

407 East Individual Environmental Assessment (IEA) and Preliminary Design Study

Air Quality Existing Conditions Technical Report

August 2009

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1. Introduction

This report provides an overview of the existing ambient air quality conditions associated with the 407 East Environmental Assessment (EA) analysis area as defined in the EA Terms of Reference. A series of overviews are proposed to identify existing and future social, economic, cultural and natural environment conditions within the EA analysis area for use in generating constraints mapping, assessing alternatives to the undertaking, and refining the EA analysis area. In total, nine overviews are proposed:

1. Socio-Economic (Provincial policy/Official Plan, industrial/commercial/residential, economic base/trade corridors, tourism, and community and recreation)
2. Agriculture
3. Natural Environment (vegetation, wildlife, fish and aquatic habitat, and hydrogeology)
4. Drainage
5. Cultural Heritage
6. Archaeology
7. Air
8. Noise
9. Waste

The results from the undertaking of each of these overviews will be documented in a stand-alone technical report during the EA. In each case, a draft will be prepared and circulated for comment. Upon finalization, the contents will be summarized along with the other technical reports under one cover as an “Existing and Future Conditions Report” and made available for agencies/public review. The final Existing Conditions Report will form a chapter of the EA Report with each of the stand-alone technical reports becoming appendices to the EA Report.

1.1 Air Quality Study Team

The RWDI AIR Inc. air quality study team consists of engineers, scientists and technologists. The actual individuals and their specific roles are provided as follows:

- **Scott Shayko, Hon. B.Comm., B.Sc., Senior Project Manager/Associate**

Scott is the Project Manager for the air quality and environmental noise studies and is responsible for the day-day operation and management of the project. He also serves as the primary interface between the client and the project team.

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- **John Alberico, B.Sc., M.Sc., Technical Director/Principal**

John is the Technical Director for the air quality studies and is responsible for the technical quality of the studies. He is a Specialist in the field of air quality with more than 17 years of experience. Before joining RWDI in 1988, John completed his M.Sc. in dust dispersion at the University of Guelph.

2. 407 East EA Analysis Area

As part of the approved ToR, an initial 407 East EA analysis area was proposed as within Durham Region based on a preliminary identification of transportation problems and opportunities. For the purposes of providing an overview of existing conditions, the boundaries of the initial 407 East analysis area have been defined as Highway 35/115 to the east, Lake Ontario to the south, Brock Road to the west, and approximately to the CPR Line to the north (see **Figure 1**).

As mentioned, during the EA, the initial analysis area will be reviewed and refined to correspond with the recommended alternative(s) to the undertaking in consultation with agencies/public. The refined analysis area will be used for developing the alternatives methods and undertaking and determining potential effects on the environment.

3. Methodology

3.1 Available Secondary Source Information Collection and Review

A list of known available secondary sources of information was provided in the approved ToR (see Supporting Document C), which have been collected and reviewed as part of determining existing ambient air quality conditions. These sources of information are described as follows:

