Air Quality Assessment - Teston Road between 250 m west of Pine Valley Drive and Kleinburg Summit Way

HDR Inc.

SLR Project No: 241.20136.00000

April 2022

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1.0 INTRODUCTION

SLR Consulting (Canada) Ltd., was retained by HDR Inc. on behalf the City of Vaughan (Vaughan) to conduct an air quality impact assessment in Vaughan Ontario. The purpose of the study is to address the proposed Teston Road roadway improvements from 250 m west of Pine Valley Drive to Kleinburg Summit Way. This work is being done as part of the Municipal Class Environmental Assessment process. This encompasses approximately 2.1 km of improved roadway.

2.0 METHODOLOGY

Transportation-related air quality assessments in Ontario generally refer to the guidelines provided by the Ontario Ministry of Transportation (MTO) and the Ministry of Environment, Conservation and Parks (MECP). Specifically, MTO's *Environmental Guide for Assessing and Mitigating Air Quality Impacts and Greenhouse Gas Emissions of Provincial Transportation Projects, and* MECP's *Transportation Assessment Guidelines - Appendix C - Air Quality Impact Assessment.*

Based on early project discussions between HDR and MECP, it was deemed that a quantitative assessment of air quality is not required for the project. In lieu of completing a detailed quantitative analysis, a qualitative air quality assessment has been completed based on of the following tasks:

- Identification of contaminants of concern, ambient monitoring stations, applicable guidelines, and meteorological data applicable to study area.
- Identification and mapping of all sensitive receptor locations within 500 m of the project.
- Identification of proposed project activities and locations relative to identified sensitive receptors.
- Providing a Summary of Best Management Practices (BMPs) to reduce construction related impacts. The BMPs will focus on mitigating diesel and dust related emissions from construction equipment.
- Providing Recommendations for documentation of inspection procedures and any air quality complaints received.

A review of site-specific construction consideration and identification sensitive receptors within the study area are provided in **Section 3.0.** General information pertaining to construction activities and mitigation measures is provided in **Appendix A**. Information provided in the appendix includes:

- SOURCE IDENTIFICATION AND CONTROL MEASURES
- DEVELOPMENT & IMPLEMENTATION OF A BEST MANAGEMENT PRACTICES PLAN (BMPP)
- STAFF TRAINING
- INSPECTION, MONITORING, RECORD KEEPING, AND REPORTING

Finally, a future operational perspective of the project was reviewed qualitatively for air quality impacts and is presented in **Section 4.0.**

2.1 Contaminants of Interest

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

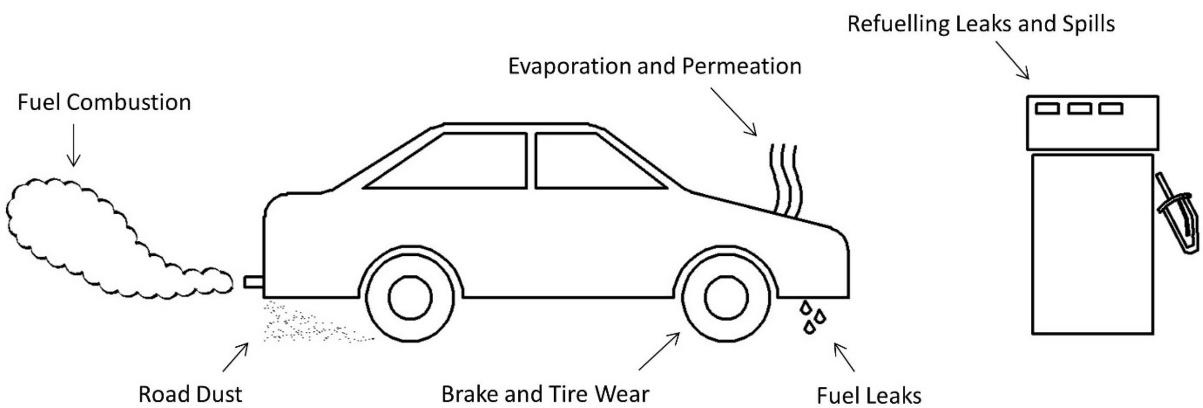

Figure 1: Motor Vehicle Emission Sources

Table 1: Contaminants of Interest

Contaminants		Volatile Organic Compounds (VOCs)	
Name	Symbol	Name	Symbol
Nitrogen Dioxide	NO_2	Acetaldehyde	C_2H_4O
Carbon Monoxide	CO	Acrolein	C_3H_4O
Fine Particulate Matter (<2.5 microns in diameter)	$PM_{2.5}$	Benzene	C_6H_6
Coarse Particulate Matter (<10 microns in diameter)	PM_{10}	1,3-Butadiene	C_4H_6
Total Suspended Particulate Matter (<44 microns in diameter)	TSP	Formaldehyde	CH_2O

2.2 Applicable Guidelines

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

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

The threshold values and averaging periods used in this assessment are presented in **Table 2**. It should be noted that the CAAQS for fine Particulate Matters less than two and a half micron in width ($PM_{2.5}$) is not based on the maximum 24-hour concentration value; $PM_{2.5}$ is assessed based on the annual 98th percentile value, averaged over 3 consecutive years.

