SS WILSON ASSOCIATES
*Consulting Engineers*

**REPORT NO. WA17-061 – R4**

# REVISION 4
# NOISE CONTROL FEASIBILITY STUDY
# A PROPOSED NEW CONDOMINIUM APARTMENT BUILDING
# 401 TO 417 MARTHA STREET
# BURLINGTON

**SUBMITTED TO:**

## LANDFORM DEVELOPMENT GROUP INC.
## 3390 SOUTH SERVICE ROAD, SUITE 205
## BURLINGTON, ON
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## 1.0 INTRODUCTION

**1.1** The services of SS Wilson Associates (SSWA) were retained by Landform Development Group Inc. to prepare a Noise Control Feasibility Study for the proposed residential development located at 401 to 417 Martha Street in Burlington.

The objective of this report is to support an application for an Official Plan amendment and Rezoning of the subject land containing the proposed development.

**1.2** The site is bounded by the following land uses:

- to the north by residential developments
- to the south by residential developments
- to the east by residential developments
- to the west by Martha Street, and furthermore by residential development, a Hydro Substation and a church.

The location of the site is shown in Figure 1.

**1.3** Major features of the development are defined by the Site Plan drawing prepared by SRM Architects Inc. Project No. 17032 dated December 18, 2020. Figure 2 illustrates the general layout of the proposed development.

**1.4** The major surface transportation noise source (current and future) of concern to the development is Martha Street and the major stationary noise sources (current and future) of concern to the development are the Transformer Substation Building, located to the North of the proposed development and the existing HVAC equipment serving the church to the west.

**1.5** The development is located outside the 25 NEF/NEP contour lines prepared by Transport Canada; therefore, aircraft noise is not considered a problem.

**1.6** The scope of this report is to define the minimum noise attenuation requirements for the control of outdoor and indoor environmental sound levels.

**1.7** Revision 1 incorporated the most up-to-date Site Plan at the time, dated May 11, 2018, as well as the comments from the City dated May 30, 2018.

**1.8** Revision 2 incorporated the updated Site Plan dated September 8, 2020. At the time, only the updated overall Site Plan drawing was provided, so only Figure 2 was updated. The change to the Site Plan does not alter the acoustic recommendations detailed herein.

**1.9** Revision 3 updated the figures and calculations based on changes to the floor layouts and the location of the elevated terrace which was moved from the rooftop to the 5th floor amenity area. Additionally, the figures were updated in accordance with comments received following the prior submission.

**1.10** Revision 4 (this document) incorporates the most up-to-date Site Plan, dated December 18, 2020, for Site Plan Approval.

## 2.0 SUMMARY AND RECOMMENDATIONS

### 2.1 SUMMARY

Based on the analysis conducted in this investigation it is concluded that:

Transportation Sources of Noise:

1. The unattenuated daytime sound level at the 5th floor terrace Outdoor Living Area (OLA)[1] of the proposed apartment building will exceed the recommended objective sound level. Therefore, outdoor noise control measures are recommended. All other Outdoor Living Areas within the proposed apartment building will not require outdoor noise control measures.

2. The unattenuated sound levels at the outside walls of the proposed apartment building will exceed the recommended objective sound levels. Indoor noise controls are required the proposed apartment building, along with relevant warning clauses.

3. Although the projected sound levels are predicted to be above the sound level criteria outlined in Section 3, it is feasible to control sound levels within the outdoor and indoor areas of the proposed development to meet the stated criteria.

Stationary Sources of Noise:

Detailed sound level calculations/measurements and analyses were performed in this study to assess the potential noise impact from the nearby stationary sources (external to the development) at the Points of Reception within the development. Additional sound level calculations were also performed using proxy data to calculate the sound levels from the internal sources within the subject development affecting the nearby existing noise sensitive land use areas. Based on the analysis conducted in this investigation it is concluded that:

The results of the investigation of the stationary sources of noise external to the development (such as the air conditioning units associated with the nearby Church and the Hydro transformer substation) indicate that the unattenuated sound levels at the most exposed building façade of the proposed development are predicted to comply with the applicable sound level criteria for external stationary sources. Accordingly, noise control measures are not required to control these sources of noise.

[1] At times, it may also be referred to as Outdoor Amenity Areas. The size of an OLA is subject to municipal standards and other project requirements (except when classified as a balcony along with other applicable MECP rules).

1. The potential sound levels from the proposed building's future rooftop HVAC system at the nearby dwellings are predicted to exceed the MECP sound levels. Therefore, noise mitigation measures are required at the source of noise.

2. Although the predicted sound levels from the internal stationary sources from the building's HVAC system are above the sound level criteria outlined in Section 3, it is feasible to control sound levels within the proposed development to meet the stated criteria during the detailed design stage of the project.

## 2.2 RECOMMENDATIONS

A summary of the minimum noise attenuation requirements is presented in Table 1. Detailed description is as follows:

### 1. Outdoor Noise Control Measures

**Balcony located on the 1st floor**

The balcony located on the 1st floor of the proposed apartment is larger than 4m in depth, and will therefore require assessment. Common Outdoor Living Area (COLA) is located on the east side of the proposed apartment building, and will receive complete shielding from the proposed apartment building. Therefore, no noise control measures are required for this COLA.

Figure 3 illustrates the location of the balcony relative to the transportation source of noise.

**5th Storey Outdoor Terrace**

The 5th storey outdoor terrace of the proposed development is larger than 4m in depth, and will therefore require assessment. The predicted sound levels due to road traffic noise at the terrace will exceed the recommended objective sound level, therefore noise control measures are recommended.

Acoustical barriers should be constructed to shield the Outdoor Living Area (OLA) with the following details:

a) Barriers should be constructed along the alignments shown schematically in Figure 4. Note that while the building layout shown in Figure 4 is the previous version, the alignment of the barrier will be similar along the roof edge to similar distance setback.
b) The required barrier heights as shown in Figure 4 could be as high as 1.1m

c) For the parapet acoustical barrier, it may consist of higher parapet wall(s) to Architect specifications and/or transparent material to OBC requirements. The added acoustic fence component to be constructed of a durable material having approximately 10 kg/m2 (Ξ 2 lb/ft2) of surface area and be in a continuous line without openings or gaps.

## 2. Central Air Conditioning

From a government requirement viewpoint, the subject building is not mandated to be equipped with central air conditioning unit system (central to each dwelling unit or central for the entire building). However, we have been advised by the proponent that this building will be centrally air conditioned in any way. Therefore, the following are the relevant requirements respecting the use of central air conditioning equipment.

The air conditioning system may be central to the entire building or may be central to each dwelling unit (for example using split-system or packaged incremental units (PTAC) with suitable duct work to all rooms). The Ministry of the Environment and Climate Change does not accept window-type air conditioning units in lieu of a central system. In all cases, serious attention should be given by the proponent, the Mechanical Engineer, and the Contractor to the noise potential of the air conditioning system as it may affect the outdoor and indoor receivers within or outside of the proposed development. It is important that the Builder, the Mechanical Engineer, and the Contractor achieve the MECP objectives (the maximum sound level $L_{AS}$ of 50 dBA[2] at the neighbour's closest point(s) of reception, i.e. at their outdoor areas as well as at the closest window on any floor level) included in Publications NPC-300 and NPC-216.

The following warning clause should be registered in all Development Agreement(s) and Offers of Sale and Purchase or Lease of these properties:

"*In order to achieve a suitable indoor noise environment, windows may have to remain closed; therefore, this dwelling unit has been equipped with a central air conditioning system*".

**It is also our recommendation that the necessary detailed technical analysis be performed prior to the certification process for Building Permit to address the specific requirements for the control of the selected air conditioning system to meet the sound level criteria at the point(s) of reception and to include same in the applicable permit drawings/specifications.**

[2] Or the lowest hourly ambient Leq due to road traffic projected at the receptor location(s)

## 3. Warning Clause *3

The following warning clause should be registered in all Development Agreement(s) and Offers of Sale and Purchase or Lease of these properties:

"*Purchasers/tenants are advised that sound levels due to increasing road traffic may continue to be of concern, occasionally interfering with some activities of the dwelling occupants as the sound level exceeds the Municipality's and the Ministry of the Environment and Climate Change sound level criteria*".

*"The sound levels due the mechanical equipment on the roofs of the nearby Hydro Substation have been measured and predicted to be in compliance with the Ministry of Environment and Climate Change during the day, evening, and night, and that on occasions, such noise may be occasionally audible to the occupants."*

The following warning clause should be registered in all Development Agreements and Offers of Sale and Purchase or Lease of these properties having a balcony:

"*Purchasers/tenants are advised that despite the inclusion of noise control features within this development and within the dwellings, sound levels from increasing road traffic will continue to be of concern as the levels in the balcony/terraces exceed the Ministry of the Environment and Climate Change criteria*".

## 4. Building Acoustic Insulation

All exterior building components (walls, windows and doors) for the proposed apartment building should meet the minimum Acoustic Insulation Factors (AIF) shown in Tables 3 and 4. All windows should be well fitted and weather-stripped.

It is also the responsibility of the developer/builder responsible for final design and construction of the subject dwellings to ensure that the correct windows, walls and doors acoustic specifications are secured from the Acoustical Engineer prior to planning and construction of the noted dwellings.

Typical Acoustic Insulation Factors (AIF) are shown in Tables 3 and 4. The Detailed Noise Control Study should provide complete and specific tabulations of AIF's for all properties affected.

*3 Reference should be made to Bulletin No. 91003, Environmental Warnings/Restrictions, Ontario Ministry of Consumer and Commercial Relations.

It is also the responsibility of the developer/builder responsible for final design and construction of the subject dwellings to ensure that the correct windows, walls and doors acoustic specifications are secured from the Acoustical Engineer prior to planning and construction of the noted dwelling(s).

## 5. Potential Noise Impact of the Proposed Building on the Neighbourhood

High-rise residential building such as the one under consideration may require the installation of central HVAC equipment, which is predicted to exceed the applicable MECP sound level criteria without the application of noise control measures to suit. Accordingly, this issue should be addressed in more detail prior to the issuance of a building permit, at which time more information would become available regarding the details of the proposed building construction and the type of mechanical systems to be used in such building. Therefore, it is recommended that detailed considerations be given by the project professionals to this issue prior to issuance of a building permit.

## 6. Implementation Procedures

a) Prior to the issuance of the building permit, a Detailed Noise Control Study, or an upgraded noise study should be required to take into consideration the following:
   - The proposed detailed grading plans
   - Final lot layout, changes, etc.
   - Possible changes to the proposed building location
   - The exact distances to all sources of concern
   - Other relevant conditions to noise in the Development Agreement
   - Detailed mechanical equipment information

b) The necessary Development Agreement(s) should include the details of all the necessary noise control measures and procedures as outlined herein this noise study to the satisfaction of all concerned parties.

c) Prior submission of the project plans for Building Permit, the Builder's plans, with respect to the units requiring noise control measures as referred to earlier, should be certified by an Acoustical Engineer as being in conformance with the recommendations of the Detailed Noise Control Study as approved and/or amended by the authorities having jurisdiction.

d) Prior to their final inspection and release for occupancy, this building should be certified by an Acoustical Engineer as being in compliance with the recommendations of the Detailed Noise Control Study.

In view of the fact that municipal implementation procedures of the noise control measures recommended herein may differ, it is the responsibility of the developer/builder responsible for final design and construction of the

subject structures/dwellings to ensure that the correct details related to the noise control measures referred in this report, such as sound barriers, building shell component specifications (windows, walls, doors, and others), air conditioning noise control technical requirements, etc. are secured from the Acoustical Engineer prior to planning and construction of the noted building(s).

## 3.0 SOUND LEVEL CRITERIA

### 3.1 SURFACE TRANSPORTATION CRITERIA[4]

The surface transportation noise is based on the objective sound levels recommended by the Ministry of the Environment and Climate Change (Ref: MECP Publication NPC-300 "Environmental Noise Guideline, Noise Assessment Criteria for Stationary Sources and for Land Use Planning, 2013") and applicable Regional/Municipal sound level standards and procedures for different land uses and spaces.

