traffic

Existing traffic volumes were provided by York Region. Peak hours as well as annual average daily traffic (AADT) were used in the assessment.

There are four intersections controlled by traffic lights within the Study Area – Warden Avenue and Elgin Mills Road, Warden Avenue and Major MacKenzie Drive, Kennedy Road and Elgin Mills Road, Kennedy Road and Major MacKenzie Drive. Existing signal timings for all intersections were utilized.

3.4 Air Dispersion Modelling

Dispersion modelling to determine maximum pollutant concentration was completed in accordance with the MTO Guide. The modelled impacts of contaminant emissions are assessed as 1-hour, 8-hour, 24-hour, and annual concentrations to match the appropriate criteria.

The appropriate model to assess the maximum impact is the US EPA CAL3QHCR model. The CAL3QHCR model estimates ground level air pollutant concentrations near roads from both moving and idling vehicles (US EPA, 1995).

A site-specific meteorological data set was provided by the MECP for use with this AQIA. The CAL3QHCR ready meteorological data set covers the dates from January 1, 2016 to December 31, 2020.

The hourly data includes many factors, which affect the dispersion of air contaminants including wind speed, wind direction, temperature, mixing height, and stability category.

As explained in Section 1.2, five sensitive receptors were selected for this assessment to assess the impact on air quality along the length of the Study Area.

The model is developed to incorporate the area road network and associated characteristics such as road width, traffic volume, travel speed, etc. In addition, the model assumes idling during the red phase of the signal cycle.

3.5 Modelling Results

The impact of the proposed Warden Avenue and Kennedy Road improvements was assessed based on the predicted ground level concentrations at the selected sensitive receptors within the Study Area as shown in Figure 2 and existing background concentrations as monitored at MECP and NAPS stations.

Ground level concentrations at the sensitive receptors with the highest predicted levels are summarized for each contaminant and averaging period in Table 6 through Table 8 for Current, Future No Build, and Future Build scenarios. Detailed results are provided in Appendix C. The highest concentrations were predicted at the receptors R4 or R5. Receptor R4 is located closest to the intersection of Elgin Mills Road East and Kennedy Road and receptor R5 is located next to the intersection of Major MacKenzie Drive East and Kennedy Road.

The results are presented by contaminant and include background concentration (90^{th} percentile or average for annual concentrations), maximum predicted concentration, receptor at which the maximum concentration occurs and cumulative concentrations (background plus predicted concentration). The predicted and cumulative concentrations are compared against applicable criteria.

Table 6 shows the maximum impact of the current scenario on the worst-case receptors including the amount contributed by the roads and background levels. Table 7 shows the same information for the future scenario assuming that there will be no road improvements implemented (Future No Build). Table 8 shows the same information for the future scenario assuming that the Warden Avenue and Kennedy Road improvements are implemented (Future Build).

Table 6 through Table 8 show that the contribution from all the roads in the area including the proposed improvements is relatively small compared to the background values.

The cumulative concentrations predicted within the Study Area for all contaminants are below their applicable criteria. Annual benzene concentrations are closest to the applicable criteria at 95.8% as shown in Table 6 through Table 8.

The ambient annual concentration of benzene is 95.8% of the of the criterion by itself. The contribution of benzene concentrations due to the current traffic and the traffic based on the Future No Build and Future Build scenarios is a much smaller portion of the cumulative concentration and the difference between the Future No Build and Future Build Scenarios is negligible (less than 0.1%).

The elevated background benzene concentration is not isolated to the York Region area but observed across the Province of Ontario. Improvements to address benzene levels are being dealt with at a national and provincial level that in turn improves air quality at a local level. Local reductions have a limited effect. As a result, reducing benzene concentrations requires a provincial solution. According to Air Quality in Ontario 2019 Report (MECP, 2021), over the 10-year period from 2010 to 2019, benzene concentrations have decreased by 41%. A review of the National Pollutant Release Inventory (NPRI) data did not show any significant industrial/commercial operations emitting benzene in the vicinity of the Study Area.

Table 6: Maximum Predicted Concentrations – Current Scenario (2022, No Widening)

Contaminant	Averaging Period	Criteria (µg/m^3)	Background Concentration (µg /m^3)	Sensitive Receptor	Predicted Maximum Concentration (µg /m^3)	Predicted % of Criteria	Cumulative Concentration (µg /m^3)	Cumulative % of Criteria
CO	1-hr	36,200	389.30	R5	178.28	0.49%	567.58	1.6%
	8-hr	15,700	360.58	R5	150.14	0.96%	510.72	3.3%
NO_2	1-hr	79	39.48	R5	14.55	18.42%	54.03	68.4%
	24-hr	200	33.44	R5	8.49	4.24%	41.92	21.0%
	Annual	23	10.62	R5	3.45	15.01%	14.08	61.2%
$PM_{2.5}$	24-hr	27	12.60	R4	0.50	1.86%	13.10	48.5%
	Annual	8.8	7.58	R4	0.19	2.20%	7.77	88.3%
PM_{10}	24-hr	50	23.33	R4	2.24	4.47%	25.57	51.1%
TSP	24-hr	120	42.00	R4	7.63	6.36%	49.63	41.4%
	Annual	60	25.26	R4	2.85	4.74%	28.11	46.9%
1,3-Butadiene	24-hr	10	0.04	R4	0.001	0.01%	0.04	0.4%
	Annual	2.0	0.03	R4	0.000	0.02%	0.03	1.5%
Acetaldehyde	0.5-hr	500	3.30	R4	0.015	0.00%	3.31	0.7%
	24-hr	500	3.30	R4	0.006	0.00%	3.30	0.7%
Acrolein	1-hr	4.5	0.20	R4	0.000	0.01%	0.20	4.5%
	24-hr	0.4	0.20	R4	0.000	0.04%	0.20	51.1%
Benzene	24-hr	2.3	0.57	R4	0.015	0.65%	0.58	25.4%
	Annual	0.45	0.43	R4	0.005	1.22%	0.43	95.8%
Formaldehyde	24-hr	65	6.48	R4	0.008	0.01%	6.49	10.0%

Notes:
-90th percentile used as background concentrations for 1-hr, 8-hr, and 24-hr averaging periods.
-Average annual values use as background concentrations for annual averaging periods.
-24-hour 90th percentile used as background concentrations for acrolein 1-hr and acetaldehyde 0.5-hr averaging periods.

