BOUSFIELDS INC.

Project No. 11148

October 31, 2013

Planning and Growth Management Committee
c/o Ms. Nancy Martins
10th Floor, West Tower, City Hall
100 Queen Street West
Toronto, Ontario M5H 2N2

Dear Ms. Martins:

Re: Five-Year Official Plan Review/Municipal Comprehensive Review
22 Metropolitan Road
Northeast Quadrant of Warden Avenue and Metropolitan Road

We are planning consultants to Novi Corporation, the owners of the property at 22 Metropolitan Road ("subject site"), with respect to the above-noted matter.

On November 8, 2012, the Planning and Growth Management Committee adopted a resolution directing staff to conduct additional analysis for a number of properties, including the subject site, which was subsequently adopted by council on November 27, 2012. The resolution directed City Planning staff to consider the following criteria as part of the additional analysis:

1. The applicant demonstrate that a significant portion of the site will include employment uses;
2. A phasing plan that articulates the employment uses noted above will be constructed as part of the first phase of any development; and
3. Any residential uses be designed or situated in a manner to prevent or mitigate against adverse impacts of noise, vibration, traffic, odour and other contaminants from industry upon occupants of the new development and lessen complaints and their potential impact on business.

In response to the Committee/Council resolution and to assist City Planning staff, we have undertaken the requested additional analysis and provide the following summary.

1. **The applicant demonstrate that a significant portion of the site will include employment uses.**
The redevelopment of the subject site proposes to provide approximately 23,554 square metres of non-residential gross floor area for employment uses including 12,157 square metres for a new upgraded hotel (approximately 201 rooms), 5,641 square metres of office and 5,756 square metres of retail/commercial. The proposed development would result in approximately 45-50 full-time and part-time hotel employees and approximately 125-150 new office/commercial jobs, which is significantly more than the current 30 full-time and part-time employees currently employed by the existing hotel.

2. **A phasing plan that articulates the employment uses noted above will be constructed as part of the first phase of any development.**

   A phasing plan has been prepared and is attached to this letter. As illustrated in the phasing plan, it is proposed that the existing hotel would be replaced with a new 13-storey hotel building as the first phase of development. The remainder of the site would be redeveloped as the second phase including the mixed-use building fronting Metropolitan Road that will include office and retail/commercial uses.

3. **Any residential uses be designed or situated in a manner to prevent or mitigate against adverse impacts of noise, vibration, traffic, odour and other contaminants from industry upon occupants of the new development and lessen complaints and their potential impact on business.**

   The following studies have been prepared and are being submitted herewith:

   - Memorandum to Transportation Considerations Report, dated October 29, 2013, prepared by BA Group
   Based upon the truck volumes on the boundary roads, BA Group concludes that the amount of truck traffic generated by the existing industries would not create an undesirable living environment for the future residents of the proposed development. As well, traffic generated by the proposed development would not adversely affect the operation of Metropolitan Road for trucks serving existing industries.

   - Noise Aspects Letter, dated October 30, 2013, prepared by J.E. Coulter Associates Limited
   The letter concludes that this project should be feasible, subject to discussion.

- Air Quality Study, dated October 11, 2013, prepared by A.J. Chandler & Associates Ltd.
  The study indicates that industrial sources will have little impact on the residents in the proposed development.

Based on the supplementary materials provided, it is our opinion that it has been demonstrated that the introduction of residential uses on the subject site is viable and would be compatible with the adjacent employment uses, and that the criteria set out in the Committee/Council resolution have been satisfactorily addressed.

We trust that the enclosed supporting materials will be found to be in order. If you require any additional information or clarification, please do not hesitate to contact me or David Huynh of our office.

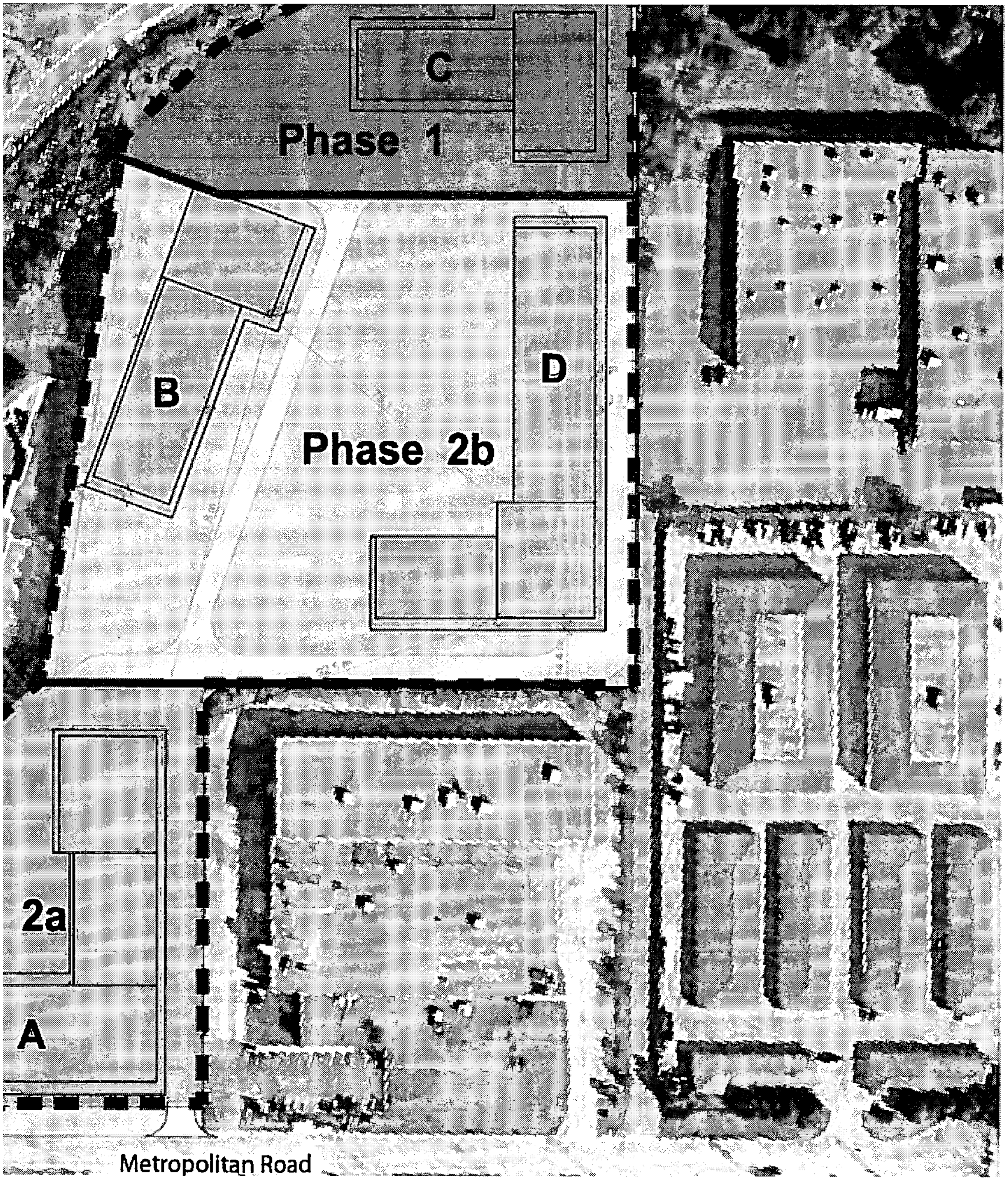
Yours very truly,

Bousfields Inc.

Peter F. Smith B.E.S., MCIP, RPP

PFS/dh:jobs

cc: *Chester Lew, COmanage Ltd.*
Adam Brown, Sherman Brown Dryer Karol
Kerri Voumvakis, Toronto Planning
Joe Nanos, Toronto Planning



22 Metropolitan

Subject Site

Phase 1 (Building C)	Hotel	201 units
Phase 2a (Building A)	Office Institutional	±5,641m
	Commercial	±3,820m
	Residential	331 units
Phase 2b (Building B & D)	Commercial	±1,935m
	Residential	546 units
	Total Summary	Hotel Office Comerci Resident

BA Consulting Group Ltd.
45 St. Clair Avenue West, Suite 300
Toronto, Ontario M4V 1K9
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www.bagroup.com
bagroup@bagroup.com

Memorandum

To:
Peter Smith, MCIP, RPP
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Principal
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Mississauga, Ontario L5R 3E7
Phone: .289-997-6878
E-mail. comanage@bell.net

From:
John Barrington
Senior Associate

Date:
October 29, 2013
22 Metropolitan Road
Mixed-Use Development

Project:
7521-01
22 Metroploitan Road
P:\75\21\01\Report\Memo to Peter Smith.doc

Subject: **Transportation Considerations Report related to the Official Plan Amendment for Proposed Mixed-use Development at 22 Metropolitan Road, City of Toronto**

As documented in the Transportation Considerations report dated November 2010, the subject site is bounded on the north by Highway 401 and on the south by Metropolitan Road.