The following is a summary of the applicable sound level criteria for surface transportation sources for the shown time periods (day=d & night=n):

**Sound Level Limits for Outdoor Living Areas (OLAs)**

| AREA & TIME PERIOD | $L_{Aeq(day)}$ ROAD AND RAIL (dBA) |
|---|---|
| Designated (Individual or common) Outdoor Living Areas (16 hr day(d), 07:00 - 23:00) | $L_{Aeq(day)}$ 55 |

**Indoor Sound Level Limits**

| Type of Space | $L_{Aeq}$ (Time Period) (dBA) | |
|---|---|---|
| | Road | Rail |
| Living/dining, den areas of residences, hospitals, nursing homes, schools, daycare centres, etc. (Time period-day: 16 hr(d), 07:00 - 23:00) | $L_{Aeq(day)}$ 45 | $L_{Aeq(day)}$ 40 |
| Living/dining, den areas of residences, hospitals. nursing homes, etc. (except schools or daycare centres) (Time period-night: 8 hr(n), 23:00 - 07:00) | $L_{Aeq(night)}$ 45 | $L_{Aeq(night)}$ 40 |
| Sleeping quarters (Time period-day: 16 hr, 07:00 - 23:00) | $L_{Aeq(day)}$ 45 | $L_{Aeq(day)}$ 40 |
| Sleeping quarters (Time period-night: 8 hr, 23:00 - 07:00) | $L_{Aeq(night)}$ 40 | $L_{Aeq(night)}$ 35 |

[4] Road, rail and rolling stock traffic.

**Additional Supplementary (Best Management Practices) Sound Level Criteria Recommended for Other Uses**

| Type of Space | $L_{Aeq}$ (Time Period) (dBA) | |
|---|---|---|
| | Road | Rail |
| General offices, reception areas, retail stores, etc.<br>(Time period-day: 16 hr, 07:00 - 23:00) | $L_{Aeq(day)}$ 50 | $L_{Aeq(day)}$ 45 |
| Living/dining areas of residences, hospitals, schools, nursing/retirement homes, daycare centres, theatres, places of worship, libraries, individual or semiprivate offices, conference rooms, reading rooms, etc.<br>(Time period-day: 16 hr, 23:00 - 07:00) | $L_{Aeq(day)}$ 45 | $L_{Aeq(day)}$ 40 |
| Sleeping quarters of hotels/motels<br>(Time period-night: 8 hr, 23:00 - 07:00) | $L_{Aeq(night)}$ 45 | $L_{Aeq(night)}$ 40 |
| Sleeping quarters of residences, hospitals, nursing/retirement homes, etc.<br>(Time period-night: 8 hr, 23:00 - 07:00) | $L_{Aeq(night)}$ 40 | $L_{Aeq(night)}$ 35 |

The criteria for acceptable outdoor and indoor sound levels are based on “free-field” predicted and/or measured sound levels at the applicable receiver locations, thus the effects of sound reflections and reverberant sound fields are not considered.

If the sound level is less than or equal to the sound level criteria, no control measures will be required.

The outdoor sound levels ***may*** exceed the outdoor sound level criterion by up to 5 decibels, provided that it can be demonstrated that it is not technically, economically or administratively feasible to achieve the criterion and that the occupants are informed of a potential disturbance due to the excess noise by means of a warning clause or cautionary note to be registered in all Development Agreement(s) and Offers of Sale and Purchase or Lease.

Central air conditioning is required when the nighttime sound level at the outside wall of the sleeping quarters or bedrooms is equal to or exceeds $L_{Aeq(night)}$ 8hrs 60 dBA or when the daytime sound level at the outside wall of the Living/Dining/ Recreation space is equal to or exceeds $L_{Aeq(day)}$ 16 hrs 65 dBA.

If the nighttime sound level at the outside wall exceeds $L_{Aeq(night)}$ 50dBA but is less than 60dBA, or if the daytime sound level at the outside wall exceeds 55dBA but is less than $L_{Aeq(day)}$ 65dBA, then forced air heating with provision for future

installation of central air conditioning is required.

**Application of Criteria**

The following table summarizes the requirements for noise control measures for the various sound level ranges:

| SOURCE OF NOISE | DAYTIME SOUND LEVEL $L_{Aeq(day)}$ | NIGHTTIME SOUND LEVEL $L_{Aeq(night)}$ | AIR COND. | FORCED AIR VENTILATION WITH PROVISION FOR FUTURE AIR COND. | WARNING CLAUSE | ACOUSTIC INSULATION |
|---|---|---|---|---|---|---|
| ROAD | <=55 | <=50 | - | - | - | - |
| | >55 & <=65 | >50 & <=60 | - | Yes | Yes "Type C" | - |
| | >65 | >60 | Yes | - | Yes "Type D" | Yes |
| RAIL | <=55 | <=50 | - | - | - | - |
| | >55 & <=60 | >50 & <=55 | - | Yes | Yes "Type C" | - |
| | >60 & <=65 | >55 & <=60 | - | Yes | Yes "Type C" | Yes |
| | >65 | >60 | Yes | - | Yes "Type D" | Yes |

## 3.2 CRITERIA FOR STATIONARY NOISE SOURCES

The following criteria apply to the impact of Stationary Sources of noise as defined by the MECP to include industrial and commercial facilities. The criteria apply to the impact of Stationary Sources external to the development on the proposed development or to the impact of any proposed Stationary Sources internal to the development on the development itself.

The criteria used in this study are based on the objective sound levels recommended by the Ministry of the Environment and Climate Change (Ref.: MECP Publication NPC-300 “Environmental Noise Guideline, Noise Assessment Criteria for Stationary Sources and for Land Use Planning, 2013) and other relevant publications.

For sound from a stationary source, including Quasi-Steady Impulsive Sound but not including other impulsive sound, the predicted and/or measured “predictable worst case” 1-hour equivalent sound levels ($L_{Aeq1hr}$) of the stationary source(s) at a point of reception is the higher of the applicable exclusion limit value (given in the following tables) or the background sound level for that point of reception. The outdoor sound level limits for stationary sources apply only to daytime and

evening (07:00 – 23:00 hours).

**Exclusion[5] Limit Values of One-Hour Equivalent Sound Level ($L_{Aeq}$, dBA) Outdoor Points of Reception**

| Time of Day | Class 1 Area | Class 2 Area | Class 3 Area | Class 4 Area |
|---|---|---|---|---|
| 07:00 – 19:00 | 50 | 50 | 45 | 55 |
| 19:00 – 23:00 | 50 | 45 | 40 | 55 |

**Exclusion Limit Values of One-Hour Equivalent Sound Level ($L_{Aeq}$, dBA) Plane of Window of Noise Sensitive Spaces**

| Time of Day | Class 1 Area | Class 2 Area | Class 3 Area | Class 4 Area |
|---|---|---|---|---|
| 07:00 – 19:00 | 50 | 50 | 45 | 60 |
| 19:00 – 23:00 | 50 | 50 | 40 | 60 |
| 23:00 – 07:00 | 45 | 45 | 40 | 55 |

[5] or the minimum hourly background (ambient) sound level $LAeq_{1hr}$, whichever is higher

# 4.0 ANALYSIS

## 4.1 TRANSPORTATION SOURCES OF NOISE

The relevant road and traffic data were obtained from Paradigm Transportation Solutions Limited, and are summarized below:

- Martha Street

| | |
|---|---|
| Current No. of Lanes | 2 |
| Future No. of Lanes | 2 |
| Posted Speed Limit | 40 km/hr. |
| AADT (Year 2017) | 3750 vpd |
| Future AADT(Year 2031)<br>– Annual Growth Rate (Assumed)<br>– Number of Years of Growth (Assumed) | 5299 vpd<br>2.5 %<br>14 years |
| Total Truck Percentage (Assumed)<br>– Medium Truck Split (Observed)<br>– Heavy Truck Split (Assumed) | 2 %<br>1 %<br>1 % |
| Day(16 hrs.)/Night(8 hrs.) Split (Assumed) | 90 %/ 10 % |
| Directional Traffic Split (Assumed) | 50 %/ 50% |
| Road Gradient (Assumed) | 2 % |

Appendix A contains the relevant road traffic data used in this study.

## 4.2 OUTDOOR NOISE ENVIRONMENT

Sound level predictions were carried out based on MECP's ORNAMENT and STEAM sound level prediction modeling procedures[6] (Ontario Road Noise Analysis Method for Environment and Transportation, Technical Document, 1989 and STEAM, Sound from Trains Environmental Analysis Method, 1990).

The representative receptor location was taken at the worst case scenario location, which consists of the top-storey West Façade as the receptor location.

In consideration of the calculations, it is concluded that for the balcony located on the 1st floor, the unattenuated daytime sound levels in the designated COLA will not exceed 60 dBA, the maximum criteria levels allowed. Therefore, no outdoor noise control measures are required for this OLA.

In consideration of the calculations, it is concluded that for the outdoor terrace located on the 5th storey, the unattenuated daytime sound levels in the

[6] The MECP's noise prediction models ORNAMENT and STEAM have a limitation as to the minimum AADT value for 24 hour traffic volume (calculated for the daytime and nighttime hourly volume). When the AADT value is less that 40 vph, there is a neutral mathematical manipulation that can be used as long as the hourly traffic volume is not very low. The manipulation is implemented by multiplying the traffic volume by any reasonable factor (for example a factor of 10) and then by deducting 10 x log "factor" from the results (in this case, 10 x log 10=10).

designated COLA will exceed the objective sound level 55 dBA. Therefore, outdoor noise control measures are recommended for this OLA.

The analysis presented earlier demonstrated that the established sound levels in the Outdoor Living Areas during the daytime at the higher levels where balconies/terraces may exist are likely to exceed the MECP OLA criteria. Based on the MECP guidelines, the balconies for the proposed development are not considered as OLAs due to the existence of the following condition(s):

a) Indoor/outdoor living areas for common use are provided within the development.
b) The depth of the balcony is less than 4 m.
c) Balconies are located outside the exterior building façade.

No physical mitigation measures are, therefore required and a warning clause registered in the Development Agreement(s) will suffice. The Architectural plans of the dwellings in question should provide direct access from the indoor areas to the front yard OLA (e.g. by using a patio door).

## 4.3 INDOOR NOISE ENVIRONMENT

The criteria for indoor $L_{Aeq}$ sound levels are based on projected $L_{Aeq}$ levels at the outside face of the dwellings with appropriate assumptions for the differences between the outdoor and indoor sound levels. If the outside $L_{Aeq}$ levels do not exceed the recommended objective sound levels, then the indoor $L_{Aeq}$ levels will not be exceeded, assuming standard building construction and operable windows.

Overall daytime sound levels at the building facades are shown in Table 3 and the overall nighttime sound levels at the building facades are shown in Table 4.

In consideration of the estimated sound levels and by comparison to the acceptable indoor sound level criteria (Section 3) the following is concluded:

- The daytime/nighttime noise environment at the outside walls of the following receptors (within any habitable room on any floor) is predicted to be in the range of $L_{Aeq\ day}$ 56-65 dBA and/or $L_{Aeq\ night}$ 51-60 dBA:

  Forced-air heating system with provision for central air conditioning is therefore required.

Typical Acoustic Insulation Factors (A.I.F.) are summarized in Tables 3 and 4.

Additional Notes Regarding Air Conditioning Systems in Apartment Buildings

Based on the Sound Level Criteria and the established future sound levels, it was

concluded that some of the dwelling units in the apartment building(s) within the proposed development may require air conditioning and/or provision for future installation of air conditioning.

There are several techniques available to air condition apartment units using either a system central to the entire building or alternatively each apartment unit would have its own central system including the indoor fan and the outdoor condensing unit.

As it is not the subject of this report to discuss the specifics of all systems that may be used, the following comments are offered, to assist the proponent, the Mechanical Engineer and the Contractor in appreciating the acoustical problems and concerns associated with some of the commonly available commercial air conditioning systems:

1. The location and the design of the central system (cooling tower, condensing unit, openings in mechanical rooms, etc.) are important elements that should be checked by the Mechanical Engineer in order to achieve the stated outdoor and indoor sound level criteria.
2. Air conditioning units central to each individual apartment unit should also be designed by the Mechanical Engineer to meet the objective sound levels. If split-systems are used, then the location of the outdoor units should be selected to avoid outdoor living areas and the windows of habitable spaces. Other noise control measures available include quieter makes, the use of sound barriers, etc. If through the wall incremental units are used, then the selected incremental units should have the following features in order to reduce the transmission of high outside noise levels into the suites:
   a) The partition in the heating/cooling chassis should be of the acoustically sealed type (this partition separates the outdoor and indoor components).
   b) The unit should preferably be of the insulated “double casing design”.
   c) The interior of the unit should be acoustically lined.
   d) The perimeter of the sleeve should be caulked all around with acoustical sealant.
   e) The unit may be placed through the living room wall and ducts extended to the adjoining bedroom or dining room in accordance with manufacturers recommendations.