Table 7: Maximum Predicted Concentrations – Future No Build Scenario (2041, No Widening)

Contaminant	Averaging Period	Criteria (µg/m^3)	Background Concentration (µg /m^3)	Sensitive Receptor	Predicted Maximum Concentration (µg /m^3)	Predicted % of Criteria	Cumulative Concentration (µg /m^3)	Cumulative % of Criteria
CO	1-hr	36,200	389.30	R5	87.94	0.24%	477.24	1.3%
	8-hr	15,700	360.58	R5	75.35	0.48%	435.93	2.8%
NO_2	1-hr	79	39.48	R5	3.97	5.02%	43.45	55.0%
	24-hr	200	33.44	R5	2.29	1.14%	35.73	17.9%
	Annual	23	10.62	R5	0.91	3.94%	11.53	50.1%
$PM_{2.5}$	24-hr	27	12.60	R4	0.84	3.13%	13.44	49.8%
	Annual	8.8	7.58	R4	0.32	3.64%	7.90	89.8%
PM_{10}	24-hr	50	23.33	R4	4.00	8.00%	27.33	54.7%
TSP	24-hr	120	42.00	R4	13.94	11.62%	55.94	46.6%
	Annual	60	25.26	R4	5.22	8.71%	30.49	50.8%
1,3-Butadiene	24-hr	10	0.04	R5	0.000	0.00%	0.04	0.4%
	Annual	2.0	0.03	R5	0.000	0.01%	0.03	1.5%
Acetaldehyde	0.5-hr	500	3.30	R5	0.007	0.00%	3.30	0.7%
	24-hr	500	3.30	R5	0.003	0.00%	3.30	0.7%
Acrolein	1-hr	4.5	0.20	R5	0.000	0.01%	0.20	4.5%
	24-hr	0.4	0.20	R5	0.000	0.07%	0.20	51.1%
Benzene	24-hr	2.3	0.57	R5	0.014	0.60%	0.58	25.3%
	Annual	0.45	0.43	R5	0.006	1.23%	0.43	95.8%
Formaldehyde	24-hr	65	6.48	R5	0.005	0.01%	6.49	10.0%

Notes:

-90th percentile used as background concentrations for 1-hr, 8-hr, and 24-hr averaging periods.

-Average annual values use as background concentrations for annual averaging periods.

-24-hour 90th percentile used as background concentrations for acrolein 1-hr and acetaldehyde 0.5-hr averaging periods.

Table 8: Maximum Predicted Concentrations – Future Build Scenario (2041, Includes Widening)

Contaminant	Averaging Period	Criteria (µg/m^3)	Background Concentration (µg /m^3)	Sensitive Receptor	Predicted Maximum Concentration (µg /m^3)	Predicted % of Criteria	Cumulative Concentration (µg /m^3)	Cumulative % of Criteria
CO	1-hr	36,200	389.30	R5	87.94	0.24%	477.24	1.3%
	8-hr	15,700	360.58	R5	75.35	0.48%	435.93	2.8%
NO_2	1-hr	79	39.48	R5	3.97	5.03%	43.45	55.0%
	24-hr	200	33.44	R5	2.31	1.16%	35.75	17.9%
	Annual	23	10.62	R5	0.92	3.99%	11.54	50.2%
$PM_{2.5}$	24-hr	27	12.60	R4	0.86	3.18%	13.46	49.8%
	Annual	8.8	7.58	R4	0.33	3.74%	7.91	89.9%
PM_{10}	24-hr	50	23.33	R4	4.07	8.14%	27.40	54.8%
TSP	24-hr	120	42.00	R4	14.04	11.70%	56.04	46.7%
	Annual	60	25.26	R4	5.28	8.79%	30.54	50.9%
1,3-Butadiene	24-hr	10	0.04	R5	0.000	0.00%	0.04	0.4%
	Annual	2.0	0.03	R5	0.000	0.01%	0.03	1.5%
Acetaldehyde	0.5-hr	500	3.30	R5	0.007	0.00%	3.30	0.7%
	24-hr	500	3.30	R5	0.003	0.00%	3.30	0.7%
Acrolein	1-hr	4.5	0.20	R5	0.001	0.01%	0.20	4.5%
	24-hr	0.4	0.20	R5	0.000	0.07%	0.20	51.1%
Benzene	24-hr	2.3	0.57	R5	0.014	0.59%	0.58	25.3%
	Annual	0.45	0.43	R5	0.005	1.21%	0.43	95.8%
Formaldehyde	24-hr	65	6.48	R5	0.005	0.01%	6.49	10.0%

Notes:
-90th percentile used as background concentrations for 1-hr, 8-hr, and 24-hr averaging periods.
-Average annual values use as background concentrations for annual averaging periods.
-24-hour 90th percentile used as background concentrations for acrolein 1-hr and acetaldehyde 0.5-hr averaging periods.

The maximum annual $PM_{2.5}$ concentrations are predicted to be 88.3% to 89.9% of the criteria. The annual average background concentration for $PM_{2.5}$ is at 86.1% of the criterion. Since the prediction of the annual $PM_{2.5}$ concentration is the result of adding the average background value to the maximum modelled value, the contribution of $PM_{2.5}$ contaminants due the traffic in the Study Area is a small fraction of the cumulative concentration (less than 4%).

According to Air Quality in Ontario 2019 Report (MECP, 2021), fine particulate matter decreased 20% from 2010 to 2019. Considering the general trend in Ontario, average annual background concentrations, and the small contribution due to the roads within the Study Area, it is reasonable to expect that cumulative $PM_{2.5}$ concentrations will remain below their annual criteria within the Study Area in the future.

Table 9 shows a comparison of all the impacts for all three assessed scenarios – Current, Future No Build, and Future Build. The results show an overall small increase at all receptors for the Future Build scenario over the Future No Build scenario. Considering the change is well below 1% for all contaminants, the impact of the proposed road improvement can be considered negligible.

