**CITY OF VAUGHAN**

**EXTRACT FROM COUNCIL MEETING MINUTES OF APRIL 19, 2017**

Item 10, Report No. 13, of the Committee of the Whole, which was adopted without amendment by the Council of the City of Vaughan on April 19, 2017.

## 10 REQUEST FOR NOISE EXEMPTION – METROLINX MAPLE AND RUTHERFORD GO STATION CONSTRUCTION - WARDS 1 & 4

**The Committee of the Whole recommends approval of the recommendation contained in the following report of the Deputy City Manager, Community Services and the Director of By-law & Compliance, Licensing & Permit Services, dated April 4, 2017:**

### Recommendation

The Deputy City Manager, Community Services and the Director of By-law & Compliance, Licensing & Permit Services, recommend:

1. That Metrolinx, be granted a noise exemption for the period of April 20, 2017 through December 31, 2017, in accordance with the City's Noise By-law 96-2006, for the purposes of construction activities located at both the Maple GO and Rutherford GO Stations associated with the Barrie Corridor Expansion.

2. That this request for extension be granted with the following conditions:

    a) That construction communication notices be sent to surrounding residents and business owners within a 60 metre radius, in keeping with City standards, advising them of the impending work;

    b) That the construction communication notices to residents and business owners include contact information for Metrolinx;

    c) That the Applicant take measures to minimize any unnecessary noise, including but not limited to idling of construction vehicles and/or equipment, revving of engines, use of airbrakes, banging of tailgates and to maintain equipment in good working order (including muffling devices) to minimize noise impacts;

    d) Select travel routes that will assist in avoiding noise sensitive areas where possible;

    e) That no construction takes place on Statutory Holidays;

    f) The Applicant ensure lighting is directed downward toward the site and away from public roadways, area businesses and residential properties.

### Contribution to Sustainability

This noise exemption request will support the Regional Express Rail (RER) initiative, contributing to accessible and frequent local transit service associated with GO Transit routes, supporting compact urban form and offering alternative modes of transportation and is consistent with the City's Community Sustainability and Environmental Master Plan – Green Directions, which identified the goal of ensuring the City is easy to get around and has a low environmental impact.

### Economic Impact

Adoption of this report has no adverse economic impact for the City.

…/2

## Communications Plan

The Applicant has provided public notice in November 2016 of the impending construction activities at Maple GO Station (Attachment No. 1), and a draft notice of work (Attachment No. 2) has been provided for construction activities at the Rutherford GO Station.

The Applicant has been instructed by the City to provide additional notification of the commencement of construction in local Vaughan newspapers and in letter form to surrounding residents and businesses in and around both locations (Maple GO and Rutherford GO Stations) within a 60 metre radius that may be affected by the construction activities of this project.

## Purpose

This report is to request Council approval of a request from Metrolinx for a noise exemption to By-law 96-2006.

## Background - Analysis and Options

The City of Vaughan Noise By-law 96-2006 delegates authority to grant noise exemptions for construction purposes up to eleven days to the Department Head/Director of By-law & Compliance, Licensing & Permit Services.

Metrolinx has written to City of Vaughan By-law & Compliance, Licensing & Permit Services, (Attachment No. 3) requesting an exemption to the City's Noise By-law for the purposes of construction at the Maple and Rutherford GO Stations in connection with RER (which will provide a two-way, all-day (TWAD) service of its rail corridors, a key objective for GO Transit as identified in "The Big Move" and "GO 2020".

The scope of both projects entails the installation of two tunnels at each location (Attachment No. 4), track upgrades (removal and re-installation), island platform construction and associated infrastructure, such as tunnels, snowmelt systems, elevators, stairs, platform shelters mini platforms, canopies, etc.

Construction work associated with the tunnel installations include, but is not limited to:

- Installation of approximately 70 Caissons (weekdays only, evening work only when required between April 20, 2017 to December 31, 2017).
- Installation of precast concrete tunnel segments (continual work over four weekends commencing in April 20, 2017. Construction will start after 7:30pm on Friday and stop before 5:30am on Monday.

Construction work activities that will occur outside of the Noise By-law restrictions will include the use of caisson rigs (large scale drilling equipment), backhoes with hoe rams, dump trucks, loaders, cranes, heavy duty pumps, concrete trucks, vibratory rollers and plate packers, tower lights, generators, welding machines, cutting torches and propane torches.

### Noise Mitigation

The Applicant has provided a Noise and Vibration Impact Assessment document provided by Valcoustics Canada Limited, which includes cataloguing of areas that may be impacted by construction noise (Attachment No. 5).

The Applicant will be required to minimize idling of construction vehicles, avoid revving of engines, banging of tailgates and use of airbrakes, as well as be required to maintain equipment in good working order (including the use of muffling devices) to minimize noise impacts and to select travel routes to avoid noise sensitive areas where possible. In addition, the applicant will be required to ensure lighting is directed downward toward the site and away from public roadways, area businesses and residential properties.

**Relationship to Term of Council Service Excellence Strategy Map (2014-2018)**

This noise exemption is directly related to the Term of Council Priority and Service Excellence Strategy Map by:

1) Continuing to develop transit options to get around the City;
2) Improve municipal road network;
3) Invest, renew and manage infrastructure and assets;

**Regional Implications**

The proposed work is being carried out by Metrolinx and its agents and contractors.

**Conclusion**

This request for noise exemption is necessary municipal work in connection with the RER initiative. The request exceeds the delegated authority of the Director of By-law & Compliance, Licensing & Permit Services; therefore, Council authorization for the exemption to the By-law is required to permit Metrolinx to proceed as planned.

**Attachments**

1. Metrolinx – Public Notice - Maple GO Station
2. Metrolinx – Draft Public Notice - Rutherford GO Station
3. Letters of Intent, Maple & Rutherford GO Stations
4. Project Maps, Maple & Rutherford GO Stations
5. Noise and Vibration Impact Assessment

**Report prepared by:**

Janice Heron,
Office Coordinator, By-law & Compliance, Licensing & Permit Services

(A copy of the attachments referred to in the foregoing have been forwarded to each Member of Council and a copy thereof is also on file in the office of the City Clerk.)

**COMMITTEE OF THE WHOLE APRIL 4, 2017**

## REQUEST FOR NOISE EXEMPTION – METROLINX MAPLE AND RUTHERFORD GO STATION CONSTRUCTION - WARDS 1 & 4

### Recommendation

The Deputy City Manager, Community Services and the Director of By-law & Compliance, Licensing & Permit Services, recommend:

1. That Metrolinx, be granted a noise exemption for the period of April 20, 2017 through December 31, 2017, in accordance with the City's Noise By-law 96-2006, for the purposes of construction activities located at both the Maple GO and Rutherford GO Stations associated with the Barrie Corridor Expansion.

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### Contribution to Sustainability

This noise exemption request will support the Regional Express Rail (RER) initiative, contributing to accessible and frequent local transit service associated with GO Transit routes, supporting compact urban form and offering alternative modes of transportation and is consistent with the City's Community Sustainability and Environmental Master Plan – Green Directions, which identified the goal of ensureing the City is easy to get around and has a low environmental impact.

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Adoption of this report has no adverse economic impact for the City.

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The scope of both projects entails the installation of two tunnels at each location (Attachment No. 4), track upgrades (removal and re-installation), island platform construction and associated infrastructure, such as tunnels, snowmelt systems, elevators, stairs, platform shelters mini platforms, canopies, etc.

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The Applicant has provided a Noise and Vibration Impact Assessment document provided by Valcoustics Canada Limited, which includes cataloguing of areas that may be impacted by construction noise (Attachment No. 5).

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## Relationship to Term of Council Service Excellence Strategy Map (2014-2018)

This noise exemption is directly related to the Term of Council Priority and Service Excellence Strategy Map by:

1) Continuing to develop transit options to get around the City;
2) Improve municipal road network;
3) Invest, renew and manage infrastructure and assets;

**Regional Implications**

The proposed work is being carried out by Metrolinx and its agents and contractors.

**Conclusion**

This request for noise exemption is necessary municipal work in connection with the RER initiative. The request exceeds the delegated authority of the Director of By-law & Compliance, Licensing & Permit Services; therefore, Council authorization for the exemption to the By-law is required to permit Metrolinx to proceed as planned.

**Attachments**

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4. Project Maps, Maple & Rutherford GO Stations
5. Noise and Vibration Impact Assessment

Report prepared by:

Janice Heron,
Office Coordinator, By-law & Compliance, Licensing & Permit Services

Respectfully submitted,

Mary Reali
Deputy City Manager
Community Services

Gus Michaels
Director, By-law & Compliance,
Licensing & Permit Services

ATTACHMENT NO. 1

# TRANSFORMING TRANSIT IN YOUR AREA

## Improvements at Maple GO Station

November 2016

Metrolinx, an agency of the Province of Ontario, is working to transform the way the region moves by building a seamless, convenient and integrated transit network across the Greater Toronto and Hamilton Area (GTHA). Over the next ten years, Metrolinx is transforming the existing GO rail system to deliver a whole new rapid transit experience to your community. With more frequent train service you'll have more options to get you where you need to go.

### IN YOUR COMMUNITY

We're working to bring you more parking and faster and more frequent train service at Maple Station.

- We are building a parking structure with **1,200** new spots with construction to start following detailed design and procurement
- We're building **new pedestrian tunnels** soon to make it easier and safer for you to access the future second track and platform. Construction on the pedestrian tunnel at Maple Station will begin this month
- Also, we're building a **new GO station at Kirby**, which will include more parking for this growing region
- We are also building a new **1,200** spot parking structure at Rutherford GO


## STAY CONNECTED

If you have any questions or would like to be added to our email distribution list to receive updates, please contact us at jennifer.capan@gotransit.com or 416-202-4732.

Follow us on Twitter @metrolinx or visit us at metrolinx.com

METROLINX
An agency of the Government of Ontario

# TRANSFORMING TRANSIT IN YOUR AREA

## Improvements at Maple GO Station

November 2016

### WHAT TO EXPECT

Residents living nearby the station can expect to see and hear regular construction vehicles operating during the construction of the tunnel, including a drill rig, excavator, concrete trucks, load trucks to carry materials in and out, and a small crane.

Due to increasing rail service, crews may need to work occasionally in the evening and overnight hours to ensure safe working conditions, as some of this work cannot take place when trains are operating. If overnight work is required, lights will be used to ensure safe working conditions; however, they will be focused away from nearby homes and businesses when possible.

### TIMING

The Maple GO station tunneling construction will begin this November and construction is expected to be complete by mid-2017. The majority of the work will take place between 9 a.m. and 3 p.m. from Monday to Friday; however, we will need to work 4 continuous weekends (from Friday at 7:30 p.m. – Monday 4 a.m.) Additional weekend work may also be required.

More information about weekend work will be communicated closer to the date, once finalized. The new 1,200 car parking structure construction will begin as soon as design and procurement are complete.

### STATION IMPACTS

The number of parking spots available will not be affected by the tunnel construction. However, some spots will have to be temporarily moved to allow for construction. Relocated spots will be within a short walk to the station. And good news, this offsite parking lot will remain open once construction is complete. Please visit www.gotransit.com under "Construction Updates" for additional information on parking at the station.

### CONTACT US

We understand that building a transit project of this size will mean some disruption for communities, but we are committed to keeping residents informed and minimizing inconvenience as best as possible. Contact us at any time.

## STAY CONNECTED

If you have any questions or would like to be added to our email distribution list to receive updates, please contact us at jennifer.capan@gotransit.com or 416-202-4732.

Follow us on Twitter @metrolinx or visit us at metrolinx.com

METROLINX
An agency of the Government of Ontario

ATTACHMENT NO. 2

# TRANSFORMING TRANSIT IN YOUR AREA

## Rutherford GO Station Pedestrian Tunnel construction

JUNE 2016

Metrolinx, an agency of the Province of Ontario, is working to transform the way the region moves by building a seamless, convenient and integrated transit network across the Greater Toronto and Hamilton Area (GTHA). Over the next ten years, Metrolinx is transforming the existing GO rail system to deliver a whole new rapid transit experience to your community. With more frequent train service you'll have more options to get you where you need to go.

### THE LOCAL PROJECT

In order to run two-way, all day train service on the Barrie corridor, the Rutherford GO Train station requires infrastructure upgrades to support the future additional track. A pedestrian tunnel will need to be constructed at the station to allow for passengers to safely cross under the train tracks to reach the second platform, which will be constructed once the tunnels are completed. Estimated platform construction is expected in 2018.




### WHAT TO EXPECT

Residents living nearby the station can expect to see and hear regular construction vehicles operating during the construction of the tunnel, including a drill rig, excavator, concrete trucks, load trucks to carry materials in and out, and a small crane. Due to increasing rail service, crews may need to work occasionally in the evening and overnight hours to ensure safe working conditions, as some of this work cannot take place when trains are operating. If overnight work is required, lights will be used to ensure safe working conditions; however, they will be focused away from nearby homes and businesses when possible.

### TIMING

The Rutherford GO station tunneling construction will begin this summer and construction is expected to take approximately 5 months to complete. The majority of the work will take place between 9 a.m. and 3 p.m. from Monday to Friday; however, we will need to work 4 continuous weekends (55 hours from Friday at 9 p.m. – Monday 4 a.m.) between the months of September to November. Additional weekend work may also be required. More information about timing and dates will be communicated closer to the date.

### SERVICE IMPACTS

There will be no service impacts as part of this construction. All trains will continue to run as scheduled, unless otherwise communicated. Metrolinx is committed to keeping local residents and businesses informed about construction activities and minimizing potential disruptions related to this work.

## STAY CONNECTED

If you have any questions or would like to be added to our email distribution list to receive updates, please contact us at jennifer.capan@gotransit.com or 416-202-4732 or follow us on Twitter @metrolinx or visit us at metrolinx.com

METROLINX
An agency of the Government of Ontario

ATTACHMENT NO. 3

METROLINX

Phone: (416) 202-5006
Fax: (416) 869-9342
Email: Stefan.Tzianetas@metrolinx.com

March 6, 2017

City of Vaughan
By-Law and Compliance, Licensing and Permit Services
2141 Major Mackenzie Drive, 1st floor
Vaughan, Ontario, L6A 1T1

Subject: Maple GO Station, Noise Exemption Application

Attention: Janice Herron

Dear Janice:

**APPLICATION FOR NOISE EXEMPTION (CONSTRUCTION) - MAPLE GO STATION - REVISED**

GO Transit currently offers peak period, peak direction rail service on six (6) of its seven (7) rail corridors. The only exception is the Lakeshore East and West Corridors, which run in both directions, from morning through to night time, seven days a week at regular intervals of thirty (30) minutes and a higher frequency in the peak periods. Provision of a two-way, all-day (TWAD) service on all of its rail corridors is one of the key objectives for GO Transit, as identified in both *The Big Move* and *GO 2020*.

To meet this objective, the remaining six (6) rail corridors would require a minimum of two tracks and upgrades at each of its stations to service the tracks. The majority of the Barrie corridor is a single track with exceptions at the southerly end of the corridor and some shunting tracks in between. In addition to infrastructure improvements along the rail corridor, new infrastructure is also required at existing stations to serve the new tracks. To this end, a project entailing station upgrades associated with TWAD service was initiated for the Maple GO station. Station upgrades will include construction of an island platform and any associated infrastructure e.g., tunnels, snowmelt system, elevators, stairs, platform shelters, mini platforms, canopies, etc.

The attached application for noise exemption is for the project to install two tunnels at the Maple GO station; see dwg. C-200. The project is anticipated to commence April 20, 2017 and installation is expected to be complete by December 31, 2017. Brief details of the work are as follows:

- Installation of approximately 70 caissons; this work will be done on weekdays. Between 9:00 am to 3:00 pm and is expected from April 20 to November 30, 2017. There may be some work occurring in the evening hours, but only when unavoidable.
- Installation of precast concrete tunnel segments; the tunnel segments will be installed over four weekends with work starting after 7:30 pm on Friday and stopping before 5:30 am on Monday. This work will be done after April 20, 2017.