In 2010, the annual average daily traffic (AADT) two-way volume on Highway 401 was approximately 354,300 vehicles of which approximately 45,000 were trucks, based upon data obtained from the Ministry of Transportation, Ontario (MTO). We note that, several residential developments are located immediately adjacent to Highway 401 and other developments are currently under construction. A combination of noise attenuation barriers and special glazing are used as mitigation measures to minimize the environmental impact.

Along the south site periphery, daily two-way traffic volume on Metropolitan Road is approximately 4500 vehicles per day, based upon 2008 turning movement counts obtained from the City for the Warden Avenue / Metropolitan Road intersection. The volumes of trucks vary between 630 (14%) and 945 vehicles (21%). A significant percentage of trucks along Metropolitan Road are generated by Zellers Distribution Centre which is located at the end of the cul-de-sac, but is no longer in operation.

Based upon the truck volumes on the boundary roads, it is quite clear that the amount if truck traffic generated by the existing industries would not create an undesirable living environment for the future residents of the proposed development.

Residential land uses, as contemplated within the proposed development plan, can generate approximately one-third (25 to 35%) of the vehicular traffic associated with land uses permitted under existing Official Plan Employment Area provisions, when compared on a per unit-floor area basis. As such, the traffic generated by the proposed development would not adversely affect the operation of Metropolitan Road for trucks serving existing industries.

J.E. COULTER ASSOCIATES LIMITED

Consulting Engineers in Acoustics, Noise & Vibration

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October 30, 2013

Novi Corp.
22 Metropolitan Road
Toronto, Ontario
M1R 2T6

Attention: Mr. Chester Lew

Re: 22 Metropolitan Road – Redevelopment Proposal
Noise Aspects

Gentlemen:

Introduction

At the request of Novi Corp., J.E. COULTER ASSOCIATES LIMITED has reviewed the acoustical feasibility of the proposed development in the southeast quadrant of the intersection of Warden Avenue and Highway 401, partly on the current site of the Howard Johnson Hotel (see site plan attached). This report does not detail all the various noise control aspects that will need to be incorporated into the buildings. This information will have to be developed further while the buildings are being designed in detail. This report does, however, identify the critical noise liabilities of the site so that they can be dealt with in the planning stages.

There are several aspects to the feasibility of this project, one of them being the relatively obvious challenge of dealing with the noise from the abutting Highway 401. This noise source reaches 77 dBA along the north side of the most northerly building and will require heavy glazing and other façade upgrades to cope with the noise. A number of developments have already been successfully constructed in similar sound fields. The Lee and Tridel buildings to the east of McCowan Road, on the south side of Highway 401, had similar challenges, as have a large number of sites built within a few meters of the Gardiner Expressway between Yonge Street and Exhibition Place, in the south end of the City. Heavy glazing with a large gap between the window panes and, in some cases, the use of laminated glass have successfully addressed the indoor noise issues at these various sites, even those several dB louder than the proposed site. These are what are expected at 22 Metropolitan, at the north end of the development. An unusual aspect of the highway noise issue is that the high levels of highway noise assist in masking the sound from the abutting industry (which may otherwise be the larger challenge on this development).

Site and Its Surrounds

The daytime ambient sound levels at grade are shown on Figure 2. The noise requirement for the surrounding industry is that the sound of the industry should not be greater than the sound from the roadways. The building at 38 Metropolitan Road contains a number of small industries, which we assume come and go. The industrial noise from indoors has been checked briefly and was not audible. The rooftop equipment is not currently an issue, as it would not be audible over the noise from the highway. The noise of most concern would be the loading or unloading of trucks either along the north façade or the west façade of the 38 Metropolitan industrial building. The loading dock on the east side of the building points southward and should not be a problem. The loading door on the north side and those on the east side could be a difficulty in circumstances of heavy use. The uncoupling of trailers and then fork lift trucks passing on and off the trailers can make up to 78 dBAI at the property line. The ambient sound levels at grade, along the south end of the existing hotel, is 61 dB L_{eq} during the daytime and 57 dB L_{eq} in the late evening. Hence, if the sound from the loading occurred often enough to trigger the MOE guidelines, there would be an excess of up to 21 dB. This excess would exist along the north end of 38 Metropolitan, whether there were new residential buildings or if the hotel remained as the hotel is supposed to be, as quiet as residences. The same statement applies to 44 Metropolitan occupied by Clixx. The loading dock is further from the hotel than the site at 38 Metropolitan but the trucking looks heavier. At the east end of Metropolitan is a large warehouse building (currently vacant). It is shielded and far enough from the proposed site that its stationary noise contribution is not significant relative to the highway noise.

There is a public storage facility to the east of the hotel property that has large loading doors along the west side of the building. This operation will be very sporadic and not fit the description of *worst case predictable* found in MOE guidelines for stationary sources.

To the west of the site is a church and the offices of the Salvation Army. The noise creation of both facilities is well below the highway sound levels.

MOE Guideline Change

To make things a little more complex, the Ministry of the Environment has just introduced a new Land Use Guidelines for Noise (*NPC-300*) which would allow a somewhat higher noise intrusion from industry should everyone agree (the industry, developer and council). With so many players in this case, it may be difficult to count on such an agreement.

Conclusions

Our general conclusion is that since there have not been battles between the hotel and neighbours about noise, the events created by the relatively small sources in 38 Metropolitan and the public storage must rarely be a nuisance, if ever. The Clixx operation at 44 Metropolitan might be of concern on the lowest floors of the development proposal. The largest concern, however, would occur on the lowest two floors of the condominium, along the east side of the proposed development, up against 38 Metropolitan. Using the lowest floors for amenity, commercial and retail operations would relieve the noise concerns by about half. Alternatively, a tall barrier along the property line (6-7m) would have the same benefit. The question then becomes whether or not the remaining industry ever makes enough noise to be an issue. In our several visits to the site, we have not recorded such noise. Approximately 10m above ground level, the ambient sound levels from the Highway are 5 dB higher than our grade level sound measurements (see Figure 3). The existing industry already has an obligation to meet the City Noise Bylaw and Provincial Guidelines at the existing hotel. Assuming this existing obligation is met, the only area left to consider is the west property line of 38 Metropolitan, which is currently operating at a very low level of goods movement.

As a result, we advise that this project should be feasible but subject to considerable discussion between the neighbours and the project proponent. In cases such as this, it takes some time for all the neighbours to form positions and get planning advice to the point where such discussions will be fruitful.

Recommendations

We recommend, as the project proceeds, formal contact with the neighbours be established and discussions on future intent of uses be reviewed by the Municipality, the developer and the neighbours. These discussions may require the occasional reminder for the neighbours with respect to the as-of-right expectations the hotel already has.

We trust the above will assist in the evaluation of this project's requirements. Please do not hesitate to contact the undersigned should there be any questions.

