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PROPOSED REDEVELOPMENT OF STONEHAVEN DRIVE, BURLINGTON

Air Quality Report

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REPORT

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1.0 INTRODUCTION

IBI Group, on behalf of Mantella Corporation (Mantella) is proposing to submit a Plan of Subdivision and Zoning By-law Amendment application to permit residential development on currently vacant lands at Stonehaven Drive in Burlington, Ontario (the Property). A concept plan for the proposed design is included in Attachment A, and includes the following:

- 10 single detached lots along an extension of Bird Blvd.
- 8 townhouse lots fronting onto Stonehaven Drive.
- 3 single detached lots along Orchard Road. (*Please note that these lots will be subject to a separate planning application and do not form part of the subdivision lands.).*

As part of the land use planning process, an understanding of whether or not proposed land uses, changes to land uses and/or amendments to land uses will introduce a potential for issues related to land use compatibility is required. As a result, The Region of Halton (the Region) has developed a series of Guidelines, including specific requirements for an Air Quality Report to address the following:

- provide supporting data to show that the proposed land use is suitable for the site; and
- assist City of Burlington staff with their analysis and report preparation.

Under the Region's policy 143(12), air quality emission studies are required when sensitive land uses (including residential are proposed and the following criteria are met:

1) a major arterial road or provincial highway is within 30 m or a provincial freeway is within 150 m;

2) industrial uses are in proximity; and

3) utility use is in proximity.

This scope of work has been prepared to identify whether the above three criteria are met and to fulfil the requirements of the Air Quality Report required as per The Region of Halton Air Quality Guidelines (The Region of Halton 2014).

2.0 METHODOLOGY

The proposed redevelopment plans for The Property include low and mid-rise residential use. A detailed "Concept Plan" is included in Appendix A. The redevelopment will not include any industrial land use and Golder understands that there will be no significant sources of emission to air from the proposed new land uses. As such, this Air Quality Report focuses on the suitability of introducing sensitive land use to the area.

The air quality assessment includes three main tasks:

- Identification of Existing Air Quality Sources;
- Land Use Compatibility Assessment; and
- Detailed Air Quality Study.

Each of these tasks is described in more detail in the following sections.

3.0 IDENTIFICATION OF EXISTING AIR QUALITY SOURCES

The first step of this assessment is to identify the main sources of air quality emissions in the area surrounding the Property. The Property is surrounded primarily by residential housing to the south and East, commercial land use to the west and industrial land use to the north. A 1 km radius was drawn around the site to identify the main sources of air emissions from both industrial and transportation sources, as indicated in Figure 1. The Property is indicated in Red and relevant industrial sources in purple and yellow.

Figure 1: 1 km radius from Property

Identified Industrial and transportation sources are discussed in the following two sections.

3.1 Industrial Sources

Within 1 km of the Property, there are two industrial facilities from various sectors that reported to the National Pollutant Release Inventory (NPRI) for emissions of the indicator compounds released to air in 2015 (Environment Canada 2016a). These emissions contribute to the local air quality and the consideration of cumulative effects. These sources are minor contributors of indicator compounds when compared to provincial totals (Table 1).

Table 1: NPRI Emission Totals for Industry within 1 km of the Property

Company Name	Distance from Property	NO_X	PM	PM_{10}	$PM_{2.5}$	CO	SO_2	HCl	HF
Dufferin Concrete	120 m (Indicated in yellow on Figure 1)	—	—	0.791	—	—	—	—	—
Forterra Brick	50 m (Indicated in purple on Figure 1) Most emission sources at least 400 m from Property	21.93	25.79	23.56	2.41	73.28	32	35.67	—
Study Area Total Emissions		**21.93**	**25.79**	**24.351**	**2.41**	**73.28**	**32**	**35.67**	**—**
Ontario Total Emissions		**67474**	**24362**	**16031**	**9353**	**69701**	**248867**	**569**	**25**
% of Local Emissions to Ontario Total		**<1%**	**<1%**	**<1%**	**<1%**	**<1%**	**<1%**	**6%**	**<1%**

Note: "—" indicates the substance was not reported for that facility.

Reporting to the NPRI is only required for facilities that have annual emissions above relevant thresholds set by Environment Canada. As a result, there may be additional industrial facilities in the vicinity of the Property that do not trigger NPRI reporting but have air quality emission sources with the potential to impact sensitive receptors introduced by the Property.

In Ontario, the Environmental Protection Act, R.S.O 1990 Chapter E.19 (EPA) regulates the discharge of contaminants into the natural environment and is administered by the Ontario Ministry of Environment and Climate Change (MOECC). Section 20.2 of Part II.1 of the EPA, for activities that fall under Section 9 of the EPA, requires that an approval must be obtained before installation or modification of all atmospheric emission sources (i.e., air, odour, noise and vibration). Depending on the facility activities, approval for the atmospheric emission sources is granted through the Environmental Activity and Sector Registry (EASR) or by obtaining an Environmental Compliance Approval (ECA) for the equipment by submitting an application to the MOECC in accordance with EPA Section 9.

Golder conducted a review of existing ECAs for facilities located within a 1km radius of the Property using the MOECC Access Environment or Environmental Registry websites. The purpose of reviewing existing ECAs is to help identify the main sources of emission to air within the surrounding area based on the descriptions of facilities that have already been permitted by the MOECC.

Copies of ECAs are publicly available on the MOECC website. Golder has obtained copies of the ECAs for the two facilities identified within 1km and completed a preliminary review of the sources of air emissions; no other facilities were identified. Table 2, below, summarises the ECAs identified and the sources of interest. The ECAs identified are for the same Facilities identified during the NPRI search. The potential impact of each of these industrial sources on the Property are further discussed in Sections 4.0 and 5.0.

Table 2: Summary of facilities with ECAs within 1 km of the Proposed Development

Distance from Property	Facility/ Company Name	Address	ECA Reference (Date Issued)	Sources of Interest as presented in the ECA	Comment
120 m	Dufferin Concrete (Formerly St Lawrence Cement)	3087 Harrison Court	4133-6XY2SQ (February 22, 2007)	Concrete Batching Plant	Limit of 100 m^3 concrete per hour
50 m (Most emission sources at least 400 m from Property)	Forterra Brick (Formerly Hanson Brick)	5155 Dundas Street West	6731-8KDKG2 (April 3, 2012)	Potential sources include crushing, screening, mixing and storage of raw materials, extrusion forming, drying, baking, cooling, packaging and shipping	Limit of 310,000 bricks per year

3.2 Transportation Sources

In addition to neighbouring industrial facilities, neighbouring transportation sources were also identified. There are several major transportation sources within a 1km radius of the site. These include:

- Dundas Street (Regional Road 5) located approximately 20 m from Property boundary;
- Appleby Line (Regional Road 20) located approximately 400 m from Property boundary;
- CN Rail Corridor located adjacent to the Property boundary (however residential development would meet at least a 15m buffer).