Table 2: Applicable Contaminant Guidelines

Contaminant	Averaging Period (hrs)	Threshold Value (µg/m^3)	Source
NO_2	1	400	AAQC
	24	200	AAQC
	1	79 (42 ppb)[1]	CAAQS (standard is to be phased-in in 2025)
	Annual	23 (12 ppb)[2]	CAAQS (standard is to be phased-in in 2025)
CO	1	36,200	AAQC
	8	15,700	AAQC
$PM_{2.5}$	24	27[3]	CAAQS (standard is to be phased-in in 2020)
	Annual	8.8[4]	CAAQS
PM_{10}	24	50	Interim AAQC
TSP	24	120	AAQC
Acetaldehyde	24	500	AAQC
Acrolein	24	0.4	AAQC
	1	4.5	AAQC
Benzene	Annual	0.45	AAQC
	24	2.3	AAQC
1,3-Butadiene	24	10	AAQC
	Annual	2	AAQC
Formaldehyde	24	65	AAQC

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

2.3 BACKGROUND AMBIENT DATA

A review of MECP and National Air Pollution Surveillance (NAPS) ambient monitoring stations in Ontario was undertaken to identify the monitoring stations that are in relative proximity to the study area and that would be representative of background contaminant concentrations in the study area. The closest MECP and NAPS station deemed to be representative of the study area is located 22km to the northeast at Eagle St. W./Mc Caffrey Rd in Newmarket (MECP Station ID 48006 and NAPS Station ID 065101). There is an MECP station slightly closer to the site (Station ID 34020 located 17km southeast of the site at Hendon Ave./Yonge St.), however, this station may not as accurately represent the ambient conditions at the study area due to the station's urban setting. Note that CO is only monitored at the Toronto West Station, therefore this station was used only to assess background CO concentrations. Also note that Windsor is the only station in Ontario at which background Acrolein, Formaldehyde, and Acetaldehyde are measured in recent years. Only these contaminants were considered from the Windsor station; the remaining contaminants from the Windsor station were not considered given the stations' distance from the study area. The locations of the relevant ambient monitoring stations in relation to the study area are shown in **Figure 2**. Station information is presented in **Table 3.**

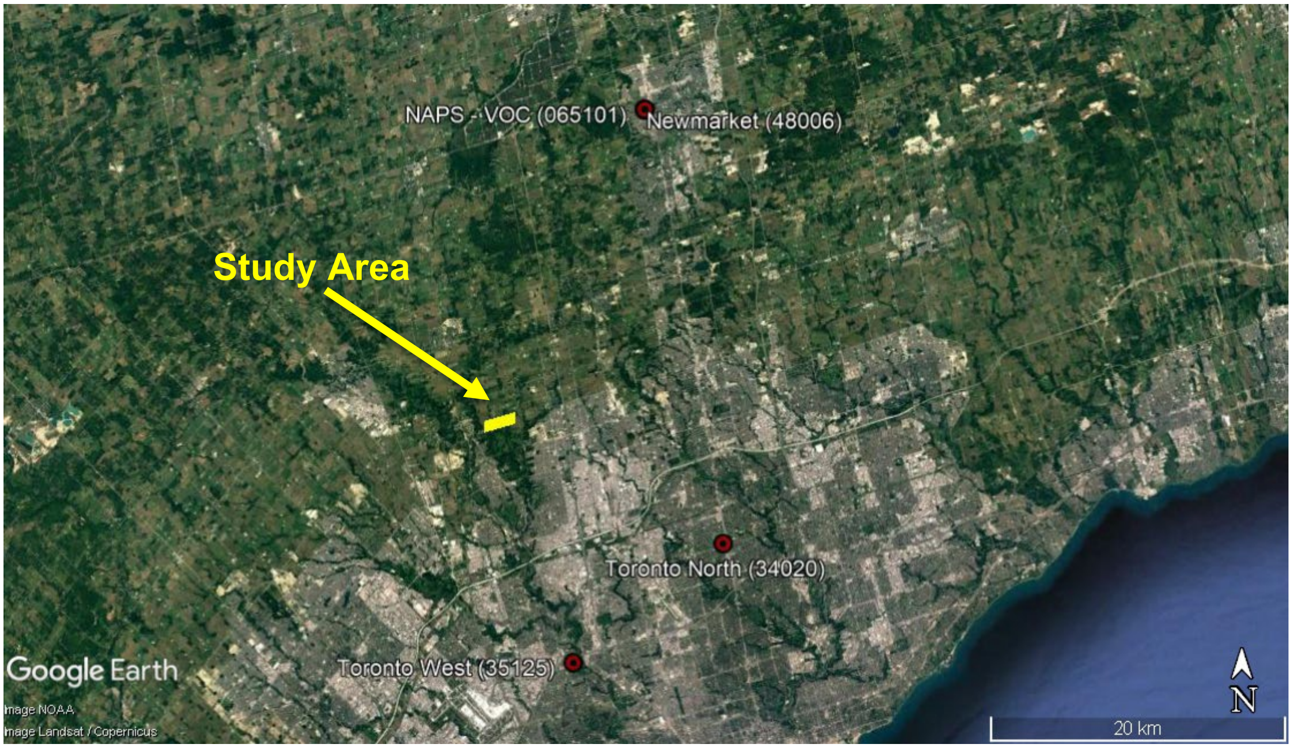

Figure 2: Location of Ambient Monitoring Stations, Relevant to the Study Area

Table 3: Relevant MECP and NAPS Station Information

City/Town	Station ID	Location	Operator	Contaminant
Toronto West	35125	125 Resources Rd	MECP	CO
Toronto North	34020	Hendon Ave./Yonge St.	MECP	NO_2| $PM_{2.5}$
Newmarket	48006	Eagle Street & McCaffrey Road	MECP	NO_2| $PM_{2.5}$
Newmarket	65101	Eagle Street & McCaffrey Road	NAPS	1,3-Butadiene|Benzene
Windsor West	60211	College St/Prince St	NAPS	Formaldehyde |Acetaldehyde | Acrolein