We expect the following equipment will be used by the contractor:

- Caisson rigs
- Backhoes equipped with hoe ram
- Dump Trucks
- Loaders
- Cranes
- Pumps (heavy duty)
- Concrete trucks (ready mix)
- Double drum walk-behind vibratory rollers
- Vibratory plate packers
- Tower lights, generators and adequate lights;
- Welding Machines
- Cutting torches & Propane torches

In support of the application, we attach the following:

- Sample copy of letter notifying surrounding businesses and homeowners
- Copy of Noise and Vibration Study undertaken by Valcoustics for Maple and Rutherford Stations
- A map of the area
- Drawing No. C-200 showing the General Plan of the Work
- 2017 Fee payment of $152

Sincerely,

Stefan Tzianetas, P. Eng.
Manager, Corridor Infrastructure – Barrie
Metrolinx

Enclosure:

cc. Joceli Pierossi, Metrolinx
Alan Dick, Metrolinx
Shabir Alidina, Cole Engineering

METROLINX

Phone: (416) 202-5056
Fax: (416) 869-9342
Email: Cathy.Borsa@metrolinx.com

January 19 2017

City of Vaughan
By-law and Compliance, Licensing and Permit Services
2141 Major Mackenzie Drive, 1st floor
Vaughan, Ontario, L6A 1T1

Subject: Rutherford GO Station, Noise Exemption Application

Attention: Janice Heron

Dear Janice,

**APPLICATION FOR NOISE EXEMPTION (CONSTRUCTION) – RUTHERFORD GO STATION**

GO Transit currently offers peak period, peak direction rail service on six (6) of its seven (7) rail corridors. The only exception is the Lakeshore East and West Corridors, which run in both directions, from morning through to night time, seven days a week at regular intervals of thirty (30) minutes and a higher frequency in the peak periods. Provision of a two-way, all-day (TWAD) service on all of its rail corridors is one of the key objectives for GO Transit, as identified in both *The Big Move* and *GO 2020*.

To meet this objective, the remaining six (6) rail corridors would require a minimum of two tracks and upgrades at each of its stations to service the tracks. The majority of the Barrie corridor is a single track with exceptions at the southerly end of the corridor and some shunting tracks in between. In addition to infrastructure improvements along the rail corridor, new infrastructure is also required at existing stations to serve the new tracks. To this end, a project entailing station upgrades associated with TWAD service was initiated for the Rutherford GO station. Station upgrades will include construction of an island platform and any associated infrastructure e.g., tunnels, snowmelt system, elevators, stairs, platform shelters, mini platforms, canopies, etc.

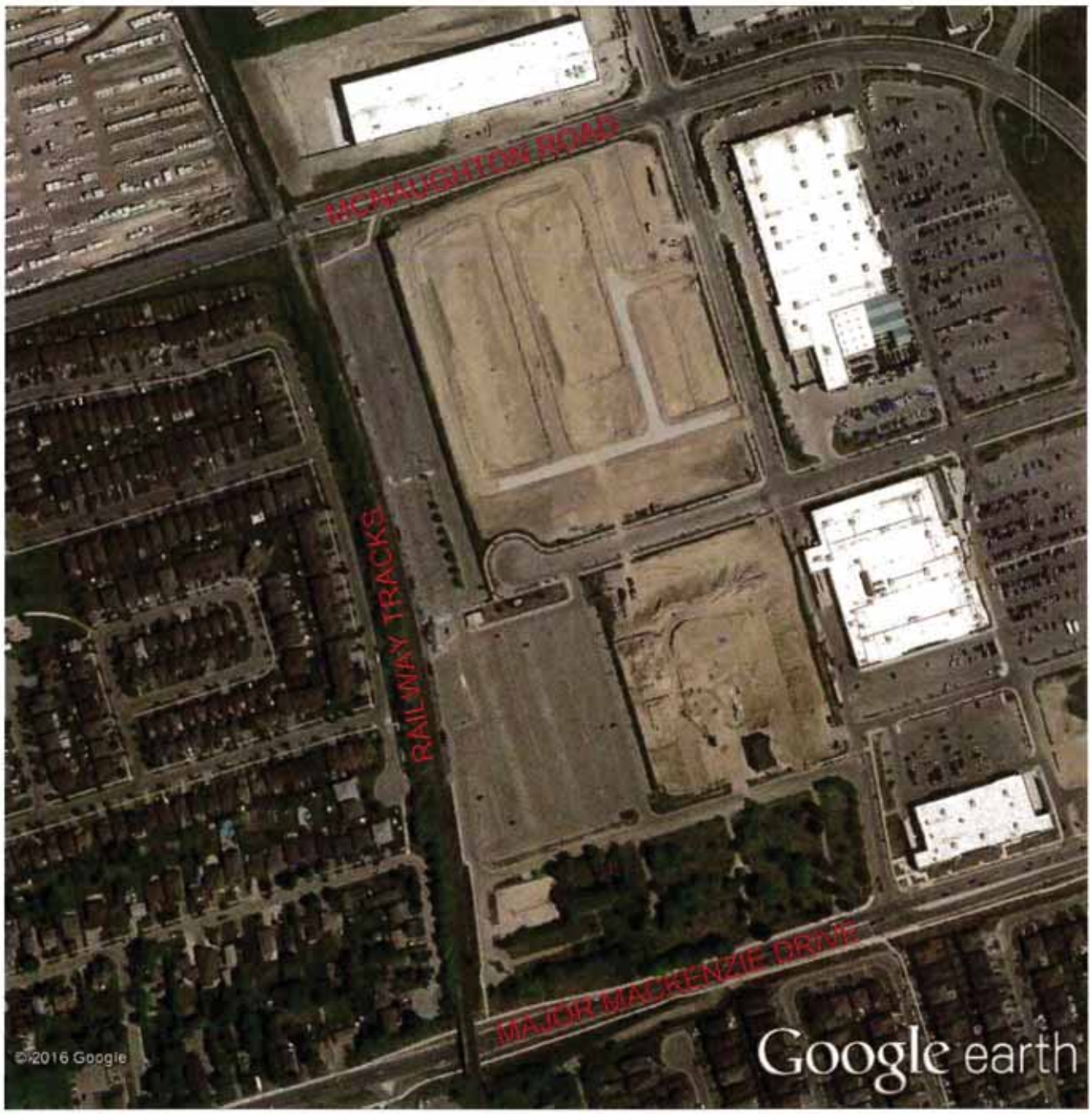
The attached application for noise exemption is for the project to install two tunnels at the Rutherford GO station; see attached drawings. The project is anticipated to commence by March 6, 2017 and installation is expected to be complete by November 30, 2017. Brief details of the work for both sites are as follows:

- Installation of approximately 70 caissons; this work will be done on weekdays. Between 9:00 am to 3:00 pm and is expected from July 3 to August 11, 2017.

Enclosure:

c.c. Joceli Pierossi, Metrolinx
Douglas Smith, Metrolinx
Shabir Alidina, Cole Engineering

ATTACHMENT NO. 4




# MAPLE GO STATION

N.T.S.


# RUTHERFORD GO STATION

N.T.S.

ATTACHMENT NO. 5

# Noise and Vibration Impact Assessment

# Metrolinx Two-Way All Day Barrie Corridor Expansion

## Station Infrastructure Upgrades

Rutherford and Maple Stations

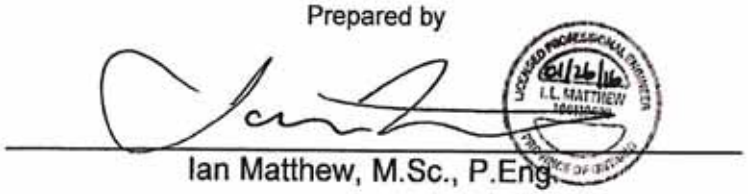
RQQ-2014-SI-019

January 26, 2016
Project: 114-380

Prepared for

**Cole Engineering Inc.**

Prepared by




Ian Matthew, M.Sc., P.Eng.

VALCOUSTICS
Canada Ltd.

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**LIST OF APPENDICES**

# Noise and Vibration Impact Assessment

# Metrolinx Two-Way All Day Barrie Corridor Expansion

## Station Infrastructure Upgrades

Rutherford and Maple Stations

RQQ-2014-SI-019

## 1.0 INTRODUCTION

Valcoustics Canada Ltd. (VCL) has been retained to prepare Noise and Vibration Impact Assessments for the station infrastructure upgrade project. The station infrastructure upgrades are part of the larger "Two-Way All Day" (TWAD) service for the Metrolinx Barrier corridor.

This report is being prepared under the terms of RQQ-2014-SI-019.

According to the terms of the project, this study does not include an investigation of the noise and vibration impacts of the additional rail lines to be constructed as part of the TWAD project. Rather, this study examines the noise and vibration impacts (both operational and construction) of the station infrastructure upgrades which are intended to support the future rail expansion. The Barrie Rail Corridor Expansion (BRCE) Transit Project Assessment Process (TPAP) is currently ongoing as a separate study and will be assessing the noise and vibration impacts from additional tracks and increased train service levels along the corridor (from Mile 3.00 to 63.00). Based on the BRCE TPAP recommendations and not precluding the mitigation measures presented in this assessment, the construction of noise walls at either Rutherford or Maple GO Station will need to be accounted for.

## 2.0 DESCRIPTION OF THE PROJECT

Various station infrastructure upgrades are required to enable the TWAD service that is ultimately the end goal for the Barrie Corridor. In general, these upgrades include new tunnels, snowmelt systems, elevators, stairs, and platform shelters as well as enclosures to house the equipment related to the upgrades.

As noted above, the new track(s) themselves are beyond the scope of this study.

This report will address two separate elements of the infrastructure upgrade project:

- Operational Noise and Vibration;
- Construction Noise and Vibration.

# 3.0 BACKGROUND - OPERATIONAL NOISE AND VIBRATION

## 3.1 OPERATIONAL NOISE SOURCES

In general, the sources of noise associated with the infrastructure upgrades include:

- Emergency Generator – 300kW to 600 kW, depending on the station;
- Bunker Building exhaust fan and cooling condenser unit; and
- Public address (PA) system.

## 3.2 OPERATIONAL NOISE GUIDELINE LIMITS

According to Section 14 of the Environmental Protection Act (R.S.O. 1990, c. E.19), "a person shall not discharge a contaminant or cause or permit the discharge of a contaminant into the natural environment, if the discharge causes or may cause an adverse effect" (note that according to the definition, noise is considered a contaminant). A common approach to mitigating "adverse affect" for noise is to maintain sound levels at or below the sound level limits presented in Ministry of the Environment and Climate Change (MOE) Publication NPC-300. The newly released (October 21, 2013 but dated August 2013) MOE Publication NPC-300 has replaced the four existing noise guidelines (Publications LU-131, NC-205 and NC-232, as well as Noise Assessment Criteria in Land Use Planning: Requirements, Procedures and Implementation) in Ontario.

### 3.2.1 Non-Emergency Equipment

As per NPC-300, the noise guideline limits of non-emergency equipment, are the higher of the ambient sound level due to road traffic noise or the minimum exclusion limits for a Class 1 Area:

- 50 dBA daytime (0700 to 1900 hours);
- 50 dBA evening (1900 to 2300 hours); and
- 45 dBA nighttime (2300 to 0700 hours).

The sound level limits apply at an exterior plane of window (POW) at all times or at an outdoor point of reception (OPOR) in the daytime and evening only. The guidelines do not apply to OPOR's at night. NPC-300 states that the outdoor point of reception should be in a usable area within 30 metres (m) of the dwelling. The sound level limits do not apply at areas that are not considered useable such as a drive way, etc.

### 3.2.2 Emergency Generator - NPC-300

MOE Publication NPC-300 states that noise produced by emergency equipment operating in non-emergency situations, such as testing or maintenance, should be assessed independently from other sources of noise from the facility. The sound level limits for the emergency equipment are 5 dB greater than the applicable guideline limits of the non-emergency equipment. Sound level limits do not apply to emergency equipment operating in emergency situations.

The guideline limits for emergency equipment (i.e., the generator) shall be defined by the higher of the ambient sound level, due to road traffic noise, or the minimum exclusion limits for a Class 1 Area plus 5 dB. These are 55 dBA daytime (0700 to 1900 hours) and evening (1900 to 2300 hours).

### 3.2.3 Environmental Protection Act (EPA) and Ontario Regulation (O.Reg. 346/12)

Section 9 of the EPA requires obtaining an Environmental Compliance Approval (ECA) to use, operate, construct, alter, extend or replace any plant, structure, apparatus, mechanism or thing that may discharge a contaminant into the environment. (Previously, prior to recent amendments to the EPA, the ECA was known as a Certificate of Approval – C of A.)

For emergency generators under 700 kW, O.Reg. 346/12, under the EPA, enacted in November 2012, no longer requires an ECA, but does require the generator to be registered on the Environmental Activity and Sector Registry (EASR) in accordance with the "regulations". O.Reg. 346/12 prescribes that for generators located outside a building or structure, the sound pressure level at a distance of 7 m from the unit shall not exceed 75 dBA.

There are other operational requirements that must be implemented such as limiting the routine testing to daytime hours only (0700 to 1900) as well as a maximum duration of testing and maintenance on the system (limited by hours per year).

Note, complying with the minimum requirements of O.Reg. 346/12 does not completely eliminate the risk of potential charges under the EPA or municipal noise by-laws. This is because compliance with the minimum requirements of O.Reg. 346/12 does not ensure compliance with the MOE noise guideline sound limits under NPC-300. Thus, the generator set should be designed to ensure full compliance with the applicable MOE noise guidelines.

## 4.0 BACKGROUND – CONSTRUCTION NOISE AND VIBRATION

### 4.1 CONSTRUCTION NOISE AND VIBRATION SOURCES

In general, the construction noise sources associated with the infrastructure upgrades include:

- Caisson drilling for shoring systems related to the tunnel installation;
- General soil removal/relocation using a bulldozer; and
- Dump truck activity for the removal of excess soil.

Sources of construction vibration are similar to those noted above except that vehicles with pneumatic tires (i.e., dump trucks) do not usually create significant vibration in relation to the proposed vibration limits.

### 4.2 CONSTRUCTION NOISE GUIDELINE LIMITS

In general, the Province of Ontario (via MOE) does not make significant attempts to regulate construction noise. The MOE focuses its attention on transportation sources and "stationary" sources and specifically defines "temporary construction activities" as NOT being a stationary source of noise. The rationale behind this being that noise due to construction is typically addressed at the municipal level through noise by-laws.

The one area of guidance that the MOE does provide with respect to construction noise is contained in document NPC-115 "Construction Equipment" (see references).

### 4.2.1 City of Vaughan By-laws 96-2006 and 207-2007

City of Vaughan By-law 96-2006 contains several provisions with respect to construction noise.

General Prohibition

No person in a residential area shall make any unusual noise or noise likely to disturb the inhabitants of the City.

Prohibitions by Time and Place

Section 4(3) requires that "no person shall emit or cause to permit the emission of sound resulting... from any act listed in Schedule 2 - Prohibitions by Time and Place, if clearly audible at a point of reception". Schedule 2 includes construction equipment in connection with construction for the following times and places:

- Quiet Zone
  - 1700 hours of one day to 0700 hours next day; and
  - all day Sundays and Statutory Holidays.

- Residential Area
  - 1900 hours of one day to 0700 hours next day; and
  - all day Sundays and Statutory Holidays.

It should be noted that the above does not limit construction activity explicitly, but rather limits noise from construction activity at receptor locations outside of the specific daytime period. The above requirements are typical in noise by-laws in Ontario.

Section 10 (Construction) prohibits the operation of construction equipment in connection with construction between:

- 1900 hours and 0700 hours Monday through Saturday; and
- all day Sunday and statutory holidays.

It should be noted that Section 10 makes no reference to noise, but rather limits the operation of construction equipment. This is not typical in noise by-laws as it is overly conservative with respect to noise (ie: this section limits the operation of construction equipment even if it is inaudible by any person at any distance from the construction equipment).

Exemptions

Section 19 of the By-law allows a person to apply for an exemption from the limitations on construction activity provided:

- the use of construction equipment shall not exceed the established noise levels of NPC-115, Construction Equipment; and

- the duration of the exemption requested shall not exceed eleven (11) calendar days in length.

### 4.2.2 Summary of Requirements

For periods which are outside the times noted above ("prohibited times"), the by-law does not provide a quantitative definition of the term "clearly audible", nor does it provide a measurable benchmark. Thus, it is often proposed that the numerical limits in NPC-300 for stationary sources be employed to provide a quantitative method of assessing the "clearly audible" criterion. Note that it is proposed that the requirements of Section 10 be superceded by the requirements of Section 4 for the purposes of this study.

As per NPC-300, the sound exposure limit at a point of reception, expressed in terms of the one hour equivalent noise level ($L_{eq,1hr}$), is the greater of the exclusion limit or the background sound level. The point of reception may be either:

- a point outdoors on a noise sensitive property, at 1.5 m above grade; or
- the outdoor plane of a window leading to a noise sensitive indoor space (bedroom, living room, etc.).

The exclusion limits for points of reception in NPC-300 (assuming the area is Class 1 as per the NPC-300 definition) are shown in Tables 1A and 1B.