Table 9: Comparison of Impact from Three Scenarios

Contaminant	Averaging Period	Criteria (µg/m^3)	Current Cumulative Concentration (µg /m^3)	Future No Build Cumulative Concentration (µg /m^3)	Future Build Cumulative Concentration (µg/m^3)	Current % of Criterion (Cumulative)	Future No Build % of Criterion (Cumulative)	Future Build % of Criterion (Cumulative)	Increase in Cumulative Impact % of Criterion from Future Build over No Build
CO	1-hr	36,200	567.58	477.24	477.24	1.6%	1.3%	1.3%	0.0%
	8-hr	15,700	510.72	435.93	435.93	3.3%	2.8%	2.8%	0.0%
NO_2	1-hr	79	54.03	43.45	43.45	68.4%	55.0%	55.0%	0.0%
	24-hr	200	41.92	35.73	35.75	21.0%	17.9%	17.9%	0.1%
	Annual	23	14.08	11.53	11.54	61.2%	50.1%	50.2%	0.1%
$PM_{2.5}$	24-hr	27	13.10	13.44	13.46	48.5%	49.8%	49.8%	0.1%
	Annual	8.8	7.77	7.90	7.91	88.3%	89.8%	89.9%	0.1%
PM_{10}	24-hr	50	25.57	27.33	27.40	51.1%	54.7%	54.8%	0.3%
TSP	24-hr	120	49.63	55.94	56.04	41.4%	46.6%	46.7%	0.2%
	Annual	60	28.11	30.49	30.54	46.9%	50.8%	50.9%	0.2%
1,3-Butadiene	24-hr	10	0.04	0.04	0.04	0.4%	0.4%	0.4%	0.0%
	Annual	2.0	0.03	0.03	0.03	1.5%	1.5%	1.5%	0.0%
Acetaldehyde	0.5-hr	500	3.31	3.30	3.30	0.7%	0.7%	0.7%	0.0%
	24-hr	500	3.30	3.30	3.30	0.7%	0.7%	0.7%	0.0%
Acrolein	1-hr	4.5	0.20	0.20	0.20	4.5%	4.5%	4.5%	0.0%
	24-hr	0.4	0.20	0.20	0.20	51.1%	51.1%	51.1%	0.0%
Benzene	24-hr	2.3	0.58	0.58	0.58	25.4%	25.3%	25.3%	0.0%
	Annual	0.45	0.43	0.43	0.43	95.8%	95.8%	95.8%	0.0%
Formaldehyde	24-hr	65	6.49	6.49	6.49	10.0%	10.0%	10.0%	0.0%

4.0 Regional Air Quality Assessment

The assessment of emission impacts associated with the proposed Warden Avenue and Kennedy Road improvement on a regional scale was based on the annual GHG emissions. Annual emissions were calculated using emission factors summarized in Table 10.

Table 10: Emission Factors for Energy Mobile Combustion Sources

Vehicles	Emission Factors (g/L fuel)		
	CO_2	CH_4	N_2O
Gasoline	2,316	0.33	0.28
Diesel	2,690	0.10	0.15

Source:
National Inventory Report 1990-2018: Greenhouse Gas Sources and Sinks in Canada. Part 2 Table A6.1-13: Emission Factors for Energy Mobile Combustion Sources.

Typical vehicle fuel consumption was taken from the Summary Report of Canadian Vehicle Survey (Natural Resources Canada, 2009). Auto manufacturers are continuously looking for ways to improve their vehicle fuel efficiency; therefore, the actual emissions for both current and future scenarios are expected to be even lower than the calculated 2009 fuel consumption. An average light vehicle (gasoline) was assumed to consume 10.7 L/100 km. An average truck (diesel) was assumed to consume 28.9 L/100 km. Based on AADT and length of segment of each road within the Study Area; total kilometers travelled were estimated to calculate GHG emissions. Annual expected GHG emissions for existing and future conditions are summarized in Table 11. Annual concentrations for all GHGs including total CO_2 equivalent, are estimated to be well below 0.01% of the provincial GHG levels associated with road transportation sector. Therefore, the impact of the proposed road improvement on GHG emissions is negligible.

Table 11: Annual GHG Emissions within the Study Area

Contaminant	Annual Emissions (Tonnes/Year)							Annual Emissions (Percentage of Provincial)		
	Current Scenario	Future No Build	Increase from Current to Future No Build	Future Scenario Build	Increase from Current to Future Build	Increase from No Build to Build	Total Provincial[2]	Current Scenario	Future No Build Scenario	Future Build Scenario
CO_2	142.294	209.716	67.422	209.716	67.422	0.000	50,900,000	<0.01%	<0.01%	<0.01%
CH_4	0.019	0.028	0.009	0.028	0.009	0.000	10,000	<0.01%	<0.01%	<0.01%
N_2O	0.016	0.024	0.008	0.024	0.008	0.000	4,000	<0.01%	<0.01%	<0.01%
Total CO2e	**147.590**	**217.509**	**69.919**	**217.509**	**69.919**	**0.000**	**52,200,000**	**<0.01%**	**<0.01%**	**<0.01%**

Detailed GHG calculations for both scenarios are provided in Appendix D.

[2] National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada. Part 3, Table A11-13: 2020 GHG Emissions Summary for Ontario.

5.0 Conclusions

The results of the dispersion modelling show that the predicted air quality levels at sensitive receptor locations (residential properties and the school) for all scenarios expected to be below the MECP criteria.

The local Air Quality Impact Assessment shows that change in concentration of all the considered contaminants between Future No Build and Future Build scenarios at any location in the Study Area is negligible.

The selected sensitive receptors were chosen to represent all the receptors in the vicinity of the Study Area. All other receptors are expected to experience the same or smaller air quality impact.

The impact of the proposed road improvement on GHG emissions within Study Area was determined to be negligible as annual concentrations for all GHGs are estimated to be well below 0.01% of the provincial GHG levels associated with road transportation sector.

Potential air quality effects associated with the construction stage is expected to be temporary and localized to the surrounding area. It is recommended to monitor dust levels during the construction stage and apply mitigation measures, such as water application, if needed to reduce the effect on surrounding residences.

6.0 References

Canadian Council of Ministers of the Environment. Canada's Air. https://ccme.ca/en/air-quality-report. (CCME, 2021).

Environment and Climate Change Canada. National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada. Part 2. 2022. (Environment and Climate Change Canada, 2022-1).

Environment and Climate Change Canada. National Inventory Report 1990-2020: Greenhouse Gas Sources and Sinks in Canada. Part 3. 2022. (Environment and Climate Change Canada, 2022-2).

Lall R., Kendall M., Ito K., Thurston G.D. Estimation of Historical Annual PM2.5 Exposures for Health Effects Assessment. Atmospheric Environment, Vol. 38, Issue 31. 2004. (Lall, 2004).

Ministry of Environment, Conservation and Parks. Air Quality in Ontario 2019 Report. 2021. (MECP, 2021).

Ministry of the Environment and Climate Change. Air Quality Impact Assessment Guidance for Schedule C Road Improvements Class EAs.

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

Natural Resources Canada. Summary Report of Canadian Vehicle Survey. 2009. (Natural Resources Canada, 2009).

US Environmental Protection Agency. Overview of EPA's MOtor Vehicle Emission Simulator (MOVES3). 2021. (US EPA, 2021).

US Environmental Protection Agency. AP 42, Compilation of Air Pollutant Emission Factors, Volume 1: Stationary Point and Area Sources. Chapter 13: Miscellaneous Sources. Section 13.2.1 Paved Roads. (US EPA, 2011).