Year 2013 to 2017 hourly ambient monitoring data from the selected stations were statistically summarized for the desired averaging periods: 1-hour, 8-hour, 24-hour, and annual. Note that for the NAPS stations Volatile Organic Compounds (VOCs), formaldehyde, acetaldehyde and acrolein are only measured at the Windsor station and were not measured after 2010. Therefore 2006-2010 data were used for these VOCs.

Note that PM_{10} and TSP are not measured in Ontario; therefore, background concentrations were estimated by applying a $PM_{2.5}/PM_{10}$ ratio of 0.54 and a $PM_{2.5}$/TSP ratio of 0.3 (Lall et al., 2004). Ambient VOC data is not monitored hourly but is typically measured every six days.

A detailed statistical analysis of the selected worst-case background monitoring station for each of the contaminants was performed and is summarized in **Figure 3**. Presented is the average, 90th percentile, and maximum concentrations as a percentage of the guideline for each contaminant from the worst-case monitoring station. Maximum ambient concentrations represent a single worst-case value. The 90th percentile concentration represents a reasonably worst-case background concentration, and the average concentration represents a typical background value. The 98th percentile concentration is shown for NO_2 and $PM_{2.5}$, as the guidelines for these contaminants are based on 98th percentile concentrations.

Based on a review of ambient monitoring data from 2013-2017, background concentrations were generally below their respective guidelines. The exceptions are benzene, as well as the 1-hour NO_2 CAAQS and the PM_{10} 24-hour standard. It should be noted that PM_{10} and TSP were calculated based on their relationship to $PM_{2.5}$.