**Table 1A NPC-300 Exclusion Limits – Steady and Varying Sound**

| Time Period | Plane of Window Receptors (dBA) | Outdoor Receptors (dBA) |
|---|---|---|
| 0700 to 1900 hours | 50 | 50 |
| 1900 to 2300 hours | 50 | 50 |
| 2300 to 0700 hours | 45 | N/A |

**Table 1B NPC-300 Exclusion Limits – Impulsive Sound**
(nine or more impulses per hour)

| Time Period | Plane of Window Receptors (dBAI) | Outdoor Receptors (dBAI) |
|---|---|---|
| 0700 to 1900 hours | 50 | 50 |
| 1900 to 2300 hours | 50 | 50 |
| 2300 to 0700 hours | 45 | N/A |

Combining the quantitative criteria (Tables 1A and 1B) for the "prohibited time periods" with the general prohibition yields a complete assessment tool for determining the sound level limits due to construction activity (Table 2).

**Table 2** **Consolidated Noise Criteria – Class 1 Areas**
(Time-Varying and Impulsive Sources)

| Weekday | Time Period | Plane of Window Receptors (dBA or dBAI) | Outdoor Receptors (dBA or dBAI) |
|---|---|---|---|
| Monday through Saturday | 0700 to 1900 hours** | General prohibition only | |
| | 1900 to 2300 hours | 50 | 50 |
| | 2300 to 0700 hours* | 45 | N/A |
| Sunday | 0700 to 1900 hours | 50 | 50 |
| | 1900 to 2300 hours | 50 | 50 |
| | 2300 to 0700 hours* | 45 | N/A |

* on the following day.
** 1700 hours for receptors in a Quiet Zone.

Note that as per Section 19 of the by-law, an individual may apply for an exemption from the noise prohibitions. Subject to the terms of the exemption, the criteria shown in Table 2 would no longer apply to the noise produced by the construction activity.

### 4.2.3 NPC-115

NPC-115 provides sound emission limits for various pieces of construction equipment according to the date of manufacture including tracked drills, portable air compressors, excavation equipment, etc. The emission ratings are sound pressure levels measured according to SAE Standard J88a.

## 4.3 CONSTRUCTION VIBRATION GUIDELINE LIMITS

There are no specific guideline limits for construction vibration which would be applicable in the municipalities in which the project will occur. However, some guidance regarding construction vibration should be applied. Specifically, it is recommended that the requirements of the City of Toronto Construction Vibration By-law (514-2008) be employed in the assessment of construction vibration for the entire project.

### 4.3.1 City of Toronto By-law 514-2008

Section 3.6 of Chapter 363 (Building Construction and Demolition) of the City of Toronto Municipal Code (also referred to as By-law 514-2008) outlines requirements with respect to construction vibration.

In general, the by-law requires that "No person shall carry on a construction activity resulting in construction vibrations that exceed the levels set out [in the table] "Prohibited Construction Vibrations". Table 3 below provides the vibration levels specified in the by-law.

**Table 3** **Prohibited Construction Vibrations**

| Frequency (Hz) | Peak Particle Velocity (mm/s) |
|---|---|
| Less than 4 | 8 |
| 4 to 10 | 15 |
| More than 10 | 25 |

The by-law also details a procedure to determine a "Zone of Influence" (ZOI) for vibration from construction activity. The ZOI is the "area of land within or adjacent to a construction site, including any buildings or structures, that potentially may be impacted by vibrations emanating from a construction activity where the peak particle velocity measured at the point of reception is equal to or greater than 5 mm/s at any frequency".

### 4.3.2 NPC-207 (Draft) – Impulse Vibration Residential Buildings

In Section 4.3.1 above, the criteria presented are in relation to damage to a building or structure. However, the criteria for perception of vibration are significantly lower in magnitude than those for structural damage.

NPC-207 is a draft guideline prepared by the MOE which provides a criterion of 0.3 mm/s (average peak particle velocity, PPV) for impulsive vibration where at least 20 impulses may be observed within a period of 20 minutes or less (such as would be typical for impact-driving of piles). This criterion is not correlated to structural damage, but rather to occupant comfort within a building which may experience vibration resulting from construction or similar activity.

Vibration in this magnitude range could also cause audible noise within a building, either due to the rattling of objects on a wall or table surface, or due to structure-based noise radiation. In either case, this could lead to occupant complaints, but is not related to structural damage.

### 4.3.3 Summary of Vibration Criteria

Implicit in the various noise by-laws, it is expected that some intrusion of noise during the daytime period is typically considered acceptable and necessary in order to complete a construction project. In a similar manner, vibration resulting from construction activities may exceed the threshold of perception and could be considered objectionable without posing a risk of structural damage. For this reason, it is proposed that the vibration criteria in the City of Toronto Construction Vibration By-law (514-2008) be employed for the project during the daytime period. Outside of the daytime period (0700 to 1900 hours), vibration resulting from construction should be reduced significantly in a manner similar to construction noise such that the impact to neighbouring properties is minimized. Notwithstanding the above, the vibration must never exceed the structural damage criteria noted here.

## 5. RUTHERFORD STATION

### 5.1 DESCRIPTION OF THE SITE

The existing Rutherford GO Station is located on the south side of Rutherford Road, between Westburne Drive to the west and the GO rail line to the east. The site is bounded by:

- Rutherford Road, with 2-storey residential development beyond to the north;
- Westburne Drive, with mid-rise commercial development beyond to the west;
- light industrial development to the south; and
- the existing GO rail line, with 2-storey residential development beyond to the east.

At present, the station site includes a station building and platform on the west side of the GO track. The current project will involve the addition of a second platform to the east of the existing GO track, with space allowed for additional track(s).

## 5.2 OPERATIONAL NOISE IMPACT ASSESSMENT

### 5.2.1 Sensitive Receptors

With regard to noise sensitive receptors, the main concern is the residential development to the north and east of the station site. There is also a daycare (child nursery) facility to the west of the station site – Peekaboo Child Care, located at 2077 Rutherford Road.

The closest receptor locations have been labelled with their civic addresses on Figure 1. Appendix A provides a catalogue of the closest receptor locations including photos for each.

### 5.2.2 Operational Noise Sources

#### 5.2.2.1 Emergency Generator

It is assumed that the emergency Generator at the Rutherford Station will be located adjacent to the existing station building. For the purpose of the preliminary model, the generator has been located to the north of the existing building, although this can be refined at a later date (see Figure 1). This analysis assumes the generator is 400 kW.

Spectral sound data for the proposed generator can be found in Appendix C.

#### 5.2.2.2 Bunker Building

The preliminary design report for Rutherford Station indicated that additional infrastructure associated with the TWAD project will be added to the existing mechanical room in the existing station building. However, the proposed Track & Platform Layout and General Plan (dated May 29, 2015) shows an above ground bunker located to the south of the existing station building. Therefore, noise from this proposed bunker building was included in the assessment.

It is assumed that one new exhaust fan and one new split cooling system condenser will be required for the newly installed equipment. These requirements are to be treated as preliminary, and should be updated once detailed information is available. For the purpose of this analysis, the following is assumed:

- Fan – Greenheck GB-180 or equivalent, 3000 CFM (0.5 hp); Sound power level of 73 dBA.
- Condensing Unit – LG LSU180 Condenser or equivalent, 18200 BTU/hr; Sound power level of 70 dBA.

Spectral sound data for the proposed fan and condensing unit can be found in Appendix C.

#### 5.2.2.3 PA System

It is assumed that the new platform will be fitted with a PA system which is similar to that on the existing platform. The analysis for this study is based on preliminary assumptions and should be revised once detailed design information is available for the PA system.

At this point, the following is assumed for the PA system:

- The loudspeaker units will be spaced approximately 15 m apart along the length of the platform. Thus, 21 units will be required to service the full length of the platform.
- The sound pressure level at head height on the platform is assumed to be 82 dBA.
- The PA system will operate for 2 minutes of each hour. This would likely be comprised of several shorter announcements For example, eight announcements of 15 seconds each in the worst case hour.

With regard to the sound level at the platform, the GO Transit "Design Requirements Manual (DRM)" requires that the "announcement" sound level be a minimum of 10 dBA above the ambient at a height of 1.5 m above the platform to a maximum of 82 dBA. As the ambient sound level at the platform will vary significantly, a conservative estimate would be to use the maximum sound level specified in the DRM (82 dBA).

For the purposes of this analysis, the entire PA system has been modelled together (both the new platform as well as the existing platform). This approach is considered conservative, but appropriate in this case.

Spectral sound data for the proposed public address system can be found in Appendix C.

### 5.2.3 Analysis

Acoustical predictions for the above noted sources have been completed in order to understand the potential sound exposures at the nearby sensitive receptor locations. Predictions have been completed using CadnaA acoustical software which is a software implementation of the ISO 9613 standard for the prediction of sound propagation outdoors.

### 5.2.4 Results and Discussion

As per Figure 1, the sound level limit of 55 dBA for the emergency generator is not expected to be exceeded at any of the residential receptors to the north or east of the subject site. This is based on the generator being fitted with an outdoor acoustical exposure which limits the sound level from the unit to 75 dBA at 7 m.

As per Figure 2 (non-emergency sources), the guideline limit of 45 dBA, applicable to plane of window receptors in the nighttime, is expected to be exceeded:

- at the closest noise-sensitive receptor locations to the east of the subject site; and
- at the closest noise-sensitive receptor locations to the north of the subject site.

### 5.2.5 Mitigation

There are significant sound level excesses predicted to occur to the east of the subject site (with marginal excesses also occurring to the north of the subject site). The dominant source of sound which is causing the excess is the preliminary model of the PA system. Excesses from the PA system can be easily mitigated in the detailed design process. For example, at the time of equipment selection, directional loudspeakers which focus the sound energy in the desired direction can be selected. Also, additional loudspeakers can be specified (more than the 21 units in the preliminary model) such that the sound output from each unit is minimized. This ensures

adequate sound coverage on the platform whilst minimizing sound projected to the surrounding receptors. Furthermore, the assumed sound level and duration of announcements is preliminary, and could be refined based on feedback from the project team. Changes to the target sound level (at head height on the platform) and the assumed duration of the announcements could have a significant impact on the predicted sound exposures due to the PA system.

## 5.3 OPERATIONAL VIBRATION IMPACT ASSESSMENT

There are no significant sources of operational vibration as part of the station infrastructure upgrade project. Additional operational vibration assessment is not required. Note that this does not consider possible vibration impacts resulting from the operation of the additional tracks.

## 5.4 CONSTRUCTION NOISE IMPACT ASSESSMENT

### 5.4.1 Sensitive Receptors

As with the operational noise assessment, the main concern is the residential developments to the north and east of the station site as well as the aforementioned daycare. See Figure 1.

### 5.4.2 Construction Noise Sources

The construction noise assessment is based on the "Stage 2 Preliminary Design Report (Draft)", prepared by Cole Engineering and dated May 2015. The report provides a conceptual construction approach from which various sources of construction noise can be identified:

- General soil removal/relocation using a bulldozer;
- Dump truck activity for the removal of unwanted soil; and
- Caisson drilling at tunnel locations for shoring installation.

In addition to the above list, it is expected that other general construction activity on site will produce sound levels that are clearly audible at the nearby noise-sensitive receptors. However, these sound levels are expected to be lower in level than those noted above and thus will not dominate the construction noise environment.

It should be noted that while the Preliminary Design Report provides some understanding of the construction requirements, it is by no means a detailed itemization of the construction methodology. Thus, it is expected that the ultimate approach to construction will be determined by the contractor on site. For that reason, it is the responsibility of the contractor to ensure that sound level limits are met as they relate to the specific equipment and activity on site which may produce noise.

### 5.4.3 Analysis

Based on the above noted sources, the following construction noise scenario has been analyzed. Note that as is typical for this type of analysis, all predictions are based on a single hour for comparison with the construction noise criteria described above.

- One bulldozer operating across the entire site for the full hour.

- One caisson drill operating in the vicinity of each tunnel location for the full hour. This is conservative as it is expected that activity at all tunnels will not happen concurrently.

- One dump truck operating across the entire site for the full hour.

Acoustical predictions for the above noted sources have been completed in order to understand the potential sound exposures at the nearby sensitive receptor locations. Predictions have been completed using CadnaA acoustical software which is a software implementation of the ISO 9613 standard for the prediction of sound propagation outdoors.

### 5.4.4 Results and Discussion

Predicted sound exposures due to the construction activity noted above, in terms of the $L_{eq1hr}$ are shown in Figure 3. Comparing the predicted sound exposures to the recommended limits, it is likely that general construction activity should be limited to:

- Monday to Saturday, 0700 to 1900 hours; or
- any time for which an exemption from the noise by-law is obtained.

It should be noted that the above analysis does not specifically preclude work outside the above noted time periods. Rather, it suggests that construction activity outside these time periods is likely to exceed the guideline sound level limits shown in Table 2. If work proceeds outside the time periods noted above, the contractor would be responsible for ensuring that the sound level limits are met at the nearest receptors.

### 5.4.5 Construction Noise Mitigation

In general, consideration should be given to the use of construction techniques which will minimize the impacts of noise and vibration emanating from the subject site.

#### 5.4.5.1 General Requirements

The contractor will be responsible for either:

- operating in accordance with the noise limits in the City of Vaughan noise by-law (it is recommended that the limits provided above in Table 2 be employed, although this cannot guarantee compliance with the by-law); or

- obtaining an exemption from the noise requirements.

If an exemption from the noise by-law is sought by the contractor, Metrolinx and its consultant are to be notified immediately at the time of the application.

#### 5.4.5.2 NPC-115

All equipment operating on the site should comply with the sound level limits of NPC-115.

#### 5.4.5.3 Additional Requirements

In addition to the general requirement to meet the sound (noise) level limits provided in this report, it is expected that the contractor will implement all possible mitigation techniques, as needed, to

ensure that noise impacts from the construction activities are minimized, and comply with the noise by-law requirements and the sound level limits identified herein. These would include:

- shields or other physical barriers to reduce the transmission of noise;
- sound attenuating housings or enclosures for noise producing machinery such as compressors, pumps, motors, and generators;
- effective intake and exhaust silencers on air equipment;
- effective intake and exhaust mufflers on internal combustion engines;
- sound/vibration deadening lining materials on hoppers and storage bins;
- operate hauling operations so that noise is kept to a minimum;
- the use of electric rather than internal combustion engine power on chain saws, hoisting equipment in fixed locations, or other equipment, where electric power is available; and
- placing stationary noise producing equipment at a maximum distance from buildings.

## 5.5 CONSTRUCTION VIBRATION IMPACT ASSESSMENT

### 5.5.1 Sensitive Receptors

In terms of vibration, sensitive receptors would include any structure in the vicinity of the construction site which could be damaged by vibration produced on the construction site. In general, this would include the same residential developments noted above as well as the commercial/industrial buildings to the west and south of the station site.

### 5.5.2 Construction Vibration Sources

The construction vibration assessment is based on the "Stage 2 Preliminary Design Report (Draft)", prepared by Cole Engineering and dated May 2015. The report provides a conceptual construction approach from which various sources of construction vibration can be identified:

- General soil removal/relocation using a bulldozer; and
- Caisson drilling at tunnel locations for shoring installation.

As with the noise assessment, this vibration assessment is not a detailed itemization of the construction methodology. As above, it is expected that the ultimate approach to construction will be determined by the contractor on site. For that reason, it is the responsibility of the contractor to ensure that vibration limits are met throughout the construction process.

### 5.5.3 ZOI Analysis

The vibration propagation model used for this assessment assumes subsurface conditions that promote the "efficient propagation of vibration", based on the procedures found in Reference 2. Relative to propagation for standard subsurface conditions, efficient propagation can result in vibration levels up to 10 dB higher. To be conservative, this assessment assumes efficient propagation and therefore a +10 dB adjustment has been applied, which has the net effect of increasing the setback to the 5 mm/s criteria (i.e., a larger ZOI).

Since the vibration velocities presented in this report are based on predictive methods, they should be considered as an approximation, but are representative of what can be expected.

The potential construction ZOI has been determined by prediction, using reference ground vibration velocities for the sources noted above, and the extrapolation methods from Reference 2, which provides reference data on vibration from various construction activities. The reference ground vibration velocities are:

- Bulldozer: 2.3 mm/s (peak particle velocity – PPV) at 7.6 m; and
- Caisson Drilling: 2.3 mm/s (peak particle velocity – PPV) at 7.6 m.

The extent of the ZOI is based on the maximum PPV at any location off-site caused by a single operation on the site. It is assumed that significant construction activities do not occur simultaneously, and as such vibration velocities are considered independently rather than additively.

