Roadway Traffic Noise Assessment

99 Fifth Avenue

Ottawa, Ontario

REPORT: GWE17-148 – Detailed Traffic Noise

Prepared For:

Kevin A. Harper
Land Development Coordinator
Minto Communities – Canada
200-180 Kent Street
Ottawa, ON
K1P 0B6

Prepared By:

Michael Lafortune, C.E.T., Environmental Scientist
Joshua Foster, P.Eng., Principal

September 7, 2018

EXECUTIVE SUMMARY

This document describes a roadway traffic noise feasibility assessment performed for a proposed mixed-use development located at 99 Fifth Avenue, in Ottawa, Ontario. The development comprises a seven-storey building connected by an enclosed atrium to a row of existing heritage buildings oriented along Bank Street. Outdoor amenity space is located at grade on the west side of the building, and terraces on the 4th floor, 6th floor and 7th floor. Balconies and terraces less than 4 m in depth are not considered as outdoor living areas, as per the ENCG. The major sources of transportation noise impacting the development are roadway traffic from Bank Street and Fifth Avenue. Figure 1 illustrates a complete site plan with surrounding context.

The assessment is based on: (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP) and City of Ottawa requirements; (ii) noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG); (iii) future vehicular traffic volumes based on the City of Ottawa's Official Plan roadway classifications; and (iv) architectural drawings received from Minto Communities dated May 3rd, 2018.

The results of the current analysis indicate that noise levels will range between 51 and 68 dBA during the daytime period (07:00-23:00) and between 43 and 61 dBA during the nighttime period (23:00-07:00). The highest noise levels (i.e. 68 dBA) occur along the development's west façade, which is nearest and most exposed to Bank Street and Fifth Avenue. Noise levels predicted due to roadway traffic sources exceed the criteria listed in Section 4.2 for building components. Therefore, upgraded building components will be required where noise levels exceed 65 dBA (see Figure 2).

Results of the calculations also indicate that the development will require air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. A Warning Clause will also be required be placed on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

With regards to stationary noise impacts from roof top mechanical units on the existing two-storey heritage building on the proposed residential building, along with stationary noise impacts from roof top mechanical units on the proposed building on surrounding noise-sensitive areas, once the mechanical plans for the proposed building become available, a stationary noise study will be performed. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels

at the proposed building from the two-storey heritage building and noise levels at the surrounding noise-sensitive buildings due to mechanical equipment on the roof of the proposed building are below the City of Ottawa's Noise Guidelines.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (GWE) was retained by Minto Communities – Canada to undertake a roadway traffic noise feasibility assessment of a proposed mixed-use development located at 99 Fifth Avenue in Ottawa, Ontario. This report summarizes the methodology, results and recommendations related to a roadway traffic noise feasibility assessment. GWE's scope of work involved assessing exterior noise levels generated by local roadway traffic. The assessment was performed on the basis of theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MECP)[2] guidelines. Noise calculations were based on architectural drawings received from Minto Communities dated May 3rd, 2018, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The focus of this roadway traffic noise feasibility assessment is a proposed mixed-use development to be located at 99 Fifth Avenue in Ottawa, Ontario. The development is located on a parcel of land bounded by Fifth Avenue to the south, Bank Street to the west, Fourth Avenue to the north, and existing residential developments to the east. The site is surrounded by commercial buildings to the west along Bank Street, and mainly residential areas to the east and south. The major sources of transportation noise impacting the development are roadway traffic from Bank Street and Fifth Avenue. Figure 1 illustrates a complete site plan with surrounding context.

The proposed development comprises a seven-storey building connected by an enclosed atrium to a row of existing heritage buildings oriented along Bank Street. The development includes amenity space in the form of balconies, terraces, and a ground level amenity space west of the building. Terraces are located on the 4th floor, 6th floor and 7th floor. However, balconies and terraces less than 4 m in depth are not considered as Outdoor Living Areas (OLA), as per the ENCG. Therefore, the only OLA assessed in this study are the ground level amenity space west of the building, and the three terraces on the 7th floor.

[1] City of Ottawa Environmental Noise Control Guidelines, January 2016

[2] Ontario Ministry of the Environment, Conservation and Parks – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013

3. OBJECTIVES

The principal objectives of this work are to: (i) calculate the future noise levels on the study building produced by local roadway traffic, and (ii) explore potential for noise mitigation where required based on the allowable limits specified by the City of Ottawa's Environmental Noise Control Guidelines as outlined in Section 4 of this report.

4. METHODOLOGY

4.1 Background

Noise can be defined as any obtrusive sound. It is created at a source, transmitted through a medium, such as air, and intercepted by a receiver. Noise may be characterized in terms of the power of the source or the sound pressure at a specific distance. While the power of a source is characteristic of that particular source, the sound pressure depends on the location of the receiver and the path that the noise takes to reach the receiver. Measurement of noise is based on the decibel unit, dBA, which is a logarithmic ratio referenced to a standard noise level (2×10^{-5} Pascals). The 'A' suffix refers to a weighting scale, which better represents how the noise is perceived by the human ear. With this scale, a doubling of power results in a 3 dBA increase in measured noise levels and is just perceptible to most people. An increase of 10 dBA is often perceived to be twice as loud.

4.2 Roadway Traffic Noise

4.2.1 Criteria for Roadway Traffic Noise

For vehicle traffic, the equivalent sound energy level, L_{eq}, provides a measure of the time varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level, which has the same energy as a time varying noise level over a period of time. For roadways, the L_{eq} is commonly calculated on the basis of a 16-hour (L_{eq16}) daytime (07:00-23:00) / 8-hour (L_{eq8}) nighttime (23:00-07:00) split to assess its impacts on buildings. Table 1 below describes the applicable indoor noise level limits for roadway sources, as specified in the City of Ottawa's ENCG.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (ROAD) [3]

Type of Space	Time Period	L_{eq} (dBA)
		Road
General offices, reception areas, retail stores, etc.	07:00 – 23:00	50
Living/dining/den areas of residences, hospitals, schools, nursing/retirement homes, day-care centres, theatres, places of worship, libraries, individual or semi-private offices, conference rooms, etc.	07:00 – 23:00	45
Sleeping quarters of hotels/motels	23:00 – 07:00	45
Sleeping quarters of residences, hospitals, nursing/retirement homes, etc.	23:00 – 07:00	40

Predicted noise levels at the plane of window (POW) dictate the action required to achieve the recommended indoor sound levels. An open window is considered to provide a 10 dBA reduction in noise, while a standard closed window is capable of providing a minimum 20 dBA noise reduction[4]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[5]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation for the building should consider the need for having windows and doors closed, which normally triggers the need for central air conditioning. Where noise levels exceed 65 dBA daytime and 60 dBA nighttime, building components will require higher levels of sound attenuation[6].