Studies by the US EPA have found that roadways generally influence air quality within a few hundred metres downwind from a heavily travelled road. The actual distance varies by location, time of day, year and prevailing meteorology, topography and traffic patterns (US EPA, 2014). Concentrations will dissipate rapidly from the road source. This is echoed by the Region's Air Quality Guidelines which require detailed air studies only for arterial roads less than 30 m from a proposed residential development. As a result, of the two roads identified above, Appleby Line was not considered further in this assessment. Comparatively, the Property is approximately 20 m from Dundas Street, which would be considered a major arterial road. Traffic volumes on Dundas Street include an Annual Average Daily Traffic (AADT) of approximately 40,000 vehicles. Impacts from traffic on Dundas Street are further discussed in Section 5.

The CN rail corridor is located adjacent to the property boundary, however there is an existing 3.5 m noise barrier that increases the distance that any potential residential properties could be located from the rail corridor to at least a 15m setback. Existing residential properties are already located along this rail corridor, adjacent to the Property and at this same 15m setback. The rail line is a freight line, therefore trains are infrequent. Air Quality emissions from the rail line are further assessed in Section 5

4.0 LAND USE COMPATIBILITY ASSESSMENT

4.1 D-Series Guidelines

During the land use planning process for proposed future land uses, the MOECC has recommendations described in a set of D-Series Guidelines developed in July 1995. The D-Series Guidelines are intended to assist in minimizing potential problems due to encroachment of sensitive land uses and industrial land uses on one another.

4.1.1 Guideline D-1 – Land Use Compatibility

The MOECC's Guideline D-1 – Land Use Compatibility (Guideline D-1) provides recommended separation distances and other control measures for land use planning proposals, which have the potential to involve encroachment of incompatible land uses. These recommendations seek to prevent or minimize potential adverse effects for an existing or proposed facility, and apply only under circumstances of changes in land use proposals (i.e., future proposals).

Adverse effects considered under Guideline D-1 may include:

- noise and vibration;
- visual impact;
- odour and other air emissions;
- litter, dust and other particulates; and
- other contaminants.

4.1.2 Guideline D-6 Compatibility between Industrial Facilities and Sensitive Land Uses

Guideline D-6 Compatibility between Industrial Facilities and Sensitive Land Uses (Guideline D-6) discusses the applicability of Guideline D-1 for industrial facilities. The purpose of Guideline D-6 is to prevent or minimize land use incompatibility between sensitive and industrial land uses through encroachment and the possibility of potential adverse effects due to normal operations of industrial facilities. This purpose is achieved by the suggestion of separation distances; however, Guideline D-6 also notes that detailed studies could be conducted to determine site-specific separation distances.

Guideline D-6 applies to proposed, committed and/or existing industrial land uses that have the potential to generate point and/or fugitive atmospheric emissions (noise, vibration, odour, dust and others) through normal operations, procedures, maintenance or storage activities, and/or from associated traffic/transportation. Guideline D-6 does not apply to non-stationary industrial facilities (e.g., mobile asphalt plant), roadways and railways (except ancillary facilities), agricultural operations, airports, or pits and quarries.

Guideline D-6 provides potential influence areas for three different classes of industrial land uses if an actual influence area is not available. The three different classes of industrial land uses are:

- Class I – Small scale business that is a self-contained plant or building which produces/stores a product contained to a package and has a low probability of fugitive emissions. Infrequent movement of products and/or heavy trucks. No outside storage. The facility only operates during the daytime period.

- Class II – Medium scale processing and manufacturing with occasional outputs of either point of fugitive emissions. Frequent movement of products and/or heavy trucks during the daytime hours. Outside storage of wastes or materials exists. The facility is permitted to have shift operations.
- Class III – Large scale processing or manufacturing. Frequent outputs of major annoyance with a high probability of fugitive emissions. Continuous movement of products. Outside storage of raw and finished product exists. The facility is permitted to have shift operations.

The MOECC has identified the following areas of potential influence for each of the industrial facility classes:

- Class I: 70 metres;
- Class II: 300 metres; and
- Class III: 1,000 metres.

Actual influence areas refer to overall ranges within which a potential adverse effect would occur or is experienced. These areas are site-specific for facilities. They may be defined within or beyond the potential area of influence before or after buffers have been implemented as the approach to prevent or minimize potential adverse effects. Category classifications can be lowered if mitigative measures are applied at the source of emissions, which would reduce the recommended minimum separation distance.

The following suggested minimum separation distances for each of the industrial facility classes are based on MOECC studies and historical complaint data:

- Class I: 20 metres;
- Class II: 70 metres; and
- Class III: 300 metres.

Guideline D-6 recommends that there should not be incompatible land uses within the range of the minimum separation distance. The minimum separation distance is the distance between the designation, zoning or property lines of closest proposed or existing sensitive and industrial land uses. It is used as an initial screening distance for land use separation to identify whether a more detailed assessment may be required.

Table 3 below summarizes the recommended potential, minimum and actual separation distances according to Guideline D-6 for each of the industrial facility classes.

Table 3: Guideline D-6 - Summary of MOECC Identified Areas of Influence and Recommended Separation Distances

Designation	Potential Influence Areas Separation Distance (m)	Minimum Separation Distance (m)	Actual Influence Areas Separation Distance (m)
Class I (Light Industrial)	70	20	Not available – to be determined on a site specific basis
Class II (Medium Industrial)	300	70	Not available – to be determined on a site specific basis
Class III (Heavy Industrial)	1000	300	Not available – to be determined on a site specific basis

According to Guideline D-6, when a change in land use is proposed within an actual or potential influence area of one of the three classes of an industrial land use, a sensitive land use should not be permitted unless evidence can prove absence of compatibility issues due to possibility of adverse effects. In cases where a sensitive land use is proposed beyond an industrial facility's influence area (potential or actual), there should be no objection to a change in land use.

It also should be noted that even where facilities meet the recommended separation distances specified in Guideline D-6, an air, odour, noise and/or vibration assessment may still be required to ensure that the facility meets the applicable guidelines and regulations. Therefore, it is possible for the MOECC to recommend separation distances greater that those outlined in this guideline. When industrial activities cannot be mitigated (reduction or minimization of potential adverse effects), the development of a new industrial facility or sensitive land use should not be permitted.