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Appendix A

Traffic Volumes

Table A 1: Current and Future Traffic Volumes

Road Description				Scenario			
				Current		Future	
Road	Posted Speed (km/h)	Percent Cars (%)	Percent Large Vehicles (%)	Peak Hour (vph)	Daily Traffic (vpd)	Peak Hour (vph)	Daily Traffic (vpd)
Elgin Mills Rd E	60	98%	2%	1,105	11,050	2,088	20,890
Warden Ave - N of Heritage Hill	80	95%	5%	1,341	11,650	2,359	21,590
Warden Ave - S of Heritage Hill	60	95%	5%	1,278	12,427	2,045	21,590
Major Mackenzie Dr. E	70	97%	3%	2,941	25,090	3,396	27,170
Kennedy Rd - S of Major Mackenzie	60	97%	3%	1,179	7,910	1,725	17,250
Kennedy Rd - N of Major Mackenzie	80	97%	3%	1,179	7,910	1,725	17,250

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Appendix B

Emission Factors

Table B1: Emission Factors for Current Scenario Free Flow Links

Road	Weighted Emission Factors (g/VMT)									
	CO	NOx	PM2.5	PM10	TSP	1,3-Butadiene	Acetaldehyde	Acrolein	Benzene	Formaldehyde
Elgin Mills Rd E	2.19	0.14	0.03	0.13	0.48	8.61E-05	3.46E-04	2.86E-05	9.68E-04	4.87E-04
Warden Ave - N of Heritage Hill	1.67	0.16	0.03	0.11	0.46	6.41E-05	3.24E-04	3.45E-05	6.99E-04	5.18E-04
Warden Ave - S of Heritage Hill	2.16	0.20	0.01	0.05	0.05	2.16E-06	2.51E-05	3.83E-06	1.32E-05	4.72E-05
Major Mackenzie Dr. E	1.76	0.14	0.01	0.03	0.03	1.75E-08	5.98E-08	3.70E-09	2.13E-07	7.67E-08
Kennedy Rd - S of Major Mackenzie	2.18	0.16	0.01	0.05	0.05	1.63E-06	1.62E-05	2.37E-06	1.18E-05	2.97E-05
Kennedy Rd - N of Major Mackenzie	1.69	0.14	0.01	0.02	0.03	1.63E-06	1.62E-05	2.37E-06	1.18E-05	2.97E-05

[1] VMT - Vehicle Mile Travelled

Table B2: Emission Factors for Current Scenario Queue Links

Road	Weighted Emission Factors (g/VMT)									
	CO	NOx	PM2.5	PM10	TSP	1,3-Butadiene	Acetaldehyde	Acrolein	Benzene	Formaldehyde
Elgin Mills - W of Warden	3.75	1.86	0.05	0.20	0.20	3.39E-04	4.12E-03	6.34E-04	1.94E-03	7.77E-03
Elgin Mills - E of Warden	3.52	1.26	0.03	0.15	0.15	2.59E-04	2.75E-03	4.10E-04	1.75E-03	5.10E-03
Warden - N of Elgin Mills	3.12	0.22	0.01	0.07	0.07	1.22E-04	4.06E-04	2.47E-05	1.41E-03	5.11E-04
Warden - S of Elgin Mills	3.33	0.77	0.02	0.11	0.11	1.94E-04	1.64E-03	2.28E-04	1.59E-03	2.93E-03
Major Mackenzie - E of Warden	3.39	0.91	0.03	0.12	0.12	2.13E-04	1.96E-03	2.80E-04	1.64E-03	3.55E-03
Major Mackenzie - W of Warden	3.12	0.22	0.01	0.07	0.07	1.22E-04	4.06E-04	2.47E-05	1.41E-03	5.11E-04
Warden - N of Major Mackenzie	3.92	2.30	0.06	0.24	0.24	3.96E-04	5.09E-03	7.95E-04	2.09E-03	9.68E-03
Warden - S of Major Mackenzie	3.51	1.23	0.03	0.15	0.15	2.56E-04	2.69E-03	4.00E-04	1.74E-03	4.98E-03
Elgin Mills - W of Kennedy	3.12	0.22	0.01	0.07	0.07	1.22E-04	4.06E-04	2.47E-05	1.41E-03	5.11E-04
Elgin Mills - E of Kennedy	4.20	3.04	0.08	0.30	0.30	4.94E-04	6.77E-03	1.07E-03	2.33E-03	1.30E-02
Kennedy - N of Elgin Mills	3.12	0.22	0.01	0.07	0.07	1.22E-04	4.06E-04	2.47E-05	1.41E-03	5.11E-04
Kennedy - S of Elgin Mills	3.12	0.22	0.01	0.07	0.07	1.22E-04	4.06E-04	2.47E-05	1.41E-03	5.11E-04
Major Mackenzie - E of Kennedy	3.32	0.72	0.02	0.11	0.11	1.88E-04	1.54E-03	2.11E-04	1.57E-03	2.73E-03
Major Mackenzie - W of Kennedy	3.43	1.01	0.03	0.13	0.13	2.26E-04	2.19E-03	3.17E-04	1.67E-03	4.00E-03
Kennedy - N of Major Mackenzie	3.23	0.51	0.02	0.09	0.09	1.60E-04	1.05E-03	1.31E-04	1.50E-03	1.77E-03
Kennedy - S of Major Mackenzie	3.33	0.76	0.02	0.11	0.11	1.93E-04	1.62E-03	2.24E-04	1.59E-03	2.88E-03

Table B3: Emission Factors for Future Scenarios Free Flow Links

Road	Weighted Emission Factors (g/VMT)									
	CO	NOx	PM2.5	PM10	TSP	1,3-Butadiene	Acetaldehyde	Acrolein	Benzene	Formaldehyde
Elgin Mills Rd E	0.83	0.03	0.03	0.13	0.48	7.61E-06	4.75E-05	4.59E-06	2.25E-04	8.39E-05
Warden Ave - N of Heritage Hill	0.66	0.04	0.00	0.02	0.03	5.62E-06	4.16E-05	3.95E-06	1.66E-04	6.61E-05
Warden Ave - S of Heritage Hill	0.84	0.06	0.01	0.05	0.05	7.38E-06	6.53E-05	6.11E-06	2.19E-04	9.36E-05
Major Mackenzie Dr. E	0.68	0.03	0.00	0.03	0.03	6.07E-06	4.00E-05	3.84E-06	1.80E-04	6.82E-05
Kennedy Rd - S of Major Mackenzie	0.83	0.04	0.01	0.04	0.05	7.53E-06	5.35E-05	5.10E-06	2.23E-04	8.72E-05
Kennedy Rd - N of Major Mackenzie	0.66	0.02	0.00	0.02	0.03	5.74E-06	3.58E-05	3.46E-06	1.70E-04	6.32E-05