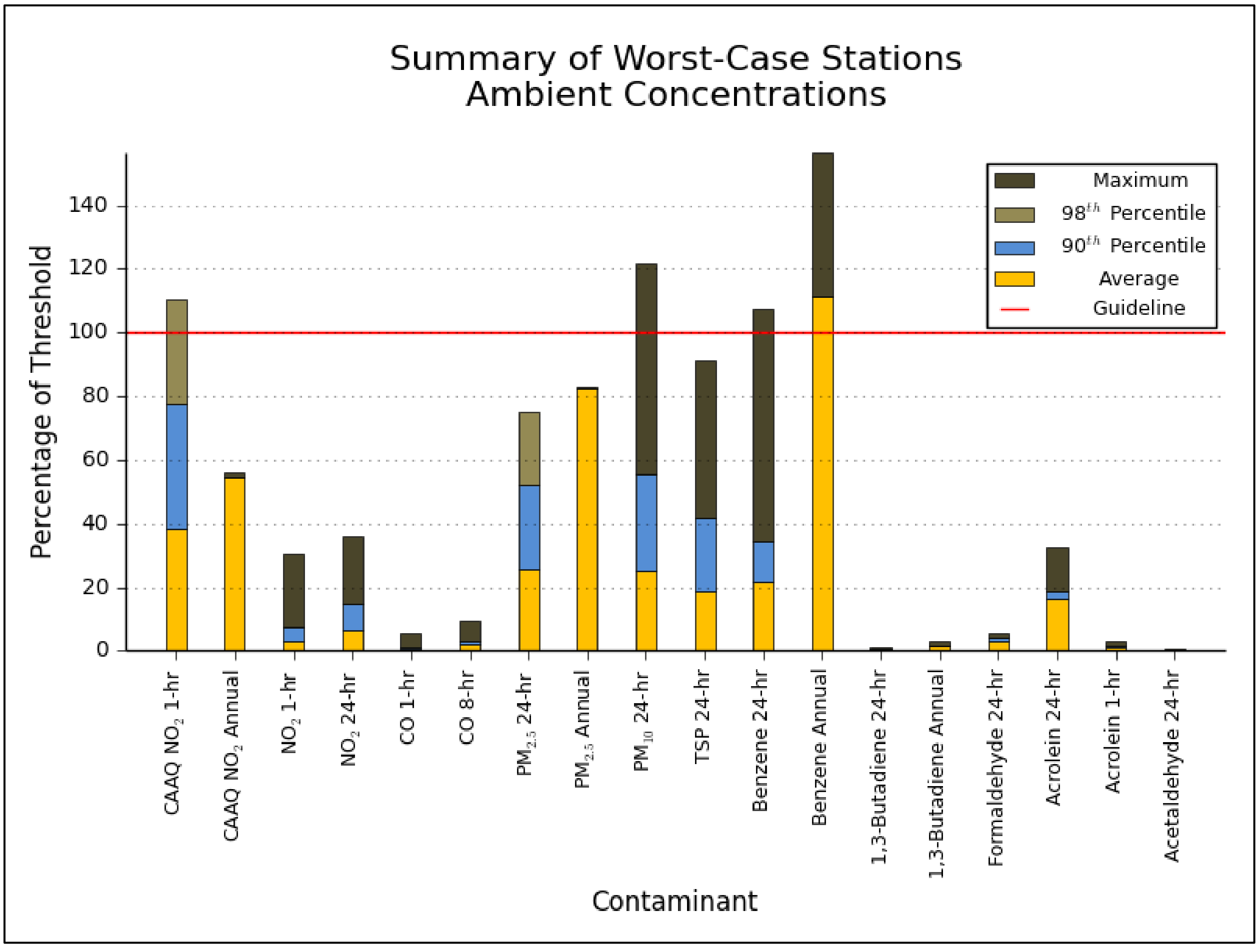

Figure 3: Worst-Case Summary of Ambient Background Concentrations

3.0 SITE SPECIFIC CONSTRUCTION CONSIDERATIONS

3.1 Meteorology

Based on the project site's location, thirty years of meteorological data (1990 to 2020) from the nearby Toronto Pearson International Airport was analyzed. The annual wind rose is shown in **Figure 4** shows the wind direction (blowing from) and wind speed along the various compass directions.

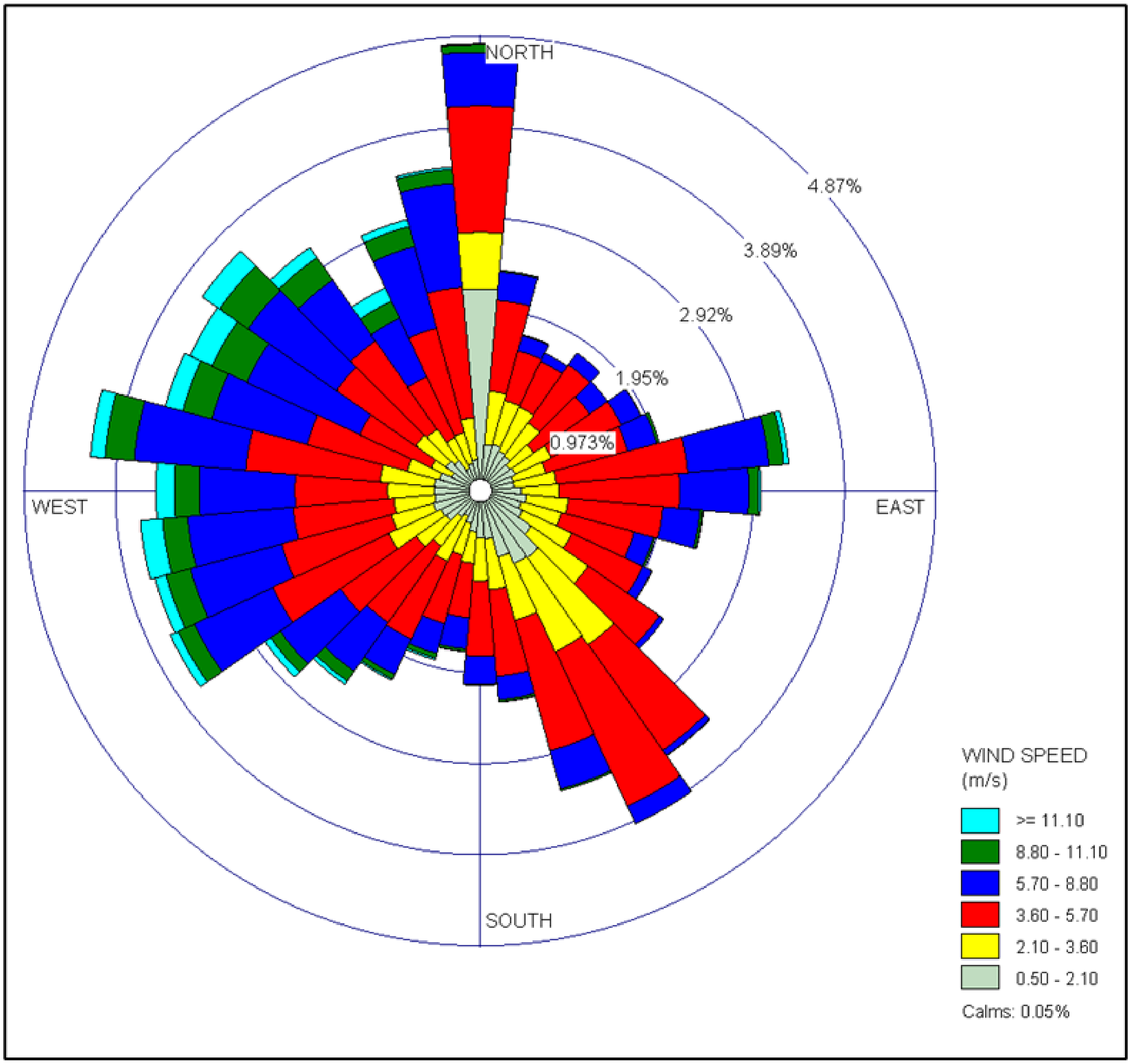

Figure 4: Annual Wind Rose for Toronto Pearson International Airport (1990–2020)

3.2 Identification of Sensitive Receptors

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

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

Worst-case impacts generally occur at the sensitive receptors closest to roadway sources. This is due to the fact that contaminant concentrations disperse significantly with downwind distance from the roadway resulting in reduced contaminant concentrations. At approximately 500 m from the roadway, contaminant concentrations from motor vehicles generally become indistinguishable from background levels.