4.2 Application of D-6 Guidelines

Industrial facilities located within the vicinity of the proposed development were identified through the use of NPRI reporting data and Environmental Compliance Approval permits as part of Section 3. As copies of the modelling files or information on site-specific mitigation measures are not available, the two closest industrial facilities would both be classified as Class III, as a result, the potential influence area is 1,000 m. As the Property is within the potential influence area of both facilities, the recommended separation distance was identified. The Property is also within the recommended separation distance of 300 m from each facility that, as a result, further assessment is required to demonstrate compatibility. This is provided in Section 5.

5.0 DETAILED AIR QUALITY STUDY

The results of the D-6 Assessment indicated that a detailed air quality study is required to demonstrate land use compatibility between existing industry and proposed residential land use at the Property. The detailed air quality study comprised two main tasks:

1. An assessment of background air quality surrounding the site using publically available information;
2. A review of the impacts from local sources, including industry and transportation.

Each of these tasks is further discussed in the following sections.

5.1 Review of Background Air Quality

5.1.1 Contaminants

The assessment of background air quality is focused on criteria air contaminants (CACs) and air toxics typically associated with road emissions, in particular:

- particulate matter, including suspended particulate matter (SPM), particles nominally smaller than 10 micrometres (µm) in diameter (PM_{10}), and particles nominally smaller than 2.5 µm in diameter ($PM_{2.5}$);
- nitrogen dioxides (NOx) (expressed as nitrogen dioxide [NO_2]);
- sulphur dioxide (SO_2);
- carbon monoxide (CO);
- Volatile Organic Compounds (including acrolein, benzene and formaldehyde which are typically associated with road traffic);
- Hydrogen Chloride (HCl); and
- Hydrogen Fluoride (HF).

5.1.2 Ambient Air Quality Criteria

The air quality criteria used for assessing the air quality effects on the Property include provincial criteria or federal standards and objectives where provincial guidelines are not available. The Ministry of the Environment and Climate Change (MOECC) has issued guidelines related to ambient air concentrations, which are summarized in *Ontario's Ambient Air Quality Criteria* (MOECC 2012). There are two sets of federal objectives and criteria: the Canadian Ambient Air Quality Standards (CAAQSs) (formerly National Ambient Air Quality Standards (NAAQS)), and the National Ambient Air Quality Objectives (NAAQOs).

The NAAQOs are benchmarks that can be used to facilitate air quality management on a regional scale, and provide goals for outdoor air quality that protect public health, the environment, or aesthetic properties of the environment (CCME 1999). The federal government has established the following levels of NAAQOs (Health Canada 1994):

- the maximum Desirable level defines the long-term goal for air quality and provides a basis for an anti-degradation policy for unpolluted parts of the country and for the continuing development of control technology; and
- the maximum Acceptable level is intended to provide adequate protection against adverse effects on soil, water, vegetation, materials, animals, visibility, personal comfort, and well-being.

The CAAQSs have been developed under the Canadian Environmental Protection Act, and include standards for $PM_{2.5}$ and ozone that must be achieved by 2020. There are two phase-in dates, the first set of standards were phased in during 2015 and the second set will be phased in during 2020 (Government of Canada 2013).

A summary of the applicable Ontario and federal standards, objectives and criteria are listed in Table 4, along with the selected project criteria, which were selected to be the most stringent.

Table 4: Ontario and Canadian Regulatory Air Quality Objectives and Criteria

Substance	Averaging Period	Ontario Ambient Air Quality Criteria[a]	Canadian Ambient Air Quality Standards[b, c]	National Ambient Air Quality Standards and Objectives[d]		Project Criteria
				Desirable	Acceptable	
SPM[e] (µg/m³)	24-Hour	120	—	—	120	120
	Annual	60[f]	—	60	70	60
PM_{10} (µg/m³)	24-Hour	50[g]	—	—	—	50
$PM_{2.5}$ (µg/m³)	24-Hour	30[h]	28/27	—	—	27
	Annual	—	10/8.8	—	—	8.8
NO_2 (µg/m³)	1-Hour	400	—	—	400	400
	24-Hour	200	—	—	200	200
	Annual	—	—	60	100	60
CO (µg/m³)	1-Hour	36,200	—	15,000	35,000	15,000
	8-Hour	15,700	—	6,000	15,000	6,000
SO_2 (µg/m³)	1-hour	690	183/170	450	900	170
	24-hour	275	—	150	300	150
	Annual	55	13.1/10.5	30	60	10.5
Acrolein (µg/m³)	1-Hour	4.5	—	—	—	4.5
	24-Hour	0.4	—	—	—	0.4
Benzene (µg/m³)	24-hour	2.3	—	—	—	2.3
	Annual	0.45	—	—	—	0.45
Formaldehyde (µg/m³)	24-hour	65	—	—	—	65
Hydrogen Chloride	24-hour	20	—	—	—	20
Hydrogen Fluoride	24-hour	1.72/3.44	—	—	—	1.72
	30-day	0.69/1.38	—	—	—	0.69

(a) MOECC 2012.
(b) CAAQS for $PM_{2.5}$ published in the Canada Gazette Volume 147, No. 21 - May 25, 2013. The standards for $PM_{2.5}$ will be phased in in 2015 and 2020, with both numbers shown in the table. The larger (first) value represents the CAAQS for 2015.
(c) CAAQS for SO_2 announced on October 3, 2016. The standards for SO_2 will be phased in in 2020 and 2025, with both numbers shown in the table. The larger (first) value represents the CAAQS for 2020.
(d) CCME 1999
(e) SPM in Ontario is defined as Suspended Particulate Matter (<44 µm diameter).
(f) Geometric Mean Value.
(g) Interim Ambient Air Quality Criteria (AAQC).
(h) Compliance is based on the 98th percentile of the annual monitored data averaged over three years of measurements.
(i) The larger criteria apply to the non-growing season and the smaller criteria to the growing season
— = No guideline available.

5.1.3 Monitoring Data

In Ontario, regional air quality is monitored through a network of air quality monitoring stations operated by the MOECC and Environment Canada National Air Pollution Surveillance Network (NAPS). Existing air quality around the Property was characterized using background air concentrations from monitoring data sources located close to the Property. The station identified as being most relevant to the Property is located in Oakville. This air monitoring data represent the combined effect of emissions from sources near the monitoring station, as well as the effect of emissions transported into the region. Details of this station are provided in Table 5.