[1] VMT - Vehicle Mile Travelled

Table B4: Emission Factors for Future Scenarios Queue Links

Road	Weighted Emission Factors (g/VMT)									
	CO	NOx	PM2.5	PM10	TSP	1,3-Butadiene	Acetaldehyde	Acrolein	Benzene	Formaldehyde
Elgin Mills - W of Warden	4.30	1.23	0.07	0.53	0.53	3.42E-05	9.23E-04	8.19E-05	1.01E-03	8.29E-04
Elgin Mills - E of Warden	4.17	0.78	0.07	0.50	0.50	3.53E-05	6.46E-04	5.80E-05	1.04E-03	6.60E-04
Warden - N of Elgin Mills	3.94	0.01	0.06	0.45	0.45	3.72E-05	1.71E-04	1.71E-05	1.10E-03	3.71E-04
Warden - S of Elgin Mills	4.06	0.41	0.07	0.47	0.47	3.62E-05	4.22E-04	3.87E-05	1.07E-03	5.24E-04
Major Mackenzie - E of Warden	4.09	0.52	0.07	0.48	0.48	3.59E-05	4.86E-04	4.42E-05	1.06E-03	5.63E-04
Major Mackenzie - W of Warden	3.94	0.01	0.06	0.45	0.45	3.72E-05	1.71E-04	1.71E-05	1.10E-03	3.71E-04
Warden - N of Major Mackenzie	4.40	1.55	0.08	0.55	0.55	3.35E-05	1.12E-03	9.89E-05	9.88E-04	9.50E-04
Warden - S of Major Mackenzie	4.16	0.76	0.07	0.50	0.50	3.54E-05	6.34E-04	5.70E-05	1.05E-03	6.53E-04
Elgin Mills - W of Kennedy	3.94	0.01	0.06	0.45	0.45	3.72E-05	1.71E-04	1.71E-05	1.10E-03	3.71E-04
Elgin Mills - E of Kennedy	4.56	2.09	0.08	0.58	0.58	3.21E-05	1.46E-03	1.28E-04	9.48E-04	1.16E-03
Kennedy - N of Elgin Mills	3.94	0.01	0.06	0.45	0.45	3.72E-05	1.71E-04	1.71E-05	1.10E-03	3.71E-04
Kennedy - S of Elgin Mills	3.94	0.01	0.06	0.45	0.45	3.72E-05	1.71E-04	1.71E-05	1.10E-03	3.71E-04
Major Mackenzie - E of Kennedy	4.05	0.38	0.07	0.47	0.47	3.63E-05	4.01E-04	3.69E-05	1.07E-03	5.11E-04
Major Mackenzie - W of Kennedy	4.11	0.59	0.07	0.48	0.48	3.58E-05	5.32E-04	4.82E-05	1.06E-03	5.91E-04
Kennedy - N of Major Mackenzie	4.00	0.22	0.06	0.46	0.46	3.67E-05	3.02E-04	2.84E-05	1.09E-03	4.51E-04
Kennedy - S of Major Mackenzie	4.06	0.41	0.07	0.47	0.47	3.62E-05	4.17E-04	3.83E-05	1.07E-03	5.21E-04

BURNSIDE

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Appendix C

Modelling Results

Table C1: Predicted CO Ground Level Concentrations - Current Scenario

Receptor ID	1-hr					8-hr				
	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria
R1	389.3	41.3	430.6	36,200	1.2%	360.6	36.5	397.1	15,700	2.5%
R2	389.3	62.0	451.3	36,200	1.2%	360.6	48.6	409.1	15,700	2.6%
R3	389.3	78.9	468.2	36,200	1.3%	360.6	62.0	422.6	15,700	2.7%
R4	389.3	109.0	498.3	36,200	1.4%	360.6	94.6	455.2	15,700	2.9%
R5	389.3	178.3	567.6	36,200	1.6%	360.6	150.1	510.7	15,700	3.3%

Table C2: Predicted CO Ground Level Concentrations - Future No Build Scenario

Receptor ID	1-hr					8-hr				
	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria
R1	389.3	30.9	420.2	36,200	1.2%	360.6	27.5	388.1	15,700	2.5%
R2	389.3	36.5	425.8	36,200	1.2%	360.6	28.6	389.2	15,700	2.5%
R3	389.3	52.9	442.2	36,200	1.2%	360.6	42.9	403.4	15,700	2.6%
R4	389.3	76.0	465.3	36,200	1.3%	360.6	65.8	426.4	15,700	2.7%
R5	389.3	87.9	477.2	36,200	1.3%	360.6	75.4	435.9	15,700	2.8%

Table C3: Predicted CO Ground Level Concentrations - Future Build Scenario

Receptor ID	1-hr					8-hr				
	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria
R1	389.3	30.9	420.2	36,200	1.2%	360.6	27.5	388.1	15,700	2.5%
R2	389.3	36.5	425.8	36,200	1.2%	360.6	28.6	389.2	15,700	2.5%
R3	389.3	52.9	442.2	36,200	1.2%	360.6	42.9	403.4	15,700	2.6%
R4	389.3	76.0	465.3	36,200	1.3%	360.6	65.8	426.4	15,700	2.7%
R5	389.3	87.9	477.2	36,200	1.3%	360.6	75.4	435.9	15,700	2.8%

Table C4: Predicted NO2 Ground Level Concentrations - Current Scenario

Receptor ID	1-hr					24-hr					Annual				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background average, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	39.5	3.6	43.0	79	54.5%	33.4	2.2	35.6	200	17.8%	9.9	0.7	10.6	23	46.3%
R2	39.5	5.6	45.0	79	57.0%	33.4	3.3	36.7	200	18.4%	9.9	0.9	10.8	23	47.1%
R3	39.5	5.9	45.3	79	57.4%	33.4	3.3	36.8	200	18.4%	9.9	1.1	11.0	23	48.0%
R4	39.5	8.2	47.6	79	60.3%	33.4	4.2	37.6	200	18.8%	9.9	1.7	11.6	23	50.6%
R5	39.5	14.5	54.0	79	68.4%	33.4	8.5	41.9	200	21.0%	9.9	3.5	13.4	23	58.1%