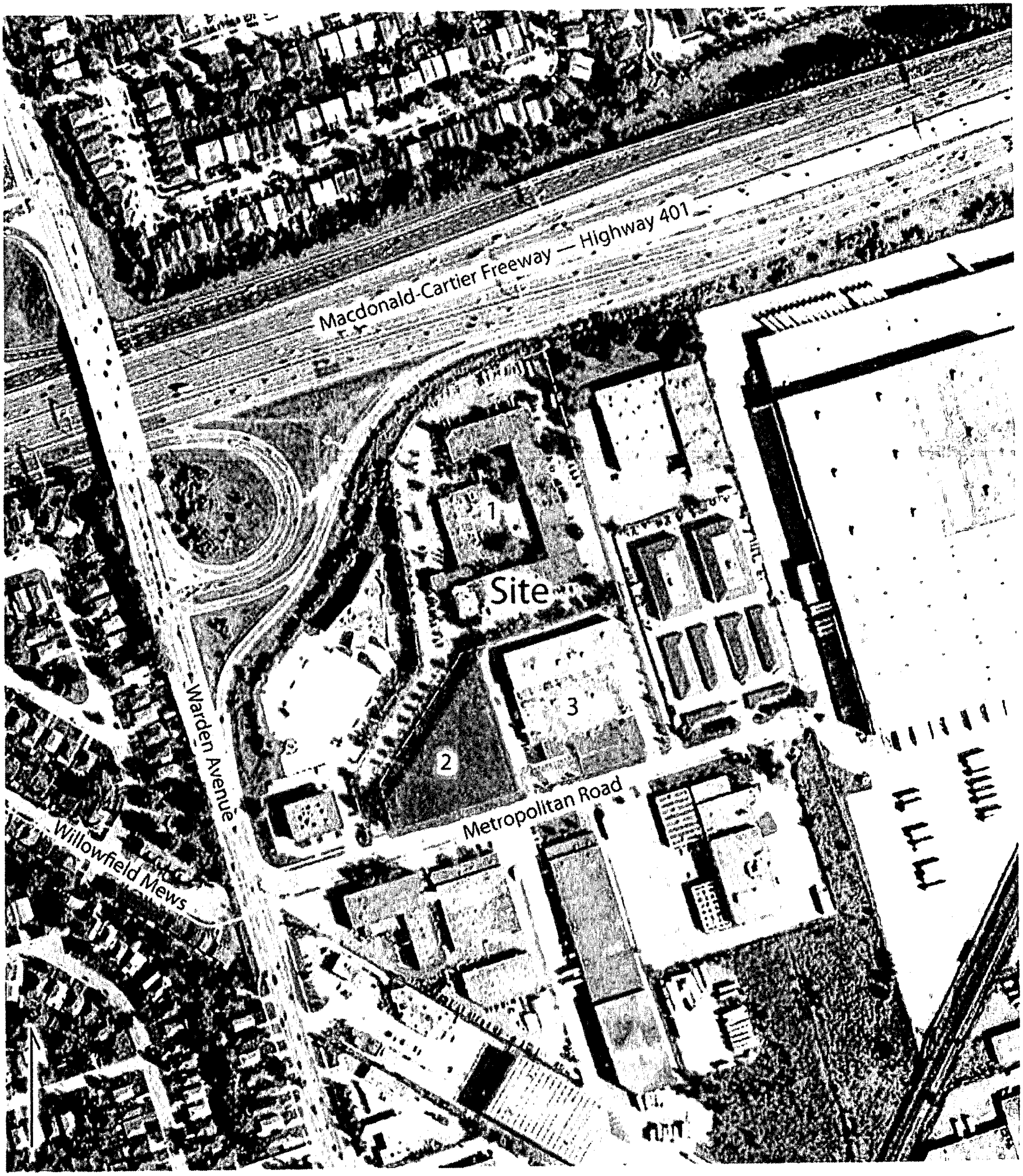
Yours truly,

J.E. COULTER ASSOCIATES LIMITED

John E. Coulter, B.A.Sc., P.Eng

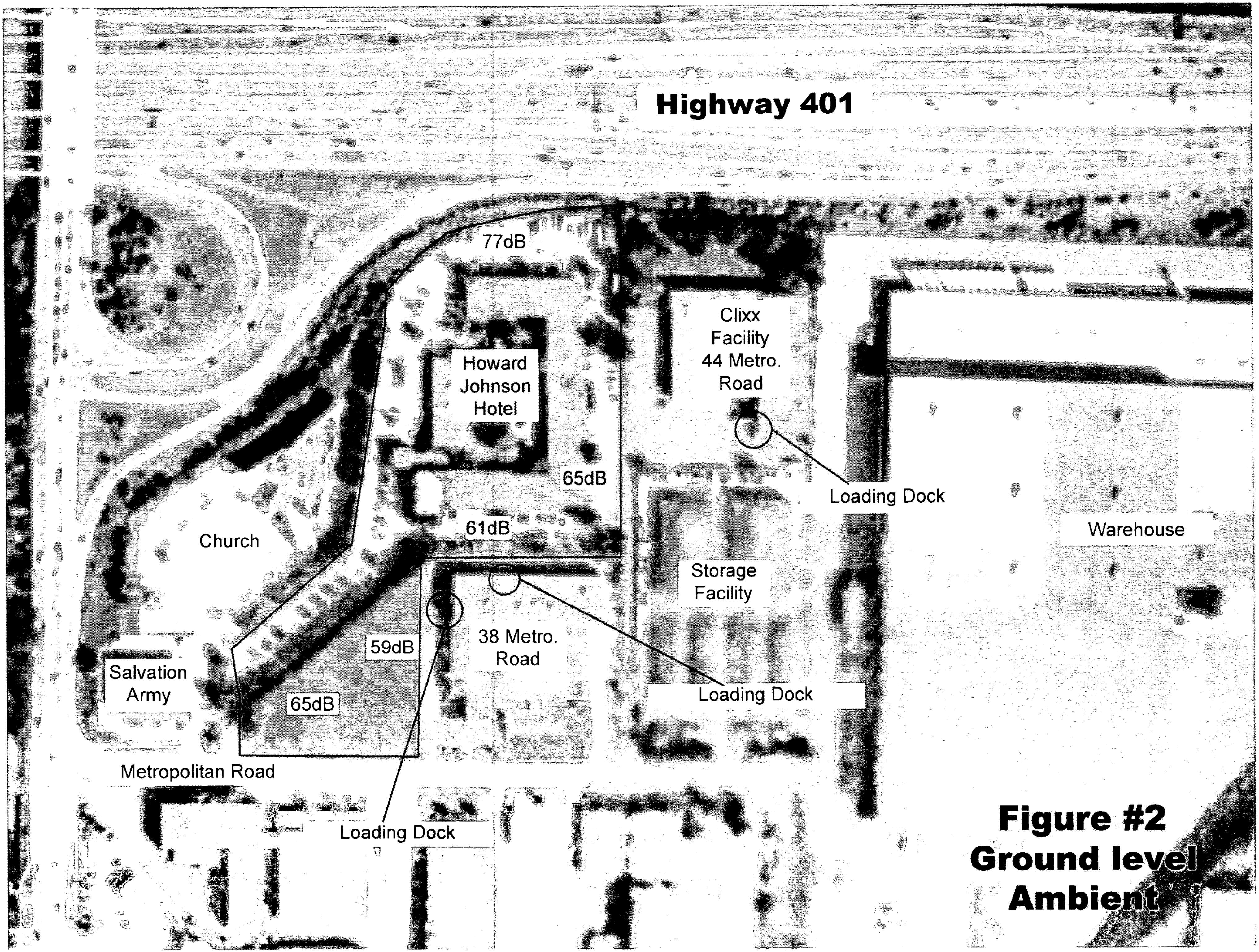
JEC:pt

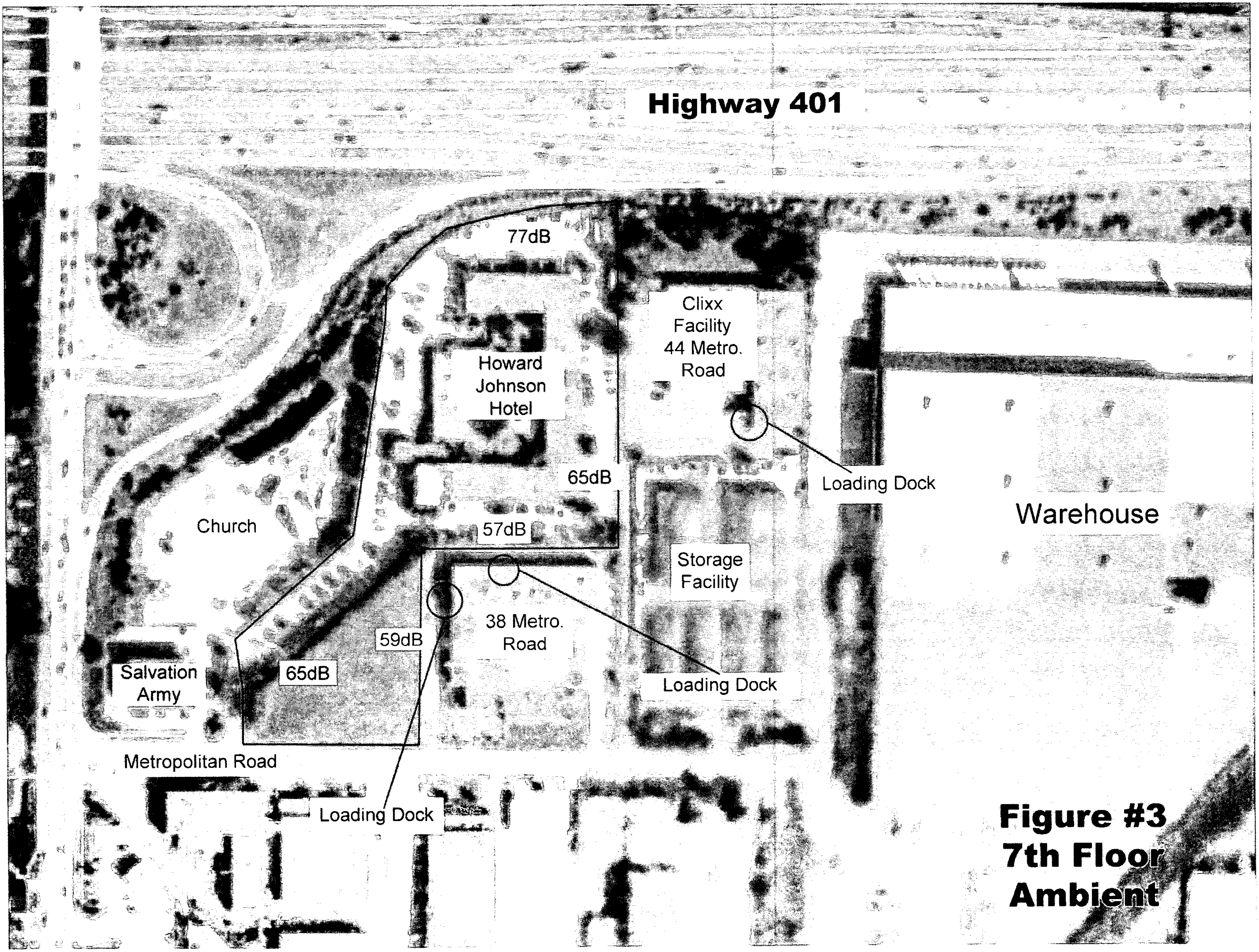
Enclosures



SITE AND CONTEXT

Figure #1


Highway 401
77dB
Howard Johnson Hotel
65dB
61dB
Clixx Facility 44 Metro. Road
Loading Dock
Warehouse
Storage Facility
Church
59dB
65dB
38 Metro. Road
Loading Dock
Salvation Army
Metropolitan Road
Loading Dock
Figure #2
Ground level
Ambient


Highway 401
77dB
Howard
Johnson
Hotel
Clixx
Facility
44 Metro.
Road
Loading Dock
65dB
Warehouse
Church
57dB
Storage
Facility
38 Metro.
Road
59dB
Salvation
Army
65dB
Loading Dock
Metropolitan Road
Loading Dock
Figure #3
7th Floor
Ambient

October 11, 2013

NOVI Corp.
22 Metropolitan Road
TORONTO, ON M1R 2T6

Attn: Mr. Chester Lew

Dear Mr. Lew

Subject: 22 Metropolitan Road, Toronto
Air Quality Study to support OP Amendment

The results of the air quality evaluation you requested follow.