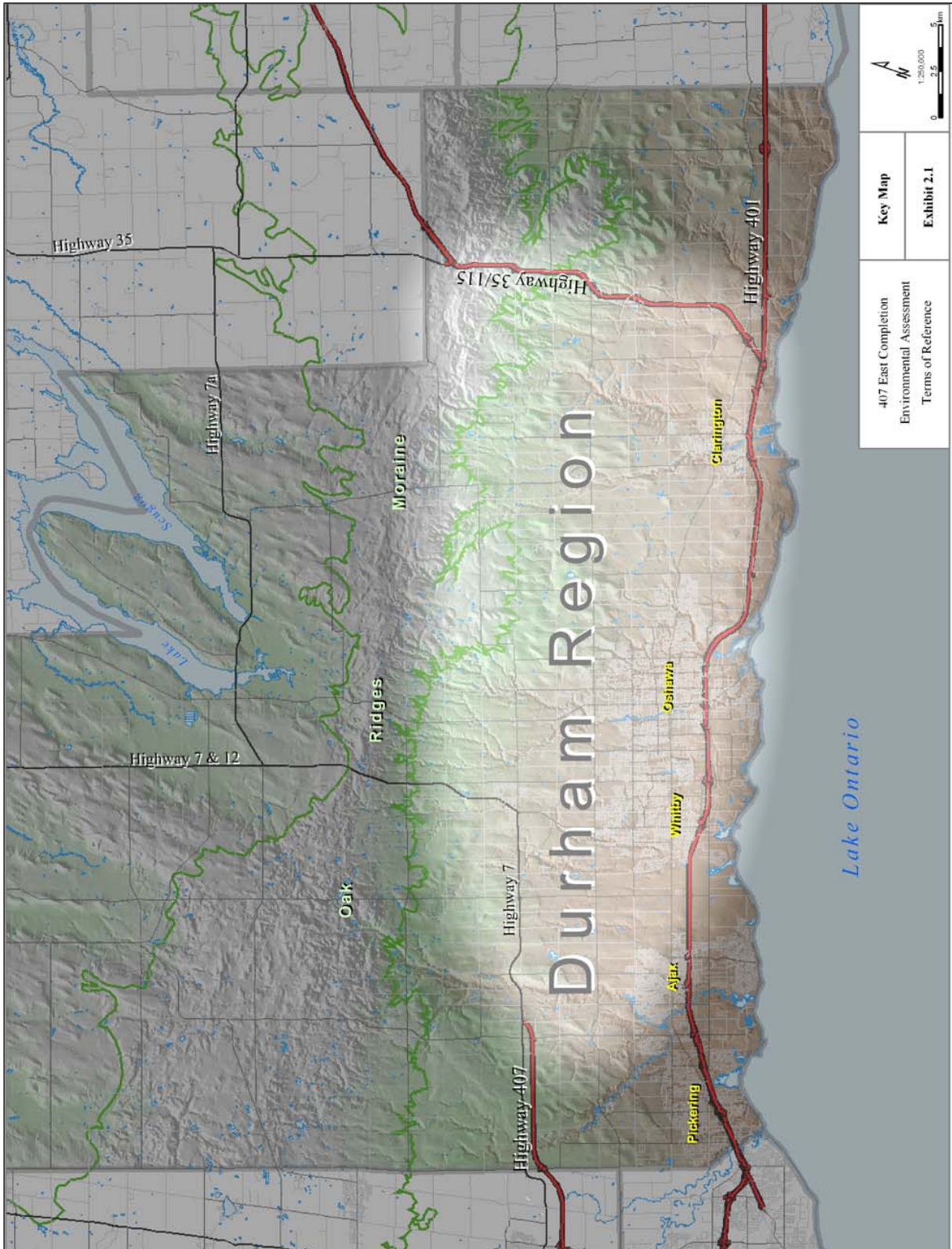
- **Ontario Ministry of the Environment. Summary of Point of Impingement Standards, Point of Impingement Guidelines, and Ambient Air Quality Criteria. September 2001.**

Provincial Ambient Air Quality Criteria Guidelines for contaminants of interest. The Ontario Ministry of the Environment (MOE) has developed Ambient Air Quality

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Figure 1. Analysis Area



407 East Completion Environmental Assessment Terms of Reference	Key Map Exhibit 2.1
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Criteria (AAQCs) for numerous contaminants, including those that are typically emitted from vehicular traffic and are known to have the potential to cause harmful effects on human health or cause degradation to the environment. In general, these guidelines represent desirable or acceptable ambient contaminant levels.

- **Health Canada: CEPA/FPAC Working Group on Air Quality Objectives and Guidelines. National Ambient Air Quality Objectives. 1999.**

National Ambient Air Quality Guidelines for contaminants of interest. The Canadian government has established National Ambient Air Quality Objectives (NAAQOs) for similar pollutants as the MOE. In general, these guidelines represent desirable or acceptable ambient contaminant levels.

- **Canadian Council of Ministers of the Environment. Canada-Wide Standards of Particulate Matter and Ozone. Endorsed by CCME Council of Ministers, June 5-6, 2000, Quebec City.**

The Canadian Council of Ministers of the Environment (CCME) created a Canada Wide Standard (CWS) for PM_{2.5}

- **Ministry of the Environment. Air Quality in Ontario Summary Reports: 1999 through 2003.**
<http://www.ene.gov.on.ca/envision/techdocs/index.htm#AirQuality>

Provides ambient air quality measurements for MOE monitoring stations surrounding the analysis area.

- **Environment Canada. Year 1995 to 2001 Hourly Ambient Air Measurements for NAPS Stations, provided by Environment Canada to RWDI. August 6, 2003.**

Provides ambient air quality measurements for NAPS monitoring stations surrounding the analysis area.

3.2 Process Undertaken

The following steps were completed in order to establish baseline and existing conditions in relation to Air Quality:

1. Reviewed the analysis area;
2. Identified MOE monitoring stations in the vicinity of the analysis area;

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3. Summarized contaminants of interest using provincial and federal ambient air measurements; and
4. Selected the appropriate ambient air quality criteria.