The sound level criterion for outdoor living areas is 55 dBA, which applies during the daytime period (07:00 to 23:00). When noise levels exceed 55 dBA, mitigation must be provided to reduce noise levels where technically and administratively feasible to acceptable levels at or below the criterion.

4.2.1 Roadway Traffic Volumes

The ENCG dictates that noise calculations should consider future sound levels based on a roadway's classification at the mature state of development. Therefore, traffic volumes are based on the roadway classifications outlined in the City of Ottawa's Official Plan (OP) and Transportation Master Plan[7] which

[3] Adapted from ENCG 2016 – Part 1, Table 2.2c
[4] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[5] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[6] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3
[7] City of Ottawa Transportation Master Plan, November 2013

provide additional details on future roadway expansions. Average Annual Daily Traffic (AADT) volumes are then based on data in Table B1 of the ENCG for each roadway classification. Table 2 summarizes the AADT values used for each roadway included in this assessment.

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway / Transit Class	Speed Limit (km/h)	Traffic Volumes
Bank Street	4-UAU	40	**30,000**
Fifth Avenue	2-UCU	40	**8,000**

4.2.2 Theoretical Transportation Noise Predictions

Noise predictions were performed with the aid of the MECP computerized noise assessment program, STAMSON 5.04, for road and rail analysis. Roadway traffic noise calculations were performed by treating each roadway segment as separate line sources of noise, and by using on-site existing building locations as noise barriers. In addition to the traffic volumes summarized in Table 2, theoretical noise predictions were based on the following parameters:

- Truck traffic on all roadways was taken to comprise 5% heavy trucks and 7% medium trucks, as per ENCG requirements for noise level predictions
- The day/night split was taken to be 92% / 8% respectively for all streets
- Reflective ground surface for pavements and roads from source-to-receiver
- Topography considered to be flat or gently sloping.
- Proposed building included in the analysis as a noise barrier with a height of 19.05 metres for Receptors 5 and 7.
- Existing heritage buildings on-site included in the analysis as a noise barrier with a height of approximately 8 metres for Receptors 5 and 6.
- Receptor heights placed at 17.43-metres and 20.70-metres for the 6th and 7th floor Plane of Window; while for the OLA, heights were placed at 1.50-metres above grade for the ground level space. These heights are based on elevation drawings dated May 3, 2018, also attached in Appendix A.
- Receptor distances and exposure angles illustrated in Figures 3-6.

Noise receptors were strategically identified at seven (7) locations around the study area (see Figure 1).

4.3 Indoor Noise Calculations

The difference between outdoor and indoor noise levels is the noise attenuation provided by the building envelope. According to common industry practice, complete walls and individual wall elements are rated according to the Sound Transmission Class (STC). The STC ratings of common residential walls built in conformance with the Ontario Building Code (2012) typically exceed STC 35, depending on exterior cladding, thickness and interior finish details. For example, concrete and masonry walls can achieve STC 50 or more. Curtain wall systems typically provide around STC 35, depending on the glazing elements. Standard good quality double-glazed non-operable windows can have STC ratings ranging from 25 to 40, depending on the window manufacturer, pane thickness and inter-pane spacing. As previously mentioned, the windows are the known weak point in a partition.

As per Section 4.2, when daytime noise levels (from road and rail sources) at the plane of the window exceed 65 dBA, calculations must be performed to evaluate the sound transmission quality of the building components to ensure acceptable indoor noise levels. The calculation procedure[8] considers:

- Window type and total area as a percentage of total room floor area
- Exterior wall type and total area as a percentage of the total room floor area
- Acoustic absorption characteristics of the room
- Outdoor noise source type and approach geometry
- Indoor sound level criteria, which varies according to the intended use of a space

Based on published research[9], exterior walls possess specific sound attenuation characteristics that are used as a basis for calculating the required STC ratings of windows in the same partition. Due to the limited information, available at the time of the study, which was prepared for site plan approval, detailed floor layouts and building elevations have not been finalized; therefore, detailed STC calculations could not be performed at this time. As a guideline, the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space (STC = outdoor noise level – targeted indoor noise levels).

[8] Building Practice Note: Controlling Sound Transmission into Buildings by J.D. Quirt, National Research Council of Canada, September 1985
[9] CMHC, Road & Rail Noise: Effects on Housing

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

The results of the roadway traffic noise calculations are summarized in Table 3 below. A complete set of input and output data from all STAMSON 5.04 calculations are available in Appendix A.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC SOURCES

Receptor Number	Receptor Height Above Grade (m)	Plane of Window Receptor Location	Noise Level (dBA)	
			Day	Night
1	17.43	6th Floor – South Façade	67	59
2	17.43	6th Floor – East Façade	60	53
3	17.43	6th Floor – North Façade	64	56
4	17.43	6th Floor – West Façade	68	61
5	1.5	Ground Level OLA	51	43
6	20.70	7th Floor – West Façade	62	54
7	20.70	7th Floor – South Façade	53	45

5.2 Noise Control Measures

The noise levels predicted due to roadway traffic exceed the criteria listed in Section 4.2 for building components. As discussed in Section 4.3 the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space (STC = outdoor noise level – targeted indoor noise levels). As per city of Ottawa requirements, detailed STC calculations will be required to be completed prior to building permit application for each unit type. The STC requirements for the windows are summarized below for various units within the development (see Figure 2):

- **Bedroom Windows**

(i) Bedroom windows facing west will require a minimum STC of 31

(ii) Bedroom windows facing south will require a minimum STC of 30

(iii) All other bedroom windows are to satisfy Ontario Building Code (OBC 2012) requirements