Table C5: Predicted NO2 Ground Level Concentrations - Future No Build Scenario

Receptor ID	1-hr					24-hr					Annual				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background average, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	39.5	1.4	40.9	79	51.7%	33.4	0.8	34.3	200	17.1%	9.9	0.3	10.2	23	44.3%
R2	39.5	2.4	41.9	79	53.0%	33.4	1.4	34.8	200	17.4%	9.9	0.4	10.3	23	44.7%
R3	39.5	1.7	41.2	79	52.2%	33.4	1.0	34.4	200	17.2%	9.9	0.4	10.3	23	44.7%
R4	39.5	2.6	42.1	79	53.3%	33.4	1.3	34.7	200	17.4%	9.9	0.5	10.4	23	45.4%
R5	39.5	4.0	43.4	79	55.0%	33.4	2.3	35.7	200	17.9%	9.9	0.9	10.8	23	47.0%

Table C6: Predicted NO2 Ground Level Concentrations - Future Build Scenario

Receptor ID	1-hr					24-hr					Annual				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background average, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	39.5	1.5	41.0	79	51.9%	33.4	0.9	34.3	200	17.2%	9.9	0.3	10.2	23	44.4%
R2	39.5	2.5	42.0	79	53.1%	33.4	1.5	34.9	200	17.5%	9.9	0.4	10.3	23	44.8%
R3	39.5	1.8	41.3	79	52.3%	33.4	1.1	34.5	200	17.3%	9.9	0.4	10.3	23	44.8%
R4	39.5	2.8	42.3	79	53.5%	33.4	1.4	34.8	200	17.4%	9.9	0.6	10.5	23	45.6%
R5	39.5	4.0	43.5	79	55.0%	33.4	2.3	35.7	200	17.9%	9.9	0.9	10.8	23	47.1%

Table C7: Predicted PM2.5 Ground Level Concentrations - Current Scenario

Receptor ID	1-hr					Annual				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background average, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	12.6	0.4	13.0	27	48.0%	7.1	0.1	7.2	8.8	82.1%
R2	12.6	0.2	12.8	27	47.5%	7.1	0.1	7.2	8.8	81.5%
R3	12.6	0.4	13.0	27	48.1%	7.1	0.1	7.2	8.8	82.3%
R4	12.6	0.5	13.1	27	48.5%	7.1	0.2	7.3	8.8	82.9%
R5	12.6	0.4	13.0	27	48.1%	7.1	0.2	7.3	8.8	82.4%

Table C8: Predicted PM2.5 Ground Level Concentrations - Future No Build Scenario

Receptor ID	1-hr					Annual				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background average, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	12.6	0.3	12.9	27	47.8%	7.1	0.1	7.2	8.8	82.0%
R2	12.6	0.2	12.8	27	47.3%	7.1	0.0	7.1	8.8	81.2%
R3	12.6	0.7	13.3	27	49.1%	7.1	0.2	7.3	8.8	83.4%
R4	12.6	0.8	13.4	27	49.8%	7.1	0.3	7.4	8.8	84.3%
R5	12.6	0.4	13.0	27	48.1%	7.1	0.2	7.3	8.8	82.5%

Table C9: Predicted PM2.5 Ground Level Concentrations - Future Build Scenario

Receptor ID	1-hr					Annual				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background average, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	12.6	0.3	12.9	27	47.8%	7.1	0.1	7.2	8.8	82.0%
R2	12.6	0.2	12.8	27	47.3%	7.1	0.1	7.2	8.8	81.3%
R3	12.6	0.7	13.3	27	49.1%	7.1	0.2	7.3	8.8	83.5%
R4	12.6	0.9	13.5	27	49.8%	7.1	0.3	7.4	8.8	84.4%
R5	12.6	0.4	13.0	27	48.2%	7.1	0.2	7.3	8.8	82.5%

Table C10: Predicted PM10 Ground Level Concentrations - Current Scenario

Receptor ID	24-hr				
	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria
R1	23.3	1.5	24.9	50	49.7%
R2	23.3	1.0	24.3	50	48.6%
R3	23.3	1.7	25.1	50	50.1%
R4	23.3	2.2	25.6	50	51.1%
R5	23.3	1.9	25.2	50	50.5%

Table C11: Predicted PM10 Ground Level Concentrations - Future No Build Scenario

Receptor ID	24-hr				
	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria
R1	23.3	1.5	24.8	50	49.7%
R2	23.3	1.1	24.4	50	48.8%
R3	23.3	3.1	26.5	50	52.9%
R4	23.3	4.0	27.3	50	54.7%
R5	23.3	2.5	25.8	50	51.6%

Table C12: Predicted PM10 Ground Level Concentrations - Future Build Scenario

Receptor ID	24-hr				
	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria
R1	23.3	1.6	24.9	50	49.8%
R2	23.3	1.2	24.5	50	49.0%
R3	23.3	3.2	26.5	50	53.0%
R4	23.3	4.1	27.4	50	54.8%
R5	23.3	2.5	25.8	50	51.6%

Table C13: Predicted TSP Ground Level Concentrations - Current Scenario

Receptor ID	24-hr					Annual				
	Background 90th percentile, µg/m^3	Maximum Concentration, µg/m^3	Maximum Concentration plus Background, µg/m^3	Criteria, µg/m^3	% of Criteria	Background average, µg/m^3	Maximum Concentration, µg/m^3	Maximum Concentration plus Background, µg/m^3	Criteria, µg/m^3	% of Criteria
R1	42.0	6.2	48.2	120	40.2%	23.7	2.1	25.7	60	42.9%
R2	42.0	3.7	45.7	120	38.1%	23.7	0.9	24.6	60	41.0%
R3	42.0	6.1	48.1	120	40.1%	23.7	2.2	25.9	60	43.1%
R4	42.0	7.6	49.6	120	41.4%	23.7	2.8	26.5	60	44.2%
R5	42.0	2.2	44.2	120	36.8%	23.7	0.9	24.6	60	40.9%

Table C14: Predicted TSP Ground Level Concentrations - Future No Build Scenario

Receptor ID	24-hr					Annual				
	Background 90th percentile, µg/m^3	Maximum Concentration, µg/m^3	Maximum Concentration plus Background, µg/m^3	Criteria, µg/m^3	% of Criteria	Background average, µg/m^3	Maximum Concentration, µg/m^3	Maximum Concentration plus Background, µg/m^3	Criteria, µg/m^3	% of Criteria
R1	42.0	4.7	46.7	120	38.9%	23.7	1.8	25.4	60	42.4%
R2	42.0	1.2	43.2	120	36.0%	23.7	0.4	24.1	60	40.1%
R3	42.0	11.2	53.2	120	44.3%	23.7	4.0	27.7	60	46.1%
R4	42.0	13.9	55.9	120	46.6%	23.7	5.2	28.9	60	48.2%
R5	42.0	2.8	44.8	120	37.3%	23.7	1.1	24.8	60	41.3%