Table 5: Ambient Monitoring Parameters

Station Name	NAPS Station ID	Monitoring Period Available								Distance from Property
		NO	NO_2	$PM_{2.5}$	CO	SO_2	VOC	HCl	HF	
8th Line/ Glenashton Drive, Halton Reserve	61603	2009-2014	2009-2014	2009-2014	N/A	N/A	N/A	N/A	N/A	11 kilometres North East

There are no stations within 10 km of the proposed development for which CO, SO_2, VOC, HCl or HF data was available. The next closest station is Downtown Hamilton at over 11 km away. This station was not considered appropriate as it lies in a much more industrial location, close to major highways and within the City of Hamilton boundary and the monitored values are not anticipated to be representative of the Burlington area.

5.1.3.1 The 90th percentile of the available monitoring data is typically considered a conservative estimate of background air quality. The mean of the 90th percentile of the measured concentrations were used to represent background air quality for parameters with shorter averaging periods (i.e., 1-hour and 24-hour). The overall annual background values were based on the average of the available data. Particulate Matter (SPM, PM_{10} and $PM_{2.5}$)

Particulate emissions occur due to anthropogenic activities, such as agricultural, industrial and transportation sources, as well as natural sources. Particulate matter is classified based on its aerodynamic particle size, primarily due to the different health effects that can be associated with the particles of different diameters. Fine particulate matter ($PM_{2.5}$) is of primary concern as they can penetrate deep into the respiratory system and cause health impacts (MOECC 2015). In Ontario, these emissions have been demonstrating a steady decline since 2003 (MOECC 2015).

For the Property, there are no monitoring data available for SPM and PM_{10}. However, an estimate of the background SPM and PM_{10} concentrations can be determined from the available $PM_{2.5}$ monitoring data. Fine particulate matter (i.e., $PM_{2.5}$) is a subset of PM_{10}, and PM_{10} is a subset of SPM. Therefore, it is reasonable to assume that the ambient concentrations of SPM will be greater than corresponding PM_{10} levels, and PM_{10} concentrations will be greater than the corresponding levels of $PM_{2.5}$. The overall levels of $PM_{2.5}$ in Canada were found to be about 50% of the PM_{10} concentrations and about 25% of the SPM concentrations (Canadian Environmental Protection Act/FPAC 1988). By applying this ratio it was possible to estimate the background SPM and PM_{10} concentrations for the region.

For 24-hour $PM_{2.5}$, measurements meet the pending CAAQS values of 27 µg/m³ (2020 phase in date). The annual average $PM_{2.5}$ values are below the pending CAAQS of 8.8 µg/m³ (2020 phase in date).

Larger particles (i.e., SPM) can result in nuisance effects, such as soiling or visibility and, therefore, must be taken into consideration as part of the study. All derived SPM and PM_{10} values are below the relevant Ontario ambient air quality criteria and NAAQOs.

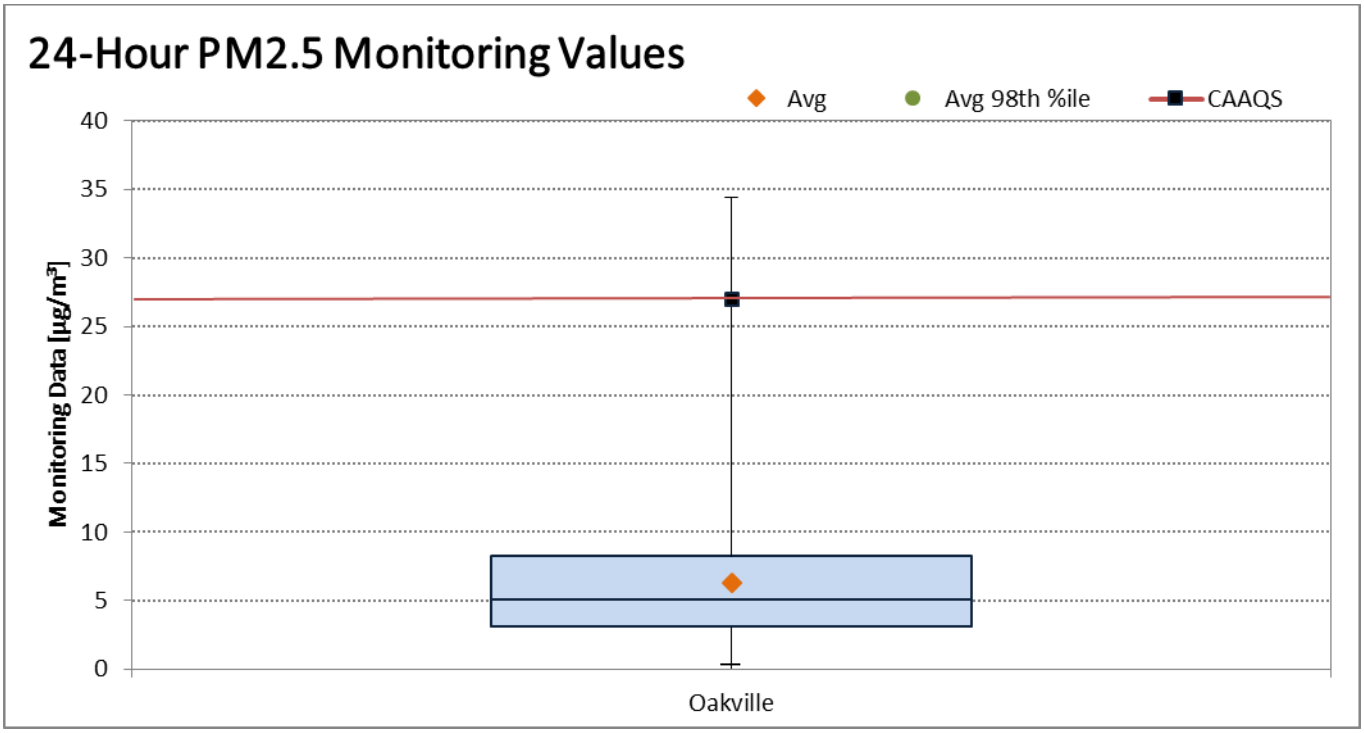
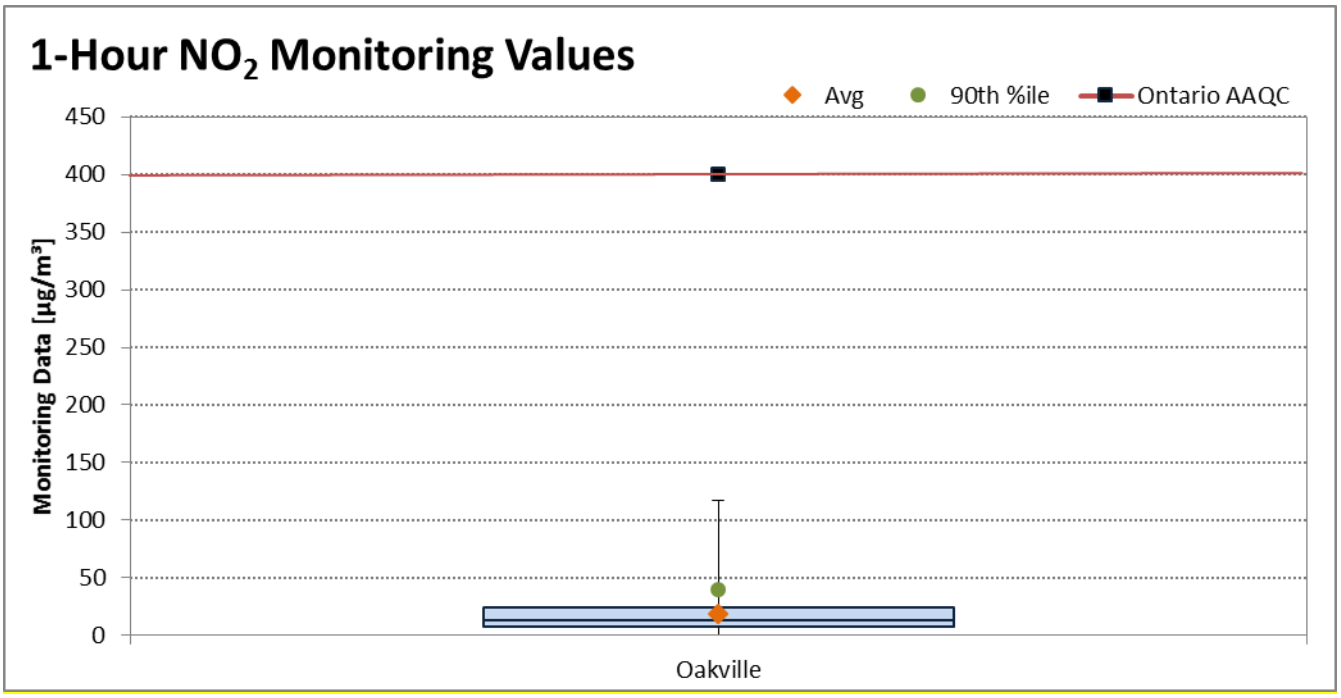