- **Living Room Windows**

(i) Living room windows facing west will require a minimum STC of 26

(ii) Living room windows facing south will require a minimum STC of 25

(iii) All other bedroom windows are to satisfy Ontario Building Code (OBC 2012) requirements

- **Exterior Walls**

(i) Exterior wall components on the south and west façades of the four-storey building will require a minimum STC of 45 which will be achieved with brick cladding or an acoustical equivalent according to NRC test data[10]

The STC requirements would apply to windows, doors, spandrel panels and curtainwall elements. Exterior wall components on these façades are recommended to have a minimum STC of 45, where a window / wall system is used. A review of window supplier literature indicates that the specified STC ratings can be achieved by a variety of window systems having a combination of glass thickness and inter-pane spacing. We have specified an example window configuration, however several manufacturers and various combinations of window components, such as those proposed, will offer the necessary sound attenuation rating. It is the responsibility of the manufacturer to ensure that the specified window achieves the required STC. This can only be assured by using window configurations that have been certified by laboratory testing. The requirements for STC ratings assume that the remaining components of the building are constructed and installed according to the minimum standards of the Ontario Building Code. The specified STC requirements also apply to swinging and/or sliding patio doors. The two-storey existing heritage building will make use of the as-built wall and window assemblies and is assumed to conform to the ENCG for retail and office use.

Results of the calculations also indicate that the development will require central air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. In addition

[10] J.S. Bradley and J.A. Birta. Laboratory Measurements of the Sound Insulation of Building Façade Elements, National Research Council October 2000.

to ventilation requirements, Warning Clauses will also be required be placed on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 51 and 68 dBA during the daytime period (07:00-23:00) and between 43 and 61 dBA during the nighttime period (23:00-07:00). The highest noise levels (i.e. 68 dBA) occur along the development's west façade, which is nearest and most exposed to Bank Street and Fifth Avenue. Noise levels predicted due to roadway traffic sources exceed the criteria listed in Section 4.2 for building components. Therefore, upgraded building components will be required where noise levels exceed 65 dBA (see Figure 2).

Results of the calculations also indicate that the development will require air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. The following Warning Clause[11] will also be required be placed on all Lease, Purchase and Sale Agreements, as summarized below:

> *"Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing roadway traffic may, on occasion, interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the City and the Ministry of the Environment and Climate Change. To help address the need for sound attenuation, this development includes:*
>
> - *STC rated multi-pane glazing elements and spandrel panels*
> - *West façade bedroom/living room: STC 31/26*
> - *South façade bedroom/living room: STC 30/25*
> - *STC rated exterior walls*
> - *East, south and west façade: STC 45*
>
> *This dwelling unit has also been designed with air conditioning. Air conditioning will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the City and the Ministry of the Environment and Climate Change.*

[11] City of Ottawa Environmental Noise Control Guidelines, January 2016

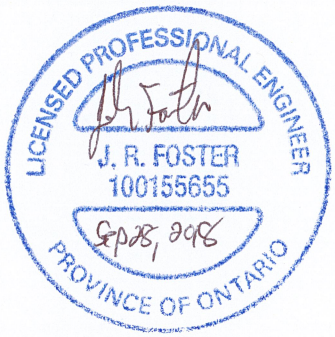
To ensure that provincial sound level limits are not exceeded, it is important to maintain these sound attenuation features."

With regards to stationary noise impacts from roof top mechanical units on the existing two-storey heritage building on the proposed residential building, along with stationary noise impacts from roof top mechanical units on the proposed building on surrounding noise-sensitive areas, once the mechanical plans for the proposed building become available, a stationary noise study will be performed. This study will include recommendations for any noise control measures that may be necessary to ensure noise levels at the proposed building from the two-storey heritage building and noise levels at the surrounding noise-sensitive buildings due to mechanical equipment on the roof of the proposed building are below the City of Ottawa's Noise Guidelines.

This concludes our assessment and report. If you have any questions or wish to discuss our findings, please advise us. In the interim, we thank you for the opportunity to be of service.