## 4.4 TYPICAL WINDOW / WALL CONSTRUCTION

As the detailed architectural plans are not available at this time, we have made certain assumptions based on typical building designs. Since the highest $L_{Aeq}$ (day) and/or $L_{Aeq}$ (night) are calculated to be equal to or lower than 65 dBA and/or 60 dBA respectively, it is expected that standard window glazing, doors and exterior walls meeting the requirements of the Ontario Building Code will be sufficient for this project. The worst case analysis assumes maximum ratios of window area to floor area of 32% and 20% for living/dining room and bedrooms

respectively which should not be exceeded in order for this analysis to remain valid.

It must be pointed out that there are several factors affecting the final glass selection including:

1. Size of window.
2. Room dimensions.
3. Floor level and direction room faces.
4. Fixed or operable glass.
5. The number of building components.
6. Type of wall to be used.
7. Projected sound levels outside the window.

As the information above are typical examples only, therefore, prior to submission of the building plans for building permit, we recommend that the detailed architectural drawings of the units requiring noise control measures, as referred to earlier, be examined by the Acoustical Engineer in order to advise the design consultant on the project specific building components for noise control.

The resulting sound levels due to large central air conditioners associated with apartment and other buildings should not exceed the Ministry of the Environment and Climate Change sound level criteria included in their Publications NPC-300 and NPC-233. Noise control measures for large central air conditioning systems include any or a combination of the following:

a. Directing the air intake and discharge openings away from the noise-sensitive receptors.
b. The use of partial and/or full enclosures.
c. Using parts of the building as sound barrier.
d. The use of silencers and/or acoustic louvers on air discharge and intake openings.
e. Distance setback.

**It is also our recommendation that the necessary detailed technical analysis be performed prior to the certification process for Building Permit to address the specific requirements for the control of the selected air conditioning system to meet the sound level criteria at the point(s) of reception and to include same in the applicable permit drawings/ specifications.**

**Indoor Sound Levels**

While the control of the indoor noise created by the air conditioning equipment is not the direct subject of this study, it is important that the selected and designed air conditioning systems achieve indoor sound levels that meet the

OBC/ASHRAE criteria and be at least 5dB lower than the Ministry of the Environment and Climate Change recommended indoor sound level criteria included in Section 3.0 of this study.

## 4.5 STATIONARY SOURCES OF NOISE EXTERNAL TO THE PROPOSED DEVELOPMENT

### 1. Introduction

The proposed development is an 11 Storey multi-residential building with four levels of underground parking. The common noise sources of concern from the external sources near the proposed development are defined in this section.

### 2. Description of the Sources of Stationary Noise

The main stationary sources of noise affecting the subject building are as follows:

1. Transformer Substation building located toward the west of the subject development.
2. The Air Conditioning equipment serving the Church building beyond the transformer substation towards the west.
3. The rooftop HVAC equipment serving the residential apartment building located east of the proposed development.

Figure 5 shows the location of the subject sources of stationary noise.

### 3. Points of Reception

To determine the level of noise impact, the nearest and most exposed outdoor areas and building facades to the sources of noise are selected to represent the worst-case scenarios. The following receptor locations were taken:

R1: 2$^{nd}$ Floor West Façade of Proposed Development
R2: 11$^{th}$ Floor South Façade of the Proposed Development

Figure 6 shows the location of the points of reception.

### 4. Description of the Sources of Ambient Noise

The land use and character of the areas near the subject site is essentially urban. This is due to its proximity to Martha Street, which qualify the area as a Class 1 Area (Urban) based on the MECP definition. The traffic data provided by Paradigm Transportation Solutions Limited determined that the road traffic

count relevant to the proposed development is low in volume.

## 5. Measurement Equipment

The attended sound level measurements of the air conditioning units for the church building were performed using the following equipment:

- Rion NA-28, Type 1 Precision Integrating Sound Level Meter and Real Time Frequency Analyzer fitted with 1/1 & 1/3 Octave Bands filters and a 1/2" condenser microphones c/w windscreen.
- Bruel & Kjaer Precision Calibrator Model B&K 4231.

The unattended sound level measurements for road noise and the transformer substation were performed using the Rion NL-22, Type 2 Integrating Sound Level Meter fitted with 1/2" condenser microphone, a preamplifier and a windscreen.

The equipment was contained in weather-protected environmental casings with the microphones mounted on extension booms.

The sound level measurement procedures were primarily based on the Ministry of Environment procedures in their Publication NPC-103 "Procedures" included in the Model Municipal Noise Control by-Law, the recommendations of the instrument manufactures and the best engineering practices to suit site specific conditions. The sound level meters were checked and calibrated before, during and following completion of the measurement sessions without any appreciable change in the sound levels.

The weather conditions during the measurement sessions were favourable for measurements as the local wind speed did not exceed 30 km/hr and there was no precipitation.

Figure 7 illustrate the locations of the long term sound level measurements

## 6. Sound Level Calculations Model

A 3-D computer program[7] for multiple point and line sources and multiple receivers developed by SS Wilson Associates was used to calculate the sound levels. The program takes into account:

- Reference sound levels and reference distances for the equipment working in each area of the subject development, i.e. sound emission levels.

[7] The model used by SSWA to predict the sound levels due to Stationary Sources in this report is a proprietary prediction spreadsheet program developed by SSWA and is primarily based on the ISO 9613-2 publication recognized by the MECP as an acceptable method for sound level predictions.

- The Cartesian co-ordinates (x, y & z) of all sources and receivers.
- The number of events or occurrences of the noise in a given time period and the time period of each event.
- Spherical divergence factor.
- Additional attenuation due to sound barriers; natural or man-made types.
- Additional attenuation due to ground (as modified by sources/receiver elevations, the presence of intervening barriers and the type of ground).
- Atmospheric attenuation due to air molecular absorption.

For the purposes of this study, tonal sound level adjustments +5db were applied to the measured transformer sound emission levels In accordance with the MECP procedures into the overall analysis of the Leq.

## 7. Established Ambient Sound Levels

Due to the absence of hourly traffic data, the MECP stationary exclusion sound level limits will be the required criteria to meet:

Daytime: 50 dBA
Evening: 50 dBA
Night: 45 dBA

Figure 8 shows the relative location of the points of reception with respect to the exclusion limits

## 8. Established Stationary Source Sound Levels

The sound levels from the two main stationary sources of noise of concern are as follows:

a. Church Building
The most audible and nearby source of noise measured during the field visit were the two air conditioning units serving the Church building located approximately 85 meters away from the subject building. The following are the measured sound levels:

- AC-1: Sound Level of 61dBA @15m
- AC-2: Sound Level of 59dBA @ 15m

b. Transformer Substation
The Transformer building is located approximately 35 meters away from the subject building with an opened section from the top where the transformer is located. During the field measurements, the Transformer was not audible. In order to measure the sound levels

from the transformer, an unattended sound level monitor was used to measure the sound levels emitted by the Transformer. Based on approximately four days of unattended sound level data, it was evident that the lowest sound level of this transformer was 46dBA @ 15m.

The details related to the establishment of the source sound levels are included in Appendix A.

Figure 8 illustrates the location of the stationary sources of noise

### 9. Impact Assessment and Findings

The following is a summary of the resulting sound level impact, with no mitigation, at each of the selected receptors:

| Point of Reception ID | Point of Reception Description | Sound Level at Point of Reception Leq(1h) | Applicable MECP Criteria | Compliance with MECP Criteria |
|---|---|---|---|---|
| R1 | 2nd Storey Plane of Window | 46 dBA Day<br>43 dBA Evening<br>45 dBA Night | 50dBA Day<br>50dBA Evening<br>45dBA Night | Yes<br>Yes<br>Yes |
| R2 | 11th Storey Plane of Window | 47 dBA Day<br>44 dBA Evening<br>45 dBA Night | 50dBA Day<br>50dBA Evening<br>45dBA Night | Yes<br>Yes<br>Yes |

Figure 6 illustrates the locations of the receptors.

The established sound levels at the selected points of reception are predicted to meet the MECP's applicable sound level criteria during the daytime, evening and night.

## 4.6 STATIONARY SOURCES OF NOISE INTERNAL TO THE PROPOSED DEVELOPMENT

### 1. Introduction

This section of the report addresses the potential noise impact from the proposed building to the internal and external noise sensitive land-use areas. Typical, a high-rise residential building such as the development under consideration also contain stationary source such as rooftop Heating Ventilation and Air Conditioning (HVAC) equipment, underground garage exhaust fans leading to the outside to expel the exhaust fumes from the underground parking levels though a shaft to the outside.

At this preliminary stage of the planning process, the detailed specifications and locations of such equipment are seldom available, however to ensure that future

consideration will be given to their potential impact, the following subsections provide typical and realistic sound levels predictions of such equipment.

## 2. Air Conditioning and Ventilation

The multi-storey residential building consists of 141 units as well as other common areas such as corridors and party rooms, which requires heating and cooling. Typically, there are three types of suite A/C units that may be used:

1. The use of a central A/C system that is central to the entire building whereby a large chiller, condenser (or fluid cooler/air-cooled condenser), pumps, etc. are used. The general location of such system is commonly on the roof of the subject building. Noise control of the referenced equipment is a straightforward design exercise whereby the engineers can make use of several standard provisions for noise control. The provisions include the use of silencers, acoustic louvers, acoustic shielding by the structure, low noise emission levels equipment, etc. All of such measures are fairly straightforward as far as selection, design, and specifications. Accordingly, the details such measures can be specified in due course suitable for this land use application.

2. For many types of buildings and for the purposes of independent energy metering for individual suites, a packaged HVAC unit that is considered central to each suite is installed within each suite in a small closet with access to the outside for heat exchange and for gas heating vents. Each closet serving one suite contains a louver to the outside for condenser intake and discharge, as well as for natural gas exhaust vents. Of concern is the potential cumulative noise impact when several of such A/C units operate simultaneously during the day and night in the hot season, thus affecting the adjoining neighbours.

3. The other alternate means for central air conditioning of apartment units in relatively low-rise apartment buildings and stacked townhouses is to use split-system heating/cooling units where the condenser is located on the roof of the building along with other condensing units serving the other neighbours in the same building or on each balcony in the suite. The evaporative coils are located in a small enclosure within the suite with access to the outside for combustion exhaust release (not usually of concern). The multiple condensing unit installation on the roof or the cumulative balcony noise potential is the source of environmental noise affecting the neighbours and other nearby residential dwellings.

At the present time, there is no information available on the type of Heating, Ventilation, and Air Conditioning system to be used. Therefore, the cumulative noise impact of the Apartment Building is determined using noise prediction model based on reasonable technical assumptions and based on information extracted from the building plan and elevation drawings. The following is a

summary of the predictions/assumptions made regarding the potential noise sources:

Cooling Tower

Overhead Sound Level Emission: 81 dBA at 1.5m

Fan Side Sound Level Emission: 72 dBA at 1.5m

Garage Exhaust Shaft

Garage Exhaust Shaft Sound Emission: 89 dBA at 1m

In general, the high density building with multiple HVAC units will have to meet the Ministry of the Environment and Climate Change limits summarized as follows: $L_{Aeq(1hr,day)}$ 50dBA, $L_{Aeq(1hr,evening)}$ 50dBA, and $L_{Aeq(1hr,night)}$ 45dBA (or the ambient sound levels due to road traffic, if higher).

For the subject building, the near-by noise sensitive receptors may be affected by the predicted sound levels summarized below, (the prediction sheets are included in Appendix C):

**POR 1**: West-building façade of the 12$^{th}$ Storey residential building located at 395 Martha St.
**POR 2**: North façade of the townhouse located at 410 Martha St.
**POR 3**: East façade of the apartments located at 431 Martha St.
**POR 4**: West façade of the apartments located on Harris Crescent
**POR 5**: 1$^{st}$ Floor East façade of the Proposed Development

Figure 9 illustrates the locations and the predicted unmitigated sound levels at the closest point of receptors.

The following is a summary of the resulting sound level assessment, without mitigation at each of the selected receptors:

**POR 1**: $L_{Aeq1hr}$ 51dBA day, 49dBA evening and 48dBA night
**POR 2**: $L_{Aeq1hr}$ 53dBA day, 53dBA evening and 53dBA night
**POR 3**: $L_{Aeq1hr}$ 39dBA day, 38dBA evening and 37dBA night
**POR 4**: $L_{Aeq1hr}$ 55dBA day, 53dBA evening and 52dBA night
**POR 5**: $L_{Aeq1hr}$ 69dBA day, 67dBA evening and 66dBA night

In conclusion, the unattenuated sound levels are predicted to exceed the MECP criteria for the selected receptors. Therefore, outdoor noise control measures will be required unless consideration is given by the project consultants to these issues during the detailed design stage.