1.0 Introduction

A request has been made to the City of Toronto to remove the designation on a parcel of land designated as 22 Metropolitan Road and two abutting westerly properties located in the southeast corner of the Highway 401 and Warden Avenue from the 'Employment Districts' currently applying to the properties. The application seeks to have the lands redesignated to 'Mixed Use Areas' for the purposes of permitting commercial, residential and hotel development on the properties.

In response to this request, the resolution of the Planning & Growth Management Committee and Council[1] make reference to odour and contaminants from industry that may impact residents of the proposed development.

As noted in the January 29, 2013 preliminary staff report the Planning & Growth Management Committee/City Council resolution states, in part, that:

> c. Any residential uses be designed or situated in a manner to prevent or mitigate against adverse impacts of noise, vibration, traffic, odour and other contaminants from industry upon occupants of the new development and lessen complaints and their potential impact on business.

In a discussion of the Official Plan the report notes that Section 2.2.4 of the Official Plan state that:

> 6. Development adjacent to or nearby Employment Districts will be appropriately designed, buffered and/or separated from industries as necessary to mitigate adverse effects from noise, vibration, traffic, odour and other

[1] Toronto City Planning Division, 2013. 22 Metropolitan Rd - Official Plan Amendment Application - Preliminary Report. Available at: http://www.toronto.ca/legdocs/mmis/2013/pg/bgrd/backgroundfile-56257.pdf

contaminants, and to promote safety and security.

The staff report notes the following land uses adjacent to the proposed site:

North:	Hwy. 401 interchange and eastbound on-ramp from Warden Ave.
South:	A manufacturer of custom made scaffolding, lifts and suspended work platforms (Swing Stage Ltd.) at 1615 Warden Avenue; Unidentified industrial uses at 19 to 23 Metropolitan Road; and, A commercial mover/warehouse (Tippet-Richardson Ltd.) at 25 Metropolitan Road.
East:	Employment uses on the north side of Metropolitan Road including: Warehousing/distribution of food products and marketing offices at No. 38; Apex Self Storage at No. 40.; and, The former Zellers distribution centre at the eastern terminus of Metropolitan Road (No. 100).
West:	The Toronto Chinese Methodist Church at 8 Metropolitan Road; and, The 2-storey Ontario Central-East Divisional Headquarters of the Salvation Army office building at 1645 Warden Avenue.

As of Sept 2013 space was for lease in the building designated as 41 Metropolitan Road on the south side of the road, east of the Tippet-Richardson property. This space was stated to be suitable for light industrial uses with a 17' clear space inside the building.

Airphotos of the area surrounding the site show residential land on the north side of the 401 on both sides of Warden, and on the south side of 401 west of Warden. Residential is also present on the north side of Ellesmere, east of Birchmount. While it is difficult to determine the exact nature of businesses surrounding the site, the warehousing and distribution operations noted in the planning staff's report tend to correspond with the Provincial Policy Statement on land use and development as quoted in the staff report:

> The PPS defines employment areas as those areas designated in an official plan for clusters of business and economic activities including, but not limited to, manufacturing, warehousing, offices, and associated retail and ancillary facilities.

Manufacturing operations have the potential to release air contaminants to the atmosphere, however according the the Environmental Protection Act such releases must be approved by the Ontario Ministry of the Environment. The issuance of an approval [ECA] for such an establishment requires that the emissions be such that concentrations of contaminants at locations on the property line of the subject business, or indeed the highest level estimated to occur downwind of the property, meets the point of impingement guidelines set by the province. These criteria were developed to protect human health and the environment. Should a facility meet these standards it is generally accepted that there will be little concern about air emissions. Process upsets are operating conditions that can give rise to contaminant levels above the criteria values. These would tend to occur for short periods of time. Typically odours are the most noticeable contaminant released to the atmosphere and the potential to release odours in an upset situation depends upon the nature of the operation.

Since the City Council's interest appears to be ensuring that future residents are not inconvenienced by local industrial activities and therefore complain about conditions at the site, an air assessment was completed. This report looks at existing air quality conditions as illustrated by monitoring undertaken by the MoE and considers the potential for emissions from surrounding industrial buildings should such spaces be occupied by commercial operations that could release contaminants.

2.0 Air Quality in the City of Toronto

Large urban centres such as Toronto have air quality conditions that are governed by their geographical setting and predominant climate and meteorology conditions in their vicinity. The movement of air through the community flushes the contaminants released by sources thus generally reducing air contaminant levels in the atmosphere. In situations where there are physical barriers to air movement, such as escarpments or mountain ranges, localised elevated concentrations can occur. In this section the factors that affect air quality in Toronto are presented and the results of recent Ontario Ministry of the Environment air quality monitoring in the city are summarized.

2.1 Climate and Meteorology

Toronto has a continental climate where the four seasons bring with them varying temperature and precipitation patterns. Being located on the edge of Lake Ontario, Toronto, like other communities around the lakes, has climatic effects moderated by the influence of large water bodies[2]. The lakes tend to have a cooling effect throughout most of the warmer parts of the year, and to some extent moderate extreme cold periods by delaying the coming of spring and prolonging warmer weather into the fall.

In land form, Toronto sits on a plain that slopes down towards the lake with a drop in elevation of nearly 100 m from about 175 m ASL at Warden and the 401 to 75 m ASL at the lake. Towards the west, there is a general trend towards higher elevations with York University being at nearly 200 m ASL. The plain is intersected by several river valleys the most notable being the Don River in the east and the Humber in the west. The higher land to the north and west tends to minimize the occurrence of fog and frosts because they have a warming effect on winds and set up conditions favourable for breezes down the slope when the land gives off heat during the night.

Toronto is in a latitude subject to winds from the west. However, it comes under the influence of the Great Lakes when winds come from all directions except the north-northwest and east-northeast quadrants. Lake Ontario influences local air quality when lake breezes, air flow off the lake unto land caused by local heat island effects and the cooler air over the lake, set up recirculating air flows that trap contaminants in the near shore regions. These conditions can lead to smog events. Lake breezes have been seen to have a non-uniform effect on smog levels along the shore line[3]. Observations have shown marked increases in NO_x or ozone levels in different locations, suggesting that the source of the pollutants, and the nature of the air mass over the lake strongly influences the air quality impacts of lake breeze situations.

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[2] Shenfeld, Louis, and D.F.A. Slater, 1960. The Climate of Toronto. A publication of the Meteorological Branch, Department of Transport, Canada. CIR-3352, TEC-327, June.

[3] Lin, Hong, Q. Li, D. Sills, J. Brook, L. Alexander and P. King. 2007. Lake Breeze Effects on Air Quality in Southern Ontario. A presentation at the AMS 9th Conference on Atmospheric Chemistry, January.

The winds will carry contaminants released to the atmosphere with them causing some mixing and dilution of the contaminants' concentrations. The higher the wind speed the more the mixing and generally the lower the concentration at most points downwind.

Figure 1 shows a wind rose for Toronto based upon 5 years of hourly data collected at Pearson Airport. The plot shows the direction that the wind is blowing from. As would be expected given the latitude, winds in Toronto come predominantly from the west to north quadrant. The NNE to ENE directions have the lowest frequency of winds, with SSE and SE winds each occurring on the order of 6% of the time. WSW and SW winds account for nearly 15% of all the data collected. Higher winds, as evidenced by the green and blue sections of the plot occur more often in the SW to NNW directions.

2.2 Regional Air Quality

Air flows coming into the Toronto area frequently pass over the Ohio Valley and other heavily industrialized areas of the United States and southern Ontario. This contributes as much as 50% of the air pollution burden seen in the communities in and around the city[4]. Other contributors include local industrial operations, fossil fuelled power generation facilities, and vehicular traffic. Being in the middle of the Windsor-Quebec transportation corridor, Toronto is a hub of one of the most heavily travelled corridors in North America.

While trans-boundary air pollution and regional transportation corridors contribute to regional air quality, heavy industry can affect air quality. Using tall stacks to disperse emissions that are carried downwind has the effect of increasing levels of air contaminants at those downwind locations. Large concentrations of asphalt and urban development create the "urban heat island" effect which also influences air quality. Higher temperatures associated with urban areas increase the potential for smog formation from the air emissions.