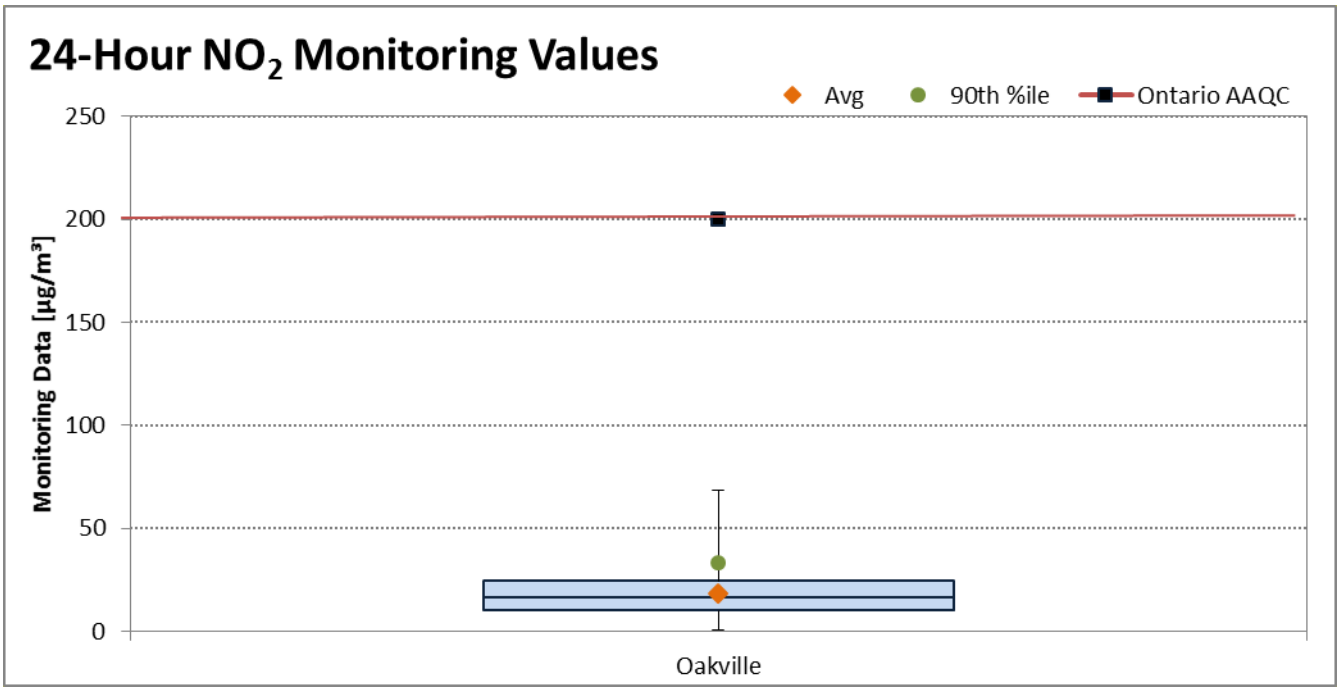
Figure 2: Monitored Fine Particulate Matter (PM2.5) from Oakville Station

5.1.3.2 NO_X and NO_2 Concentrations

NO_X is emitted in two primary forms: nitric oxide (NO) and NO_2. NO reacts with ozone in the atmosphere to create NO_2. The primary source of NO_X in the region is the combustion of fossil fuels. Emissions of NO_X result from the operation of stationary equipment such as incinerators, boilers, and generators, as well as the operation of mobile sources such as vehicles, haul trucks, and other equipment.

The presence of NO_2 in the atmosphere has known health effects (e.g., lung irritation) and environmental effects (e.g., acid precipitation, ground-level ozone formation) (MOECC 2015). As a result, regulatory guideline levels are based on NO_2 emissions and concentrations. Emissions of NO_2 in Ontario have shown a steady decline from 2002 (MOECC 2015). Over the monitored period, no exceedances of the 1-hour or 24-hour Ambient Air Quality Criteria (AAQC) for NO_2 were recorded (Figure 3).