For this assumed scenario, typical recommendations include implementing a silencer and louvres onto the rooftop cooling tower, and acoustic liner for the

garage exhaust fan shaft. The following predicted sound levels are the sound levels predicted assuming these noise control measures are implemented:

**POR 1**: $L_{Aeq1hr}$ 42dBA day, 42dBA evening and 42dBA night
**POR 2**: $L_{Aeq1hr}$ 37dBA day, 37dBA evening and 37dBA night
**POR 3**: $L_{Aeq1hr}$ 34dBA day, 34dBA evening and 33dBA night
**POR 4**: $L_{Aeq1hr}$ 41dBA day, 41dBA evening and 41dBA night
**POR 5**: $L_{Aeq1hr}$ 49dBA day, 47dBA evening and 46dBA night

Figure 10 illustrates the sound level contours with the inclusion of typical noise control mitigation measures.

**Conclusions and Recommendation**

High-rise residential building such as the one under consideration will certainly require the installation of HVAC equipment, which is predicted to exceed the applicable MECP sound level criteria without the application of noise control measures to suit. Accordingly, this issue should be addressed in more details during the issuance of the building permit stage, at which time more information would become available regarding the details of the proposed building construction and the type of mechanical systems to be used in such building. In reviewing the sound levels predicted at the nearest receptors as well as the type of noise emitted from the source, it is our professional opinion that it is feasible to attenuate the stationary noise sources to meet the specified criteria, with the following typical noise mitigation measures:

1. Incorporate acoustic liner within the garage exhaust fan shaft.
2. Incorporate a silencer and acoustic louvres onto the rooftop cooling tower unit.

Therefore, it is recommended that detailed considerations be given by the project professionals to this issue prior to the issuance of the building permit.

## 4.7 Important Notes for the Residential Builder Regarding Windows

The results in this report provide information on the calculated Acoustic Insulation Factors (AIF) for windows based on typical assumed window and room dimensions.

To assist the Builder in appreciating the fact of whether the results presented herein require typical commercially available residential type windows, or special type windows, the following table[8] provides reasonably accurate information on whether such window(s) are standard industry window or not:

[8] Based on a typical commercially available glazing: 3mm inside pane, 16mm inter-pane air space & 3mm exterior pane.

| Acoustic Insulation Factor (AIF) in this report | 35 | 34 | 33 | 32 | 31 | 30 | 29 | 28 | 27 | 26 |
|---|---|---|---|---|---|---|---|---|---|---|
| Window to room floor area percentage NOT to be exceeded | 10% | 13% | 16% | 20% | 25% | 32% | 40% | 50% | 63% | 80% |

If the above ratios are exceeded, several options are available to the builder including one or more of: reducing the size of the window, increasing the inter-pane air spacing, the use of thicker glazing, the use of "laminated" glazing (1 or 2 panes), etc.

**WORKED EXAMPLE 1:**

- AIF shown in this study: 31
- Actual room floor area: 250 sq.ft.
- You selected a window area of: 45 sq.ft
- Your window/floor ratio: (45 divided by 250, then times 100) =18%
- Your result is less than above table value 25%; i.e. standard glazing unit

**WORKED EXAMPLE 2:**

- AIF shown in this study: 34
- Actual room floor area: 200 sq.ft.
- You selected a window area of: 50 sq.ft
- Your window/floor ratio: (50 divided by 200, then times 100) =25%
- Your result is more than above table value 13%; i.e. Non-standard (special) glazing unit

## 4.8 Abbreviations

| Basic Descriptor | Measurement Weighting | Time Weighting Characteristics<br>**F**(Fast). **S**(Slow). **I**(Impulse). |
|---|---|---|
| **$L_p$ Sound pressure level** | A-Weighted sound pressure level | $L_{AF}$, $L_{AS}$, $L_{AI}$ |
| | C-Weighted sound pressure level | $L_{CF}$, $L_{CS}$, $L_{CI}$ |
| | Z-Weighted sound pressure level(Flat) | $L_{ZF}$, $L_{ZS}$, $L_{ZI}$ |
| **$L_{eq}$ Equivalent continuous sound level** | Equivalent continuous A-weighted sound level | $L_{Aeq}$, $L_{AIeq}$ |
| | Equivalent continuous C-weighted sound level | $L_{Ceq}$, $L_{CIeq}$ |
| | Equivalent continuous Z-weighted(Flat) sound level | $L_{Zeq}$, $L_{ZIeq}$ |
| **$L_E$ Sound Exposure Level** | A-Weighted sound exposure Level | $L_{AE}$, $L_{AIE}$ |
| | C-Weighted sound exposure Level | $L_{CE}$, $L_{CIE}$ |
| | Z-Weighted sound exposure Level(Flat) | $L_{ZE}$, $L_{ZIE}$ |
| **$L_{max}$, $L_{min}$ Maximum Sound Level** | Maximum A-weighted sound level | $L_{AFmax}$, $L_{ASmax}$, $L_{AImax}$ |
| | Maximum C-weighted sound level | $L_{CFmax}$, $L_{CSmax}$, $L_{CImax}$ |
| | Maximum Z- weighted sound level(Flat) | $L_{ZFmax}$, $L_{ZSmax}$, $L_{ZImax}$ |
| **$L_N$ Percentile Sound Level** | Percentile A-weighted sound level | $L_{AFNn}$, $L_{ASN}$, $L_{AIN}$ |
| | Percentile C-weighted sound level | $L_{CFNn}$, $L_{CSN}$, $L_{CIN}$ |
| | Percentile Z-weighted sound level(Flat) | $L_{ZFNn}$, $L_{ZSN}$, $L_{ZIN}$ |
| **$L_{peak}$ Peak Sound Level** | A-Weighted peak sound level | $L_{Apeak}$ |
| | C-Weighted peak sound level | $L_{Cpeak}$ |
| | Z-Weighted peak sound level(Flat) | $L_{Zpeak}$ |

# TABLES

## TABLE 1

## SUMMARY OF MINIMUM REQUIRED NOISE CONTROL MEASURES

| RECEPTOR | SOUND BARRIER | CENTRAL AIR CONDITIONING | PROVISION FOR CENTRAL AIR CONDITIONING | WARNING CLAUSE |
|---|---|---|---|---|
| Floors 1 to 11 | No | No | Yes | Yes |
| 5th Storey Terrace | Yes | - | - | Yes |

N6 Leq-AIF Master-Sept 12, 2017 **SS WILSON ASSOCIATES** Proceed

3/18/2019 12:12 **Leq- AIF CALCULATIONS AND TYPICAL WINDOW GLAZING REQUIREMENTS** (Using NRC/MOE Pocedure

File Number : WA17-061 **OUTDOORS**

Project Name : 401 to 417 Martha Street, Burlington **Table 2**

Description : Proposed Apartment Building Any Heavy Rail Line ? No

Description : 2413350 Ontario Ltd.

| Record Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Consider Record | Y | N | N | N | N | N | N | N | N | N | N | N |
| UNIT/LOT NO. | 11th Floor Terrace | | | | | | | | | | | |
| FACE/DIRECTION | South | | | | | | | | | | | |
| | | | | | | | | | | | | |
| **Martha Street** | Road Traffic | | OUTDOOR DAYTIME LEVELS | | | OUTDOOR DAYTIME LEVELS | | | OUTDOOR DAYTIME LEVELS | | | |
| **Leq Outdoors** | 58.00 | | | | | | | | | | | |
| Partial angle of exposure, degrees | 180 | | | | | | | | | | | |
| Partial exposure adjust., dB | | | | | | | | | | | | |
| Additional Adjustment, dB | -15.00 | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| **Sub-Total Leq, dBA** | 43.00 | | | | | | | | | | | |
| **Source 2: .....** | Road Traffic | | OUTDOOR DAYTIME LEVELS | | | OUTDOOR DAYTIME LEVELS | | | OUTDOOR DAYTIME LEVELS | | | |
| **Leq Daytime** | | | | | | | | | | | | |
| Partial angle of exposure, degrees | 180 | | | | | | | | | | | |
| Partial exposure adjust., dB | | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| **Sub-Total Leq, dBA** | | | | | | | | | | | | |
| **Source 3: .....** | Road Traffic | | OUTDOOR DAYTIME LEVELS | | | OUTDOOR DAYTIME LEVELS | | | OUTDOOR DAYTIME LEVELS | | | |
| **Leq Daytime** | | | | | | | | | | | | |
| Partial angle of exposure, degrees | 180 | | | | | | | | | | | |
| Partial exposure adjust., dB | | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| **Sub-Total Leq, dBA** | | | | | | | | | | | | |
| **Source 4: .....** | Road Traffic | | OUTDOOR DAYTIME LEVELS | | | OUTDOOR DAYTIME LEVELS | | | OUTDOOR DAYTIME LEVELS | | | |
| **Leq Daytime** | | | | | | | | | | | | |
| Partial angle of exposure, degrees | 180 | | | | | | | | | | | |
| Partial exposure adjust., dB | | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| **Sub-Total Leq, dBA** | | | | | | | | | | | | |
| **Sub-Tot. 4 Sources Leq, dBA** | **43.00** | | | | | | | | | | | |
| **Aircraft noise NEF/NEP** | | | | | | | | | | | | |
| Adjust.1 | | | | | | | | | | | | |
| Adjust.2 | | | | | | | | | | | | |
| Adjusted NEF/NEP | | | | | | | | | | | | |
| *Approx. Overall Combined Leq* | *43* | | | | | | | | | | | |
| ***Overall Road and/or Rail and/or Stationary Sources, Leq (dBA)*** | ***43*** | | | | | | | | | | | |
| ***Aircraft Noise Only, NEF*** | | | | | | | | | | | | |
| NOTES | 1.1m High Parapet Wall | | | | | | | | | | | |

| | N6 Leq-AIF Master-Sept 12, 2017 | SS WILSON ASSOCIATES | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/18/2019 12:12 | Leq- AIF CALCULATIONS AND TYPICAL WINDOW GLAZING REQUIREMENTS | | | | | | | | | | | |
| File Number : | WA17-061 | DAYTIME | | | | | | | (Using NRC/MOE Pocedures) | | | |
| Project Name : | 401 to 417 Martha Street, Burlington | Table 3 | | | | | | | | | | |
| Description : | Proposed Apartment Building | | | | | | | | | | | |
| Description : | 2413350 Ontario Ltd. | | | | | | | | | | | |
| Record Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Consider Record | Y | N | N | N | N | N | N | N | N | N | N | N |
| UNIT/LOT NO. | Floors 1-11 | | | | | | | | | | | |
| FACE/DIRECTION | South | | | | | | | | | | | |
| | | | | | | | | | | | | |
| ROOM CLASSIFICATION | Living /Dining | | | | | | | | | | | |
| Manual Adjust. to Criterion, | | | | | | | | | | | | |
| MOE Transportation Sources Daytime Leq Indoor Criteria, dBA | 45 | | | | | | | | | | | |
| Aircraft Indoor Criteria, NEF | 5 | | | | | | | | | | | |
| **Martha Street** | Traffic | | DAYTIME LEVELS | | | DAYTIME LEVELS | | | DAYTIME LEVELS | | | |
| **Leq Daytime** | 59.00 | | | | | | | | | | | |
| Partial angle of exposure, 1-180° | 180 | | | | | | | | | | | |
| Partial exposure adjust., dB | | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| **Sub-Total Leq, dBA** | 59.00 | | | | | | | | | | | |
| Caculated AIF | 21 | 31 | 27 | 29 | 38 | 30 | 38 | -38 | -38 | -38 | -38 | -38 |
| Angular range of incidence Case(0,12,3) | | | | | | | | | | | | |
| Adjusted AIF | 21 | 31 | 27 | 29 | 38 | 30 | 38 | -38 | -38 | -38 | -38 | -38 |
| **Source 2: .....** | Road Traffic | | DAYTIME LEVELS | | | DAYTIME LEVELS | | | DAYTIME LEVELS | | | |
| **Leq Daytime** | | | | | | | | | | | | |
| Partial angle of exposure, 1-180° | 180 | | | | | | | | | | | |
| Partial exposure adjust., dB | | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| **Sub-Total Leq, dBA** | | | | | | | | | | | | |
| Caculated AIF | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 |
| Angular range of incidence Case(0,12,3) | | | | | | | | | | | | |
| Adjusted AIF | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 |
| **Source 3: .....** | Traffic | | DAYTIME LEVELS | | | DAYTIME LEVELS | | | DAYTIME LEVELS | | | |
| **Leq Daytime** | | | | | | | | | | | | |
| Partial angle of exposure, 1-180° | 180 | | | | | | | | | | | |
| Partial exposure adjust., dB | | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| **Sub-Total Leq, dBA** | | | | | | | | | | | | |
| Caculated AIF | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 |
| Angular range of incidence Case(0,12,3) | | | | | | | | | | | | |
| Adjusted AIF | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 |
| **Source 4: .....** | Road Traffic | | DAYTIME LEVELS | | | DAYTIME LEVELS | | | DAYTIME LEVELS | | | |
| **Leq Daytime** | | | | | | | | | | | | |
| Partial angle of exposure, 1-180° | 180 | | | | | | | | | | | |
| Partial exposure adjust., dB | | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| **Sub-Total Leq, dBA** | | | | | | | | | | | | |
| Caculated AIF | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 |
| Angular range of incidence Case(0,12,3) | | | | | | | | | | | | |
| Adjusted AIF | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 | -38 |
| **Sub-Tot. 4 Sources Leq, dBA** | **59.00** | | | | | | | | | | | |
| **Aircraft noise NEF/NEP** | | | | | | | | | | | | |
| Adjust.1 | | | | | | | | | | | | |
| Adjust.2 | | | | | | | | | | | | |
| Adjusted NEF/NEP | | | | | | | | | | | | |
| *Approx. Overall Combined Leq* | *59* | | | | | | | | | | | |
| Assumed Window/ Floor Area % | 32.0 | | | | | | | | | | | |
| Assumed Total # of Components (Road, Rail, and Other Sources) | 3 | | | | | | | | | | | |
| Assumed Total # of Components Aircraft ONLY | 3 | | | | | | | | | | | |
| AIF of 4 Sources | *21* | | | | | | | | | | | |
| Aircraft AIF | | | | | | | | | | | | |
| Combined AIF | 21 | | | | | | | | | | | |
| Openable or Fixed windows ? | Fixed | | | | | | | | | | | |
| Regular or Laminated Glass | Regular | | | | | | | | | | | |
| Other Adjustment (dB,AIF), Specify | | | | | | | | | | | | |
| Final Adjusted AIF | 18 | | | | | | | | | | | |
| AIF for Line # 1 | 26 | | | | | | | | | | | |
| Line # (Min. set is Line 1) | 1 | | | | | | | | | | | |
| *Minimum STC (Approx)* | *19* | | | | | | | | | | | |
| Typical Minimum Double Glazing Alternatives | 3( 6 )3 | | | | | | | | | | | |
| NOTES | Forced Air Required | | | | | | | | | | | |