Overall, compared to other communities in southern Ontario, the Toronto area has fewer occurrences of poor air quality than Windsor, London or Waterloo; however, as pointed out by the MMAH report cited above, with its higher population Toronto has more people affected by poor air quality.

2.3 Common Air Contaminants

A number of common air pollutants are monitored and reported on a routine basis:

- particulate matter [PM] and the inhalable fraction [PM_{10}] and respirable fraction [$PM_{2.5}$];
- oxides of nitrogen [NO_x];
- sulphur oxides [SO_2];
- carbon monoxide [CO]; and,
- ozone [O_3].

[4] Ontario MMAH, 20004. Building Strong Communities: Municipal Strategies for Cleaner Air. Available at: http://www.mah.gov.on.ca/Page1307.aspx

The first four compounds are referred to as Criteria Pollutants. This is because the emissions of these contaminants are regulated based upon human health-based and/or environmentally-based criteria (science-based guidelines). Limits based on human health are called primary standards. Secondary standards limit emissions to prevent environmental and property damage.

The fifth contaminant on the list, ozone would typically be categorized as a Criteria Pollutant because of its health effects, however, it is seldom released from sources. Rather, at ground level, it is created by a chemical reaction between oxides of nitrogen and volatile organic compounds in the presence of sunlight. Volatile organic compounds can be released from industrial operations that involve the use of solvents, or from operations where liquid fuels are handled. These compounds are not monitored on a routine basis. Ground-level ozone is the primary constituent of smog. Ozone levels are higher in the summer when sunlight and higher temperatures increase the reaction rate between the chemical constituents. In southern Ontario a portion of the ozone measured has been attributed to sources hundreds of kilometres upwind.

The contaminant list above is by no means all inclusive. Air Toxics, known formally as Mobile Source Air Toxics [MSATs] in the United States, are a subset of the 188 air toxics defined by the US Clean Air Act. Mobile sources, highway vehicles and non-road equipment, release these chemicals from fuel when it evaporates or when it passes through the engine unburned. Other toxics are emitted when there is incomplete combustion of fuels. Others are formed as secondary combustion products. Metal air toxics could also be included but since they are the result from engine wear or from impurities in oil or gasoline they are difficult to quantify and not currently targeted by US legislation which emphasizes 6 priority MSATs:

- Benzene - characterized as a known human carcinogen;
- Acrolein - the potential carcinogenicity of acrolein cannot be determined because the existing data are inadequate for an assessment of human carcinogenic potential for either the oral or inhalation route of exposure;
- Formaldehyde - a probable human carcinogen, based on limited evidence in humans, and sufficient evidence in animals;
- 1,3-butadiene - characterized as carcinogenic to humans by inhalation;
- Acetaldehyde - a probable human carcinogen based on increased incidence of nasal tumors in male and female rats and laryngeal tumors in male and female hamsters after inhalation exposure;
- Diesel exhaust (DE) - likely to be carcinogenic to humans by inhalation from environmental exposures. Diesel exhaust is the combination of diesel particulate matter and diesel exhaust organic gases. Diesel exhaust also represents a chronic respiratory irritant, possibly the primary non-cancer hazard from MSATs. Prolonged exposures may impair pulmonary function and could produce symptoms, such as cough, phlegm, and chronic bronchitis.

In the US, the EPA is the lead Federal Agency for administering the Clean Air Act and has certain responsibilities regarding the health effects of MSATs. Studies suggest that between 2000 and 2020, the current programs aimed at lowering vehicular emissions will result in the reduction of on-highway emissions of benzene, formaldehyde, 1,3-butadiene, and acetaldehyde by 57 percent to 65 percent, and will reduce on-highway diesel PM emissions by 87 percent. The US Federal Highway Agency [FHWA] projects that even with a 64 percent increase in the number of vehicle miles travelled [VMT] the effect of these reductions will be realised. Since Canadian vehicular emission standards are tied to those in the United States, it can be expected that similar trends will occur in Ontario.

In a report on the relationship between illness and traffic in Toronto[5] the authors list nine specific compounds associated with vehicle emissions:

- chromium;
- benzene;
- polyaromatic hydrocarbons, [PAHs];
- 1,3-butadiene;
- formaldehyde;
- acrolein;
- acetaldehyde;
- nickel; and,
- manganese.

This list is contains the organic compounds discussed above and three metals: chromium, nickel and manganese.

The priority contaminants, ozone and $PM_{2.5}$, have been associated with mortality, respiratory effects and cardiovascular effects according to the reviews in Campbell et al. The health concerns raised by these contaminants resulted in them being targeted by the CCME CWS for Particulate Matter and Ozone[6].

The FHWA[7] developed a tiered approach for analyzing MSATs. Depending on the specific project circumstances, FHWA identified three levels of analysis:

- No analysis for projects with no potential for meaningful MSAT effects;
- Qualitative analysis for projects with low potential MSAT effects; or
- Quantitative analysis to differentiate alternatives for projects with higher potential MSAT effects.

The FHWA suggests that the threshold for meaningful increases in MSAT exposures is the addition of a new highway with capacity for over 114,000 AADT. The new development will be introduced into an area adjacent to roads with high traffic levels however the exposures will be similar to those at residential properties located in the other 3 quadrants of the Warden and 401 intersection. Siting high rise residential along the highway is not unusual as evidenced by developments at both McCowan and

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5 Campbell, Monica, K. Bassil, C. Morgan, M, Lalani, R. Macfarlane, and M. Bienefeld, 2007. Air Pollution Burden of Illness from Traffic in Toronto, Problems and Solutions. Published by Dr. David McKeown, Medical Officer of Health, Toronto Public Health. Available at: http://www.toronto.ca/health/hphe.

6 CCME, 2000. CANADA-WIDE STANDARDS for PARTICULATE MATTER (PM) and OZONE http://www.ccme.ca/assets/pdf/pmozone_standard_e.pdf

7 FHWA, Interim Guidance on Air Toxic Analysis in NEPA Documents, February 3, 2006.

Yonge Street and the 401.

2.4 Air Monitoring Initiatives

The Ontario Ministry of the Environment operate a network of air quality monitoring stations in the Toronto area, Table 1. Data from these locations can be used to track trends in both the temporal and spatial variations in contaminant levels in the atmosphere. The 2011 monitoring data is used in this report to define typical levels in the city. Particulate matter, oxides of nitrogen and ozone are monitored at all the stations. Carbon monoxide is monitored at the downtown and west stations whereas sulphur dioxide is monitored only at the west station.

Table 1 Toronto Area Air Monitoring Stations

Location	Nearest Intersection	Station #	Contaminants Monitored				
			O_3	$PM_{2.5}$	NO_2	CO	SO_2
Downtown	Bay/Wellesley	31103	x	x	x	x	
East	Kennedy/Lawrence	33003	x	x	x		
North	Yonge/Hendon	34020	x	x	x		
West	Resources Road/Islington near 401	35125	x	x	x	x	x

2.4.1 Fine Particulate Matter

Particulate matter includes all particles that could remain suspended in the air for any length of time, but those of most interest are the respirable fraction that are less than 2.5 um (micrometers or microns) in size. These are designated as $PM_{2.5}$. These particles are approximately 30 times smaller than the average diameter of a human hair and can have significant health effects when retained in the lungs.

The $PM_{2.5}$ in the atmosphere comes from two sources: primary emissions of fine particles and secondary formation through chemical reactions after they enter the atmosphere. Primary particulate matter in the atmosphere includes those particles emitted directly from a source be it re-suspended road dust, or emissions from internal combustion engines, space heating, or other combustion sources, as well as those from industrial processes. Residential combustion sources emitted 39% of the $PM_{2.5}$ in the province in 2011[8] while transportation sources accounted for 24% and industrial sources 30%. Secondary particulate matter are largely ammonium nitrate and ammonium sulphate particles formed from gaseous sulphur and nitrogen oxides emissions reacting with ammonia in the atmosphere.

Table 2 summarizes the pertinent 2011 particulate data from the Toronto stations. To meet the fine particle standard, no more than 7 daily averages in any year can be in excess of the 30 ug/m³ criteria

[8] MoE, 2013. Air Quality in Ontario, 2011 Report. PIBS 9196e Available at http://www.ene.gov.on.ca/stdprodconsume/groups/lr/@ene/@resources/documents/resource/stdprod_104486.pdf

level. The 90th percentile is generally accepted as a reasonable estimate of background levels, while the mean provides an average over the year and the maximum is the peak value recorded. Levels would be expected to vary depending upon both regional and local influences.

Table 2 Summary of Toronto Area 2011 $PM_{2.5}$ [ug/m^3] Data

Location	24-hr Mean	24-hr 90th Percentile	Maximum 24 Hour	Number of Days Value > 30 ug/m^3
Downtown	6.2	14	21	0
East	6.2	14	21	0
North	7.7	17	30	0
West	6.9	15	24	0

The Air Quality report compares $PM_{2.5}$ data for 2002 - 2011 indicating that the level has decreased between 22% and 39% over that time and the standard has been satisfied in Toronto since 2005.