### 5.5.4 Results and Discussion

Figure 4 shows the ZOI (the setback to the 5 mm/s contour) for the above noted activity. It is clear that the ZOI does not extend out to the surrounding buildings around the subject site.

As with the noise assessment, this vibration assessment is generic based on typical vibration that may be associated with the construction activity. The contractor will be ultimately responsible for ensuring that the vibration criteria are met at all vibration-sensitive locations.

Note that the ZOI considers the damage criteria noted above. It is not based on perception of, or annoyance by, vibration.

### 5.5.5 Construction Vibration Mitigation

#### 5.5.5.1 General Requirements

The contractor will be responsible for complying with the vibration limits in Section 3.6 of Chapter 363 of the City of Toronto municipal code (notwithstanding that the construction will occur outside the City of Toronto).

#### 5.5.5.2 Additional Requirements

In addition to the general requirement to meet the vibration limits provided in this report, it is expected that the contractor will implement all possible mitigation techniques to ensure that vibration impacts from the construction activities are minimized. These would include:

- staging of high vibration activities such as caisson drilling such that vibration effects are not additive; and
- drilling caissons at an appropriate speed such that vibration limits are not exceeded.

## 5.6 MONITORING PLAN

In order to collect data, assess noise complaints, and avoid structural damage to adjacent buildings, it is recommended that a noise and vibration monitoring programme be completed as part of the project (the monitoring is outside the scope of the current project).

This monitoring plan has been developed based on the noise and vibration assessments provided above. Although the aim of the monitoring is to assist with compliance with the noise and vibration limits, it is the sole responsibility of the contractor to comply with the noise and vibration requirements.

### 5.6.1 Noise Monitoring

#### 5.6.1.1 Noise Monitoring Locations

It is recommended that two noise monitors be located adjacent to the construction site. The monitors should be placed at the closest receptors in each of the following areas:

- to the east in the direction of the detached and semi-detached dwellings; and
- to the northwest in the direction of the detached dwellings.

Where possible, the monitors should be located on private property for security purposes, at the worst case location relative to the noise from the construction activity.

The microphone should be placed at least 3 m above grade with a clear line of sight to the construction activity.

#### 5.6.1.2 Data Collection

The following sound level parameters are to be collected on an hourly basis:

- $L_{eq}$ (equivalent sound level);
- $L_{10}$;
- $L_{90}$.

All parameters are to be reported in dBA (A-weighted).

The sound level meter can be either Type 1 or Type 2 and must be field calibrated on-site at least every 6 weeks (as well as during installation and removal of the equipment). Laboratory calibration must be up-to-date according to the manufacturer's recommendation.

#### 5.6.1.3 Baseline Monitoring

The sound level monitor must be installed at least one week prior to the start of construction. Ambient sound data must be collected for a full week (24 hours per day).

#### 5.6.1.4 Continuous Sound Level Monitoring

Sound level monitoring must be conducted for the duration of the construction activity. Monitoring is to be conducted 24 hours per day.

As with any monitoring system, all attempts should be made to ensure continuous monitoring data is available for all units. However, it is possible that equipment failures or downtime may be encountered during the monitoring. All attempts must be made to minimize disruptions in the data.

### 5.6.2 Vibration Monitoring

As noted above, vibration magnitudes much lower than the damage criteria can yield discomfort and complaints from residential neighbours in close proximity to the construction site. For this reason, a comprehensive vibration monitoring plan is required to ensure that adequate vibration data is collected throughout the course of the construction project.

#### 5.6.2.1 Vibration Monitoring Locations

It is recommended that two vibration monitors be located adjacent to the construction site. To the east of the subject site, it is recommended that the vibration monitor be placed coincident with the noise monitor. It is also recommended that one vibration monitor be placed along the east facade of 671 Westburne Drive (the closest receptor location to the west). The vibration monitors should be closer to the construction site than the nearest building/structure that it is attempting to represent.

#### 5.6.2.2 Data Collection

The following vibration parameters are to be collected on an hourly basis:

- Peak Particle Velocity (PPV) in each of the three orthogonal axes; and
- Maximum Peak Vector Sum (PVS) of the three orthogonal axes.

All parameters are to be reported in mm/s.

In addition to the PPV and PVS data, if the cautionary limit of 5 mm/s is exceeded in any one of the axes, data must be collected regarding the frequency content of the vibration signal.

The vibration monitor (seismograph) must be capable of monitoring the three orthogonal axes simultaneously. The unit must have a flat frequency response (range of zero to -3 dB) of at least 2 to 100 Hz. Laboratory calibration must be up-to-date according to the manufacturer's recommendation.

#### 5.6.2.3 Baseline Monitoring

The vibration monitor(s) must be installed at least one week prior to the start of construction. Ambient vibration data must be collected for a full week (24 hours per day).

#### 5.6.2.4 Continuous Vibration Monitoring

Vibration monitoring must be conducted for the duration of the construction activity. Monitoring is to be conducted 24 hours per day.

As with any monitoring system, all attempts should be made to ensure continuous monitoring data is available for all units. However, it is possible that equipment failures or downtime may be encountered during the monitoring. All attempts must be made to minimize disruptions in the data.

### 5.6.3 Reporting

Noise and vibration reporting is to be provided every two weeks. Data measured during inclement weather is to be identified in the report, but is not to be excluded from the dataset. For the purposes of the reporting, inclement weather is identified as:

- for noise, wind over 20 kph or precipitation of any kind; and
- for vibration, wind over 50 kph or precipitation of any kind.

All measurement parameters described above are to be reported in tabular and graphical format along with wind speed data.

A discussion of any anomalous data is to be provided where applicable.

# 6.0 MAPLE STATION

## 6.1 DESCRIPTION OF THE SITE

The existing Maple GO Station is located north of Major Mackenzie Drive, on the east side of the GO rail line. The site is bounded by:

- McNaughton Road, with commercial/light industrial development beyond to the north;
- proposed residential development including 6 to 12-storey apartments and 3-storey townhouse units to the east;
- Hill Street with existing detached residential development beyond to the south; and
- the existing GO rail line, with 2-storey residential development beyond to the west.

At present, the station site includes a station building and platform on the east side of the GO track. The current project will involve the addition of a 2nd platform to the west of the existing GO track, with space allowed for additional track(s).

## 6.2 OPERATIONAL NOISE IMPACT ASSESSMENT

### 6.2.1 Sensitive Receptors

With regard to noise sensitive receptors, the main concern is the existing and proposed residential developments to the south, west, and east of the station site.

The closest receptor locations have been labelled with their civic addresses on Figure 4. Appendix B provides a catalogue of the closest receptor locations including photos for each.

### 6.2.2 Operational Noise Sources

#### 6.2.2.1 Emergency Generator

It is assumed that the emergency Generator at the Maple Station will be located east of the existing utility building (see Figure 5). This analysis assumes the generator is 400 kW.

Spectral sound data for the proposed generator can be found in Appendix C.

6.2.2.2 Bunker Building

Maple Station will be outfitted with an underground bunker for new mechanical equipment. It is assumed that there may be additional exterior equipment (fans, condensing units) which would be required to service the additional new equipment.

As with Rutherford, it is assumed that one new exhaust fan and one new split cooling system condenser will be required for the newly installed equipment. These requirements are to be treated as preliminary, and should be updated once detailed information is available. For the purpose of this analysis, the following is assumed:

- Fan – Greenheck GB-180 or equivalent, 3000 CFM (0.5 hp); Sound power level of 73 dBA.
- Condensing Unit – LG LSU180 Condenser or equivalent, 18200 BTU/hour; Sound power level of 70 dBA.

Spectral sound data for the proposed fan and condensing unit can be found in Appendix C.

6.2.2.3 PA System

It is assumed that the new platform will be fitted with a PA system which is similar to that on the existing platform. The analysis for this study is based on preliminary assumptions and should be revised once detailed design information is available for the PA system.

At this point, the following is assumed for the PA system:

- The loudspeaker units will be spaced approximately 15 m apart along the length of the platform. Thus, 21 units will be required to service the full length of the platform.
- The sound pressure level at head height on the platform is assumed to be 82 dBA.
- The PA system will operate for 2 minutes of each hour. This would likely be comprised of several shorter announcements For example, eight announcements of 15 seconds each in the worst case hour.

With regard to the sound level at the platform, the GO Transit "Design Requirements Manual (DRM)" requires that the "announcement" sound level be a minimum of 10 dBA above the ambient at a height of 1.5 m above the platform to a maximum of 82 dBA. As the ambient sound level at the platform will vary significantly, a conservative estimate would be to use the maximum sound level specified in the DRM (82 dBA).

For the purposes of this analysis, the entire PA system has been modelled together (both the new platform as well as the existing platform). This approach is considered conservative, but appropriate in this case.

Spectral sound data for the proposed public address system can be found in Appendix C.

### 6.2.3 Analysis

Sound exposure predictions for the above noted sources have been completed in order to understand the potential sound exposures at the nearby sensitive receptor locations. Predictions have been completed using CadnaA acoustical software which is a software implementation of the ISO 9613 standard for the prediction of sound propagation outdoors.

### 6.2.4 Results and Discussion

As per Figure 5, the sound level limit of 55 dBA for the emergency generator is expected to be exceeded at the proposed high-rise residential units to the east of the station site. This is based on the generator being fitted with an outdoor acoustical exposure which limits the sound level from the unit to 75 dBA at 7 m during testing.

As per Figure 6 (non-emergency sources), the guideline limit of 45 dBA, applicable to plane of window receptors in the nighttime, is expected to be exceeded:

- at the closest noise-sensitive receptor locations to the west of the subject site; and
- at the proposed noise-sensitive receptor locations to the east of the subject site.

### 6.2.5 Mitigation

As noted above, the sound level limits for the emergency generator are expected to be exceeded at the proposed high-rise residential units to the east of the station site. Based on the minor excess, it is recommended that the acoustical enclosure for the generator be upgraded to meet a sound level limit of 73 dBA at 7 m in order to satisfy the guideline sound level limit at all receptor locations.

In addition to the generator, there are significant sound level excesses for non-emergency equipment predicted to occur to the east and west of the subject site. The dominant source of sound which is causing the excess is the preliminary model of the PA system. Excesses from the PA system can be easily mitigated in the detailed design process. For example, at the time of equipment selection, directional loudspeakers which focus the sound energy in the desired direction can be selected. Also, additional loudspeakers can be specified (more than the 21 units in the preliminary model) such that the sound output from each unit is minimized. This ensures adequate sound coverage on the platform whilst minimizing sound projected to the surrounding receptors. Furthermore, the assumed sound level and duration of announcements is preliminary, and could be refined based on feedback from the project team. Changes to the target sound level (at head height on the platform) and the assumed duration of the announcements could have a significant impact on the predicted sound exposures due to the PA system.

## 6.3 OPERATIONAL VIBRATION IMPACT ASSESSMENT

There are no significant sources of operational vibration as part of the station infrastructure upgrade project. Additional operational vibration assessment is not required. Note that this does not consider possible vibration impacts resulting from the operation of the additional tracks.

## 6.4 CONSTRUCTION NOISE IMPACT ASSESSMENT

### 6.4.1 Sensitive Receptors

The main concern is the residential development to the west of the subject site. Depending on the timing of construction of the proposed developments to the east in comparison with the construction of the station infrastructure upgrades, these proposed residential dwellings may also need to be considered. See Figure 5.

### 6.4.2 Construction Noise Sources

The construction noise assessment is based on the "Stage 2 Preliminary Design Report (Draft)", prepared by Cole Engineering and dated May 2015. The report provides a conceptual construction approach from which various sources of construction noise can be identified:

- General soil removal/relocation using a bulldozer;
- Dump truck activity for the removal of unwanted soil; and
- Caisson drilling at tunnel locations for shoring installation.

In addition to the above list, it is expected that other general construction activity on site will produce sound levels that are clearly audible at the nearby noise-sensitive receptors. However, these sound levels are expected to be lower in level than those noted above and thus will not dominate the construction noise environment.

It should be noted that while the Preliminary Design Report provides some understanding of the construction requirements, it is by no means a detailed itemization of the construction methodology. Thus, it is expected that the ultimate approach to construction will be determined by the contractor on site. For that reason, it is the responsibility of the contractor to ensure that sound level limits are met as they relate to the specific equipment and activity on site which may produce noise.

### 6.4.3 Analysis

Based on the above noted sources, the following construction noise scenario has been analyzed. Note that as is typical for this type of analysis, all predictions are based on a single hour for comparison with the construction noise criteria described above.

- One bulldozer operating across the entire site for the full hour.

- One caisson drill operating in the vicinity of each tunnel location for the full hour. This is conservative as it is expected that activity at all tunnels will not happen concurrently.

- One dump truck operating across the entire site for the full hour.

Acoustical predictions for the above noted sources have been completed in order to understand the potential sound exposures at the nearby sensitive receptor locations. Predictions have been completed using CadnaA acoustical software which is a software implementation of the ISO 9613 standard for the prediction of sound propagation outdoors.

### 6.4.4 Results and Discussion

Predicted sound exposures due to the construction activity noted above, in terms of the $L_{eq1hr}$ are shown in Figure 7. Comparing the predicted sound exposures to the recommended limits, it is likely that general construction activity should be limited to:

- Monday to Saturday, 0700 to 1900 hours; or
- any time for which an exemption from the noise by-law is obtained.

It should be noted that the above analysis does not specifically preclude work outside the above noted time periods. Rather, it suggests that construction activity outside these time periods is likely to exceed the guideline sound level limits shown in Table 2. If work proceeds outside the time periods noted above, the contractor would be responsible for ensuring that the sound level limits are met at the nearest receptors.

### 6.4.5 Construction Noise Mitigation

In general, consideration should be given to the use of construction techniques which will minimize the impacts of noise and vibration emanating from the subject site.

#### 6.4.5.1 General Requirements

The contractor will be responsible for either:

- operating in accordance with the noise limits in the City of Vaughan noise by-law (it is recommended that the limits provided above in Table 2 be employed, although this cannot guarantee compliance with the by-law); or

- obtaining an exemption from the noise requirements.

If an exemption from the noise by-law is sought by the contractor, Metrolinx and its consultant are to be notified immediately at the time of the application.

#### 6.4.5.2 NPC-115

All equipment operating on the site should comply with the sound level limits of NPC-115.

#### 6.4.5.3 Additional Requirements

In addition to the general requirement to meet the sound (noise) level limits provided in this report, it is expected that the contractor will implement all possible mitigation techniques, as needed, to ensure that noise impacts from the construction activities are minimized, and comply with the noise by-law requirements and the sound level limits identified herein. These would include:

- shields or other physical barriers to reduce the transmission of noise;
- sound attenuating housings or enclosures for noise producing machinery such as compressors, pumps, motors, and generators;
- effective intake and exhaust silencers on air equipment;
- effective intake and exhaust mufflers on internal combustion engines;
- sound/vibration deadening lining materials on hoppers and storage bins;

- operate hauling operations so that noise is kept to a minimum;
- the use of electric rather than internal combustion engine power on chain saws, hoisting equipment in fixed locations, or other equipment, where electric power is available; and
- placing stationary noise producing equipment at a maximum distance from buildings.

## 6.5 CONSTRUCTION VIBRATION IMPACT ASSESSMENT

### 6.5.1 Sensitive Receptors

In terms of vibration, sensitive receptors would include any structure in the vicinity of the construction site which could be damaged by vibration produced on the construction site. In general, this would include the same residential developments noted above (but not considering the proposed residential development to the east if it has not yet been constructed).

### 6.5.2 Construction Vibration Sources

The construction vibration assessment is based on the "Stage 2 Preliminary Design Report (Draft)", prepared by Cole Engineering and dated May 2015. The report provides a conceptual construction approach from which various sources of construction vibration can be identified:

- General soil removal/relocation using a bulldozer; and
- Caisson drilling at tunnel locations for shoring installation.

As with the noise assessment, this vibration assessment is not a detailed itemization of the construction methodology. As above, it is expected that the ultimate approach to construction will be determined by the contractor on site. For that reason, it is the responsibility of the contractor to ensure that vibration limits are met throughout the construction process.

### 6.5.3 ZOI Analysis

The vibration propagation model used for this assessment assumes subsurface conditions that promote the "efficient propagation of vibration", based on the procedures found in Reference 1. Relative to propagation for standard subsurface conditions, efficient propagation can result in vibration levels up to 10 dB higher. To be conservative, this assessment assumes efficient propagation and therefore a +10 dB adjustment has been applied, which has the net effect of increasing the setback to the 5 mm/s criteria (i.e., a larger ZOI).

Since the vibration velocities presented in this report are based on predictive methods, they should be considered as an approximation, but are representative of what can be expected.