Sensitive receptors within the study area were identified using aerial imagery and a by conducting a review of proposed development plans in the area.

Figure 5 shows sensitive receptor locations identified within 500 meters of the study area. The identified receptors consist of residential houses on both the north and south sides of Teston Road, as well as future residential developments near Grace Lake Park to the northwest and near the Teston Road/Pine Valley Drive intersection.

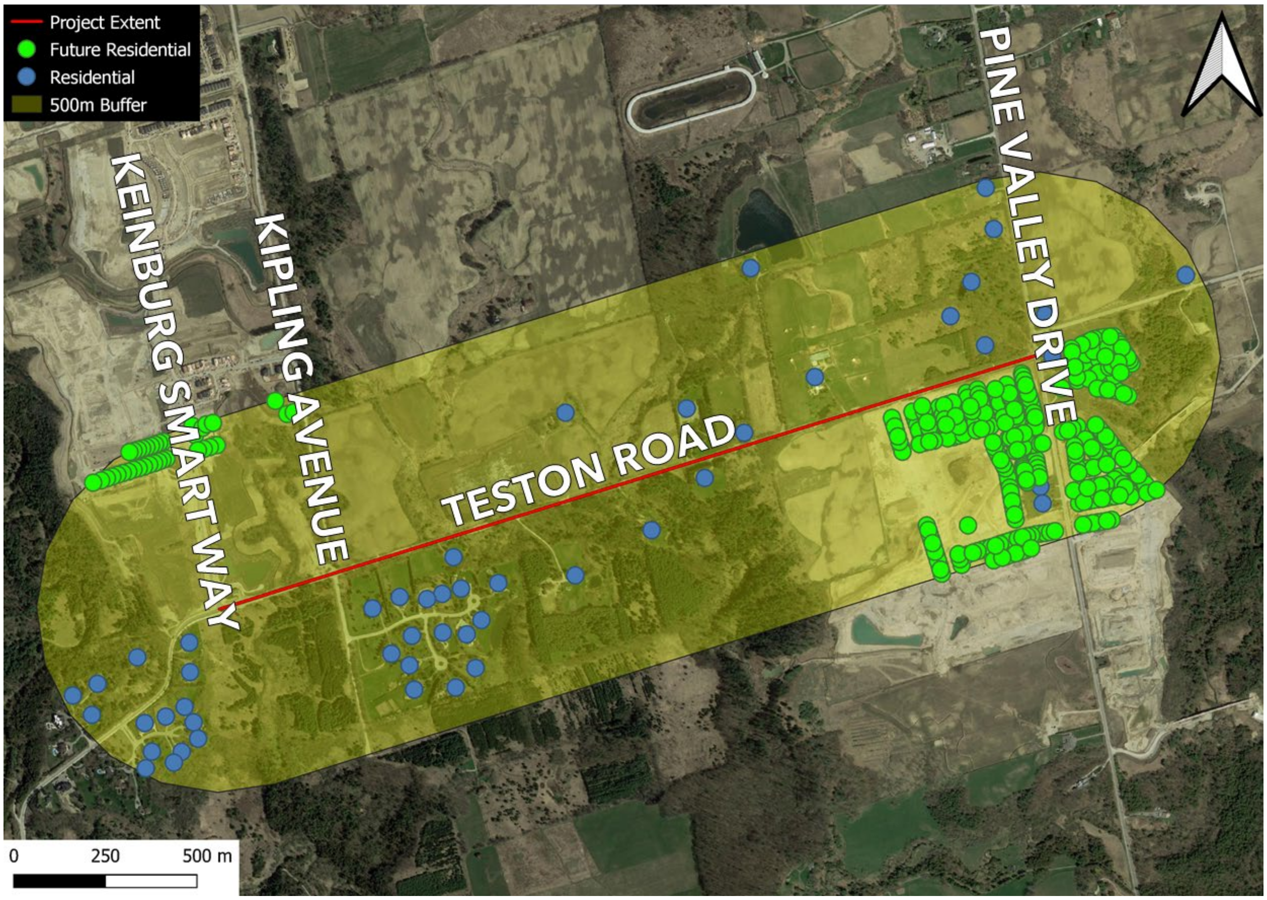

Figure 5: Identified Sensitive Receptors Within the Study Area

3.3 Key Receptor Locations (nearest to construction along Teston Road)

A review of the proposed upgrade/improvement plans on this segment of Teston Road indicates that the overall Teston Road footprint is expected to expand further north and south of its current extents given the inclusion of the proposed cycle track and sidewalk (even though traffic lanes remain unmoved). This will likely place construction activities within a proximity of approximately 40 m of the nearest residential houses (existing and future). The nearest existing houses are denoted with blue stars in **Figure 6** and **Figure 7.** In addition, the proposed future Klein Estates development by Lindvest is a planned single family home project/community located on the lands southwest of the Teston Road/Pine Valley Drive intersection. Based on the site plan of the proposed developed shown in **Figure 8**, a row of residential dwellings is situated approximately 50 m south of Teston Road.