2.4.2 Ozone

Ozone levels are influenced by releases of VOC and NO_x to the atmosphere. The Air Quality report states that the formation and transport of ground-level ozone are strongly dependent on meteorological conditions. Short-term and year-to-year differences in ozone concentrations are attributable to causes beyond emissions in the air shed. Elevated concentrations of ground-level ozone are generally recorded on hot and sunny days, between May and September.

Transportation sources release the majority of NO_x emitted Ontario: 25% from road vehicles and 46% from other transportation sources. Industry accounts for 14%, and utilities release 7%. Oxides of nitrogen include nitrogen dioxide [NO_2] and nitric oxide [NO]. Most internal combustion engines release mainly NO. NO emissions convert to NO_2 which has adverse health effects at a lower level than NO. NO reacts with ozone in this chemical reaction. Thus, morning rush hour emissions can result in a decrease in ambient ozone levels as the NO scavenges the ozone from the atmosphere. Ground level ozone generation continues throughout the day peaking in midafternoon and decreases as the sun sets.

Table 3 provides the results for Toronto area ozone monitoring for 2011. The Toronto West station had one of the lowest annual mean values in the province. Some rural areas were significantly higher a situation attributed to the scavenging effect of NO releases in the urban environment. The MoE note that the annual mean values have risen in Toronto since 2002. The MoE attributes some of this to a drop in NO_x emissions, and thus less scavenging effects, but not a rise in global ground level ozone levels.

The Canada Wide Standard numerical target for ozone is based upon the average of the 4th highest 8 hour rolling average value of ozone for each of the last three years. The criteria value is 65 ppb. The MoE shows that the Toronto average level based upon the criteria was 71 ppb for the latest three year period, reflecting a drop of 10% since values were first calculated in 2005.

Table 3 Summary of Toronto Area 2011 Ozone [ppb] Data

Location	Annual Mean	1-hr 90th Percentile	Maximum 1 Hour	Number of Hours Value > 80 ppb
Downtown	25.4	42	88	1
East	23.3	40	82	1
North	23.6	40	85	1
West	20.1	38	87	1

2.4.3 Other Pollutants

Trends in the concentrations of other criteria air pollutants in the Toronto area are presented in the latest MoE report. These were based upon the MoE annual data reported since 1980. CO has declined 73% based upon 1 hour maximum values at the downtown location, while the west location is down 69%. SO_2 concentrations in the city have declined 69% at the west location. NO_2 annual mean levels in the city have decreased by between 29% and 37% depending upon the location of the monitor. This is likely attributable to decreases in vehicular emissions.

Tables 4 - 6 provide 2011 monitoring data for CO, SO_2 and NO_2 at the various monitoring stations. These tables show that there were no occurrences of measured values exceeding the applicable criteria levels.

Table 4 Summary of Toronto Area 2011 Carbon Monoxide [ppm] Data

Location	Annual Mean	1-hr 90th Percentile	Maximum 1 Hour	Number of Times 1 hour Maximum Value > 30 ppm	Maximum 8 hour Average	Number of Times 8 hour Average Value > 13 ppm
Downtown	INS	INS	INS	INS	INS	INS
West	0.20	0.33	1.39	0	0.76	0

INS insufficient data for average

Table 5 Summary of Toronto Area 2011 SO_2 [ppb] Data

Location	Annual Mean	1-hr 90th Percentile	1 hour Average		24 hour Average	
			Maximum	Times >250 ppb	Maximum	Times >250 ppb
West	1.5	3	17	0	5	0

Table 6 Summary of Toronto Area 2011 NO_2 [ppb] Data

Location	Annual Mean	1-hr 90th Percentile	1 hour Average		24 hour Average	
			Maximum	Times >200 ppb	Maximum	Times >100 ppb
Downtown	14.9	27	54	0	36	0
East	15.2	30	60	0	41	0
North	15.4	30	61	0	44	0
West	19.1	34	71	0	42	0

2.5 Toronto Emissions Inventory

The emission inventory data referred to in the previous section was the MoE's compilation of province wide levels. A detailed emissions inventory for Toronto was prepared in 2007[9]. It covered both criteria air contaminants and greenhouse gas emissions based upon 2004 emissions data. A staff report to council[10] notes that that report was updated based upon 2011 data but there was considerable uncertainty in the more current emission estimates. A review of the inventory is to be completed by late 2013. The City's inventory identifies the sources of emissions and estimates emissions based upon local use factors. The percentage of emissions attributed to transportation sources is much higher in the Toronto inventory than in the province wide inventory. Given the uncertainty in the 2011 data, the numbers, summarized by source category in Table 7, are based upon the 2004 inventory .

As explained in the ICF report, the natural gas combustion and mobile source related emissions were calculated from basic data such as gas sales by postal code and mobile source operating fleet data from traffic counts adjusted for vehicle operated in the City, TTC, GO and school boards. Mobile source emission factors were developed by the federal environment agency. Mobile data includes the contribution of road dust re-suspension that is typically included in area source calculations. Area sources include: industrial fugitive emissions; residential and commercial fuel combustion (not including natural gas); residential wood fuel combustion; utility emissions not included elsewhere; dry cleaning; fuel marketing; general solvent use; pesticides and fertilizer applications; printing; structural fires; surface coating (painting); meat cooking and human emissions including smoking. Specifically excluded from the City's inventory at the time it was created were construction related emissions. These tend to be localized and variable and while economic activity in this sector might provide an overall emission estimate, to apportion it across the city was not possible. Point source data relate mainly to industrial facilities that file emission information to the National Pollutant Release Inventory. These data include emission rates, and the characteristics of the stacks which can be entered into the City's air

[9] ICF International, 2007. Greenhouse Gases and Air Pollutants in the City of Toronto: Towards a Harmonized Strategy for Reducing Emissions. Prepared in collaboration with Toronto Atmospheric Fund and Toronto Environment Office. June. Available at http://www.toronto.ca/taf/pdf/ghginventory_jun07.pdf

[10] Staff Report, 2013. Summary of Toronto's 2011 Greenhouse Gas and Air Quality Pollutant Emissions Inventory. Available at: http://www.toronto.ca/legdocs/mmis/2013/pe/bgrd/backgroundfile-57187.pdf

quality model. Industrial releases that cannot be assigned to specific stacks were removed from the site emissions and included as part of the Area source emissions.

Table 7 Summary of Toronto's 2004 Emissions [Mg/year] as Used in the City's AQM[11]

Contaminant	Natural Gas Combustion			Other Sources			Total	Mobile [%]
	Short	Medium	Tall	Mobile	Area	Point		
CO	2,344	896	914	306,174	47,573	435	358,336	85
NO_x	3,858	1,264	1,562	27,434	3,740	1,749	39,607	69
PM_{10}	304	98	123	7,432	10,848	470	19,275	39
$PM_{2.5}$	304	98	123	1,576	7,305	408	9,814	16
SO_2	24	8	10	117	8,531	304	8,993	1
VOC	220	71	89	25,003	562,053	1,273	588,709	4

The table shows the contribution of mobile traffic to air quality in the City. There appears to be little difference between the emission factors for $PM_{2.5}$ between expressways, arterials or residential roads because only the diesel bus and motorcycle emissions change for different road types. There are data to suggest that the rate of $PM_{2.5}$ emissions is related to the speed and acceleration on any particular section of road[12].

2.6 Ambient Air Quality Criteria

The monitoring data discussed earlier in this report can be judged against a number of criteria or standards. While the Canada Wide Standards for Ozone and $PM_{2.5}$ have already been presented, a number of other criteria are summarized in Table 9.

In all cases these criteria are set to protect the general community. Monitoring locations do not always reflect the average seen in the community as they tend to be located in areas that are heavily influenced by traffic on nearby roads. Should air quality around these stations meet the criteria levels it would be anticipated that much of the community further removed from the heavy traffic areas would experience lower levels.

[11] Morgan, Christopher, 2007. Appendix B - The City of Toronto's Air Quality Model. Part of ICF International, 2007.

[12] Soliman, Ahmed S. and R.B. Jacko, 2008. A Quantitative Approach to the Traffic Air Quality Program: The Traffic Air Quality Index. JAWMA, 58:641-646. May.

Table 9 Ambient Air Quality Objectives

NO_x [ug/m^3]	Level	1-Hour	24-Hour	Annual
National	Maximum Desirable	-	-	60
	Maximum Acceptable	400	200	100
	Maximum Tolerable	1100	300	-
Provincial		400 [200 ppb]	200 [100 ppb]	
CO [mg/m^3]	**Level**	**1-Hour**	**8-Hour**	
National	Maximum Desirable	15	6	
	Maximum Acceptable	35	15	
	Maximum Tolerable	-	20	
Provincial		36 [30 ppm]	16 [13 ppm]	
Particulate Matter [ug/m^3]	**Level**		**24-Hour**	**Annual**
National [TSP total]	Maximum Desirable		-	
	Maximum Acceptable		120	
	Maximum Tolerable		400	
CWS $PM_{2.5}$	National Target		30	
Provincial [SPM <44 um]	AAQC		120	60
	PM_{10} Target Interim		50	
Ozone [ppb]	**Level**	**1-Hour**	**24-Hour**	**Annual**
National	Maximum Desirable	100	30	
	Maximum Acceptable	100	50	30
			4th Highest 8-Hour Avg.	
CWS Ozone	National Target		65	
Provincial CWS Adopted			65	

2.7 General Conclusions Air Quality

There are few differences between the measured air contaminant levels at the Toronto stations in 2011. Thus, these data should reflect air quality conditions in the project area. The levels are well within the standards considered acceptable by the MoE for ambient air quality.