The potential construction ZOI has been determined by prediction, using reference ground vibration velocities for the sources noted above, and the extrapolation methods from Reference 2, which provides reference data on vibration from various construction activities. The reference ground vibration velocities are:

- Bulldozer: 2.3 mm/s (peak particle velocity – PPV) at 7.6 m; and
- Caisson Drilling: 2.3 mm/s (peak particle velocity – PPV) at 7.6 m.

The extent of the ZOI is based on the maximum PPV at any location off-site caused by a single operation on the site. It is assumed that significant construction activities do not occur

simultaneously, and as such vibration velocities are considered independently rather than additively.

### 6.5.4 Results and Discussion

Figure 8 shows the ZOI (the setback to the 5 mm/s) for the above noted activity. It is clear that the ZOI does not extend out to the surrounding buildings to the west and south of the construction site.

As with the noise assessment, this vibration assessment is generic based on typical vibration that may be associated with the construction activity. The contractor will be ultimately responsible for ensuring that the vibration criteria are met at all vibration-sensitive locations.

Note that the ZOI considers the damage criteria noted above. It is not based on perception of, or annoyance by, vibration.

### 6.5.5 Construction Vibration Mitigation

#### 6.5.2.1 General Requirements

The contractor will be responsible for complying with the vibration limits in Section 3.6 of Chapter 363 of the City of Toronto municipal code (notwithstanding that the construction will occur outside the City of Toronto).

#### 6.5.2.2 Additional Requirements

In addition to the general requirement to meet the vibration limits provided in this report, it is expected that the contractor will implement all possible mitigation techniques to ensure that vibration impacts from the construction activities are minimized. These would include:

- staging of high vibration activities such as caisson drilling such that vibration effects are not additive; and
- drilling caissons at an appropriate speed such that vibration limits are not exceeded.

## 6.6 MONITORING PLAN

In order to collect data, assess noise complaints, and avoid structural damage to adjacent buildings, it is recommended that a noise and vibration monitoring programme be completed as part of the project. The monitoring is beyond the scope of the current project.

This monitoring plan has been developed based on the noise and vibration assessments provided above. Although the aim of the monitoring is to assist with compliance with the noise and vibration limits, it is the sole responsibility of the contractor to comply with the noise and vibration requirements.

### 6.6.1 Noise Monitoring

#### 6.6.1.1 Noise Monitoring Locations

It is recommended that two noise monitors be located adjacent to the construction site. The monitors should be placed at the closest receptors in each of the following areas:

- to the west in the direction of the detached residential dwellings; and
- to the east in the direction of the proposed high-rise development.

If the proposed high rise development to the east is not occupied by the time of the station upgrade construction, then this receptor location would not be necessary.

Where possible, the monitors should be located on private property for security purposes, at the worst case location relative to the noise from the construction activity.

The microphone should be placed at least 3m above grade with a clear line of sight to the construction activity.

6.6.1.2 Data Collection

The following sound level parameters are to be collected on an hourly basis:

- $L_{eq}$ (equivalent sound level);
- $L_{10}$;
- $L_{90}$.

All parameters are to be reported in dBA (A-weighted).

The sound level meter can be either Type 1 or Type 2 and must be field calibrated on-site at least every 6 weeks (as well as during installation and removal of the equipment). Laboratory calibration must be up-to-date according to the manufacturer's recommendation.

6.6.1.3 Baseline Monitoring

The sound level monitor must be installed at least one week prior to the start of construction. Ambient sound data must be collected for a full week (24 hours per day).

6.6.1.4 Continuous Sound Level Monitoring

Sound level monitoring must be conducted for the duration of the construction activity. Monitoring is to be conducted 24 hours per day.

As with any monitoring system, all attempts should be made to ensure continuous monitoring data is available for all units. However, it is possible that equipment failures or downtime may be encountered during the monitoring. All attempts must be made to minimize disruptions in the data.

### 6.6.2 Vibration Monitoring

As noted above, vibration magnitudes much lower than the damage criteria can yield discomfort and complaints from residential neighbours in close proximity to the construction site. For this reason, a comprehensive vibration monitoring plan is required to ensure that adequate vibration data is collected throughout the course of the construction project.

6.6.2.1 Vibration Monitoring Locations

It is recommended that two vibration monitors be located adjacent to the construction site. It is expected that the vibration monitors will be located coincident with the noise monitoring equipment. The vibration monitors should be closer to the construction site than the nearest building/structure that it is attempting to represent.

In addition to the above monitoring locations, it is recommended that vibration monitoring be completed in the existing station building. As this building is historic in nature, it is possible that it is particularly susceptible to damage resulting from vibration. For this reason, it is recommended that one additional monitoring location be provided for the station building.

6.6.2.2 Data Collection

The following vibration parameters are to be collected on an hourly basis:

- Peak Particle Velocity (PPV) in each of the three orthogonal axes; and
- Maximum Peak Vector Sum (PVS) of the three orthogonal axes.

All parameters are to be reported in mm/s.

In addition to the PPV and PVS data, if the cautionary limit of 5 mm/s is exceeded in any one of the axes, data must be collected regarding the frequency content of the vibration signal.

The vibration monitor (seismograph) must be capable of monitoring the three orthogonal axes simultaneously. The unit must have a flat frequency response (range of zero to -3 dB) of at least 2 to 100 Hz. Laboratory calibration must be up-to-date according to the manufacturer's recommendation.

6.6.2.3 Baseline Monitoring

The vibration monitor(s) must be installed at least one week prior to the start of construction. Ambient vibration data must be collected for a full week (24 hours per day).

6.6.2.4 Continuous Vibration Monitoring

Vibration monitoring must be conducted for the duration of the construction activity. Monitoring is to be conducted 24 hours per day.

As with any monitoring system, all attempts should be made to ensure continuous monitoring data is available for all units. However, it is possible that equipment failures or downtime may be encountered during the monitoring. All attempts must be made to minimize disruptions in the data.

### 6.6.3 Reporting

Noise and vibration reporting is to be provided every two weeks. Data measured during inclement weather is to be identified in the report, but is not to be excluded from the dataset. For the purposes of the reporting, inclement weather is identified as:

- for noise, wind over 20 kph or precipitation of any kind; and
- for vibration, wind over 50 kph or precipitation of any kind.

All measurement parameters described above are to be reported in tabular and graphical format along with wind speed data.

A discussion of any anomalous data is to be provided where applicable.

## 7.0 CONCLUSIONS

In order to accommodate the TWAD service on the Metrolinx Barrie corridor, various station infrastructure upgrades are proposed for the Maple and Rutherford stations. As the stations are in close proximity to noise and vibration sensitive receptors, this report considers the potential noise and vibration impact of the proposed project on the neighbouring properties.

## 8.0 REFERENCES

1. "Construction Equipment", Ontario Ministry of the Environment Publication NPC-115.

2. "High Speed Ground Transportation Noise and Vibration Impact Assessment", Harris Miller, Miller and Hanson Inc., October 2005.

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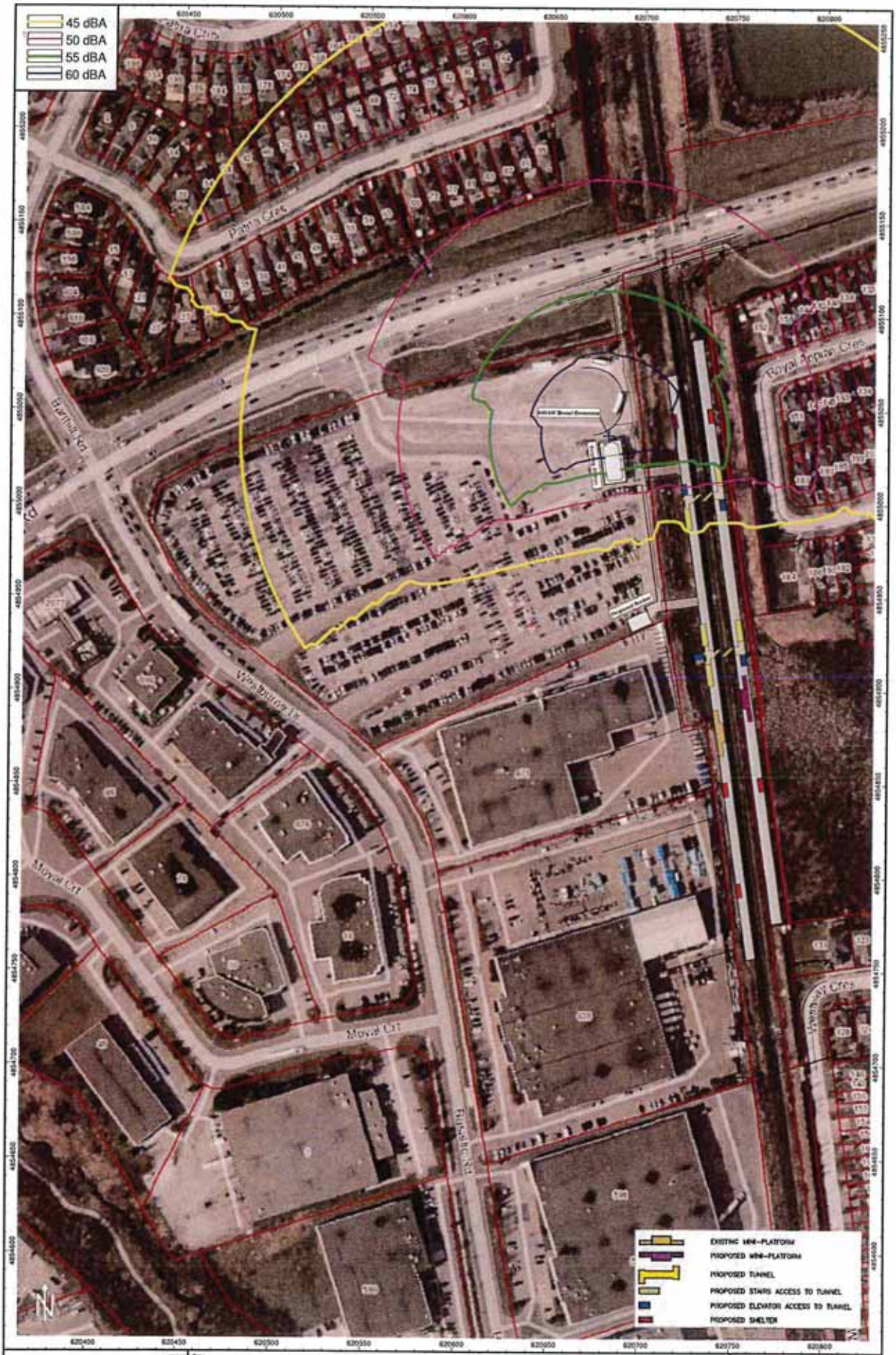
J:\2014\114380\000\Reports\TWAD Ruth-Maple Combined NV Fnl.wpd




VALCOUSTICS Canada Ltd.
consulting acoustical engineers

Title: Predicted Sound Levels (dBA) - Emergency Equipment

Project Name: GO TWAD - Rutherford

Date: 2015-11-27

Project No.: 114-380

Figure: 1


VALCOUSTICS Canada Ltd. consulting acoustical engineers

Title: Predicted Sound Levels (dBA) - Non-Emergency Equipment

Project Name: GO TWAD - Rutherford

Date: 2015-11-27

Project No.: 114-380

Figure: 2


VALCOUSTICS Canada Ltd. consulting acoustical engineers

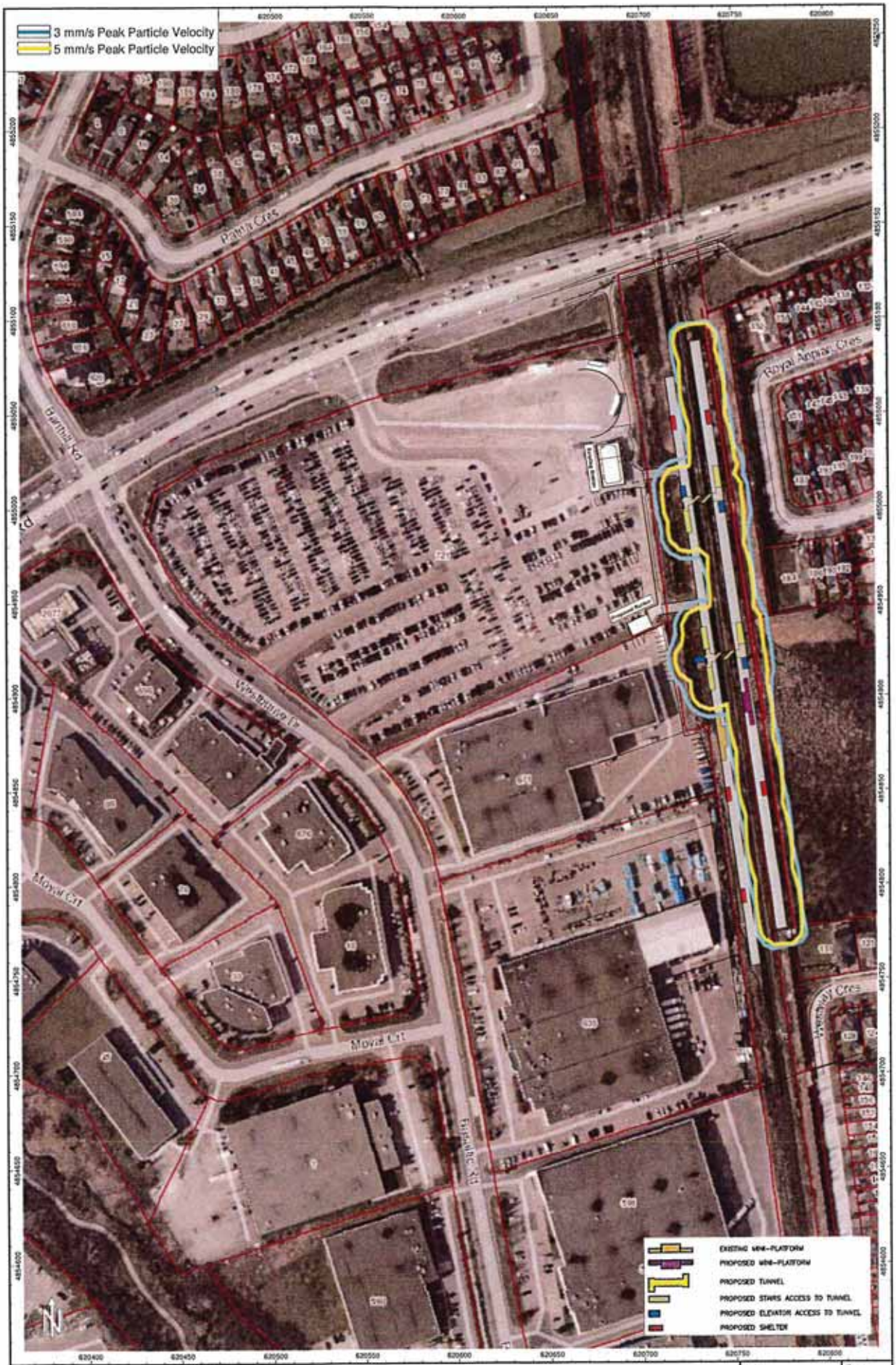
Title: **Predicted Sound Levels (dBA) - Construction Equipment**