Table C15: Predicted TSP Ground Level Concentrations - Future Build Scenario

Receptor ID	24-hr					Annual				
	Background 90th percentile, µg/m^3	Maximum Concentration, µg/m^3	Maximum Concentration plus Background, µg/m^3	Criteria, µg/m^3	% of Criteria	Background average, µg/m^3	Maximum Concentration, µg/m^3	Maximum Concentration plus Background, µg/m^3	Criteria, µg/m^3	% of Criteria
R1	42.0	4.8	46.8	120	39.0%	23.7	1.8	25.4	60	42.4%
R2	42.0	1.3	43.3	120	36.1%	23.7	0.4	24.1	60	40.1%
R3	42.0	11.2	53.2	120	44.3%	23.7	4.0	27.7	60	46.2%
R4	42.0	14.0	56.0	120	46.7%	23.7	5.3	28.9	60	48.2%
R5	42.0	2.8	44.8	120	37.3%	23.7	1.1	24.8	60	41.3%

Table C16: Predicted 1,3-Butadiene Ground Level Concentrations - Current Scenario

Receptor ID	24-hr					Annual				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background average, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	0.039	0.0010	0.040	10	0.4%	0.020	0.0003	0.020	2	1.0%
R2	0.039	0.0005	0.039	10	0.4%	0.020	0.0001	0.020	2	1.0%
R3	0.039	0.0011	0.040	10	0.4%	0.020	0.0004	0.020	2	1.0%
R4	0.039	0.0013	0.040	10	0.4%	0.020	0.0005	0.020	2	1.0%
R5	0.039	0.0001	0.039	10	0.4%	0.020	0.0000	0.020	2	1.0%

Table C17: Predicted 1,3-Butadiene Ground Level Concentrations - Future No Build Scenario

Receptor ID	24-hr					Annual				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background average, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	0.039	0.0002	0.039	10	0.4%	0.020	0.0001	0.020	2	1.0%
R2	0.039	0.0002	0.039	10	0.4%	0.020	0.0001	0.020	2	1.0%
R3	0.039	0.0003	0.039	10	0.4%	0.020	0.0001	0.020	2	1.0%
R4	0.039	0.0003	0.039	10	0.4%	0.020	0.0001	0.020	2	1.0%
R5	0.039	0.0005	0.039	10	0.4%	0.020	0.0002	0.020	2	1.0%

Table C18: Predicted 1,3-Butadiene Ground Level Concentrations - Future Build Scenario

Receptor ID	24-hr					Annual				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background average, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	0.039	0.0002	0.039	10	0.4%	0.020	0.0001	0.020	2	1.0%
R2	0.039	0.0002	0.039	10	0.4%	0.020	0.0001	0.020	2	1.0%
R3	0.039	0.0003	0.039	10	0.4%	0.020	0.0001	0.020	2	1.0%
R4	0.039	0.0004	0.039	10	0.4%	0.020	0.0002	0.020	2	1.0%
R5	0.039	0.0005	0.039	10	0.4%	0.020	0.0002	0.020	2	1.0%

Table C19: Predicted Acetaldehyde Ground Level Concentrations - Current Scenario

Receptor ID	0.5-hr					24-hr				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	3.30	0.009	3.31	500	0.7%	3.30	0.004	3.30	500	0.7%
R2	3.30	0.009	3.30	500	0.7%	3.30	0.003	3.30	500	0.7%
R3	3.30	0.012	3.31	500	0.7%	3.30	0.004	3.30	500	0.7%
R4	3.30	0.015	3.31	500	0.7%	3.30	0.006	3.30	500	0.7%
R5	3.30	0.003	3.30	500	0.7%	3.30	0.001	3.30	500	0.7%

Table C20: Predicted Acetaldehyde Ground Level Concentrations - Future No Build Scenario

Receptor ID	0.5-hr					24-hr				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	3.30	0.002	3.30	500	0.7%	3.30	0.001	3.30	500	0.7%
R2	3.30	0.003	3.30	500	0.7%	3.30	0.002	3.30	500	0.7%
R3	3.30	0.003	3.30	500	0.7%	3.30	0.002	3.30	500	0.7%
R4	3.30	0.005	3.30	500	0.7%	3.30	0.002	3.30	500	0.7%
R5	3.30	0.007	3.30	500	0.7%	3.30	0.003	3.30	500	0.7%

Table C21: Predicted Acetaldehyde Ground Level Concentrations - Future Build Scenario

Receptor ID	0.5-hr					24-hr				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	3.30	0.002	3.30	500	0.7%	3.30	0.001	3.30	500	0.7%
R2	3.30	0.003	3.30	500	0.7%	3.30	0.002	3.30	500	0.7%
R3	3.30	0.004	3.30	500	0.7%	3.30	0.002	3.30	500	0.7%
R4	3.30	0.005	3.30	500	0.7%	3.30	0.002	3.30	500	0.7%
R5	3.30	0.007	3.30	500	0.7%	3.30	0.003	3.30	500	0.7%

Table C22: Predicted Acrolein Ground Level Concentrations - Current Scenario

Receptor ID	1-hr					24-hr				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	0.204	0.0004	0.205	4.50	4.5%	0.204	0.0001	0.204	0.40	51.1%
R2	0.204	0.0003	0.204	4.50	4.5%	0.204	0.0001	0.204	0.40	51.1%
R3	0.204	0.0004	0.205	4.50	4.5%	0.204	0.0001	0.204	0.40	51.1%
R4	0.204	0.0005	0.205	4.50	4.5%	0.204	0.0002	0.204	0.40	51.1%
R5	0.204	0.0001	0.204	4.50	4.5%	0.204	0.0000	0.204	0.40	51.1%

Table C23: Predicted Acrolein Ground Level Concentrations - Future No Build Scenario

Receptor ID	1-hr					24-hr				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	0.204	0.0002	0.204	4.50	4.5%	0.204	0.0001	0.204	0.40	51.1%
R2	0.204	0.0002	0.204	4.50	4.5%	0.204	0.0001	0.204	0.40	51.1%
R3	0.204	0.0003	0.204	4.50	4.5%	0.204	0.0002	0.204	0.40	51.1%
R4	0.204	0.0004	0.205	4.50	4.5%	0.204	0.0002	0.204	0.40	51.1%
R5	0.204	0.0005	0.205	4.50	4.5%	0.204	0.0003	0.204	0.40	51.1%