From an air quality perspective during the construction phase of the project, it is recommended that precautionary and mitigation approaches be considered for activities in closest proximity to the identified sensitive receptor locations. Construction staging and storage areas should be planned to be located away from identified receptors. The greatest potential for adverse impacts would occur on dry and/or windy days, so weather forecasts and conditions should be monitored. During such meteorological events, consideration should be given to limiting or postponing operations that may create fugitive dust emissions and result in downwind impacts at nearby sensitive receptor locations. As per guidance from the MECP, it is recommended that non-chloride dust suppressants be applied for all excavation and unpaved vehicle track movements to minimize fugitive dust. Regular cleaning of the construction site and vehicles should be undertaken, as per the recommendations of APPENDIX A.

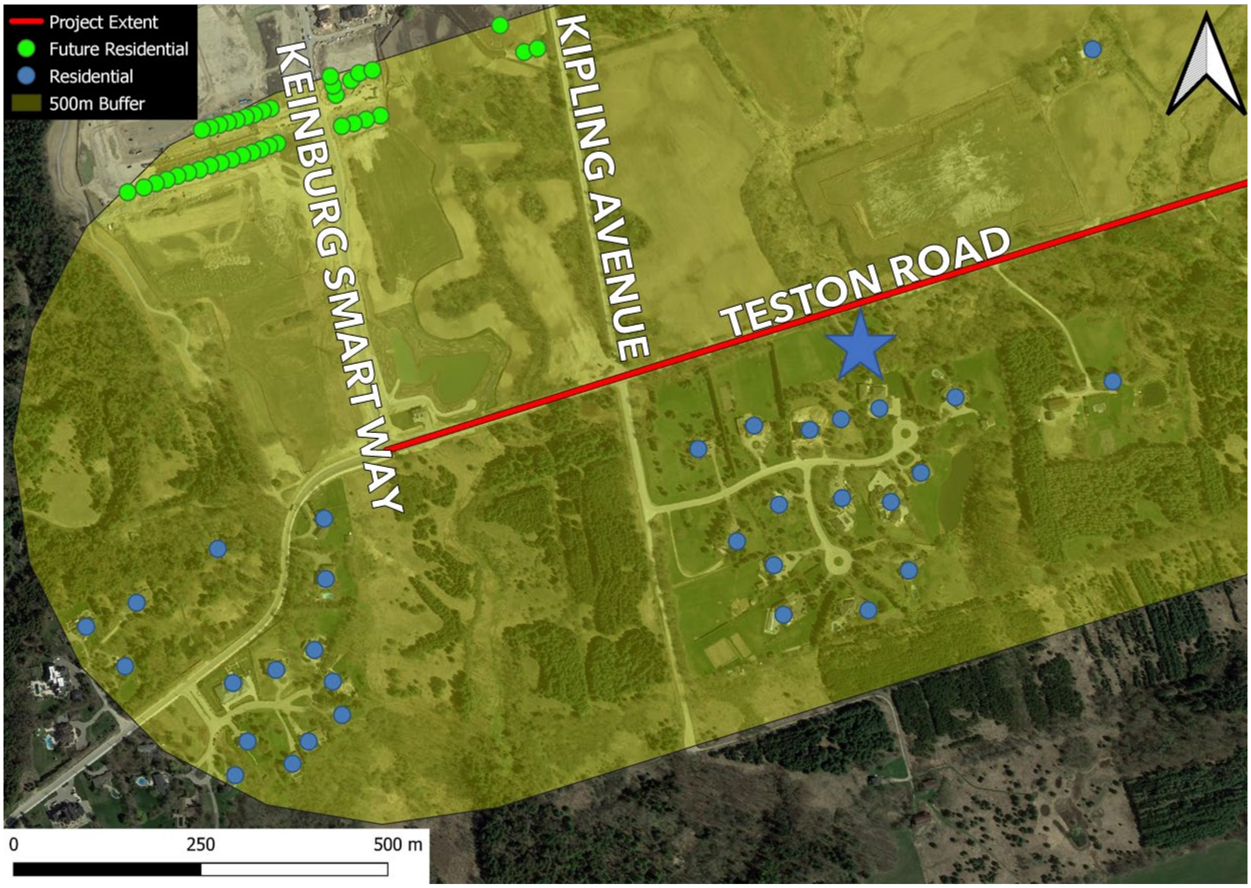

Figure 6: Nearest Receptors for western portion of Study Area (marked as stars)

Figure 7: Nearest Receptors near eastern portion of Study Area (marked as stars)

Figure 8: Klein Estates Site Plan

4.0 QUALITATIVE OPERATIONAL AIR QUALITY ASSESSMENT

Based on early project discussions between HDR and MECP, it was deemed that a quantitative assessment of air quality is not required for the project. In lieu of completing a detailed quantitative analysis, a qualitative review of air quality from an operational (future build) perspective has been undertaken.