Project Name: **GO TWAD - Rutherford**

Date: 2015-11-27

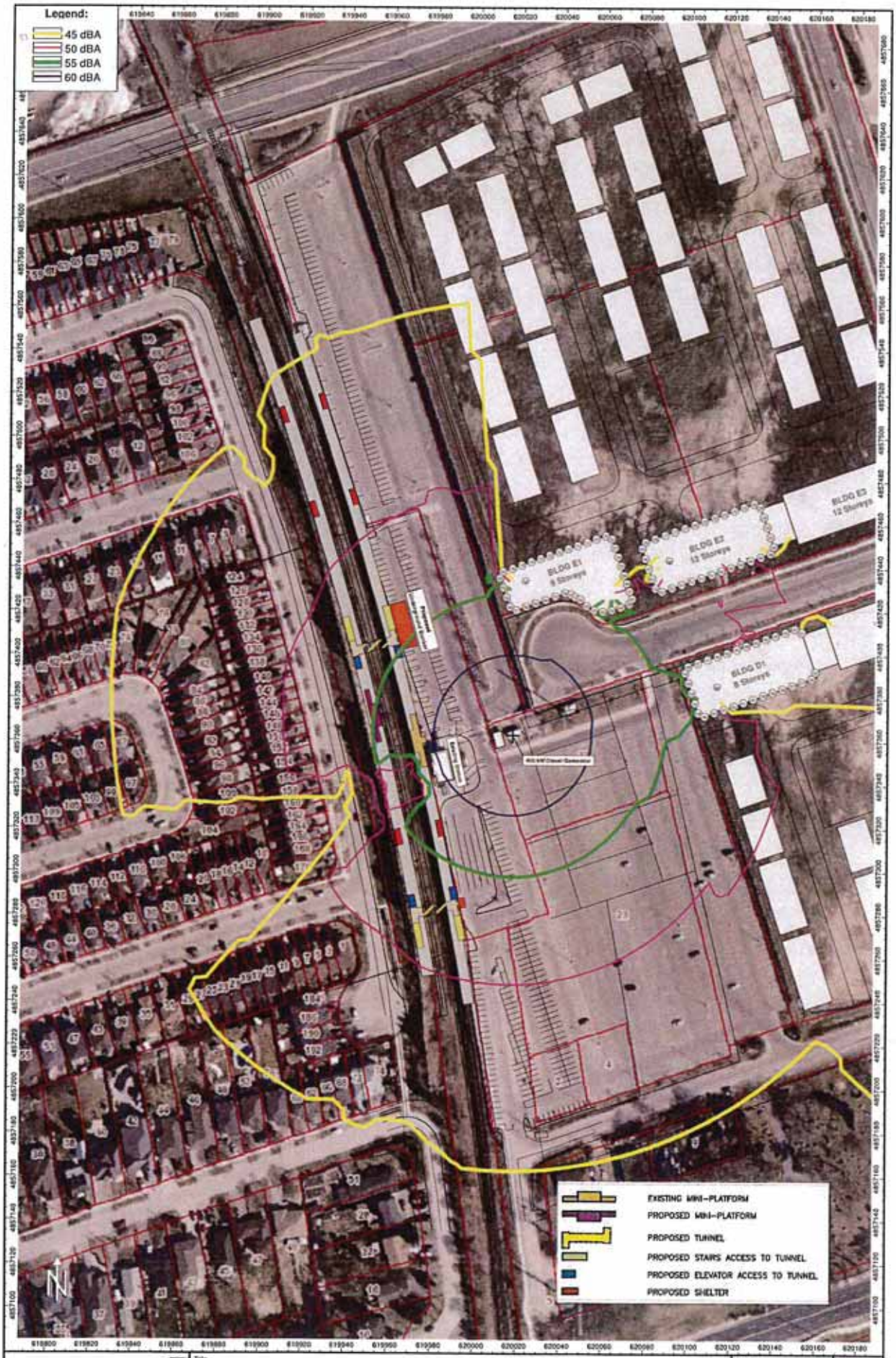
Project No.: 114-380

Figure: **3**




VALCOUSTICS Canada Ltd.
consulting acoustical engineers

| | | |
|---|---|---|
| Title: Construction Vibration "Zone of Influence" | Date: 2015-11-27 | Figure: 4 |
| Project Name: GO TWAD - Rutherford | Project No.: 114-380 | |




VALCOUSTICS Canada Ltd.
consulting acoustical engineers

Title: Predicted Sound Levels (dBA) - Emergency Equipment

Project Name: GO TWAD - Maple Station

Date: 2015-11-27

Project No.: 114-380

Figure: 5


VALCOUSTICS Canada Ltd.
consulting acoustical engineers

| | | |
|---|---|---|
| Title: Predicted Sound Levels (dBA) - Non-Emergency Equipment | Date: 2015-11-27 | Figure: 6 |
| Project Name: GO TWAD - Maple Station | Project No.: 114-380 | |


VALCOUSTICS Canada Ltd.
consulting acoustical engineers

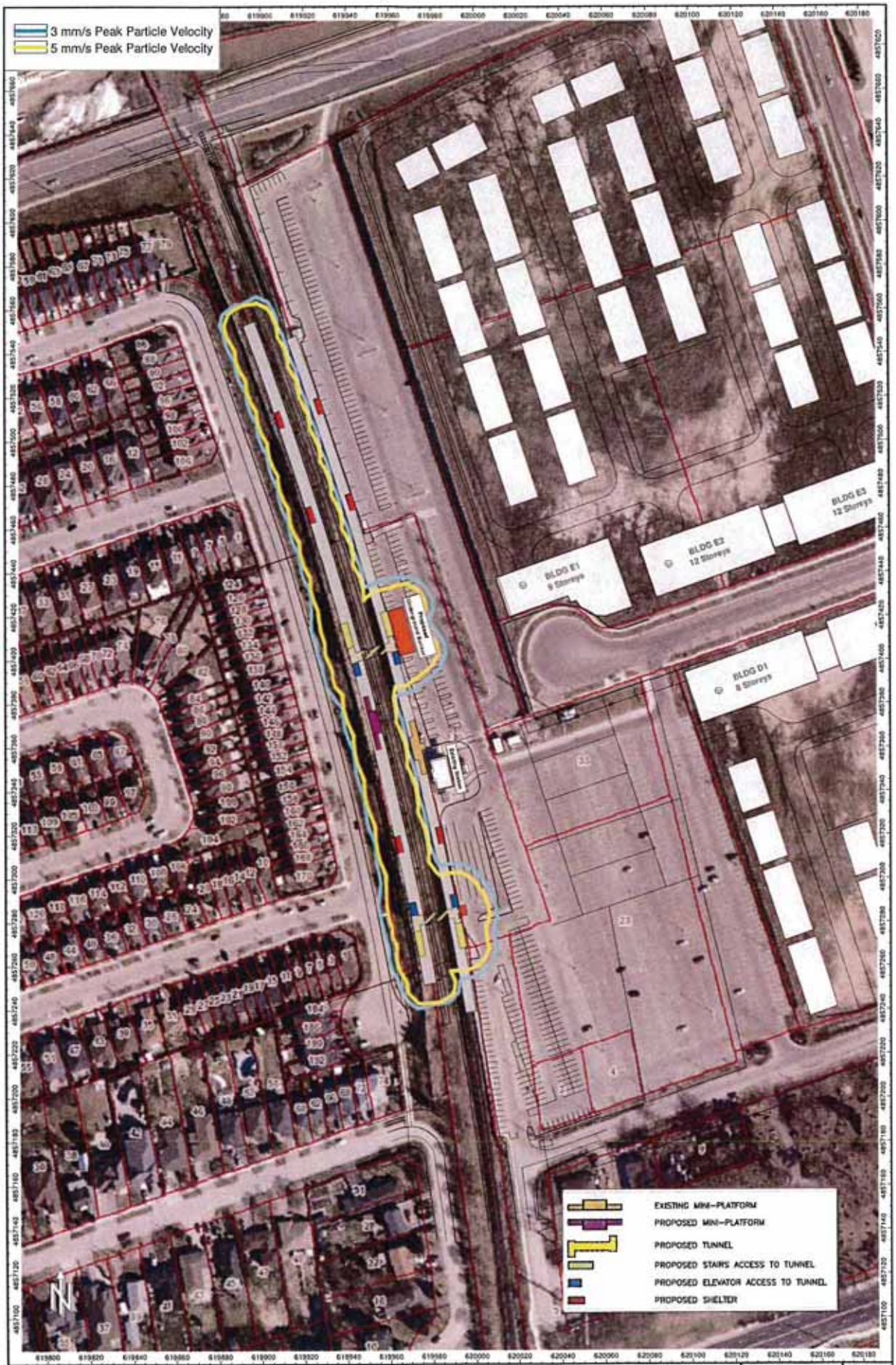
Title: Predicted Sound Levels (dBA) - Construction Equipment

Project Name: GO TWAD - Maple Station

Date: 2015-11-27

Project No.: 114-380

Figure: 7




VALCOUSTICS Canada Ltd.
consulting acoustical engineers

Title: Construction Vibration "Zone of Influence"