4. Existing Ambient Air Quality Conditions

4.1 Air Quality Guidelines

The Ontario Ministry of the Environment (MOE) has developed Ambient Air Quality Criteria (AAQCs) for numerous contaminants, including those that are typically emitted from vehicular traffic and are known to have the potential to cause harmful effects on human health or cause degradation to the environment [1]. The Canadian government has established National Ambient Air Quality Objectives (NAAQOs) for similar pollutants [2]. In general, these guidelines represent desirable or acceptable ambient contaminant levels. The Canadian Council of Ministers of the Environment (CCME) created a Canada Wide Standard (CWS) for respirable particulate matter (PM_{2.5}) [3].

Table 1 presents the guidelines for contaminants that are to be modelled in the local air quality study [1-3]. The contaminants to be modelled include CO, NO_x, PM_{2.5} and PM₁₀ and constitute the main contaminants emitted from vehicle tailpipes and roadway surfaces.

Table 1. Summary of Relevant Air Quality Guidelines [in :g/m³]

Contaminant	Ministry of the Environment 1-Hour AAQC	Ministry of the Environment 24-Hour AAQC	Environment Canada 1-Hour NAAQO	Environment Canada 24-Hour NAAQO
CO	36,200 (30 ppm)	N/A	35,000 (29 ppm)	N/A
NO ₂	400 (200 ppb)	200 (100 ppb)	400 (200 ppb)	200 (100 ppb)
PM _{2.5}	N/A	30 ⁽¹⁾	N/A	N/A
PM ₁₀	N/A	50 ⁽²⁾	N/A	N/A

Notes: N/A – Not applicable; guideline is not established.

AAQC – Ambient Air Quality Criterion.

NAAQO – National Ambient Air Quality Objective – Acceptable Levels.

(1) Canada Wide Standard (CWS) for PM_{2.5} established for the year 2010 based on the 98th percentile ambient measurement (24-hour) annually averaged over three consecutive years.

(2) Interim AAQC.

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The limiting effect for the ambient air quality guidelines listed in Table 4.1.1 is human health. Below is a brief description of the potential health effects associated with these air contaminants:

- **Carbon Monoxide**

CO is a colourless, odourless, tasteless, and potentially poisonous gas produced primarily by incomplete combustion of fossil fuels. Exposure to high levels of CO is linked with impairment of vision, work capacity, learning ability, and performance of difficult tasks [4].

- **Nitrogen Dioxide**

All combustion in air produces oxides of nitrogen (NO_x), of which nitrogen dioxide (NO₂) is a component. NO₂ is a reddish brown gas with a pungent and irritating odour. It transforms in the air to form gaseous nitric acid and toxic organic nitrates. NO₂ also plays a major role in atmospheric reactions that produce ground level ozone, a major component of smog.

It is also a precursor to nitrates, which contribute to increased respirable particle levels in the atmosphere. Exposure to high levels can irritate the lungs and lower resistance to respiratory infection. People with asthma and bronchitis have increased sensitivity [4].

- **Particulate Matter**

Particulate matter is the general term used for a mixture of solid particles and liquid droplets found in the air. These particles, which come in a wide range of sizes, are emitted directly from sources or formed in the atmosphere by the transformation of gaseous emissions into secondary pollutants. Inhalable particulate matter, or PM₁₀, refers to the fraction of PM having a diameter less than or equal to 10 microns. Respirable particulate matter, or PM_{2.5}, refers to the fraction of PM having a diameter less than or equal to 2.5 microns. The smaller the particle size, the farther the particle can penetrate into the lungs. Therefore, smaller particles pose the greatest potential for human health effects. The greatest effect on human health is from particles 10 microns or less in diameter, which can aggravate bronchitis, asthma, and other respiratory diseases. People with asthma, cardiovascular or lung disease, children, and elderly people, are considered to be the most sensitive to the effects of PM₁₀ or PM_{2.5} [4].