1-Hour NO2 Monitoring Values
Avg
90th %ile
Ontario AAQC
450
400
350
300
250
200
150
100
50
0
Monitoring Data [µg/m³]
Oakville


24-Hour NO2 Monitoring Values
Avg
90th %ile
Ontario AAQC
250
200
150
100
50
0
Monitoring Data [µg/m³]
Oakville

5.1.4 Figure 3: Monitored Nitrogen Dioxide (NO_2) from Oakville Station Summary of Monitoring Data

Background air quality data for all compounds monitored at Oakville Station is provided in Table 6. The data illustrates that for all measured compounds, the background air quality is below the relevant ambient air quality criteria, which are used in Ontario to provide an indicator of good air quality.

Table 6: Air Quality Monitoring from Oakville Station (61603)

Criteria Air Contaminant	Averaging Period	Background Concentration [µg/m³]	Regulatory Criteria [µg/m³]	% of AAQC
SPM	24-Hour	49.0	120	41%
	Annual	25.2	60	42%
PM_{10}	24-Hour	24.5	50	49%
$PM_{2.5}$	24-Hour	12.3	27	45%
	Annual	6.3	8.8	71%
NO_X (reported as NO_2)	1-Hour	39.5	400	10%
	24-Hour	33.5	200	17%
	Annual	18.4	60	31%

Note: All values, with the exception of annual averages, are based on 90th percentile.

5.2 Review of Air Quality Impacts from Local Sources

5.2.1 Industrial Sources

Of the two industrial facilities identified within a 1km radius of the Property, both are approved to operate under an ECA. To be granted an ECA under EPA section 9, facilities are required to demonstrate that predicted concentrations of all air quality contaminants released are below the relevant air quality standards listed in Ontario regulation 419/05 at ground level beyond their property line and at any elevated sensitive receptors such as condominium balconies or windows. The proposed land use for the property is for low-rise residential use. As a result, the land use does not introduce any new receptors to the area that are not already required to be considered. Both of the existing facilities would already have had to document that they meet the relevant air quality standards at these locations and the studies would have been reviewed and approved by the MOECC.

The only sources that may not be captured under an existing approval would be fugitive sources of dust such as emissions from outdoor storage of dusty materials and material handling activities. These sources of dust emission are typically controlled through dust control best management practices and the ECA for each Facility requires the operators to maintain fugitive dust best management plans to minimize and mitigate the release of fugitive dust. Typical methods used to control these emissions are employing water sprays on roads and stockpiles, minimizing stockpile drop heights and good housekeeping practices.

Fugitive dust sources are typically low level sources are not buoyant and stay at low elevations. As a result, air quality impacts diminish as the distance from the source increases. For this reason, the highest predicted concentrations from these sources are most likely to occur at or close to the source's property or fenceline at ground level.

The closest stockpile at the Dufferin Concrete batching plant is approximately 120 m from the closest portion of The Property but this site reports relatively low annual emissions of particulate matter to the NPRI (see section 3). As a result, it is unlikely to result in elevated concentrations at the Property. The Forterra Brick property reports much larger annual emissions of particulate matter to the NPRI, however, the majority of fugitive sources are located at the north end of their facility and over 500 m away from the Property. This is greater than the recommended separation distance from the D-6 Assessment. Additionally, as previously mentioned, fugitive low level sources stay at low elevations, with air quality impacts diminishing as distance from the source increases. As a result, emissions from this Facility are also unlikely to result in significant concentrations at the Property

5.2.2 Transportation Sources

5.2.2.1 Roads

Studies by the US EPA have found that roadways generally influence air quality within a few hundred metres downwind from a heavily travelled road. The actual distance varies by location, time of day, year and prevailing meteorology, topography and traffic patterns (US EPA, 2014).

Golder used the Canadian version of the US EPA Mobile 6.2 on-road emissions model to calculate emission factors in grams per vehicle kilometer travelled for Dundas Street, an arterial road with a speed limit of 60 km per hour. These emission factors were used in combination with the Annual Average Daily Traffic for the road to calculate emission rates in g/s for a 1km stretch of the road. The estimated emission rates are presented in Table 7, below.

Table 7: Air Quality Emission Rates for Dundas Street

Contaminant	Emission Factor [g/VKT]	Estimated Emission Rate per km of Road [g/s/km]
SPM	0.010	0.0047
PM_{10}	0.010	0.0047
$PM_{2.5}$	0.010	0.0047
SO_2	0.0057	0.0026
NOx	0.40	0.18
CO	6.8	3.1
Acrolein	0.00017	0.000079
Benzene	0.0012	0.0054
Formaldehyde	0.0039	0.0018

A 1 km stretch of Dundas Street was then modelled using the US EPA AERMOD model to predict concentrations at 10m intervals from the road centreline. Figure 4, below illustrates the 24 hour average concentrations of Nitrogen oxides with distance from the road edge. Maximum concentrations occur within 10 m of the road edge, at which point the relevant 24-hour averaged nitrogen oxides concentration is approximately 28 µg/m³ compared to an ambient air quality criteria of 200µg/m³. At 11.1 µg/m³, annual averaged nitrogen oxides at have the highest predicted concentration, relative to Project criteria, representing approximately 18.6 % of the respective criteria.

Predicted concentrations of all criteria air contaminants are presented in Table 8, below. All predicted concentrations are below the relevant Project criteria.