Project Name: GO TWAD - Maple Station

Date: 2015-11-27

Project No.: 114-380

Figure: 8

# APPENDIX A

## CATALOGUE OF SENSITIVE RECEPTORS

### RUTHERFORD

95 & 91 Patna Crescent

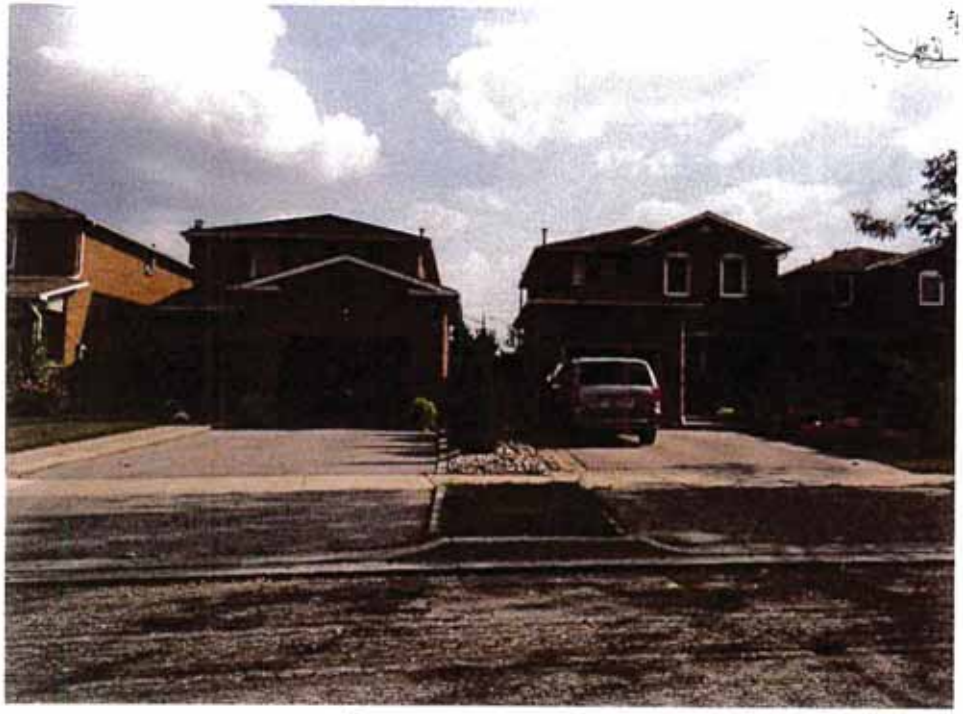
87 & 83 Patna Crescent

81 & 77 Patna Crescent

73 & 69 Patna Crescent

63 & 59 Patna Crescent

55 & 53 Patna Crescent

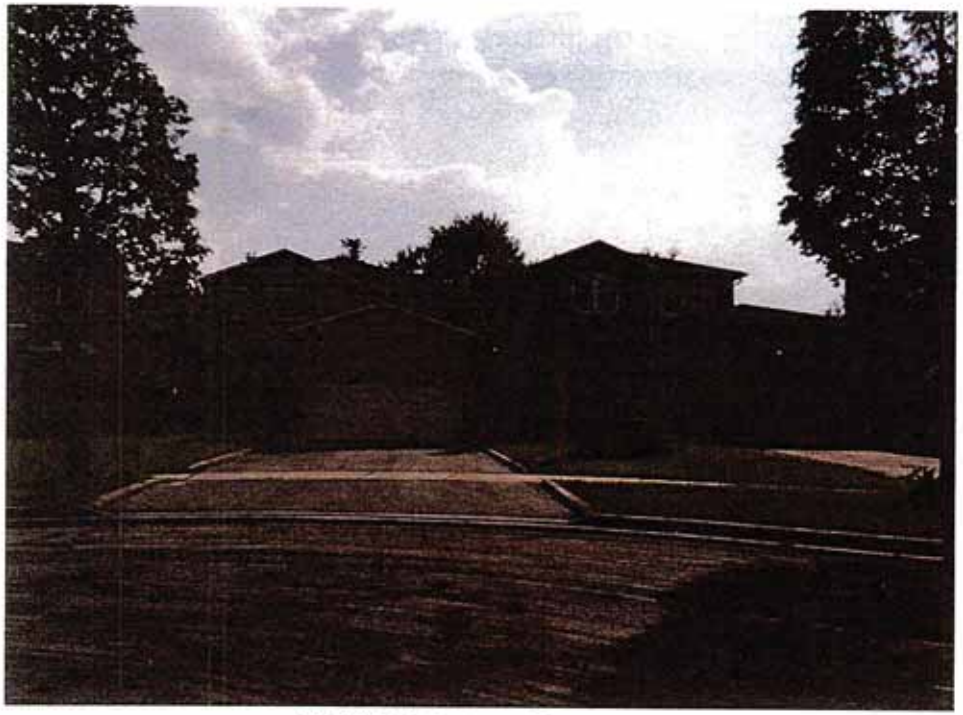


49 & 45 Patna Crescent

41 & 39 Patna Crescent

35 & 33 Patna Crescent

29 & 27 Patna Crescent



23 & 21 Patna Crescent

17 & 15 Patna Crescent

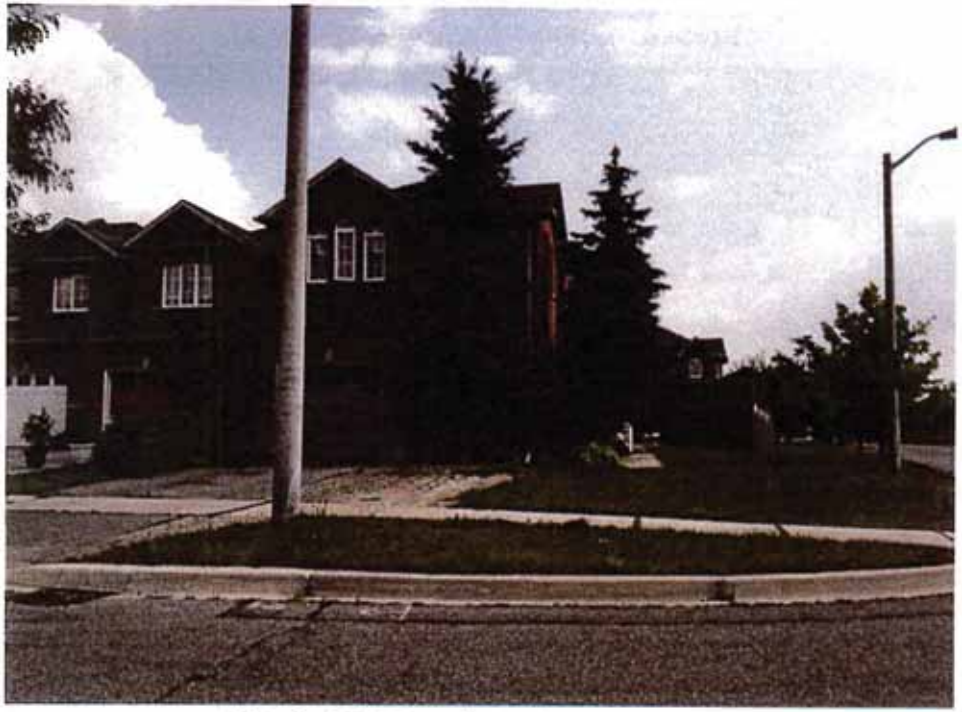
584 & 590 Barrhill Road

598 & 604 Barrhill Road

610 & 616 Barrhill Road

2077 Westburne Drive

152 & 150 Royal Appian Crescent



153 & 151 Royal Appian Crescent

186 & 184 Royal Appian Crescent

187 & 189 Royal Appian Crescent

131 Westway Crescent

128 Westway Crescent

146 – 156 Westway Crescent

160 – 172 Westway Crescent

# APPENDIX B

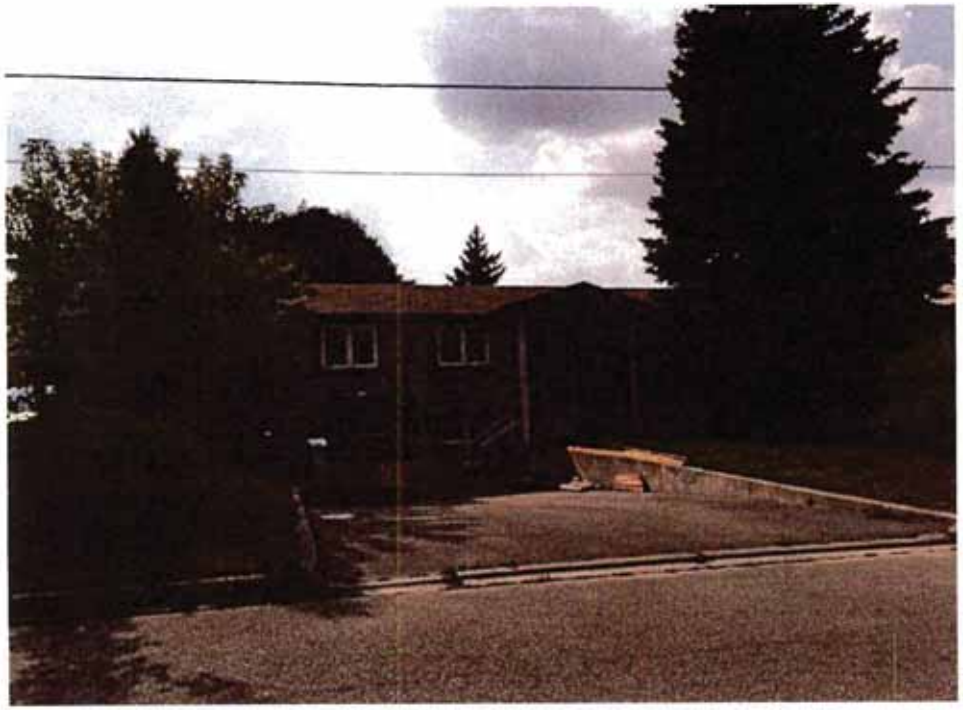
## CATALOGUE OF SENSITIVE RECEPTORS

### MAPLE

9 Hill Street

2 and 10 Simcoe Street

16 Simcoe Street



22 Simcoe Street

28 Simcoe Street

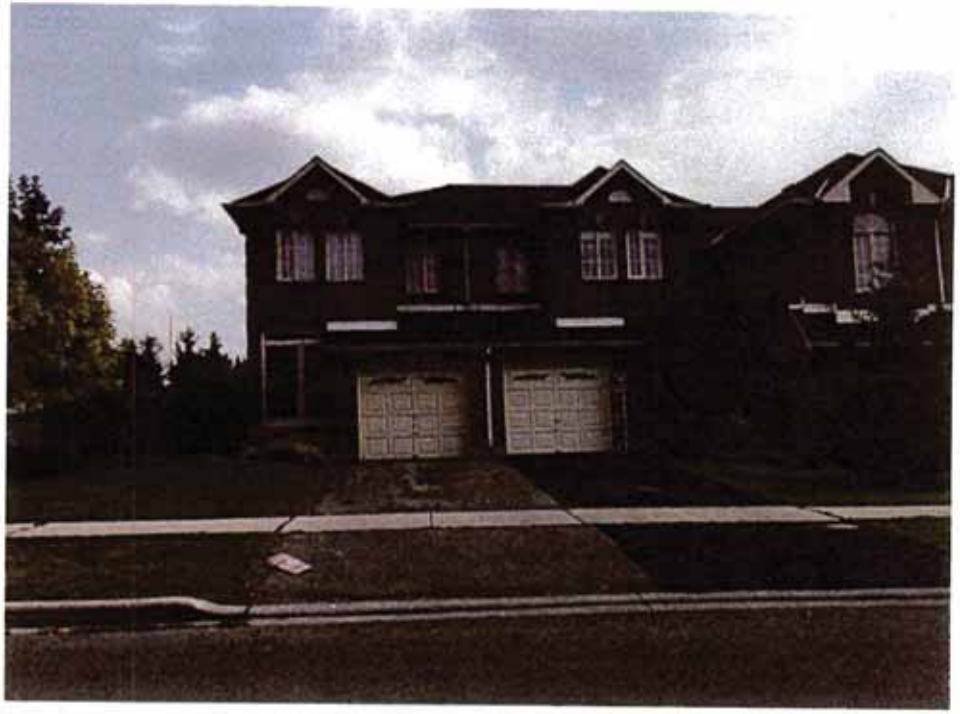
28 Simcoe Street

72 & 74 Railway St.