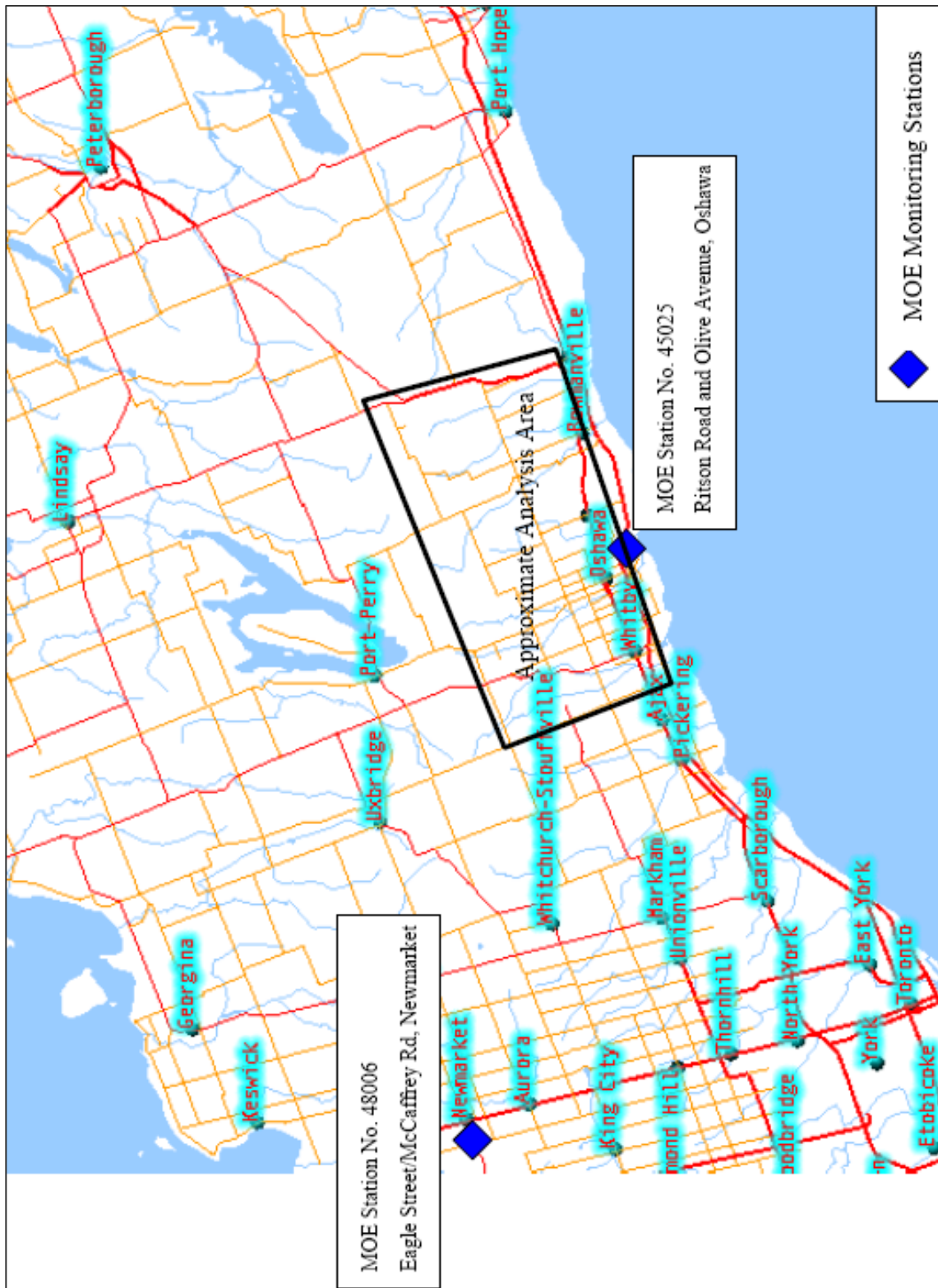
4.2 Historical Air Quality Monitoring Results

The Ministry of the Environment (MOE) operates three ambient air quality-monitoring stations within a 44 km radius of the analysis area between Pickering and Clarington, Ontario (see **Figure 2**). The ambient air quality monitoring stations are located in Stouffville (MOE Station No. 48002, Hwy 47/East of Hwy 48), Oshawa (MOE Station No. 45025, Ritson Road and Olive Avenue) and Newmarket (MOE Station No. 48006, Eagle Street/McCaffrey Road). The Stouffville monitoring station is located in rural,

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Figure 2. Locations of MOE and NAPS Monitoring Stations



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agricultural lands and may be considered representative of rural sections of the analysis area. MOE Station No. 48002, Stouffville has not been monitored for the past few years and therefore has been eliminated from the list of MOE monitoring stations surrounding the analysis area. The Oshawa monitoring station is located in downtown Oshawa and is located near industry; these data may be representative of urban sections of the analysis area. The Newmarket monitoring station is located in the downtown; these data may also be representative of urban sections of the analysis area. Where data from MOE Station No. 45025 (Ritson Road and Olive Avenue, Oshawa) were not available, the data from MOE Station No. 48006 (Eagle Street/McCaffrey Road, Newmarket) were used, and vice versa.

A five-year summary (1999-2003) of the measurements from monitoring stations surrounding the analysis area is provided in Table 2.