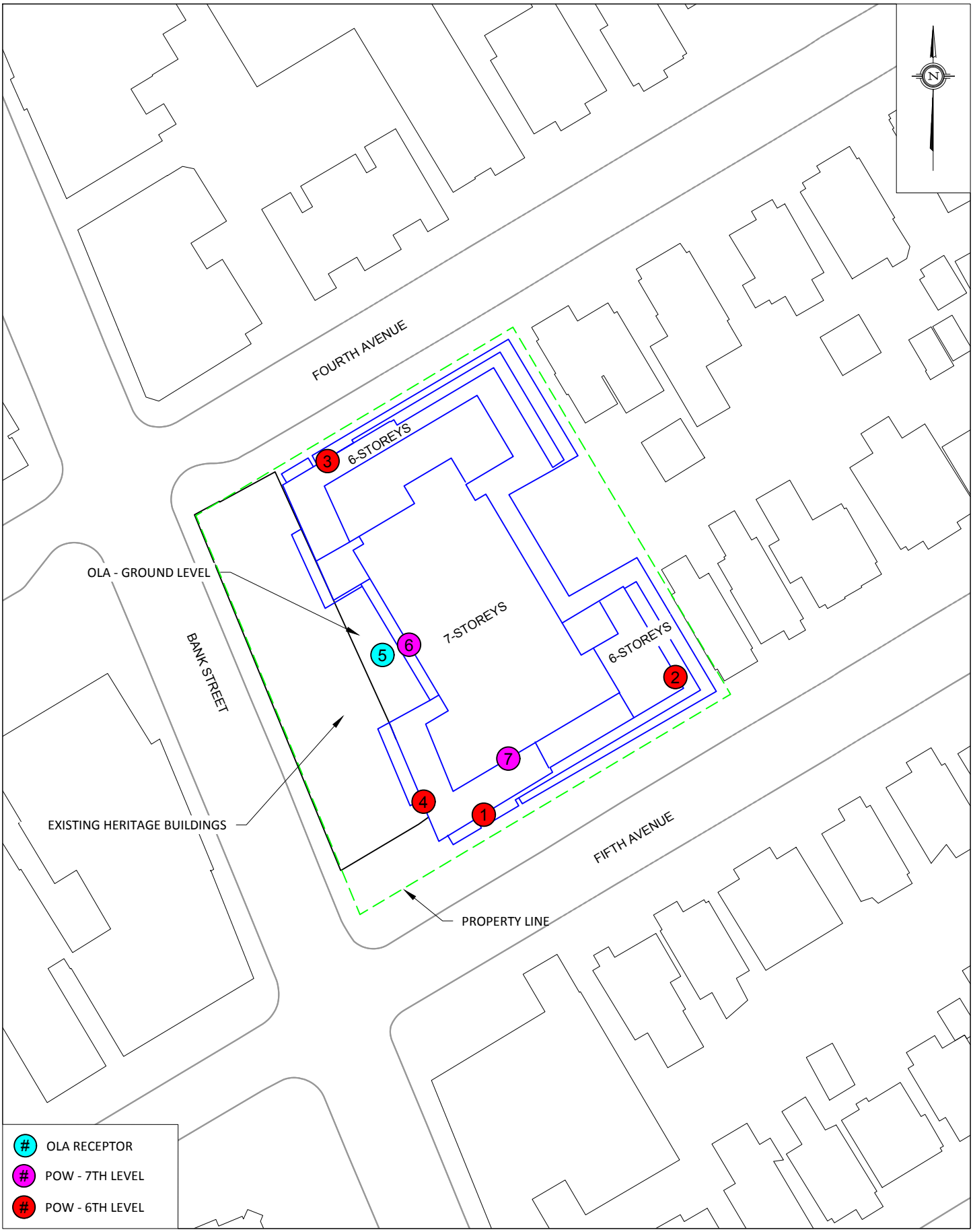
Yours truly,

Gradient Wind Engineering Inc.



Michael Lafortune, C.E.T.
Environmental Scientist
GWE17-148 – Detailed Traffic Noise

Joshua Foster, P.Eng.
Principal



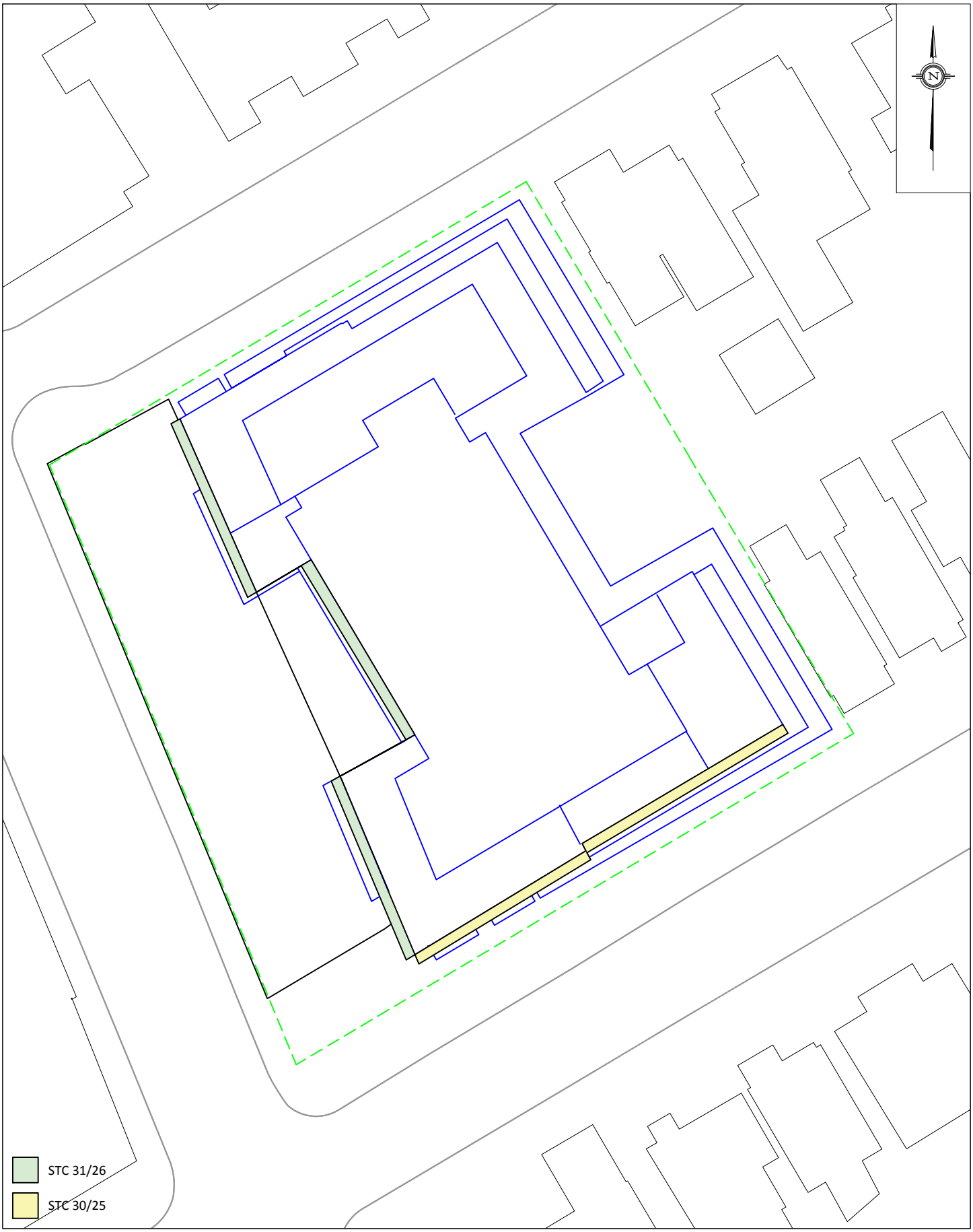
127 Walgreen Road
Ottawa, Ontario
(613) 836 0934

GRADIENT WIND ENGINEERING INC

PROJECT	99 FIFTH AVENUE - TRAFFIC NOISE ASSESSMENT
SCALE	1:750 (APPROX.)
DRAWING NO.	GWE17-148-1
DATE	SEPTEMBER 7, 2018
DRAWN BY	O.D.