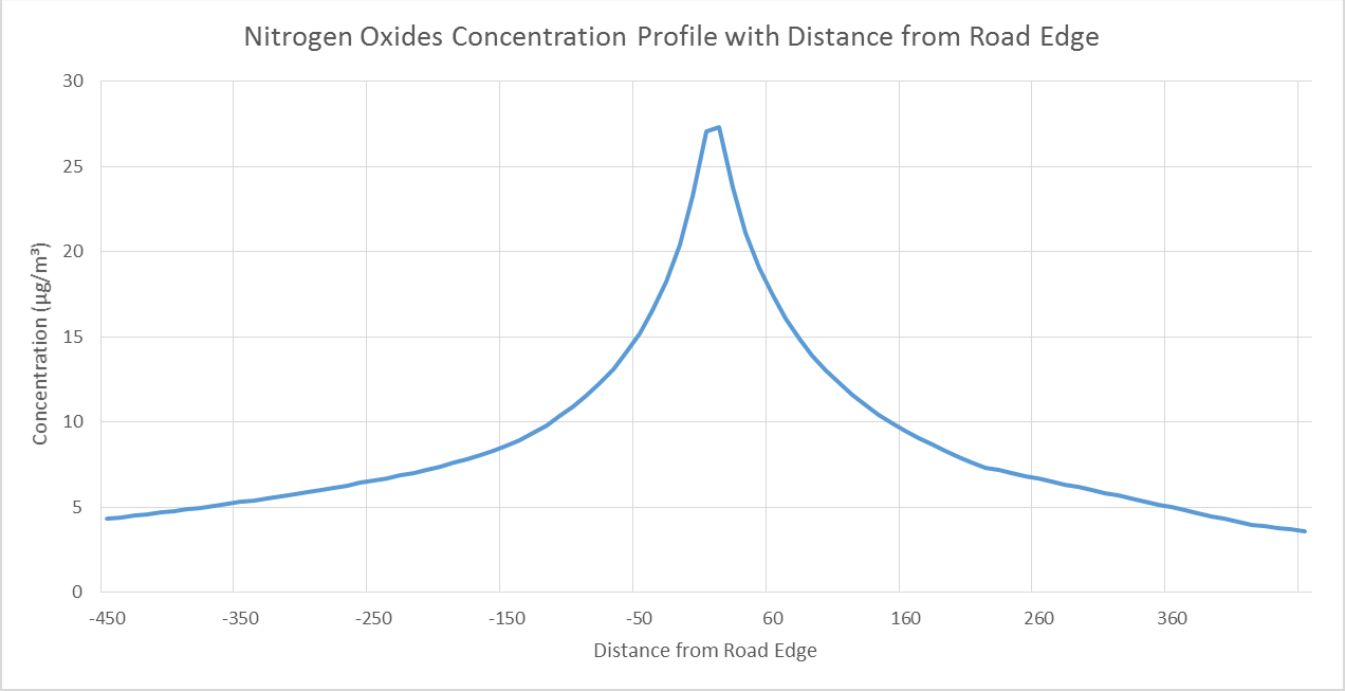


Figure 4: 24-hour Nitrogen Oxide Concentration Profile for Dundas Street

Table 8: Predicted Air Quality Concentrations from Roads

Substance	Averaging Period	Ambient Air Quality Criteria [µg/m³]	Predicted Concentration [µg/m³] at Distance from Road Edge										
			0 m	10 m	20 m	30 m	40 m	50 m	60 m	100 m	200 m	300 m	400 m
SPM	24-Hour	120	0.60	0.71	0.62	0.55	0.50	0.45	0.42	0.32	0.20	0.16	0.13
	Annual	60	0.23	0.29	0.25	0.22	0.19	0.18	0.16	0.12	0.07	0.05	0.04
PM_{10}	24-Hour	50	0.60	0.71	0.62	0.55	0.50	0.45	0.42	0.32	0.20	0.16	0.13
$PM_{2.5}$	24-Hour	27	0.60	0.71	0.62	0.55	0.50	0.45	0.42	0.32	0.20	0.16	0.13
	Annual	8.8	0.23	0.29	0.25	0.22	0.19	0.18	0.16	0.12	0.07	0.05	0.04
NO_2	1-Hour	400	46.91	47.89	41.88	37.38	33.86	31.16	28.89	23.19	16.96	13.51	11.06
	24-Hour	200	22.97	27.27	23.77	21.12	19.06	17.42	16.05	12.29	7.64	6.02	4.89
	Annual	60	9.04	11.12	9.52	8.35	7.45	6.75	6.17	4.63	2.86	2.02	1.50
CO	1-Hour	15,000	804.18	820.86	718.00	640.70	580.46	534.10	495.20	397.53	290.69	231.60	189.52
	8-Hour	6,000	449.25	458.57	401.11	357.92	324.27	298.37	276.64	222.07	162.39	129.38	105.87
SO_2	1-hour	170	0.68	0.69	0.60	0.54	0.49	0.45	0.42	0.33	0.24	0.19	0.16
	24-hour	150	0.33	0.39	0.34	0.30	0.27	0.25	0.23	0.18	0.11	0.09	0.07
	Annual	10.5	0.13	0.16	0.14	0.12	0.11	0.10	0.09	0.07	0.04	0.03	0.02
Acrolein	1-Hour	4.5	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.00
	24-Hour	0.4	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.00	0.00	0.00
Benzene	24-hour	2.3	0.68	0.81	0.70	0.62	0.56	0.51	0.47	0.36	0.23	0.18	0.14
	Annual	0.45	0.27	0.33	0.28	0.25	0.22	0.20	0.18	0.14	0.08	0.06	0.04
Formaldehyde	24-hour	65	0.23	0.27	0.23	0.21	0.19	0.17	0.16	0.12	0.08	0.06	0.05

5.2.2.2 Rail

Residential properties at the Property could be as close as 15m to the CN rail line. However the rail line is a freight line and therefore schedules are infrequent. Environment and Climate Change Canada publishes data annually on estimated emissions from rail transportation for each province (ECCC, 2016b). The data for 2015 emissions is presented in Table 9, below. Ontario has a total of 16,151 km or rail lines (Statistics Canada, 2016), therefore this distance has been used to estimate an average g/s/km of rail emissions such that we can estimate approximate emissions for the section of rail line that is adjacent to the Property. This is likely a very conservative assessment as in reality a large percentage of provincial rail emissions would be allocated to commuter train lines with frequent trains and train stations/rail yards, where trains are stationary or idling for significant periods of time.

Table 9: Air Quality Emission Rates for Rail

Contaminant	Total 2015 Rail Emissions across Ontario [tpy][1]	Estimated Emission Rate per km of Rail Line [g/s/km]
SPM	580	0.0011
PM_{10}	580	0.0011
$PM_{2.5}$	563	0.0011
SO_2	87	0.00017
NOx	24,168	0.047
CO	3506	0.0069

Note:
1. Data Taken from Canadian Air Pollution Emission Inventory (ECCC, 2016b)

If we compare the emission rates for a 1km stretch of rail line to the emission rates for a 1 km stretch of road (presented earlier in Table 8), the rail emission rates are less than 25% compared to those for Dundas Street. Therefore, if we use the Dundas Street emissions as a surrogate for the rail emissions, the , predicted concentrations from the rail line are expected to be significantly less than the ambient air quality criteria at the Property and the cumulative impact of predicted concentrations from transportation emissions would be below Project Criteria at the Property.