# SS WILSON ASSOCIATES

***SUMMARY TABLE OF*** **Leq- AIF CALCULATIONS AND TYPICAL WINDOW GLAZING REQUIREMENTS**

**WA17-061**

**401 to 417 Martha Street, Burlington**

**Proposed Apartment Building**

**2413350 Ontario Ltd.**

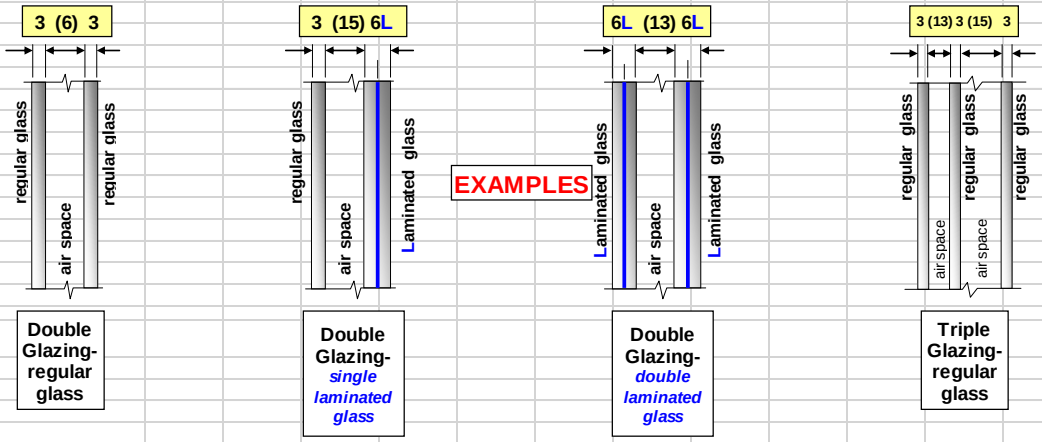
**DAYTIME**

**Table 3**

- Windows must be well-fitted weatherstripped units.
- The interpane spacing shown in the tables are the minimum acceptable.
- Larger spacing for a given glazing thickness normally improves the performance.

| UNIT/LOT NO. | FACE/DIRECTION | ROOM CLASSIFICATION | | Openable or Fixed Window | Regular Strength or Laminated Glass | Combined AIF | Approx. Overall Combined Leq | Double Glazing Alternatives , mm | | | Triple Glazing Alternatives , mm | | *Minimum STC (Approx)* |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Floors 1-11 | South | Living/Dining | | Fixed | Regular | 21 | 59 | 3( 6 )3 | | | | | *19* |
| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |
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| | | | | | | | | | | | | | |
| | | | | | | | | | | | | | |

ABBREVIATIONS SPECIFIC TO THIS PROJECT : FF(Front Face), RF(Rear Face), RS(Right Side face), LS(Left Side face)



| | N6 Leq-AIF Master-Sept 12, 2017 | SS WILSON ASSOCIATES | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3/18/2019 12:12 | | Leq- AIF CALCULATIONS AND TYPICAL WINDOW GLAZING REQUIREMENTS | | | | | | | | | | (Using NRC/MOE Poc |
| File Number : | WA17-061 | | | | NIGHT TIME | | | | | | | |
| Project Name : | 401 to 417 Martha Street, Burlington | | | | Table 4 | | | | | | | |
| Description : | Proposed Apartment Building | | | | | | | | | | | |
| Description : | 2413350 Ontario Ltd. | | | | | | | | | | | |
| Record Number | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 |
| Consider Record | Y | N | N | N | N | N | N | N | N | N | N | N |
| UNIT/LOT NO. | Floors 1-11 | | | | | | | | | | | |
| FACE/DIRECTION | South | | | | | | | | | | | |
| ..... | | | | | | | | | | | | |
| ROOM CLASSIFICATION | Bedroom | | | | | | | | | | | |
| Manual Adjust. to Criterion, | | | | | | | | | | | | |
| MOE Transportation Sources Night Leq Indoor Criteria, dBA | 40 | | | | | | | | | | | |
| Aircraft Indoor Criteria, NEF | | | | | | | | | | | | |
| **Martha Street** | Traffic | | NIGHT TIME LEVELS | | | NIGHT TIME LEVELS | | | NIGHT TIME LEVELS | | | |
| **Leq Night Time** | 53.00 | | | | | | | | | | | |
| Partial angle of exposure, degrees | 180 | | | | | | | | | | | |
| Partial exposure adjust., dB | | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| **Sub-Total Leq, dBA** | 53.00 | | | | | | | | | | | |
| Angular range of incidence (0,12,3) | | | | | | | | | | | | |
| Adjusted AIF | 20 | 33 | 25 | 28 | 36 | 29 | 36 | -33 | -33 | -33 | -33 | -33 |
| **Source 2: .....** | Road Traffic | | NIGHT TIME LEVELS | | | NIGHT TIME LEVELS | | | NIGHT TIME LEVELS | | | |
| **Leq Night Time** | | | | | | | | | | | | |
| Partial angle of exposure, degrees | 180 | | | | | | | | | | | |
| Partial exposure adjust., dB | | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| **Sub-Total Leq, dBA** | | | | | | | | | | | | |
| Angular range of incidence (0,12,3) | | | | | | | | | | | | |
| Adjusted AIF | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 |
| **Source 3: .....** | Traffic | | NIGHT TIME LEVELS | | | NIGHT TIME LEVELS | | | NIGHT TIME LEVELS | | | |
| **Leq Night Time** | | | | | | | | | | | | |
| Partial angle of exposure, degrees | 180 | | | | | | | | | | | |
| Partial exposure adjust., dB | | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| **Sub-Total Leq, dBA** | | | | | | | | | | | | |
| Angular range of incidence (0,12,3) | | | | | | | | | | | | |
| Adjusted AIF | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 |
| **Source 4: .....** | Road Traffic | | NIGHT TIME LEVELS | | | NIGHT TIME LEVELS | | | NIGHT TIME LEVELS | | | |
| **Leq Night Time** | | | | | | | | | | | | |
| Partial angle of exposure, degrees | 180 | | | | | | | | | | | |
| Partial exposure adjust., dB | | | | | | | | | | | | |
| Additional Adjustment, dB | | | | | | | | | | | | |
| **Sub-Total Leq, dBA** | | | | | | | | | | | | |
| Angular range of incidence (0,12,3) | | | | | | | | | | | | |
| Adjusted AIF | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 | -33 |
| **Sub-Tot. 4 Sources Leq, dBA** | **53.00** | | | | | | | | | | | |
| **Aircraft noise NEF/NEP** | | | | | | | | | | | | |
| Adjust.1 | | | | | | | | | | | | |
| Adjust.2 | | | | | | | | | | | | |
| Adjusted NEF/NEP | | | | | | | | | | | | |
| *Approx. Overall Combined Leq* | *53* | | | | | | | | | | | |
| Assumed Window/ Floor Area % | 20.0 | | | | | | | | | | | |
| Assumed Total # of Components (Road, Rail, and Other Sources) | 3 | | | | | | | | | | | |
| Assumed Total # of Components Aircraft ONLY | 3 | | | | | | | | | | | |
| AIF of 4 Sources | *20* | | | | | | | | | | | |
| Aircraft AIF | | | | | | | | | | | | |
| Combined AIF | 20 | | | | | | | | | | | |
| Openable or Fixed windows ? | Openable | | | | | | | | | | | |
| Regular or Laminated Glass | Regular | | | | | | | | | | | |
| Other Adjustment | | | | | | | | | | | | |
| Final Adjusted AIF | 20 | | | | | | | | | | | |
| *Minimum STC (Approx)* | *19* | | | | | | | | | | | |
| Typical Minimum Double Glazing Alternatives | 3(6)3 | | | | | | | | | | | |
| NOTES | Forced Air Required | | | | | | | | | | | |

# SS WILSON ASSOCIATES

***SUMMARY TABLE OF*** **Leq- AIF CALCULATIONS AND TYPICAL WINDOW GLAZING REQUIREMENTS**

**WA17-061**

**401 to 417 Martha Street, Burlington**

**Proposed Apartment Building**

**2413350 Ontario Ltd.**

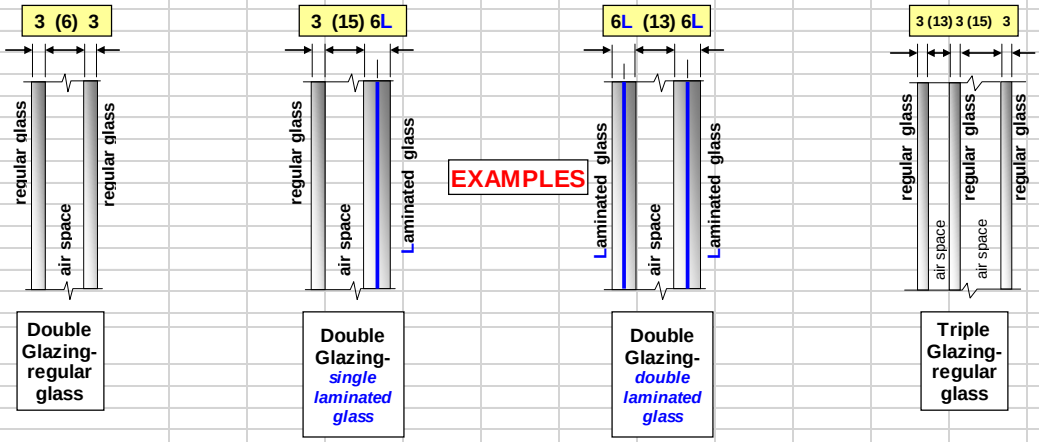
**NIGHT TIME**

**Table 4**

- Windows must be well-fitted weatherstripped units.
- The interpane spacing shown in the tables are the minimum acceptable.
- Larger spacing for a given glazing thickness normally improves the performance.

| UNIT/LOT NO. | FACE/DIRECTION | ROOM CLASSIFICATION | ..... | Openable or Fixed Window | Regular Strength or Laminated Glass | Combined AIF | Approx. Overall Combined Leq | Double Glazing Alternatives , mm | Triple Glazing Alternatives , mm | *Minimum STC (Approx)* |
|---|---|---|---|---|---|---|---|---|---|---|
| Floors 1-11 | South | Bedroom | | Openable | Regular | 20 | 53 | 3( 6 )3 | | *19* |
| | | | | | | | | | | |
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| | | | | | | | | | | |

ABBREVIATIONS SPECIFIC TO THIS PROJECT : FF(Front Face), RF(Rear Face), RS(Right Side face), LS(Left Side face)