Table C24: Predicted Acrolein Ground Level Concentrations - Future Build Scenario

Receptor ID	1-hr					24-hr				
	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria	Background 90th percentile, µg/m³	Maximum Concentration, µg/m³	Maximum Concentration plus Background, µg/m³	Criteria, µg/m³	% of Criteria
R1	0.204	0.0002	0.204	4.50	4.5%	0.204	0.0001	0.204	0.40	51.1%
R2	0.204	0.0003	0.204	4.50	4.5%	0.204	0.0002	0.204	0.40	51.1%
R3	0.204	0.0003	0.204	4.50	4.5%	0.204	0.0002	0.204	0.40	51.1%
R4	0.204	0.0004	0.205	4.50	4.5%	0.204	0.0002	0.204	0.40	51.1%
R5	0.204	0.0005	0.205	4.50	4.5%	0.204	0.0003	0.204	0.40	51.1%

Table C25: Predicted Benzene Ground Level Concentrations - Current Scenario

Receptor ID	24-hr					Annual				
	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria	Background average, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria
R1	0.569	0.0107	0.579	2.3	25.2%	0.316	0.0036	0.319	0.45	71.0%
R2	0.569	0.0056	0.574	2.3	25.0%	0.316	0.0012	0.317	0.45	70.4%
R3	0.569	0.0121	0.581	2.3	25.2%	0.316	0.0043	0.320	0.45	71.1%
R4	0.569	0.0149	0.583	2.3	25.4%	0.316	0.0055	0.321	0.45	71.4%
R5	0.569	0.0011	0.570	2.3	24.8%	0.316	0.0004	0.316	0.45	70.2%

Table C26: Predicted Benzene Ground Level Concentrations - Future No Build Scenario

Receptor ID	24-hr					Annual				
	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria	Background average, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria
R1	0.569	0.0047	0.573	2.3	24.9%	0.316	0.0016	0.317	0.45	70.5%
R2	0.569	0.0055	0.574	2.3	25.0%	0.316	0.0015	0.317	0.45	70.5%
R3	0.569	0.0078	0.576	2.3	25.1%	0.316	0.0027	0.318	0.45	70.8%
R4	0.569	0.0097	0.578	2.3	25.1%	0.316	0.0040	0.320	0.45	71.0%
R5	0.569	0.0138	0.582	2.3	25.3%	0.316	0.0055	0.321	0.45	71.4%

Table C27: Predicted Benzene Ground Level Concentrations - Future Build Scenario

Receptor ID	24-hr					Annual				
	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria	Background average, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria
R1	0.569	0.0051	0.574	2.3	24.9%	0.316	0.0017	0.317	0.45	70.5%
R2	0.569	0.0058	0.574	2.3	25.0%	0.316	0.0017	0.317	0.45	70.5%
R3	0.569	0.0083	0.577	2.3	25.1%	0.316	0.0029	0.319	0.45	70.8%
R4	0.569	0.0103	0.579	2.3	25.2%	0.316	0.0044	0.320	0.45	71.1%
R5	0.569	0.0136	0.582	2.3	25.3%	0.316	0.0055	0.321	0.45	71.4%

Table C28: Predicted Formaldehyde Ground Level Concentrations - Current Scenario

Receptor ID	24-hr				
	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria
R1	6.48	0.007	6.49	65	10.0%
R2	6.48	0.004	6.49	65	10.0%
R3	6.48	0.006	6.49	65	10.0%
R4	6.48	0.008	6.49	65	10.0%
R5	6.48	0.002	6.48	65	10.0%

Table C29: Predicted Formaldehyde Ground Level Concentrations - Future No Build Scenario

Receptor ID	24-hr				
	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria
R1	6.48	0.002	6.48	65	10.0%
R2	6.48	0.002	6.48	65	10.0%
R3	6.48	0.003	6.48	65	10.0%
R4	6.48	0.004	6.48	65	10.0%
R5	6.48	0.005	6.49	65	10.0%

Table C30: Predicted Formaldehyde Ground Level Concentrations - Future Build Scenario

Receptor ID	24-hr				
	Background 90th percentile, $\mu g/m^3$	Maximum Concentration, $\mu g/m^3$	Maximum Concentration plus Background, $\mu g/m^3$	Criteria, $\mu g/m^3$	% of Criteria
R1	6.48	0.002	6.48	65	10.0%
R2	6.48	0.002	6.48	65	10.0%
R3	6.48	0.003	6.48	65	10.0%
R4	6.48	0.004	6.49	65	10.0%
R5	6.48	0.005	6.49	65	10.0%

BURNSIDE

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Appendix D

GHG Impact

Table D1: Annual GHG Emissions - Current Scenario

Road Segment	Daily Traffic (vpd)	Percent Cars (%)	Percent Large Vehicles (%)	Segment Length, m	CO_2, tonnes/yr	CH_4, tonnes/yr	N_2O, tonnes/yr
Elgin Mills Rd E	11,050	98%	2%	2,640	27.407	0.004	0.003
Warden Ave - N of Heritage Hill	11,650	95%	5%	2,053	23.853	0.003	0.003
Warden Ave - S of Heritage Hill	12,427	95%	5%	573	7.105	0.001	0.001
Major Mackenzie Dr. E	25,090	97%	3%	2,656	63.900	0.009	0.007
Kennedy Rd - S of Major Mackenzie	7,910	97%	3%	299	2.270	0.000	0.000
Kennedy Rd - N of Major Mackenzie	7,910	97%	3%	2,341	17.760	0.002	0.002
				Total	**142.294**	**0.019**	**0.016**

Table D2: Annual GHG Emissions - Future Scenarios

Road	Daily Traffic (vpd)	Percent Cars (%)	Percent Large Vehicles (%)	Segment Length, m	CO_2, tonnes/yr	CH_4, tonnes/yr	N_2O, tonnes/yr
Elgin Mills Rd E	20,890	98%	2%	2,053	40.293	0.006	0.005
Warden Ave - N of Heritage Hill	21,590	95%	5%	2,053	44.204	0.006	0.005
Warden Ave - S of Heritage Hill	21,590	95%	5%	573	12.343	0.002	0.001
Major Mackenzie Dr. E	27,170	97%	3%	2,656	69.198	0.009	0.008
Kennedy Rd - S of Major Mackenzie	17,250	97%	3%	299	4.949	0.001	0.001
Kennedy Rd - N of Major Mackenzie	17,250	97%	3%	2,341	38.730	0.005	0.004
				Total	**209.716**	**0.028**	**0.024**

R.J. Burnside & Associates Limited