DESCRIPTION

FIGURE 1:
SITE PLAN, SURROUNDING CONTEXT AND RECEPTOR LOCATIONS



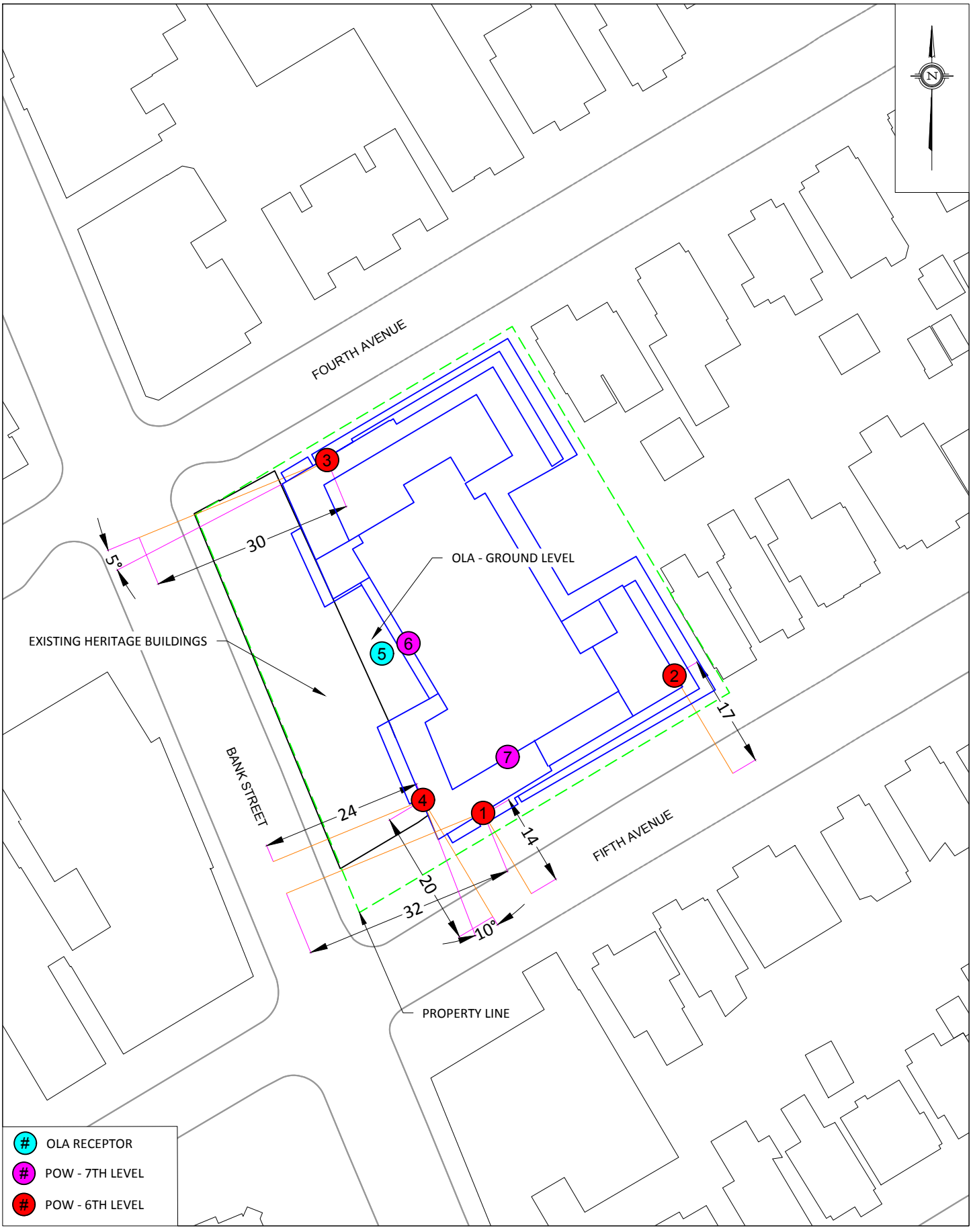
127 Walgreen Road
Ottawa, Ontario
(613) 836 0934

GRADIENT WIND ENGINEERING INC

PROJECT	99 FIFTH AVENUE - TRAFFIC NOISE ASSESSMENT		
SCALE	1:500 (APPROX.)	DRAWING NO.	GWE17-148-2
DATE	SEPTEMBER 7, 2018	DRAWN BY	O.D.