The measurements do not address the concentrations of other contaminants, such as VOCs that can be associated with odours or metallic emissions from welding or similar operations or even increased vehicular emissions due to high numbers of idling heavy diesel trucks adjacent to the development.

This raises a question about whether local sources might affect the quality of the air in the vicinity of the development. This issue is addressed in the following sections.

3.0 Potential Effects of Emissions from Industrial Operations

The existing zoning for the development area is a mix of highway commerial and employment. South and east of the proposed development is currently designated as an employment area. The types of businesses that could be located in an employment area, according to the City's official plan, include offices, manufacturing, warehousing, distribution, research and development, utilities, media facilities, hotels and retail outlets ancillary to the preceding uses. The city identified warehousing operations taking place in at least four of the properties, 25, 38, 40, and 100 Metropolitan. The direct marketing operation at 44 Metropolitan fits the media category with digital printing facilities along with fulfillment distribution services. 41 Metropolitan was listed for rent as of September 2013. The Swing Stage operation at the corner of Metropolitan and Warden is the only current 'manufacturing' operation identified in the area.

Given that the tenants in some of the properties have changed over the past 10 years it is not unreasonable to suggest that they will change in the future. This suggests that there might be a potential for conflict between a new tenant and the proposed development. How significant this might be should be considered.

3.1 Regulatory Environment for New Sources

Under the Environmental Protection Act in Ontario, all persons installing sources of emissions to the atmosphere are required to seek approval for these releases from the MoE before they commence operation. Approvals are granted when the proponent demonstrates, to the satisfaction of the Approvals Branch of the MoE, that the facility will meet the applicable standards as defined in O.Reg. 419/05. These standards include levels for many more air contaminants than those discussed in the previous section. In all cases the criteria levels for these contaminants are set to be protective of human health and the environment. Thus, approval should ensure that, under normal operating conditions, there will be minimal conflict between stack emissions from buildings and the occupants of adjacent buildings. Such approvals only consider fixed sources of emissions, fans and stacks that discharge to the atmosphere, and would not address emissions arising from vehicular traffic on the subject property. While the approval process requires the proponent to determine the worst case emission condition, that is the highest conceivable emission release rate, upsets might occur in the process that could increase the emissions. It is recognized that should such upsets occur they should be infrequent and short lived with minimal potential to aggravate the occupants of nearby buildings.

There are some situations where the proponent does not need to apply for an Environmental Compliance Approval for air emissions. Small heating systems, typically those used in single family dwellings are exempt from any requirements if the energy input is less than 1.58 GJ/h. Practically, these systems have no potential to create health or environmental issues thus new high efficiency heating system exhausts are vented just above ground level where people can walk past them.

A second category of sources can be registered with the province provided certain size restrictions are met. This approach addresses the need to document the types of sources operating in the community, but recognizes that if these types of units are operated in accordance with the regulation they are unlikely to cause environmental or health impacts. The heating systems that incorporate any number of individual units that are larger than the low end cut-off, but smaller than 10.5 GJ/h, require registration of under the provisions of O.Reg. 346/12. Similar registration and operating provisions have been set for emergency generators smaller than 700 kW. Generators larger than that are required to go through the ECA process. Registration provisions are also provided for automobile finishing facilities, typically body shops, and conventional printing operations.

Obtaining provincial approval of an exhaust system should ensure that facilities will be unlikely to cause problems with their neighbours. Certain types of facilities that are more problematic than others include those where large quantities of garbage are stored. However waste transfer and processing facilities are not included in the allowable facilities in an employment area. Small quantities of putrescible waste can create odour, but typically it would only be noticeable within a few metres of the waste container. Odours are the most likely air contaminant that can cause complaints from occupants of adjacent buildings. High levels of volatile organic compounds from a manufacturing facility can cause issues if there is insufficient separation between the source and the receptor. Separation and the dilution of contaminants as they move downwind from the source are considered in the approval application. This issue is discussed below to illustrate the potential for issues associated with the use of industrial buildings in the vicinity of the development.

3.2 Factors that Affect Dispersion

The concentration of contaminants released from a source, a stack or exhaust fan, is reduced as the stack gases move between the exhaust point and the receptor, a building fresh air intake, or a person. The amount of dilution depends upon the turbulence, or mixing, that occurs in the atmosphere and the time it takes for the plume to reach the receptor. The further the gases travel from their point of exit the greater the potential for a reduction in the concentration. Higher wind speeds create more mixing and thus more dilution.

The exhaust stream, or plume, will rise in the atmosphere after it is discharged. If the discharge is unimpeded in a vertical direction, the momentum imparted by the exiting gas velocity will aid this rise. Thermal buoyancy that results from stack gas temperatures that are higher than the ambient air temperature adds to the amount the plume rises. Typically as the plume rises it will spread both horizontally and vertically. The downwards spreading will continue until the plume meets the ground, or a similar surface such as the roof. Upwards spreading can be limited by some atmospheric conditions but these are unlikely to be significant for exhaust streams from short industrial buildings. Typically, the plume is assumed to spread at an angle of 11.5^{O}, approximately 1 foot of spread for every 5 feet the plume moves downwind. Horizontal spreading can be assumed to occur in the same manner unless the plume meets another structure. Winds blowing around a building create zones of increased mixing further diluting concentrations. A stack too near the roof may result in the plume being trapped in the mixing zone on the roof, or downwind of the building thereby limiting the dilution.

The plume moves with the wind as it is carried. Any point upwind of the source is thus unlikely to experience any effect of the emissions until the wind direction changes. This means that the frequency of exposures at any point around a source are limited by the amount of time that the wind blows from the source to that point. This behaviour suggests that buildings should be designed to take advantage of the predominant wind directions. It is common practice to place fresh air intakes are on the side of the building that experiences the highest frequency of winds blowing toward the inlet. This limits the potential for re-entraining contaminants emitted from the building into the fresh air intakes on that building. Similarly, keeping fresh intakes on the upwind of a building away from potential industrial sources will limit the potential for issues. Furthermore, fresh air inlets higher on a building are less likely to be exposed to high concentrations from sources on typical industrial buildings, and are less likely to be influenced by traffic related emissions.

Figure 1 illustrates the predominant wind directions in Toronto. That data suggests that design measures that incorporate fresh air intakes on the western sides of all the buildings in the new development will limit the occurrence of air from the industrial areas being entrained in fresh air inlets.

3.3 Modelling the Effect of Industrial Emissions

The provincial approval process for air emissions requires modelling the emissions to predict the concentrations around the site. Modelling is essentially a mathematical simulation of the behaviour of the plume in the atmosphere. Models come with various levels of sophistication but the majority of smaller industrial facilities can be modelled using the O.Reg. 346 model released by the MoE. This model treats three scenarios: the potential for a release to be re-entrained into fresh air inlets on the same building; the behaviour of a plume from an exhaust that is close to the roof; and the behaviour of a plume from a stack that is at least 2 times the height of the building it services. Taller stacks will result in lower concentrations at points on the ground close to the source. None of the exhaust points in the industrial area around the development are likely to meet the point source criteria so the third scenario is of little import for this evaluation. Since the first alternative does not relate to concentrations at receptors off the source site, it does not apply. The second alternative, sometimes referred to as the virtual source model can be employed. The virtual source model typically predicts higher concentration levels close to the source due to limited dilution of the plume as it moves downwind.

The presence of a building in the wind field will create turbulence and impart some initial mixing of the plume in the atmosphere. The virtual source model uses the building's dimensions in the cross wind direction to define the amount of mixing that is likely to occur, and from that derives a virtual location for the stack in the upwind direction. In this manner, the virtual source model assumes that the emissions from the building come from a single point located some distance upwind from the building's windward face. The height of the stack matches the height of the building being modelled.

According to the provincial protocol the models are used to determine the concentration at the property of the business, and at other points downwind of the sources. The MoE's computer code for the model calculates the point of maximum concentration around and off the site. A second code calculates the concentration at any point in the space surrounding the source with these locations being specified by the user. These points can be at ground level or any height above grade. For tall buildings one can specify points on the roof of the building where the fresh air intakes are located, or one can assume that there are openable windows in the building and the model will determine at what height the maximum concentration would be found.

The virtual source model does not contain any plume rise algorithms thus it provides a conservative estimate of the concentration. Parameters such as exit velocity and gas temperature are not used in this model, just the emission rate specified in grams per second.

4.0 Modelling the Effect of Surrounding Sources

The virtual source model was applied for the various structures around the development site to ascertain the potential effects of emissions from those locations on the new development's various buildings. The buildings on the development site were assumed to be rectangular structures ranging in height from 15 to 50 m above grade. The concentrations at the middle of the roof of each of the rectangular blocks was calculated, in both the open and closed configuration. The maximum concentrations at the property lines of each of the industrial source buildings was also determined.