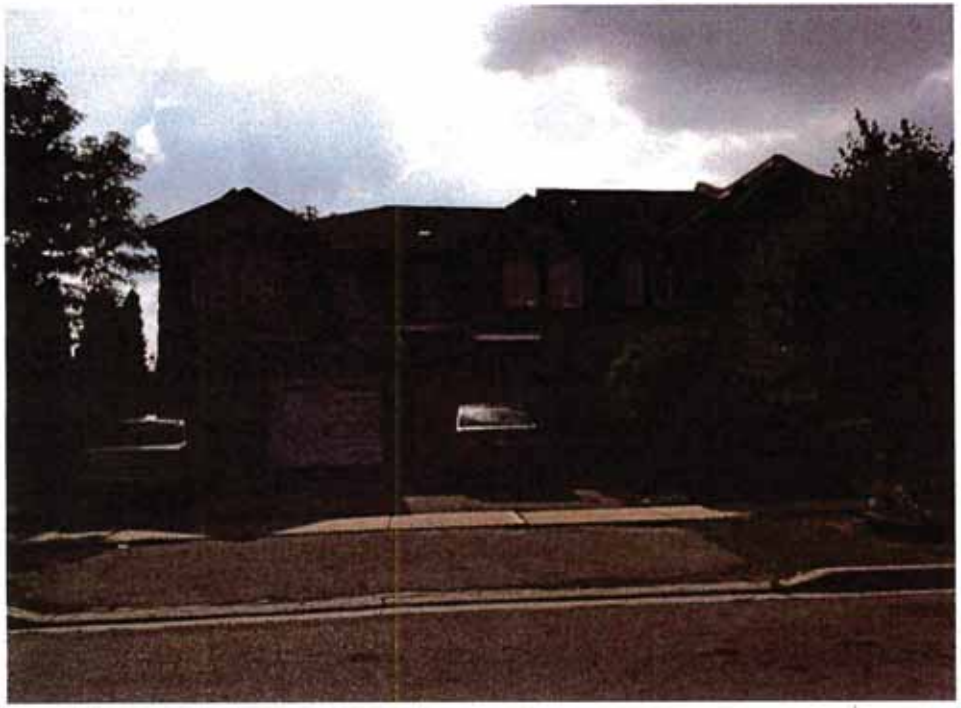
51 Railway Street

192 & 190 Lindenshire Avenue

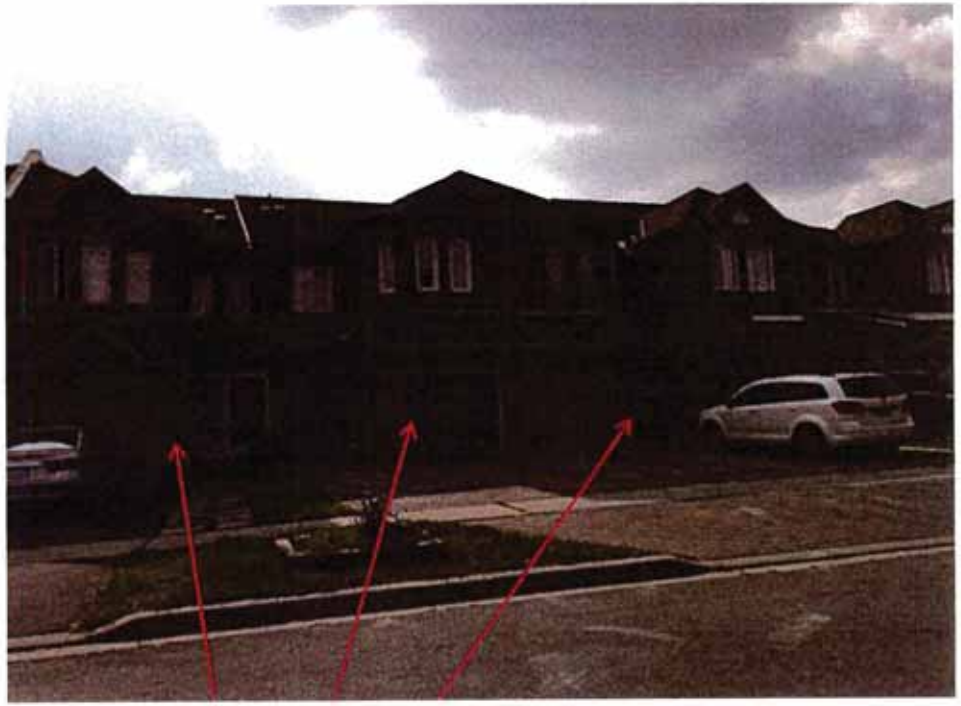
186 & 184 Lindenshire Avenue



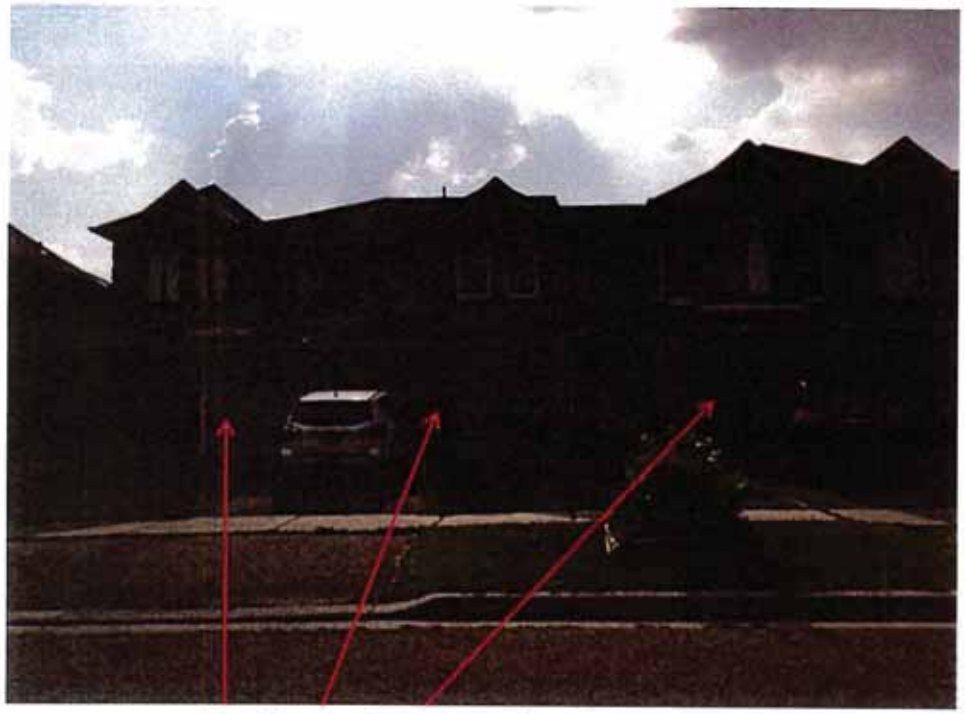
1 & 3 Stonebriar Drive



170 & 168 Lindenshire Avenue



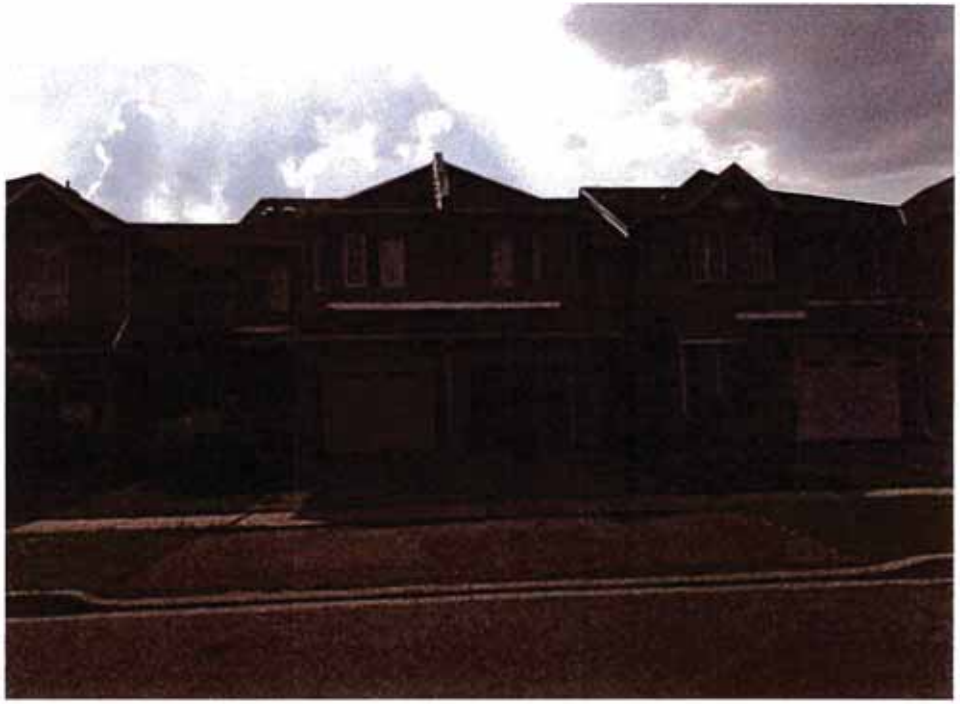
164 & 162 & 160 Lindenshire Avenue



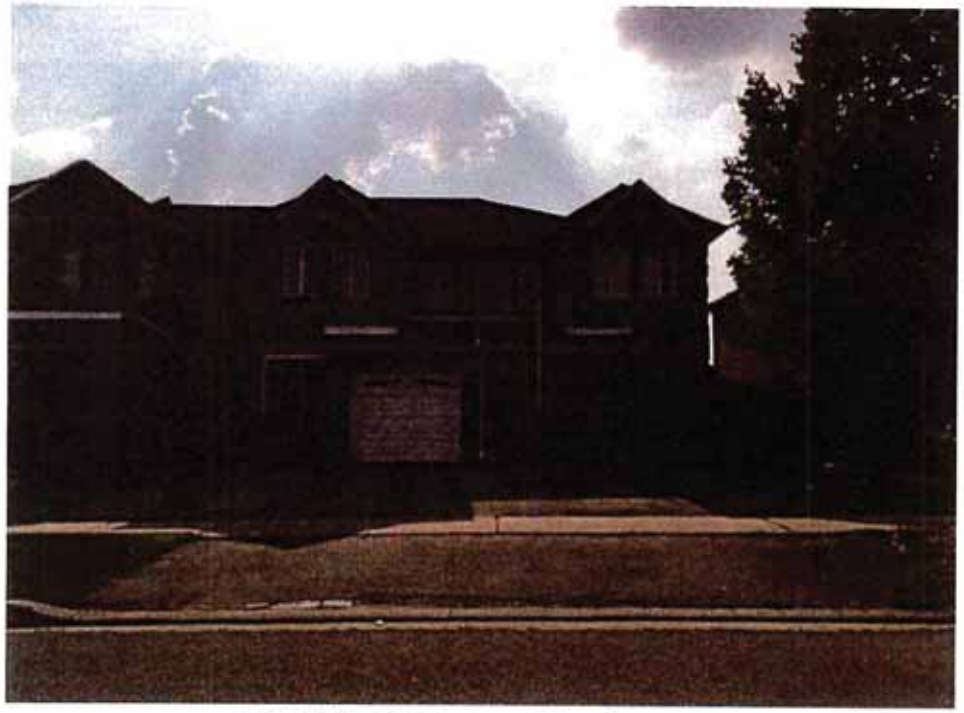
154 & 152 & 150 Lindenshire Avenue

160 & 158 & 156 Lindenshire Avenue

150 & 148 Lindenshire Avenue



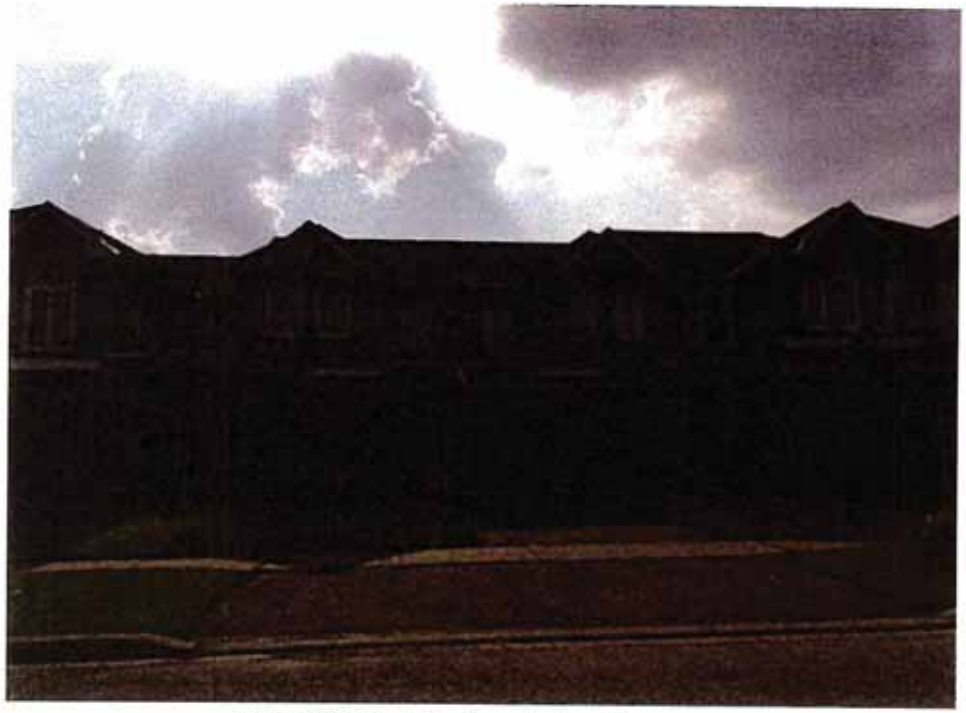
146 & 144 Lindenshire Avenue



142 & 140 Lindenshire Avenue

138 & 136 Lindenshire Avenue

134 & 132 Lindenshire Avenue

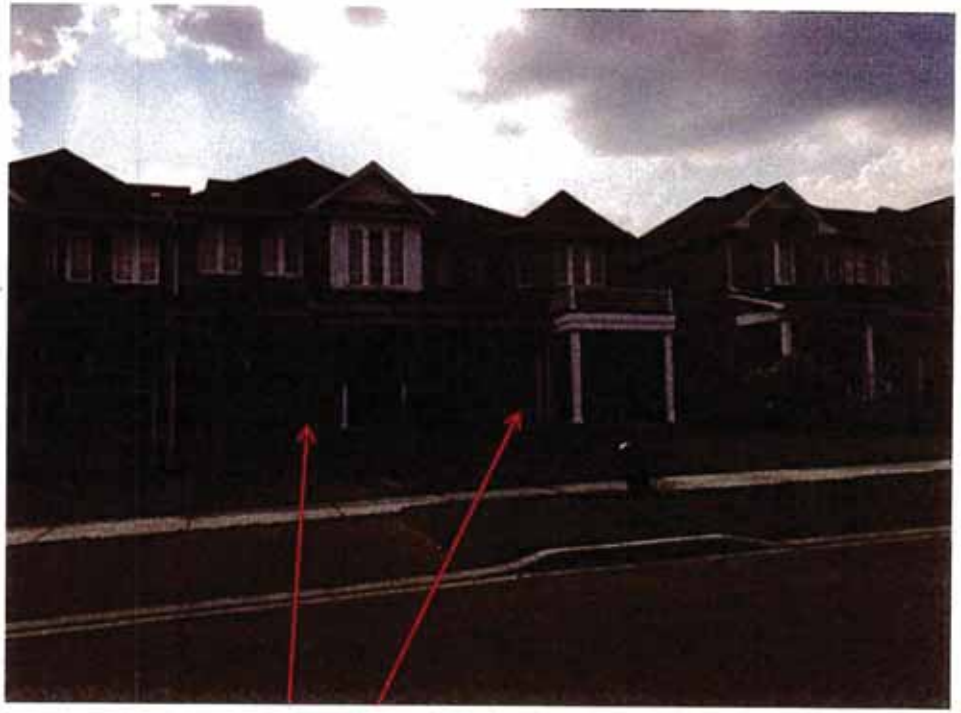


130 & 128 Lindenshire Avenue

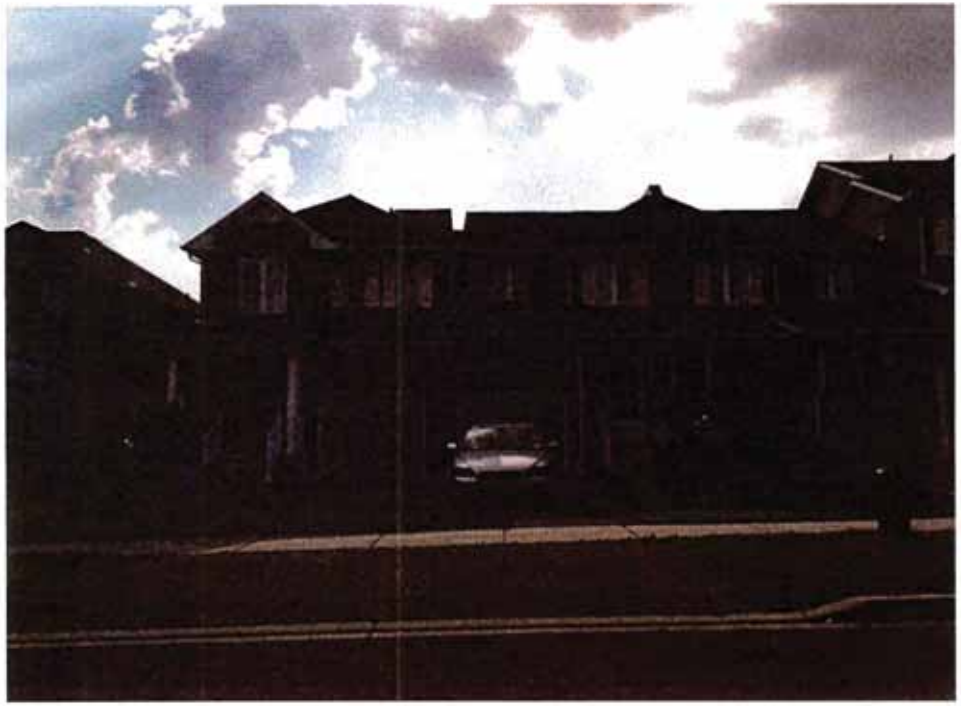
126 & 124 Lindenshire Avenue

1 & 5 Falvo Street

106 & 102 Lindenshire Avenue



100 & 98 Lindenshire Avenue



96 & 94 Lindenshire Avenue

90 & 88 & 86 Lindenshire Avenue

77 & 79 Lindenshire Avenue


Proposed Residential

Proposed Residential

# APPENDIX C

## SOURCE SOUND LEVEL DATA

## Point Sources

| Name | M. | ID | Result. PWL | | | Lw / Li | | | Correction | | | Sound Reduction | | Attenuation | Operating Time | | | K0 | Freq. | Direct. | Height | | Coordinates | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Day | Evening | Night | Type | Value | norm. | Day | Evening | Night | R | Area | | Day | Special | Night | | | | | | X | Y | Z |
| | | | (dBA) | (dBA) | (dBA) | | | dB(A) | dB(A) | dB(A) | dB(A) | | (m²) | | (min) | (min) | (min) | (dB) | (Hz) | | (m) | | (m) | (m) | (m) |
| Diesel Generator (400 kW) | ~ | GENSET | 100.0 | 100.0 | 100.0 | Lw | GENSET | | 0.0 | 0.0 | 0.0 | | | | | | | 0.0 | | (none) | 2.50 | r | 620681.27 | 4855036.55 | 222.09 |
| Exhaust Fan | ~ | EF1 | 72.9 | 72.9 | 72.9 | Lw | EF1 | | 0.0 | 0.0 | 0.0 | | | | | | | 0.0 | | (none) | 4.50 | r | 620701.13 | 4854938.58 | 224.00 |
| Condensing Unit | ~ | CND1 | 69.7 | 69.7 | 69.7 | Lw | CND1 | | 0.0 | 0.0 | 0.0 | | | | | | | 0.0 | | (none) | 4.50 | r | 620696.37 | 4854935.91 | 224.00 |
| Auger Drill Rig | | DRILL | 115.0 | 115.0 | 115.0 | Lw | 115 | | 0.0 | 0.0 | 0.0 | | | | | | | 0.0 | 500 | (none) | 2.50 | r | 620743.70 | 4854999.85 | 220.00 |
| Auger Drill Rig | | DRILL | 115.0 | 115.0 | 115.0 | Lw | 115 | | 0.0 | 0.0 | 0.0 | | | | | | | 0.0 | 500 | (none) | 2.50 | r | 620755.57 | 4854916.76 | 219.00 |

## Line Sources

| Name | M. | ID | Result. PWL | | | Result. PWL' | | | Lw / Li | | | Correction | | | Sound Reduction | | Attenuation | Operating Time | | | K0 | Freq. | Direct. | Moving Pt. Src | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Day | Evening | Night | Day | Evening | Night | Type | Value | norm. | Day | Evening | Night | R | Area | | Day | Special | Night | | | | Number | | | Speed |
| | | | (dBA) | (dBA) | (dBA) | (dBA) | (dBA) | (dBA) | | | dB(A) | dB(A) | dB(A) | dB(A) | | (m²) | | (min) | (min) | (min) | (dB) | (Hz) | | Day | Evening | Night | (km/h) |
| Public Address System | ~ | PA1 | 114.6 | 114.6 | 114.6 | 89.7 | 89.7 | 89.7 | Lw | PA+10*log10(21) | | 0.0 | 0.0 | 0.0 | | | | 2.00 | 2.00 | 2.00 | 0.0 | | (none) | | | | |
| Public Address System | ~ | PA2 | 114.6 | 114.6 | 114.6 | 89.7 | 89.7 | 89.7 | Lw | PA+10*log10(21) | | 0.0 | 0.0 | 0.0 | | | | 2.00 | 2.00 | 2.00 | 0.0 | | (none) | | | | |

## Area Sources

| Name | M. | ID | Result. PWL | | | Result. PWL" | | | Lw / Li | | | Correction | | | Sound Reduction | | Attenuation | Operating Time | | | K0 | Freq. | Direct. | Moving Pt. Src | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Day | Evening | Night | Day | Evening | Night | Type | Value | norm. | Day | Evening | Night | R | Area | | Day | Special | Night | | | | Number | | |
| | | | (dBA) | (dBA) | (dBA) | (dBA) | (dBA) | (dBA) | | | dB(A) | dB(A) | dB(A) | dB(A) | | (m²) | | (min) | (min) | (min) | (dB) | (Hz) | | Day | Evening | Night |
| Dozer and Dump Truck | | Cons_Noise | 115.0 | 115.0 | 115.0 | 79.1 | 79.1 | 79.1 | Lw | 115 | | 0.0 | 0.0 | 0.0 | | | | | | | 0.0 | 500 | (none) | | | |

## Sound Level Library

| Name | ID | Type | Oktave Spectrum (dB) | | | | | | | | | | | | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Weight. | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | A | lin | |
| 400 kW Generator in Enclosure (75 dBA @ 7m) | GENSET | Lw | | 113.8 | 111.6 | 109.0 | 101.6 | 99.1 | 90.1 | 85.8 | 80.7 | 76.6 | 100.0 | 116.9 | Manufacturer's data (Generac SG400) |
| 3000 CFM Exhaust Fan | EF1 | Lw | | 0.0 | 77.0 | 76.0 | 76.0 | 71.0 | 65.0 | 64.0 | 56.0 | 50.0 | 72.9 | 81.7 | Manufacturer's data (Greenheck GB-180) |
| 18200 BTUH Split System Condensing Unit | CND1 | Lw | | 0.0 | 74.0 | 69.0 | 69.0 | 67.0 | 64.0 | 62.0 | 58.0 | 52.0 | 69.7 | 77.1 | Manufacturer's data (LG LSU181) |
| Public Address System (82 dBA @ platform) | PA | Lw | | 0.0 | 76.0 | 86.0 | 99.2 | 101.7 | 95.4 | 90.8 | 85.8 | 80.6 | 101.4 | 104.6 | ANSI S3.5-1997 (Table 4) |

## Point Sources

| Name | M. | ID | Result. PWL | | | Lw / Li | | | Correction | | | Sound Reduction | | Attenuation | Operating Time | | | K0 | Freq. | Direct. | Height | | Coordinates | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Day | Evening | Night | Type | Value | norm. | Day | Evening | Night | R | Area | | Day | Special | Night | | | | | | X | Y | Z |
| | | | (dBA) | (dBA) | (dBA) | | | dB(A) | dB(A) | dB(A) | dB(A) | | (m²) | | (min) | (min) | (min) | (dB) | (Hz) | | (m) | | (m) | (m) | (m) |
| Emergency Generator (400 kW) | ~ | GENSET | 100.0 | 100.0 | 100.0 | Lw | GENSET | | 0.0 | 0.0 | 0.0 | | | | | | | 0.0 | | (none) | 2.50 | r | 620017.03 | 4857362.75 | 252.06 |
| Condensing Unit | | CND1 | 69.7 | 69.7 | 69.7 | Lw | CND1 | | 0.0 | 0.0 | 0.0 | | | | | | | 0.0 | | (none) | 1.50 | r | 619966.66 | 4857415.81 | 250.36 |
| Exhaust Fan | | EF1 | 72.9 | 72.9 | 72.9 | Lw | EF1 | | 0.0 | 0.0 | 0.0 | | | | | | | 0.0 | | (none) | 1.50 | r | 619967.66 | 4857412.46 | 250.29 |
| Auger Drill Rig | ~ | DRILL | 115.0 | 115.0 | 115.0 | Lw | 115 | | 0.0 | 0.0 | 0.0 | | | | | | | 0.0 | 500 | (none) | 2.50 | r | 619970.76 | 4857286.01 | 250.03 |
| Auger Drill Rig | ~ | DRILL | 115.0 | 115.0 | 115.0 | Lw | 115 | | 0.0 | 0.0 | 0.0 | | | | | | | 0.0 | 500 | (none) | 2.50 | r | 619944.33 | 4857395.95 | 250.71 |

## Line Sources

| Name | M. | ID | Result. PWL | | | Result. PWL' | | | Lw / Li | | | Correction | | | Sound Reduction | | Attenuation | Operating Time | | | K0 | Freq. | Direct. | Moving Pt. Src | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Day | Evening | Night | Day | Evening | Night | Type | Value | norm. | Day | Evening | Night | R | Area | | Day | Special | Night | | | | Number | | | Speed |
| | | | (dBA) | (dBA) | (dBA) | (dBA) | (dBA) | (dBA) | | | dB(A) | dB(A) | dB(A) | dB(A) | | (m²) | | (min) | (min) | (min) | (dB) | (Hz) | | Day | Evening | Night | (km/h) |
| Public Address System | | PA1 | 114.6 | 114.6 | 114.6 | 89.7 | 89.7 | 89.7 | Lw | PA+10*log10(21) | | 0.0 | 0.0 | 0.0 | | | | 2.00 | 2.00 | 2.00 | 0.0 | | (none) | | | | |
| Public Address System | | PA2 | 114.6 | 114.6 | 114.6 | 89.7 | 89.7 | 89.7 | Lw | PA+10*log10(21) | | 0.0 | 0.0 | 0.0 | | | | 2.00 | 2.00 | 2.00 | 0.0 | | (none) | | | | |

## Area Sources

| Name | M. | ID | Result. PWL | | | Result. PWL" | | | Lw / Li | | | Correction | | | Sound Reduction | | Attenuation | Operating Time | | | K0 | Freq. | Direct. | Moving Pt. Src | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Day | Evening | Night | Day | Evening | Night | Type | Value | norm. | Day | Evening | Night | R | Area | | Day | Special | Night | | | | Number | | |
| | | | (dBA) | (dBA) | (dBA) | (dBA) | (dBA) | (dBA) | | | dB(A) | dB(A) | dB(A) | dB(A) | | (m²) | | (min) | (min) | (min) | (dB) | (Hz) | | Day | Evening | Night |
| Dozer and Dump Truck | ~ | Cons_Noise | 115.0 | 115.0 | 115.0 | 79.1 | 79.1 | 79.1 | Lw | 115 | | 0.0 | 0.0 | 0.0 | | | | | | | 0.0 | 500 | (none) | | | |

## Sound Level Library

| Name | ID | Type | Oktave Spectrum (dB) | | | | | | | | | | | Source |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Weight. | 31.5 | 63 | 125 | 250 | 500 | 1000 | 2000 | 4000 | 8000 | A | lin | |
| 400 kW Generator in Enclosure (75 dBA @ 7m) | GENSET | Lw | | 113.8 | 111.6 | 109.0 | 101.6 | 99.1 | 90.1 | 85.8 | 80.7 | 76.6 | 100.0 | 116.9 | Manufacturer's data (Generac SG400) |
| 3000 CFM Exhaust Fan | EF1 | Lw | | 0.0 | 77.0 | 76.0 | 76.0 | 71.0 | 65.0 | 64.0 | 56.0 | 50.0 | 72.9 | 81.7 | Manufacturer's data (Greenheck GB-180) |
| 18200 BTUH Split System Condensing Unit | CND1 | Lw | | 0.0 | 74.0 | 69.0 | 69.0 | 67.0 | 64.0 | 62.0 | 58.0 | 52.0 | 69.7 | 77.1 | Manufacturer's data (LG LSU181) |
| Public Address System (82 dBA @ platform) | PA | Lw | | 0.0 | 76.0 | 86.0 | 99.2 | 101.7 | 95.4 | 90.8 | 85.8 | 80.6 | 101.4 | 104.6 | ANSI S3.5-1997 (Table 4) |