# FIGURES




**FIGURE 1**
**KEY PLAN**

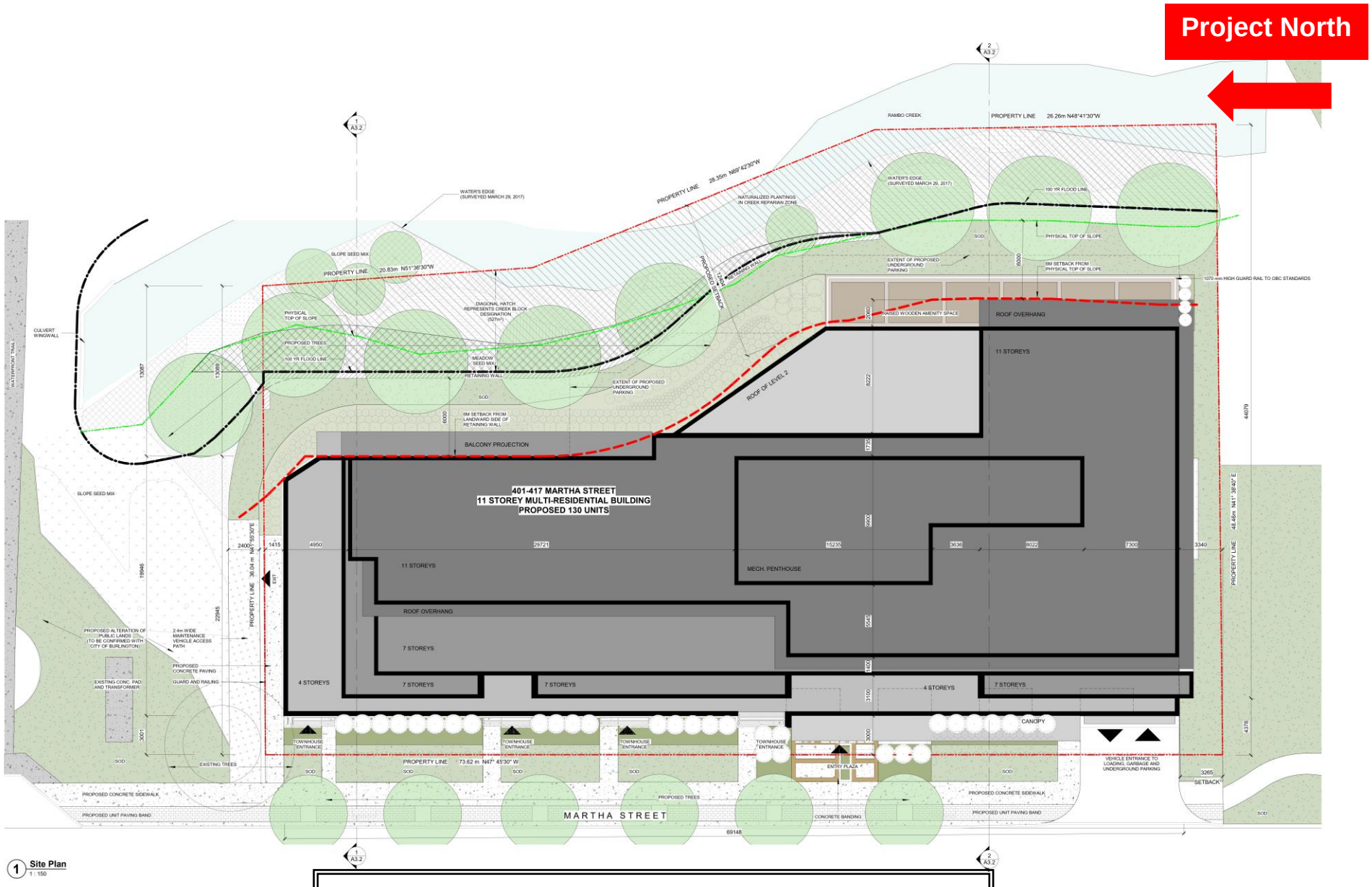



**FIGURE 2**
**SITE PLAN**

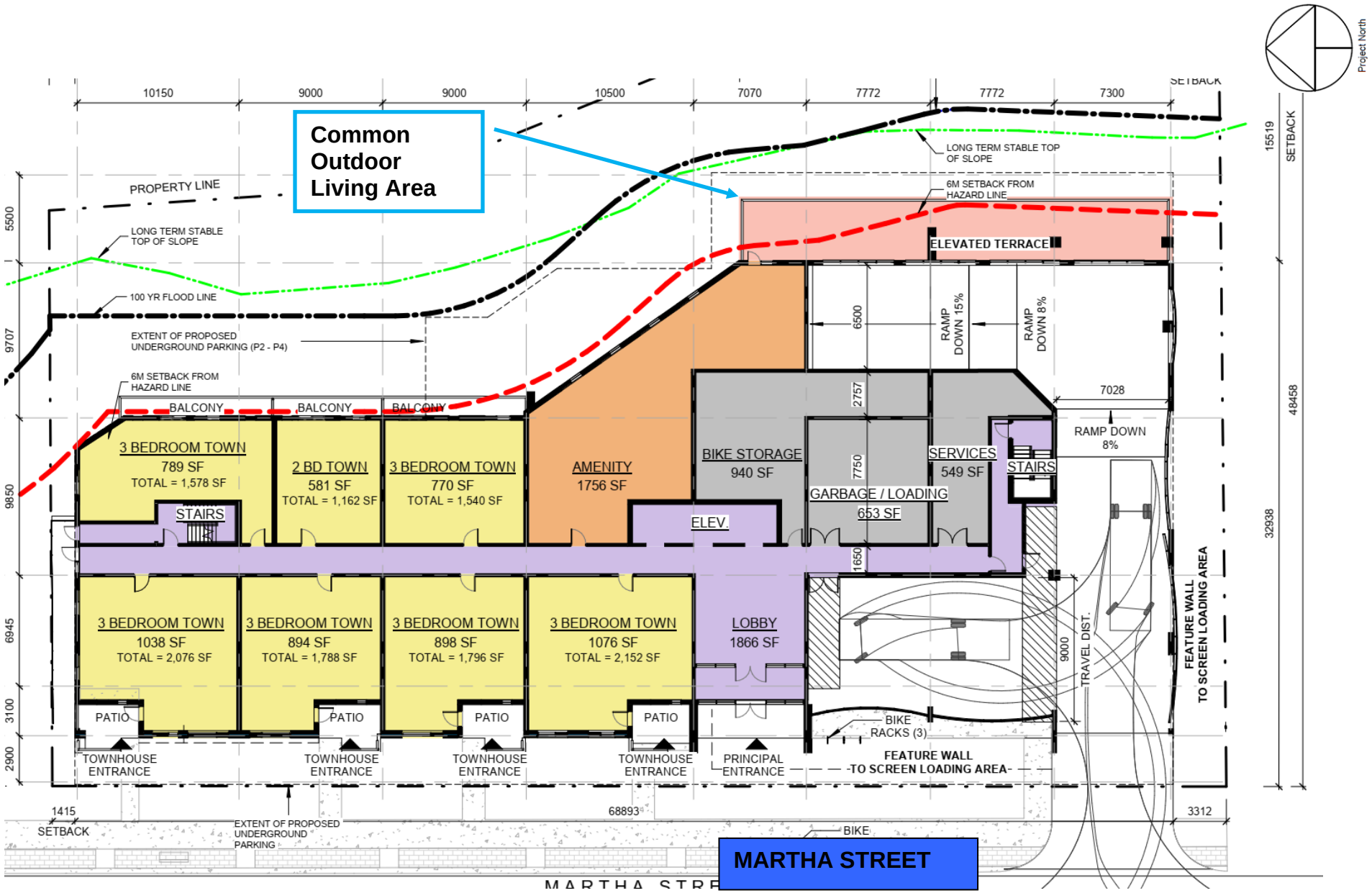



**FIGURE 3**
**LOCATION OF FIRST FLOOR BALCONY**

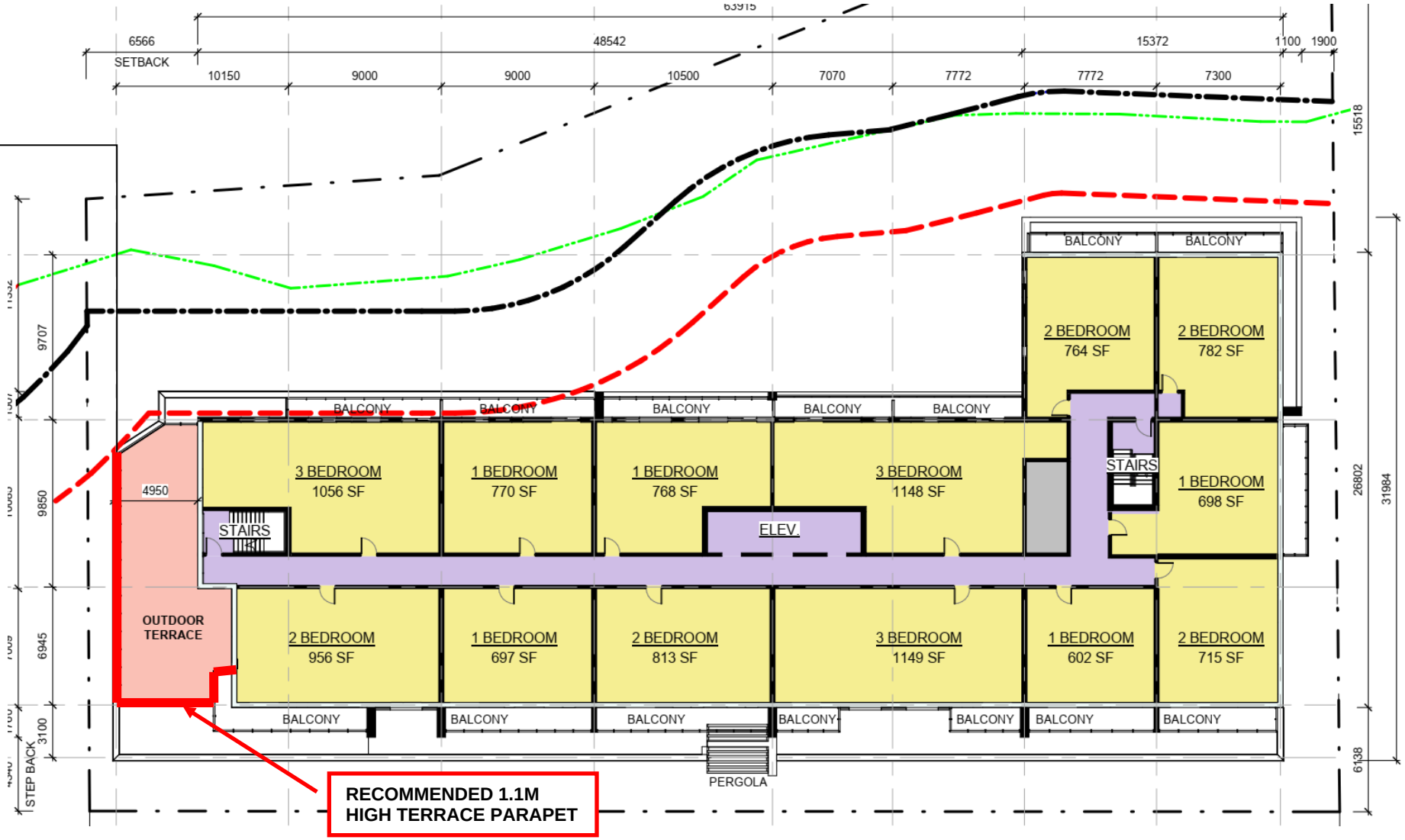



**FIGURE 4**
**RECOMMENDED TERRACE BARRIER ALIGNMENT**




**FIGURE 5**
**LOCATION OF THE EXERNAL STATIONARY SOURCES OF NOISE**

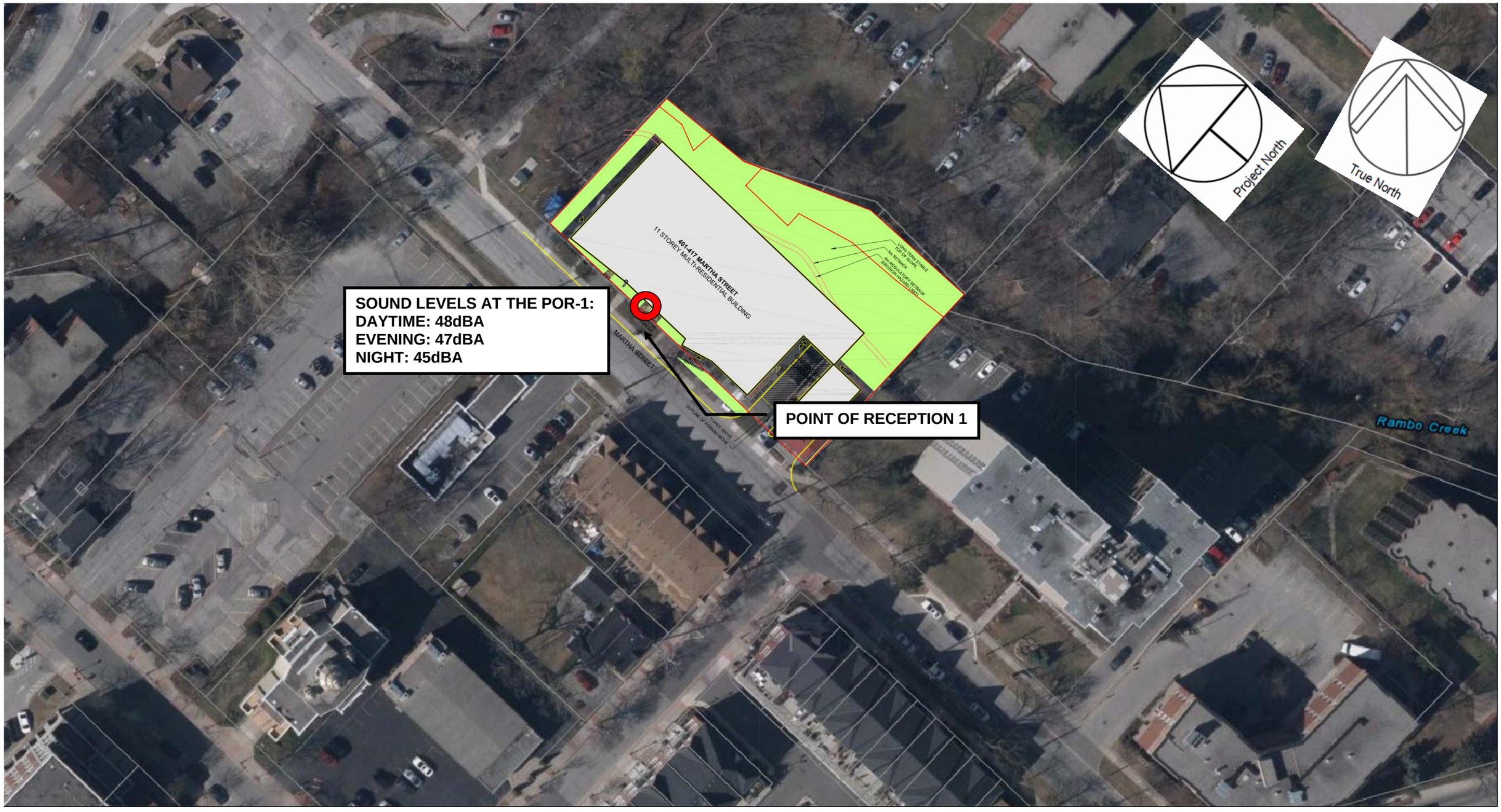



**FIGURE 6**
**LOCATION OF THE POINT OF RECEPTION AT THE SUBJECT BUILDING**




**FIGURE 7**
**LOCATION OF THE LONG TERM SOUND LEVEL MEASUREMENTS AND CALCULATED AMBIENT HOURLY SOUND LEVELS AT THE POINT OF RECEPTION**