Using the airphoto available on GoogleEarth, the outlines of the various structures on the properties surrounding the site were determined. Property lines for the various businesses are distinguishable on the airphoto but the City's mono-viewer was used to confirm the locations of property lines that were not clear. All the industrial buildings were assumed to be 8 m high.

The wind oriented centre of each complex was determined from the outlines. All points were defined on a two dimensional grid with the origin to the south and west of the industrial area. The development, the location of the receptors on site and the relative locations of buildings surrounding the site are shown in Figure 2. For modelling purposes each of the individual properties was dimensioned in a manner similar to the green lines shown for the 100 Metropolitan site.

The calculated concentrations from any source at a given receptor are proportional to the emission rate. For this study, in an attempt to show the relative potential impact from the various industrial properties on buildings on the development site a standard emission rate of 1 gram per second was used. The model generates concentrations estimates for the receptors that are expressed in $\mu g/m^3$ [10^{-6} g/m^3]. Thus, if 1 gram per second emissions result in concentrations on the order of 250 $\mu g/m^3$ they have been diluted by 4,000 times before they get to the receptor.

Emissions from each building were considered separately partly because this allows the Maximum Ground Level Concentration along property lines to be determined based upon the relations of the property line to the building and the virtual source location. Secondly, given the relative locations of the sources and the receptors on the various buildings, running each case separately allows the model to determine the maximum concentration from each source at each receptor. If one assumes that the wind blows in a given direction, the contribution of sources to the left or right of the line connecting a specific source and receptor will be less than that from the source that directly upwind from the receptor. This is because as the plumes spread the concentration of contaminants at any point off the centerline is lower than that on the centerline.

The results of the modelling are presented in two tables, Table 10 shows the maximum concentrations on the property line for each of the buildings. Table 11 shows the concentrations estimated to occur at each of the 11 receptors on the development site.

Three concentrations are listed for each source in Table 10:

- the predicted maximum concentration;
- the maximum concentration predicted to occur off-property;
- the maximum concentration predicted to occur on the property line;

In addition, the distance where the maximum concentration is expected to occur is shown and the property line where the maxima is estimated to occur is identified.

In all cases, except for 100 Metropolitan, the maximum concentration predicted is greater than the maximum GLC at the property line, or beyond. The maximum on the property line is greater in the case of 100 Metropolitan due to the location of the property line, which is actually inside the rectangle that encompasses the building. Most of the buildings are predicted to create the maximum concentration at a distance of between 30 and 50 m from the source. The long narrow building at 25 Metropolitan creates a maximum value further from the source, due largely to the narrow dimensions of the building. The large building at 100 also created a maximum further from the virtual source location. The maximum GLC off property is lower than the value on the property line, except for 100, due to the fact that that point is further from the virtual source than the property line. The lowest predicted concentrations occur from the largest building due to incorporation of the building dimensions to describe the variation across the plume. The distance to the property line from the source location also influences the estimated concentration due to the potential for increased dilution. In all cases, the releases from the buildings will create a maximum concentration that reflects a dilution in excess of 2500 times at the point of maximum concentration.

Table 10 Results of Maximum Ground Level Calculations for 1 g/s Emissions

Property	Maximum GLC [$\mu g/m^3$]	Distance [m]	Maximum GLC Off Property [$\mu g/m^3$]	Maximum GLC on Property Line [$\mu g/m^3$]	Property Side where Maxima Occur
Swing Stage	396	31	362	370	S
19-21	391	50	356	361	N
25	349	94	299	295	N
41	300	51	276	283	S
38	277	41	262	265	N
44	289	36	277	281	E
100	65	145	59	69	S/E

Table 11 provides concentration estimates at the approximate location of the centre of the buildings' plan area for the 22 Metropolitan site. These results are presented by receptor location, for each of the sources. Two numbers are provided, the one at ground level and the one at the roof elevation. In all cases the values at the receptors on the development site are lower than those in Table 10. This is to be expected given the greater separation between source and receptor. In most cases the ground level values at the buildings are at least 20% lower than the maximum for that source and in two cases the reduction was nearly 50%. The reduction from the maximum is much greater for the elevated receptors with the worst situation being a reduction of only 65% while most locations were in the 79 - 94% reduction range. One can presume that the concentrations at any elevation of the buildings will be between those reported for ground level and roof level. The emissions concentrations have been reduced by a minimum of 3500 times by the time they get to the ground level receptor points. Locations on the roof of the buildings where the fresh air intakes might be are estimated to experience levels that have been reduced by at least 14,000 times.

Table 11 Estimated Maxima from Each Source at Receptors [ground level/roof]

Receptor	Source Building						
	Swing Stage	19&21	25	38	41	44	100
D Block							
Low South (192,442)	99/57	101/56	108/64	223/59	106/56	150/55	34/23
Tower (217,452)	91/3	92/2	95/3	190/0	115/1	166/0	36/2
Low North (208,487)	83/53	83/51	84/54	166/58	101/58	193/53	33/21
Hotel							
East Block (193,558)	68/42	67/42	67/43	121/48	79/46	184/34	29/17
Center Block (165,555)	71/13	71/13	72/15	129/11	74/13	165/4	27/6
West Block (141,544)	75/21	76/21	79/25	123/16	71/19	153/12	26/9
B Block							
Tower (136,509)	85/4	87/4	93/5	133/0.4	75/4	163/0.2	27/2
Low Rise (124,461)	103/60	108/63	99/63	141/53	80/48	136/61	28/20
A Block							
Residential Tower (135,373)	146/1	161/1	124/2	181/0	95/1	102/1	30/3
Residential Low (139,353)	157/65	177/72	131/65	205/53	99/49	96/52	29/22
Office Block (123,300)	207/12	286/16	117/16	161/12	100/16	79/20	25/12

To reiterate, assuming that businesses in the buildings surrounding the proposed development site do not install tall stacks, the existing regulatory environment should ensure that there are no issues with air pollution at the new buildings. As demonstrated by the modelling discussed in this section, the maximum at the property line and off property must meet provincial standards for the facility to receive approval, and points in and around the development will only be exposed to levels that are some fraction of those at the property line, that is levels below the standards. If emissions from a specific property cannot meet the requirements the operator is required to undertake pollution control measures before any releases to the atmosphere.

5.0 Review of Typical Industrial Emissions Situations

The analysis in the previous section should provide some confidence that industrial sources will have little impact on the residents in the proposed development however, people might suggest scenarios that could create issues. To address that concern, the author's files have been examined in an attempt to identify industrial applications where approvals have been obtained even though there was a potential for concerns. Three operations were identified:

- a grease manufacturing facility that used oil and surfactants to create grease for machinery;
- a plastic packaging manufacturing operation that took plastic pellets and melted them to created sheet materials that were then thermally formed into packages for food and other products; and,
- a kitchen cabinet manufacturer that operated a paint spray booth for finishing their products.

In all three cases the contaminants released from the processes were associated with odours that could create concerns if they became noticeable in the community. In some of these cases specific compounds in the emissions could be identified and the results of modelling these emissions could be compared to the standards for those compounds specified by the MoE. Many concentration limits specified by the MoE were derived on the basis of the odours associated with the specific chemicals. In the case of the plastics manufacturer, specific odour testing was undertaken to derive an estimate of the odour being released from the facility and an advanced dispersion model was used to estimate the worst case odour levels in the nearby community. These estimates were compared to the 10 minute average 1 OU/m^3 threshold level used by the MoE to define acceptable odour levels. At 1 OU/m^3 only about 50% of the population will typically be able to identify its presence.

In the case of the grease manufacturing operation two organic chemicals were identified in the emissions: isobutanol and n-butanol. Butanol compounds are known for their odour and the MoE set standards for these compounds of 1940 ug/m^3 for isobutanol and 2278 ug/m^3 for n-butanol. The facility was found to have a worst case emission rate of 0.15 g/s for isobutanol and 0.73 g/s for n-butanol. With the lowest dilutions determined for the buildings around the proposed development site, if this factory was housed in the vicinity the worst case levels that would be found is 56 ug/m^3 for isobutanol and 270 ug/m^3 n-butanol both well below the limits on the property line.

At the plastics manufacturing facility the odour emission rates were on the order of 1400 OU/s which, with a 2500 minimum dilution factor would result in concentrations on the order of 0.6 OU/m^3. Even if this was to be converted to a dilution factor for 10 minutes, the result, 0.82 OU/m^3, would be below the 1 OU/m^3 threshold.

A number of chemicals are present in paint formulations used in the industrial sector. In the case of the cabinet shop the worst case situation involved the release of ethyl-3-ethoxy propionate which has an MoE 30 minute limit of 147 ug/m^3 based upon odour. The release rate from the process was 0.07 g/s and the configuration of the building where the source was located resulted in a dilution factor of 1655 but the result was still only 29% of the standard. A similar release in the buildings surrounding the development site would lower this level to 26 ug/m^3 well below the standard.

These three examples, with a range of emission rates, help to put emissions from buildings surrounding the development into perspective. This adds further evidence that potential industrial uses of the surrounding properties should not create issues with residents of the proposed buildings.

Should you have any questions please contact me.

Yours truly,
A.J. Chandler & Associates Ltd.

John Chandler
Principal