DESCRIPTION

FIGURE 2:
BEDROOM/LIVING ROOM STC REQUIREMENTS



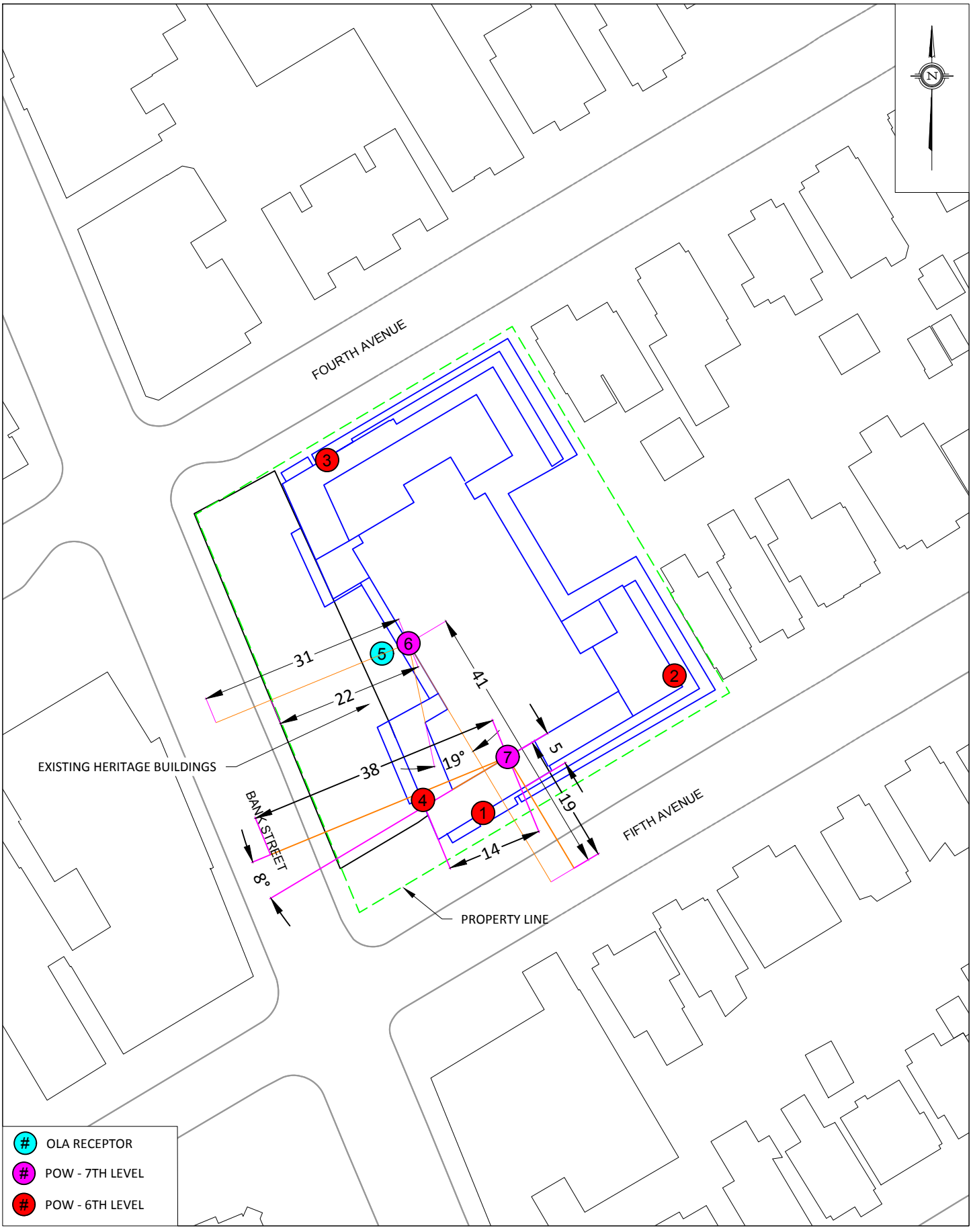
127 Walgreen Road
Ottawa, Ontario
(613) 836 0934

GRADIENT WIND ENGINEERING INC

PROJECT	99 FIFTH AVENUE - TRAFFIC NOISE ASSESSMENT
SCALE	1:750 (APPROX.)
DRAWING NO.	GWE17-148-3
DATE	SEPTEMBER 7, 2018
DRAWN BY	O.D.

DESCRIPTION

FIGURE 3:
RECEPTOR DISTANCES AND EXPOSURE ANGLES



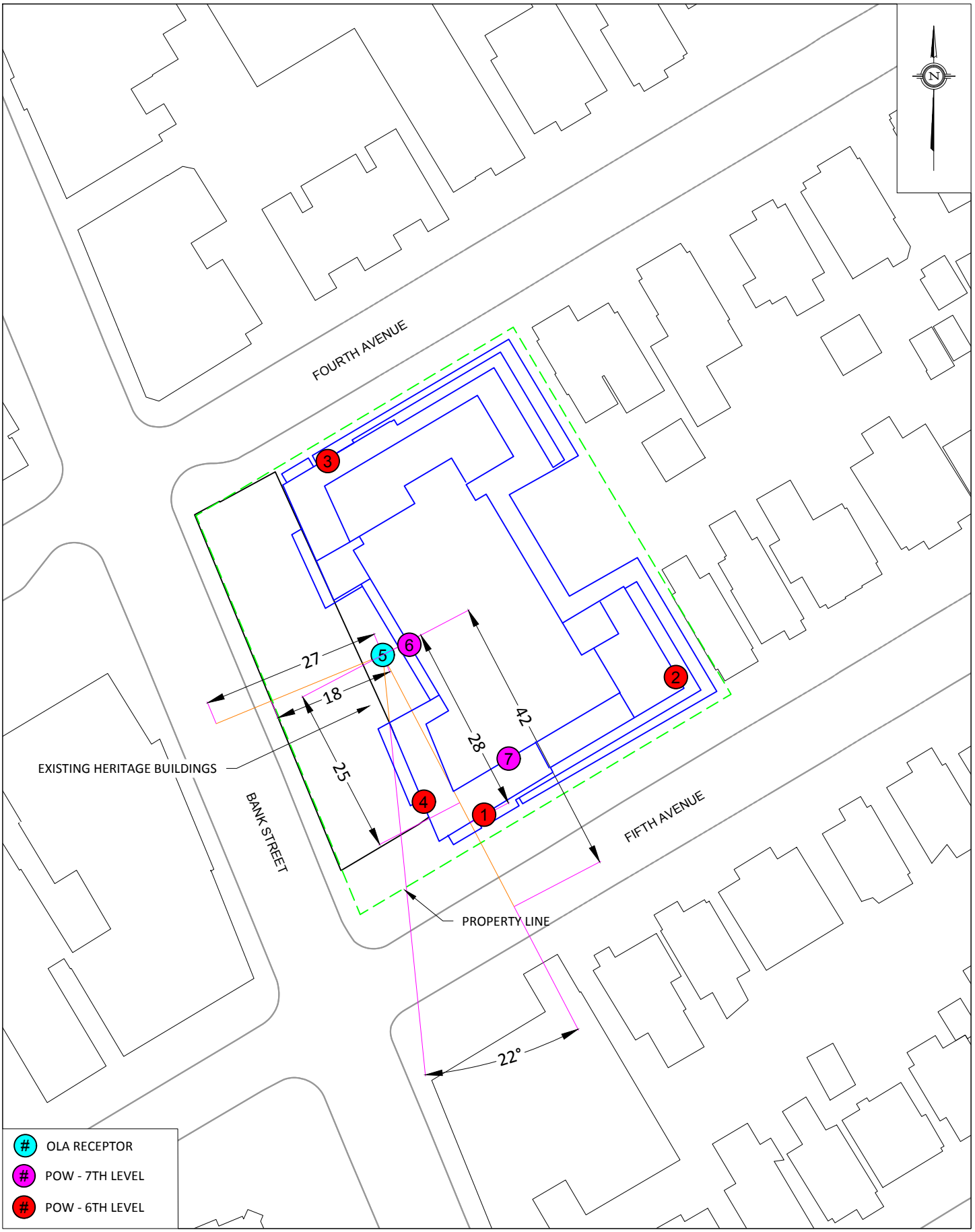
127 Walgreen Road
Ottawa, Ontario
(613) 836 0934