6.0 CONCLUSIONS

Golder was retained by IBI group, on behalf of Mantella to carry out an Air Quality assessment to address the Region of Halton's Air Quality Guidelines for the proposed redevelopment at Stonehaven Drive, Burlington, including specific requirements for an Air Quality Report to address the following:

- evaluate if a proposed land use is suitable for a site;
- assist City of Burlington staff with their analysis and report preparation.

The proposed redevelopment plans for the Property include low rise residential housing in close proximity to industrial and transportation sources of air emissions. Golder completed an assessment of the air quality emission sources close to the project to identify whether there is a potential for elevated air quality emissions at the Property Through the following steps:

1. Identification of existing sources of air quality emissions in the surrounding area, including:
    a. Industrial sources
    b. Transportation sources
2. Application of D-Series Guidelines to identify whether detailed air studies are required for industrial sources;
3. Review of existing background air quality in the surrounding area;
4. Assessment of likely impacts from industrial sources; and
5. Assessment of likely impacts from transportation sources.

The results of the assessment indicate that there are two industrial facilities, one major arterial road and a rail line that are located within close proximity of the Property and have the greatest potential to influence local air quality in the surrounding area. However, existing monitoring data indicates that background air quality in the surrounding area is currently within ambient air quality criteria, which are used in Ontario as an indicator of good air quality. Furthermore, there is already significant residential development in the area and the proposed residential development does not introduce any new elevated receptors that would affect existing industrial facilities ability to comply with their current approvals from the MOECC. As a result, predicted concentrations from industrial sources at these locations would be expected to be less than the relevant MOECC criteria. .Transportation sources were also assessed to identify whether they are likely to cause elevated air quality concentrations at the Property. The predicted concentrations of all contaminants were predicted to decrease rapidly with distance from the source and predicted concentrations of all contaminants assessed were below the relevant Project Criteria. As a result, it is considered unlikely that the Property would experience elevated levels of air quality above provincial or federal criteria and the use of low-rise residential land use at the Property would be considered a compatible with current surrounding land uses.

Report Signature Page

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Principal

KSA/FSC/ng

https://golderassociates.sharepoint.com/sites/12526g/deliverables/final/1779081-r-rev0 17may2017 stonehaven air quality assessment.docx

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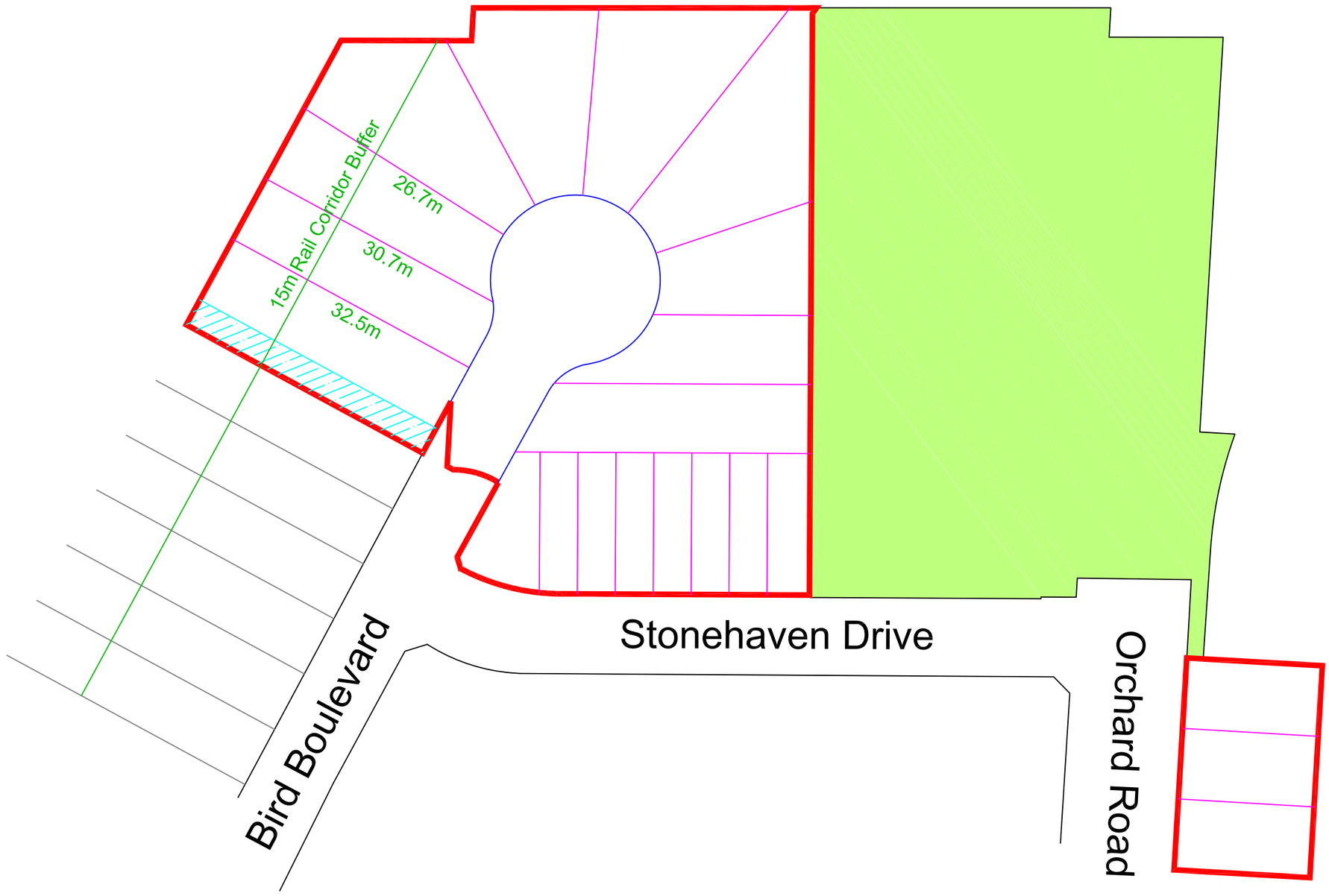
APPENDIX A

Concept A



CONCEPT - A1

Based on MOU

Halton District School Board Lands

Preliminary Concept Plan

City of Burlington

FOR DISCUSSION PURPOSES ONLY

15 0 15 30 45 60 75

SCALE = 1:350

Legend

- Subject Site(s)
- Proposed Park
- Easements

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Date: May 12, 2017	Project No.: 105842
Scale: 1:350 (11x17)	

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