4.1 Teston Road Improvement

The project will involve upgrading the existing two-lane Teston Road between 250 m west of Pine Valley Drive and Kleinburg Summit Way to meet modern roadway standards. Roadway improvements are expected to include:

- Smoothing of the general elevation profile of the roadway.
- Addition of cycle and sidewalk track (existing traffic lane widths to remain unchanged).
- Improvement of sidewalk features in both directions symmetrically along newly defined sidewalk tracks.
- Lowering posted speed limit of Teston Road from 60 km/h to 50 km/h (existing traffic volumes to remain unchanged).

A review of the proposed roadway upgrade/improvement plans indicates that the overall Teston Road footprint is expected to expand further north and south of its current extents given the inclusion of the proposed cycle track and sidewalk; however, the number of lanes, lane position and lane widths will remain unchanged. Furthermore, a review of traffic data for the project indicates that traffic volumes for the proposed future build scenario remain unchanged from existing traffic volumes.

Based on the project involving no alterations to the number of traffics lanes, lane positioning or lane widths, and no associated increase in future traffic volumes, the overall air quality impact from a day-to-day operational standpoint is expected to be insignificant between a build versus no build scenario.

5.0 CONCLUSION

From an air quality perspective, the main concerns relating to construction activities include fugitive dust and diesel exhaust emissions. In addition, worst-case meteorically conditions will include dry and/or windy days. Meteorological data from Pearson International Airport is provided in **Figure 4** and should be considered when planning construction staging and storage areas relative to air-sensitive receptors. The project study area was reviewed, and air-sensitive receptors were identified, as outlined in **Section 3.0** and presented in **Figure 5.** Consideration should be given to limiting or postponing construction operations that may create fugitive dust emissions resulting in downwind impacts at nearby sensitive receptor locations. Examples of common BMPs and controls are provided in **Appendix A**.

From an operational perspective, the project involves no alterations to the number of traffics lanes, lane positioning or lane widths, and there will be no associated increase in future traffic volumes. Based on these factors, the overall air quality impact from a day-to-day operational standpoint is expected to be insignificant between a build versus no build scenario.

6.0 STATEMENT OF LIMITATIONS

This report has been prepared and the work referred to in this report has been undertaken by SLR Consulting (Canada) Ltd. (SLR) for Vaughan and HDR Inc., hereafter referred to as the "Client". It is intended for the sole and exclusive use of the Client. The report has been prepared in accordance with the Scope of Work and agreement between SLR and the Client. Other than by the Client and as set out herein, copying or distribution of this report or use of or reliance on the information contained herein, in whole or in part, is not permitted unless payment for the work has been made in full and express written permission has been obtained from SLR.

This report has been prepared in a manner generally accepted by professional consulting principles and practices for the same locality and under similar conditions. No other representations or warranties, expressed or implied, are made.

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APPENDIX A General Construction Air Quality Information

Teston Road between 250 m west of Pine Valley Drive and Kleinburg Summit Way between 250 m west of Pine Valley Drive and Kleinburg Summit Way

HDR Inc.

SLR Project No: 241.20136.00000

1.0 SOURCE IDENTIFICATION AND CONTROL MEASURES

In general, the emission sources and control measures for construction activities are identified in the Environment and Climate Change Canada publication *Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities*[1].

1.1 Fugitive Dust from Vehicle Movement

1.1.1 Paved Roads

The most significant source of dust emissions from construction activities is typically from vehicular traffic on unpaved roads or open construction areas. Emissions from paved roads can also occur, typically due to material spillage, the transportation of uncovered material, or from dirty equipment. Additionally, paved roads surrounding a construction area can become dirty if left unattended, and vehicular traffic on these roads can cause the re-suspension of dust.

Mitigation and control measures to reduce dust emissions from paved surfaces include:

- Street sweeping as required, based on visual inspection. Roads should be kept clear of dust as much as possible.
- Swift removal of spilled materials.
- Use of enclosed cargo holds on trucks and vehicles or cover of open bodied trucks.
- Minimize or limit the number of trucks accessing the site.
- Clean the wheels and empty cargo holds of vehicles prior to leaving the site.

1.1.2 Unpaved Roads and Exposed Surfaces

Dust from unpaved roads and exposed construction sites will occur due to vehicle travel as well as wind erosion. The predominant mechanism of dust generation from unpaved roads is the re-suspension of surface particulate due to vehicle traffic.

Mitigation and control measures to minimize fugitive dust from unpaved areas include:

- Minimize vehicle traffic on-site.
- Set low speed limits (i.e., 15 km/hr or less) for on-site traffic.
- Apply water or a dust suppressant on unpaved surfaces, including all roads and lots.
- Vegetating disturbed lands (e.g., seed disturbed lands) to reduce potential for dust to develop from exposed soil.

[1] Cheminfo Services Inc., Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities, March 2005

1.2 Dust from Storage of Materials and Residual Waste

1.2.1 Storage

Dust generation occurs from wind erosion of storage piles. Dust generation due to these activities is increased during strong wind conditions.

Mitigation and control measures to control fugitive dust from aggregate material and earth storage include:

- Minimize uncovered storage of materials on-site.
- Apply water or a dust suppressant to storage piles.
- Construct wind breaks surrounding storage piles.