GRADIENT WIND ENGINEERING INC

PROJECT	99 FIFTH AVENUE - TRAFFIC NOISE ASSESSMENT		
SCALE	1:750 (APPROX.)	DRAWING NO.	GWE17-148-4
DATE	SEPTEMBER 7, 2018	DRAWN BY	O.D.

DESCRIPTION

FIGURE 4:
RECEPTOR DISTANCES AND EXPOSURE ANGLES



127 Walgreen Road
Ottawa, Ontario
(613) 836 0934

GRADIENT WIND ENGINEERING INC

PROJECT	99 FIFTH AVENUE - TRAFFIC NOISE ASSESSMENT		
SCALE	1:750 (APPROX.)	DRAWING NO.	GWE17-148-5
DATE	SEPTEMBER 7, 2018	DRAWN BY	O.D.

DESCRIPTION

FIGURE 5:
RECEPTOR DISTANCES AND EXPOSURE ANGLES

APPENDIX A

STAMSON 5.04 - INPUT AND OUTPUT DATA AND SUPPORTING INFORMATION

```
STAMSON 5.0        NORMAL REPORT        Date: 26-04-2018 10:17:48
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r1.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Fifth Avenue (day/night)
-----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Fifth Avenue (day/night)
----------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :  17.43 / 17.43  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Bank Street (day/night)
-----------------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  30000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Bank Street (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  32.00 / 32.00  m
Receiver height           :  17.43 / 17.43  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Fifth Avenue (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 63.96 + 0.00) = 63.96 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  63.96   0.00   0.00   0.00   0.00   0.00   0.00  63.96
-------------------------------------------------------------------------------

Segment Leq : 63.96 dBA


Results segment # 2: Bank Street (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 63.40 + 0.00) = 63.40 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.00  69.70   0.00  -3.29  -3.01   0.00   0.00   0.00  63.40
-------------------------------------------------------------------------------

Segment Leq : 63.40 dBA

Total Leq All Segments: 66.70 dBA
```

```
Results segment # 1: Fifth Avenue (night)
------------------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.36 + 0.00) = 56.36 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  56.36   0.00   0.00   0.00   0.00   0.00   0.00  56.36
-------------------------------------------------------------------------------

Segment Leq : 56.36 dBA


Results segment # 2: Bank Street (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 55.80 + 0.00) = 55.80 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.00  62.10   0.00  -3.29  -3.01   0.00   0.00   0.00  55.80
-------------------------------------------------------------------------------

Segment Leq : 55.80 dBA

Total Leq All Segments: 59.10 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 66.70
                           (NIGHT): 59.10
```

```
STAMSON 5.0        NORMAL REPORT        Date: 26-04-2018 10:17:55
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r2.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Fifth Avenue (day/night)
-----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Fifth Avenue (day/night)
----------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  17.00 / 17.00  m
Receiver height           :  17.43 / 17.43  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Fifth Avenue (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 60.40 + 0.00) = 60.40 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.00  63.96   0.00  -0.54  -3.01   0.00   0.00   0.00  60.40
-------------------------------------------------------------------------------

Segment Leq : 60.40 dBA

Total Leq All Segments: 60.40 dBA


Results segment # 1: Fifth Avenue (night)
-----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 52.81 + 0.00) = 52.81 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.00  56.36   0.00  -0.54  -3.01   0.00   0.00   0.00  52.81
-------------------------------------------------------------------------------

Segment Leq : 52.81 dBA

Total Leq All Segments: 52.81 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 60.40
                           (NIGHT): 52.81
```

```
STAMSON 5.0        NORMAL REPORT        Date: 26-04-2018 10:18:07
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r3.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Bank Street (day/night)
-----------------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  30000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Bank Street (day/night)
---------------------------------------------
Angle1   Angle2           :  -5.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  30.00 / 30.00  m
Receiver height           :  17.43 / 17.43  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Bank Street (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 63.91 + 0.00) = 63.91 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    -5     90   0.00  69.70   0.00  -3.01  -2.78   0.00   0.00   0.00  63.91
-------------------------------------------------------------------------------

Segment Leq : 63.91 dBA

Total Leq All Segments: 63.91 dBA


Results segment # 1: Bank Street (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.31 + 0.00) = 56.31 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    -5     90   0.00  62.10   0.00  -3.01  -2.78   0.00   0.00   0.00  56.31
-------------------------------------------------------------------------------

Segment Leq : 56.31 dBA

Total Leq All Segments: 56.31 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.91
                           (NIGHT): 56.31
```

```
STAMSON 5.0        NORMAL REPORT        Date: 26-04-2018 10:18:14
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r4.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Fifth Avenue (day/night)
-----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Fifth Avenue (day/night)
----------------------------------------------
Angle1   Angle2           :  10.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  20.00 / 20.00  m
Receiver height           :  17.43 / 17.43  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Bank Street (day/night)
-----------------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  30000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Bank Street (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  24.00 / 24.00  m
Receiver height           :  17.43 / 17.43  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Fifth Avenue (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 59.18 + 0.00) = 59.18 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    10     90   0.00  63.96   0.00  -1.25  -3.52   0.00   0.00   0.00  59.18
-------------------------------------------------------------------------------

Segment Leq : 59.18 dBA


Results segment # 2: Bank Street (day)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 67.65 + 0.00) = 67.65 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  69.70   0.00  -2.04   0.00   0.00   0.00   0.00  67.65
-------------------------------------------------------------------------------

Segment Leq : 67.65 dBA

Total Leq All Segments: 68.23 dBA
```

```
Results segment # 1: Fifth Avenue (night)
------------------------------------------

Source height = 1.50 m

ROAD (0.00 + 51.59 + 0.00) = 51.59 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    10     90   0.00  56.36   0.00  -1.25  -3.52   0.00   0.00   0.00  51.59
-------------------------------------------------------------------------------

Segment Leq : 51.59 dBA


Results segment # 2: Bank Street (night)
----------------------------------------

Source height = 1.50 m

ROAD (0.00 + 60.06 + 0.00) = 60.06 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  62.10   0.00  -2.04   0.00   0.00   0.00   0.00  60.06
-------------------------------------------------------------------------------

Segment Leq : 60.06 dBA

Total Leq All Segments: 60.64 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 68.23
                           (NIGHT): 60.64
```

```
STAMSON 5.0         NORMAL REPORT         Date: 26-04-2018 10:18:34
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r5.te                 Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Bank Street (day/night)
-----------------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  30000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Bank Street (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  27.00 / 27.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :   8.00 m
Barrier receiver distance :  18.00 / 18.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: Fifth Avenue (day/night)
------------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Fifth Avenue (day/night)
----------------------------------------------
Angle1   Angle2           : -90.00 deg   22.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  42.00 / 42.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 22.00 deg
Barrier height            :  19.05 m
Barrier receiver distance :  28.00 / 28.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 3: Fifth Avenu2 (day/night)
-----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 3: Fifth Avenu2 (day/night)
-----------------------------------------------
Angle1   Angle2           :  22.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  42.00 / 42.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :  22.00 deg   Angle2 : 90.00 deg
Barrier height            :   8.00 m
Barrier receiver distance :  25.00 / 25.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Bank Street (day)
--------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 50.11 + 0.00) = 50.11 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  69.70   0.00  -2.55   0.00   0.00   0.00 -17.03  50.11
-------------------------------------------------------------------------------

Segment Leq : 50.11 dBA


Results segment # 2: Fifth Avenue (day)
---------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 38.17 + 0.00) = 38.17 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     22   0.00  63.96   0.00  -4.47  -2.06   0.00   0.00 -19.25  38.17
-------------------------------------------------------------------------------

Segment Leq : 38.17 dBA
```

```
Results segment # 3: Fifth Avenu2 (day)
---------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 40.17 + 0.00) = 40.17 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    22     90   0.00  63.96   0.00  -4.47  -4.23   0.00   0.00 -15.08  40.17
-------------------------------------------------------------------------------

Segment Leq : 40.17 dBA

Total Leq All Segments: 50.77 dBA


Results segment # 1: Bank Street (night)
----------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 42.51 + 0.00) = 42.51 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  62.10   0.00  -2.55   0.00   0.00   0.00 -17.03  42.51
-------------------------------------------------------------------------------

Segment Leq : 42.51 dBA
```

```
Results segment # 2: Fifth Avenue (night)
------------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 30.58 + 0.00) = 30.58 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     22   0.00  56.36   0.00  -4.47  -2.06   0.00   0.00 -19.25  30.58
-------------------------------------------------------------------------------

Segment Leq : 30.58 dBA


Results segment # 3: Fifth Avenu2 (night)
------------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 32.58 + 0.00) = 32.58 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    22     90   0.00  56.36   0.00  -4.47  -4.23   0.00   0.00 -15.08  32.58
-------------------------------------------------------------------------------

Segment Leq : 32.58 dBA

Total Leq All Segments: 43.18 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 50.77
                           (NIGHT): 43.18
```

```
STAMSON 5.0        NORMAL REPORT        Date: 26-04-2018 10:37:37
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r6.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Bank Street (day/night)
-----------------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  30000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Bank Street (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  31.00 / 31.00  m
Receiver height           :  20.70 / 20.70  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :   8.00 m
Barrier receiver distance :  22.00 / 22.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: Fifth (day/night)
------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Fifth (day/night)
---------------------------------------
Angle1   Angle2           :  19.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  41.00 / 41.00  m
Receiver height           :  20.70 / 20.70  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Results segment # 1: Bank Street (day)
--------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       20.70 !        7.07 !         7.07

ROAD (0.00 + 60.37 + 0.00) = 60.37 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  69.70   0.00  -3.15   0.00   0.00   0.00  -6.17  60.37
-------------------------------------------------------------------------------

Segment Leq : 60.37 dBA
```