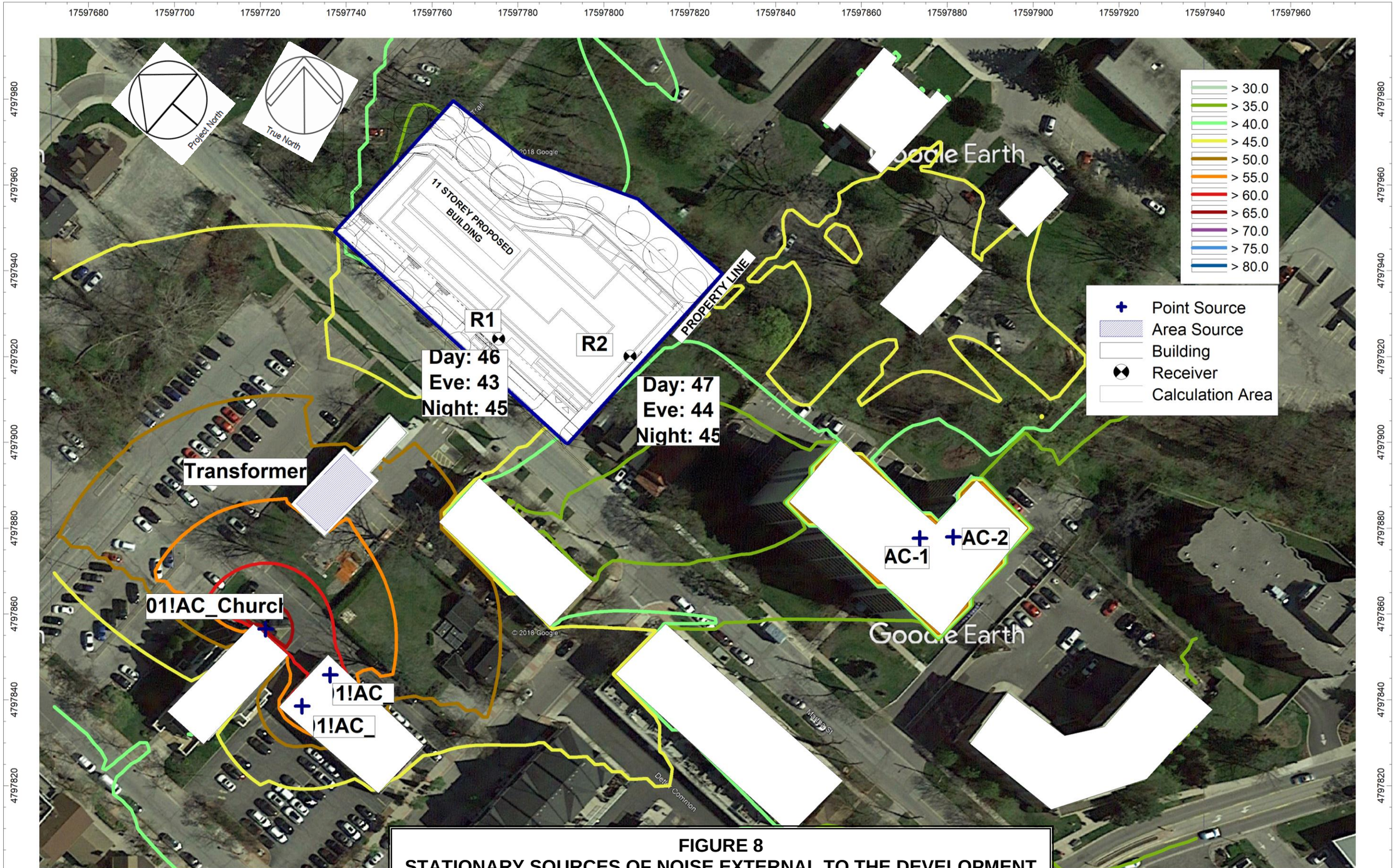



**FIGURE 8**
**STATIONARY SOURCES OF NOISE EXTERNAL TO THE DEVELOPMENT**

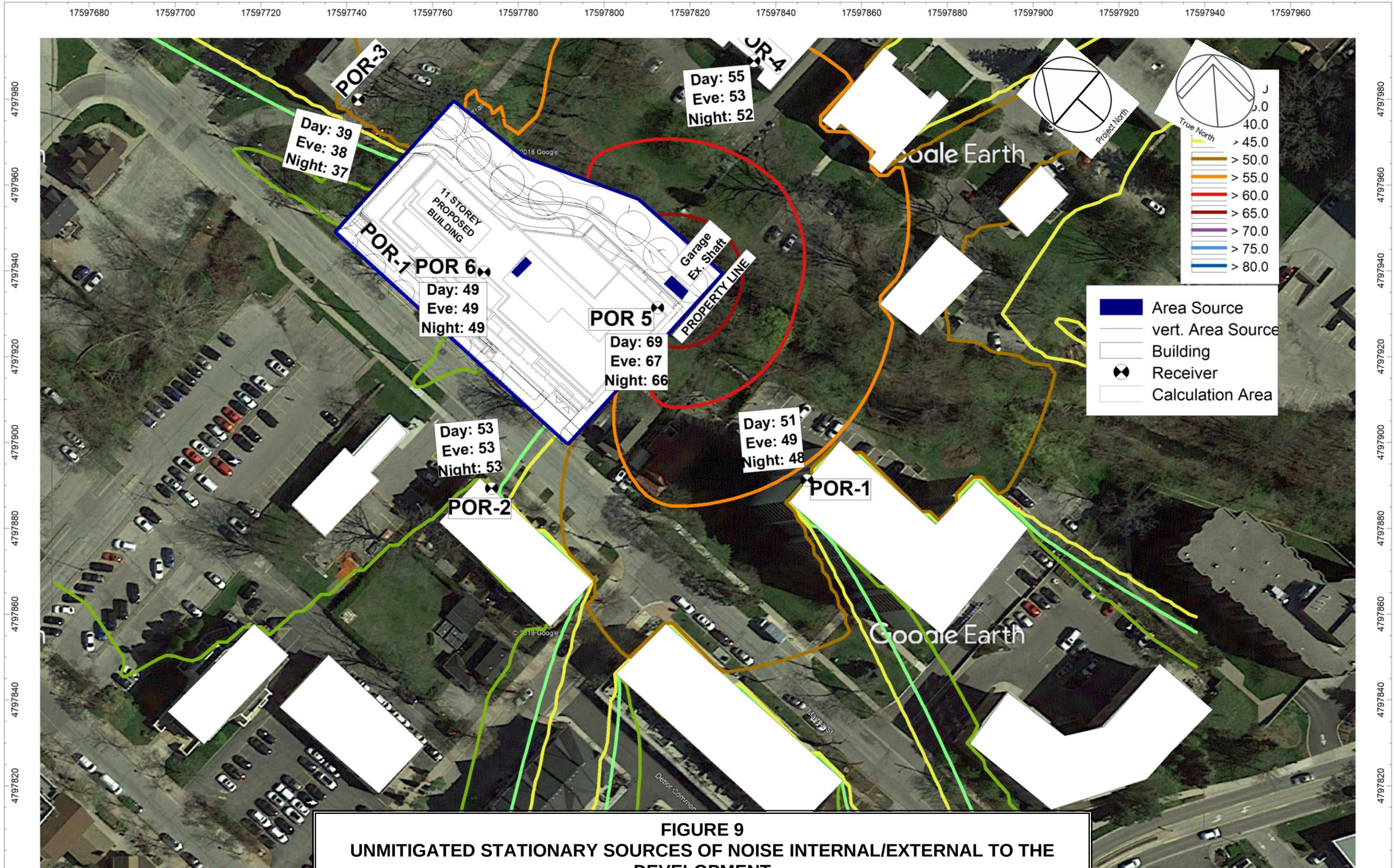



**FIGURE 9**
**UNMITIGATED STATIONARY SOURCES OF NOISE INTERNAL/EXTERNAL TO THE DEVELOPMENT**

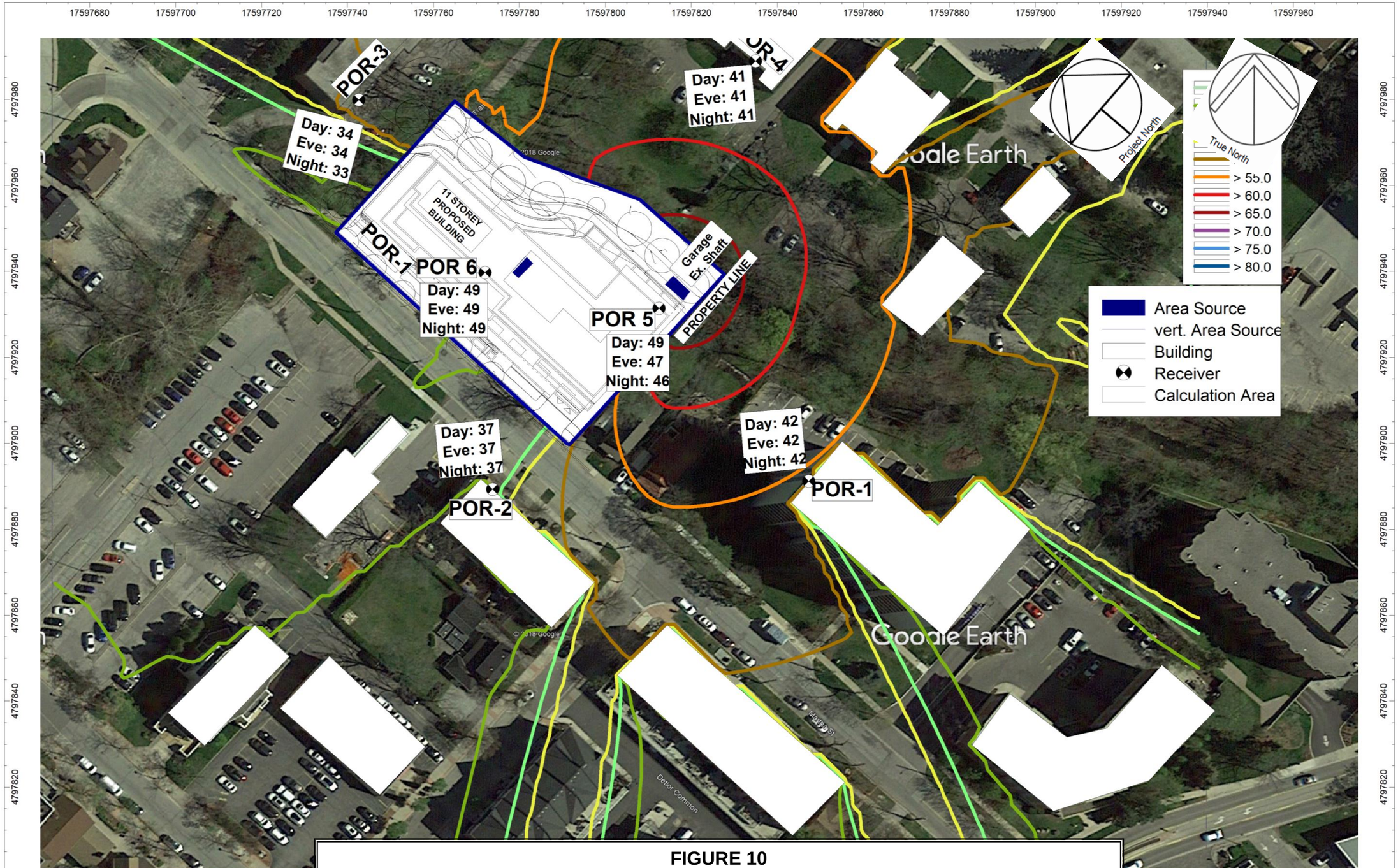
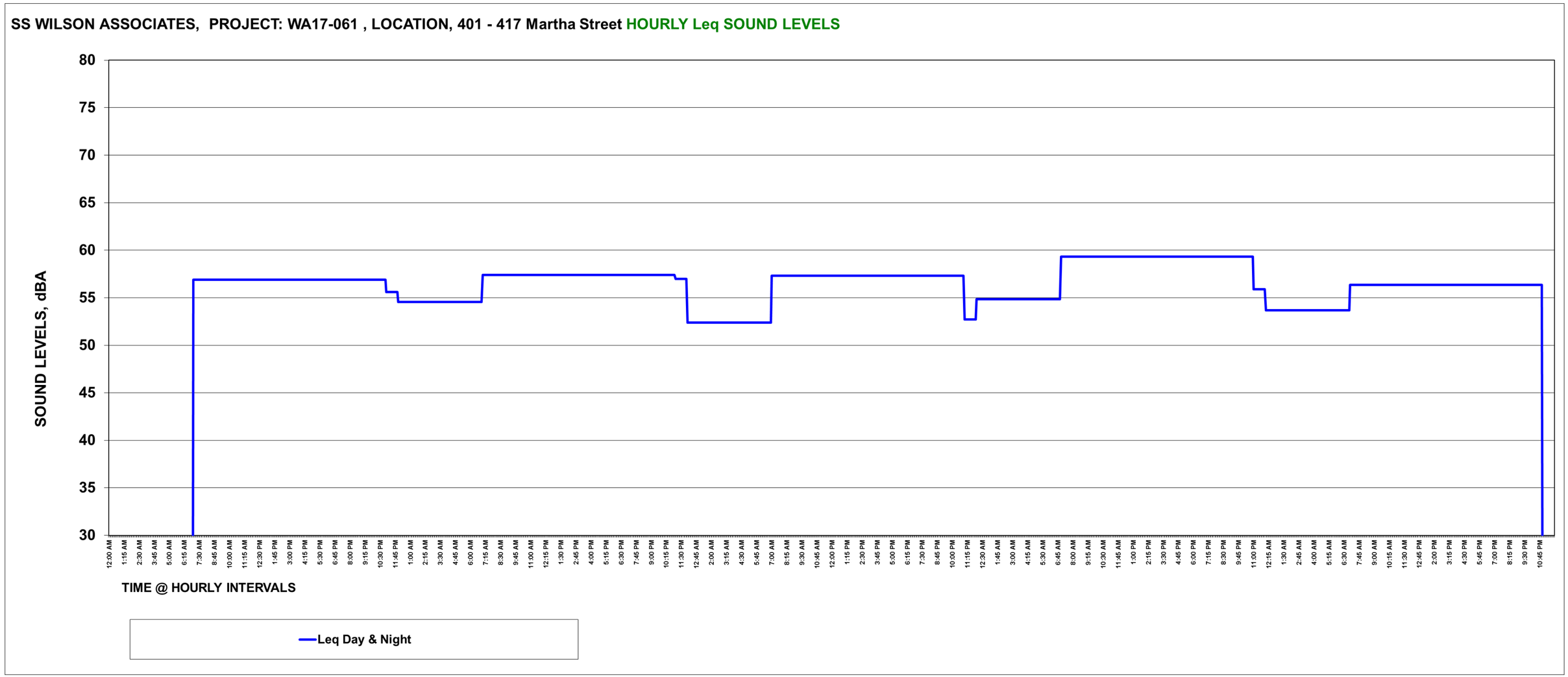


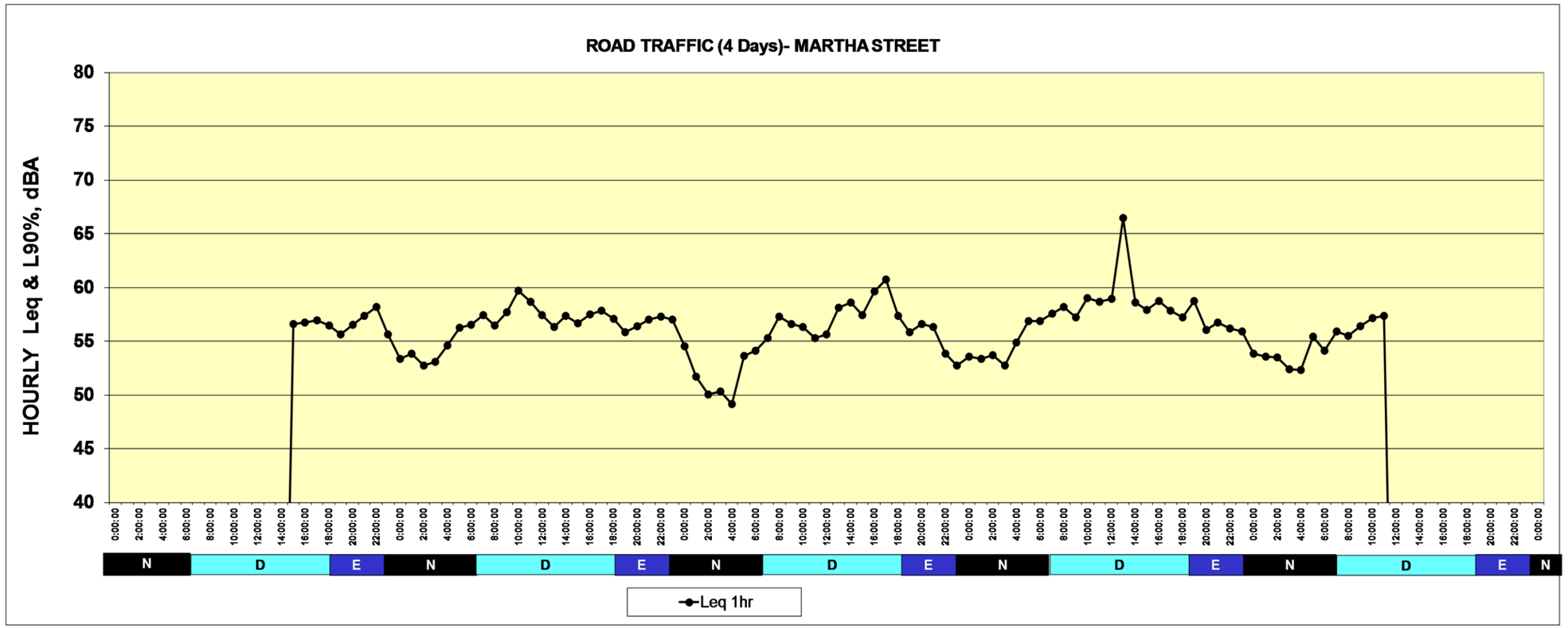

**FIGURE 10**
**STATIONARY SOURCES OF NOISE INTERNAL/EXTERNAL TO THE DEVELOPMENT WITH TYPICAL MITIGATION MEASURES**

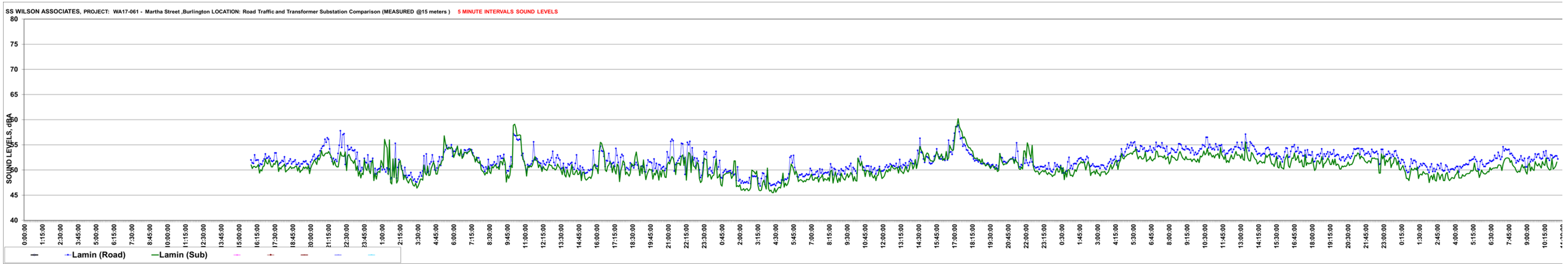
# APPENDIX A

# MEASUREMENTS OF THE ROAD AMBIENT AND HYDRO TRANSFORMER SOUND LEVELS




**HOURLY ROAD TRAFFIC MEASUREMENTS**




**TRANSFORMER SOUND LEVELS COMPARISON WITH ROAD AMBIENT NOISE (Lmin)**

# APPENDIX B

# SAMPLE STATIONARY SOUND LEVEL CALCULATIONS

# APPENDIX C

# CORRESPONDENCE WITH PARADIGM TRANSPORTATION SOLUTIONS LIMITED REGARDING MARTHA STREET TRAFFIC

Hi Derek,

My apologies on the delay in getting back to you; I was awaiting some information from a colleague with respect to the traffic counts we collected on Martha Street. Based on an estimated two-way volume of 375 vehicles per hour, we would estimate the AADT to be **3750**.

I'll note that the turning movement counts conducted at James Street/Martha Street and Pine Street/Martha Street were counted on different days which may attribute to some of the variation between the intersections. We counted James Street/Martha Street and Martha Street/New Street simultaneously, and derived the northbound right-turn traffic volumes as the difference between eastbound volumes at James Street and New Street.

If you have any questions or require anything further, please do not hesitate to contact me.

Thanks,

**Andrew Steinsky, B.Eng., EIT**
*Transportation Consultant*

**Paradigm Transportation Solutions Limited**
5A-150 Pinebush Road, Cambridge, Ontario, N1R 8J8
p: 905.381.2229 x306
e: asteinsky@ptsl.com
w: www.ptsl.com

Hi Derek,

We did not observe any heavy trucks, but did observe approximately 1% of north-south traffic as medium trucks. The AADT estimate is based on a combination of 2017 and 2018 count data, but we would not expect much variation within the year time period between counts.

Regards,

**Andrew Steinsky, B.Eng., EIT**
*Transportation Consultant*

**Paradigm Transportation Solutions Limited**
p: 905.381.2229 x306