1.2.2 Unloading and Loading

Loading, unloading, and transferring materials is a significant source of fugitive dust. Dust generation due to these activities is increased during strong wind conditions. Mitigation and control measures for unloading, loading, and transferring aggregate materials include:

- Minimize the amount of material being transferred on-site at any one time.
- Lower drop distances when unloading material onto piles or surfaces.
- Load trucks and vehicles so that the dump load will not spill over the sides of the target vehicle. Loads should be dropped as close to the vehicle opening as possible.
- Apply a water spray or dust suppressant to the materials being transferred.
- Cover loads when hauling or transferring materials.

1.3 On-Site Operations

1.3.1 Machinery Exhaust

All diesel operated vehicles and machinery including generators, excavators, crushers, etc., will emit suspended particulate matter and odours as part of exhaust emissions. Higher amounts of particulate emissions can be expected during long idling times and when many vehicles or engines are operating at any one time.

Mitigation and control measures to control particulate matter and odours from engine exhaust include:

- Minimize the number of vehicles and engines operating concurrently.
- Increase separation distances between sensitive receptors, such as schools, residences, and parks and all exhaust points
- When possible, ensure that engine exhausts are oriented upwards.
- Limit idle times of vehicles and engines and shut off engines when not in use.
- When possible, limit operations to times when winds are blowing away from sensitive receptors and minimize use when winds would direct exhaust gases towards sensitive receptors.

- Ensure equipment and vehicles are well-maintained and in good working order.

1.3.2 Excavation

Drilling, blasting, crushing, and excavating during construction are all sources of fugitive dust. Mitigation and control measures to minimize fugitive dust from excavation operations include:

- Minimize the number of machines operating concurrently.
- Use water or dust suppressants on the work surface
- Decrease the travel distance between the work area and storage piles or trucks.
- Lower drop distances of the excavated earth and materials.

1.4 Demolition and Deconstruction

Demolition activities such as bridge reconstruction can result in fugitive dust emissions resulting from blasting or removal of structures. In addition to the measures described above, mitigation measures for demolition and deconstruction include:

- Applying deconstruction techniques, rather than demolition.
- Minimize drop heights for debris.
- Enclose chutes and cover bins.
- Vacuum debris from paved and other surfaces prior to conducting reconstruction activities.
- Avoid prolonged storage of debris onsite.

2.0 DEVELOPMENT & IMPLEMENTATION OF A BEST MANAGEMENT PRACTICES PLAN (BMPP)

2.1 Purpose

It is the contractor's responsibility to ensure their staff and operating procedures follow a project-specific Best Management Practices Plan (BMPP) to reduce pollutants that contribute to poor air quality and ground level ozone formation. Given the unique nature of each construction project, contractors must develop and follow a BMPP specific to each project. The following sections provide a general overview/reference for the contract administrator as a guidance to look for or to step in promptly in the unlikely scenario the contractor appears to not operate under a BMPP during the project.

2.2 Introduction

A project specific BMPP should be developed before the start of construction and be followed for the duration of all construction activities. The BMPP can also be used as a tool for staff training and should remain in effect for the life of the construction job with the understanding that the plan will be reviewed and updated periodically by the contractor. The following conditions should be followed by designated construction managers and personnel:

- The BMPP is to be kept on file in the site office and available for review upon request.
- Training of relevant staff on new and existing operating procedures.
- Refresher training a minimum of once every year.
- Management is to communicate the BMPP to responsible personnel, who should ensure staff are following operating procedures defined in the BMPP.
- The site manager is responsible for ensuring the BMPP is followed.
- Management should ensure BMPP is reviewed as required.

3.0 STAFF TRAINING

All construction staff should be trained to follow the BMPP efficiently and safely. Training manuals should be prepared and reviewed with existing staff and new hires, as well as prior to the start of the construction project to identify site-specific measures to be implemented. The plan should be updated from time to time as required.

All employees directly involved with activities relating to the highway upgrades are to be trained in the following:

- Housekeeping requirements.
- Importance of following the BMPP.
- Procedures for control of dust and odour.
- Record keeping procedures.
- Reporting adverse conditions that have the potential to cause dust or odour to the site manager.

The construction manager should maintain a written record of employee training, including the date of training, the name and signature of the employee, and a description of the training received.

Trained personnel are to be present during construction activities to supervise receiving, handling, transfer of materials, and all other relevant site operations.

4.0 INSPECTION, MONITORING, RECORD KEEPING, AND REPORTING

A record keeping procedure should be implemented by the contractor to track daily information. Records are to be kept by the contractor's designated individual responsible for completing daily site inspections. The designated individual should be trained in the requirements and objectives of the BMPP. All records are to be kept on-site at the site office. Reporting will include:

- Confirmation that the inspection has been completed and that the items on the checklist have been addressed.
- Weather conditions, such as wind speed and direction, cloud cover, precipitation, and temperature.
- Any actions taken to control nuisance issues on-site.
- A summary of any on-site spills that were reported to the MECP.
- A summary of complaints received.

4.1 Complaint Procedure

The construction manager should ensure that all formal complaints are recorded, kept on file, and addressed. When a formal complaint is made, the following information should be recorded:

- Employee name and title receiving the complaint.
- Personal information of the complainant, such as name, address, and telephone number.
- Date and time the complaint was made.
- Nature and description of the complaint.
- Corrective action taken to resolve the issue.
- Follow up with complainant in the form of a formal response.

Formal complaints should initiate an inspection of the suspected cause of the complaint. Corrective action should be implemented to mitigate the cause of the complaint wherever possible.

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