The review of historical ambient air quality measurements indicates that levels of CO and NO₂ are well below their respective ambient air quality guidelines at the monitoring sites. The PM₁₀ and PM_{2.5} air quality levels measured at MOE Station No.45025 are common to many cities in Southern Ontario, where there are infrequent measured levels in excess of the guidelines. Particulate matter levels are associated with long-range transport and complex chemical interactions in the atmosphere. Fine particulate matter is emitted from vehicles in addition to being formed in the atmosphere.

Table 2. Summary of Ambient Measurements from MOE Station No. 45025, Ritson Road and Olive Avenue, Oshawa, MOE Station No. 48006, Eagle Street/McCaffrey Road, Newmarket [3-5]

Pollutant	Statistic	1999	2000	2001	2002	2003	Average
CO (ppm) [1]	1-hr Max	7.00	n/a	2.83	2.25	7.05	5
	8-hr Max	3.40	n/a	1.80	1.49	2.22	2
	Annual Mean	0.70	n/a	INS	0.53	0.43	1
	1-hr 90th Percentile	1.00	n/a	0.87	0.85	0.71	1
	Times > 1-hr AAQC (30 ppm)	0	n/a	0	0	0	0
	Times > 8-hr AAQC (13 ppm)	0	n/a	0	0	0	0
NO ₂ (ppb) [2]	1-hr Max	95	84	85	83	82	86
	24-hr Max	53	47	50	40	48	48
	Annual Mean	22	20	19	17	16	19
	1-hr 90th Percentile	39	37	35	33	31	35
	Times > 1-hr AAQC (200 ppb)	0	0	0	0	0	0
	Times > 24-hr AAQC (100 ppb)	0	0	0	0	0	0
PM _{2.5} TEOM (µg/m ³) [3]	1-hr Max	83	55	68	133	60	80
	24-hr Max	57	34	40	57	46	47
	Annual Mean	10	8	9	9	8	9
	1-hr 90th Percentile	22	19	20	21	17	20
	Times > 24-hr CWS (30 µg/m ³)	6	3	8	14	6	7

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Pollutant	Statistic	1999	2000	2001	2002	2003	Average
PM ₁₀ TEOM (µg/m ³) [3]	1-hr Max	138	92	113	222	100	133
	24-hr Max	95	57	67	95	77	78
	Annual Mean	16	14	15	15	13	15
	1-hr 90th Percentile	37	32	33	35	28	33
	Times > 24-hr AAQC (50 µg/m ³) *	n/a	n/a	n/a	n/a	n/a	n/a

Notes:

[1] Measurements taken from MOE Station No.48006, Eagle Street/McCaffrey Road, Newmarket

[2] Measurements taken from MOE Station No. 45025, Ritson Road and Olive Ave., Oshawa

[3] Measurements taken from MOE Station No.45025, Ritson Road and Olive Ave., Oshawa, PM₁₀ data was not available and was estimated using $PM_{10} = PM_{2.5}/0.6$ (equation provided by MOE)

n/a – Not available

TEOM – Tapered Element Oscillating Microbalance (Continuous Monitor)

AAQC – Ambient Air Quality Criterion

CWS – Canada Wide Standard

* Interim AAQC

5. Conclusions

The review of historical ambient air quality measurements indicates that levels of CO and NO₂ are well below their respective guidelines at the Oshawa and Newmarket monitoring sites surrounding the analysis area. Measured levels of PM₁₀ and PM_{2.5} were found to occasionally exceed the respective air quality criteria. In conclusion, it would appear that existing ambient air quality in the analysis area is typical of the rest of Southwestern Ontario.

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6. Recommendations / Further Work

As part of the 407 East EA ToR, the following air quality studies are to be undertaken, following the existing conditions technical report:

1. Assessment of “Alternatives to” for Air Quality and Climate Change Impacts;
2. Assessment of Route Alternatives with Respect to Air Quality Impacts;
3. Assessment of the Technically Preferred Concept Design with Respect to Air Quality;
4. Regional Air Pollution Study; and
5. Assessment of the Technically Preferred Concept Design with Respect to Climate Change Impacts.

Report Prepared By:

Terri-Lynn Pearson, B.Sc.(Agr.)
Environmental Technologist

Report Reviewed By:

Scott Shayko, Hon. B.Comm., B.Sc.
Senior Project Manager/Associate

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7. References

Canadian Council of Ministers of the Environment, 2000:

Canada-Wide Standards of Particulate Matter and Ozone. Endorsed by CCME Council of Ministers, June 5-6, 2000, Quebec City.

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Ontario Ministry of the Environment, 2001:

Summary of Point of Impingement Standards, Point of Impingement Guidelines, and Ambient Air Quality Criteria. September 2001.