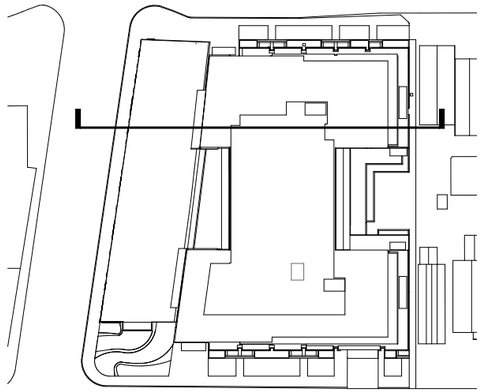
```
Results segment # 2: Fifth (day)
---------------------------------

Source height = 1.50 m

ROAD (0.00 + 55.55 + 0.00) = 55.55 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    19     90   0.00  63.96   0.00  -4.37  -4.04   0.00   0.00   0.00  55.55
-------------------------------------------------------------------------------

Segment Leq : 55.55 dBA

Total Leq All Segments: 61.61 dBA


Results segment # 1: Bank Street (night)
----------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       20.70 !        7.07 !         7.07

ROAD (0.00 + 52.78 + 0.00) = 52.78 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  62.10   0.00  -3.15   0.00   0.00   0.00  -6.17  52.78
-------------------------------------------------------------------------------

Segment Leq : 52.78 dBA


Results segment # 2: Fifth (night)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 47.96 + 0.00) = 47.96 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
    19     90   0.00  56.36   0.00  -4.37  -4.04   0.00   0.00   0.00  47.96
-------------------------------------------------------------------------------

Segment Leq : 47.96 dBA

Total Leq All Segments: 54.02 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 61.61
                           (NIGHT): 54.02
```

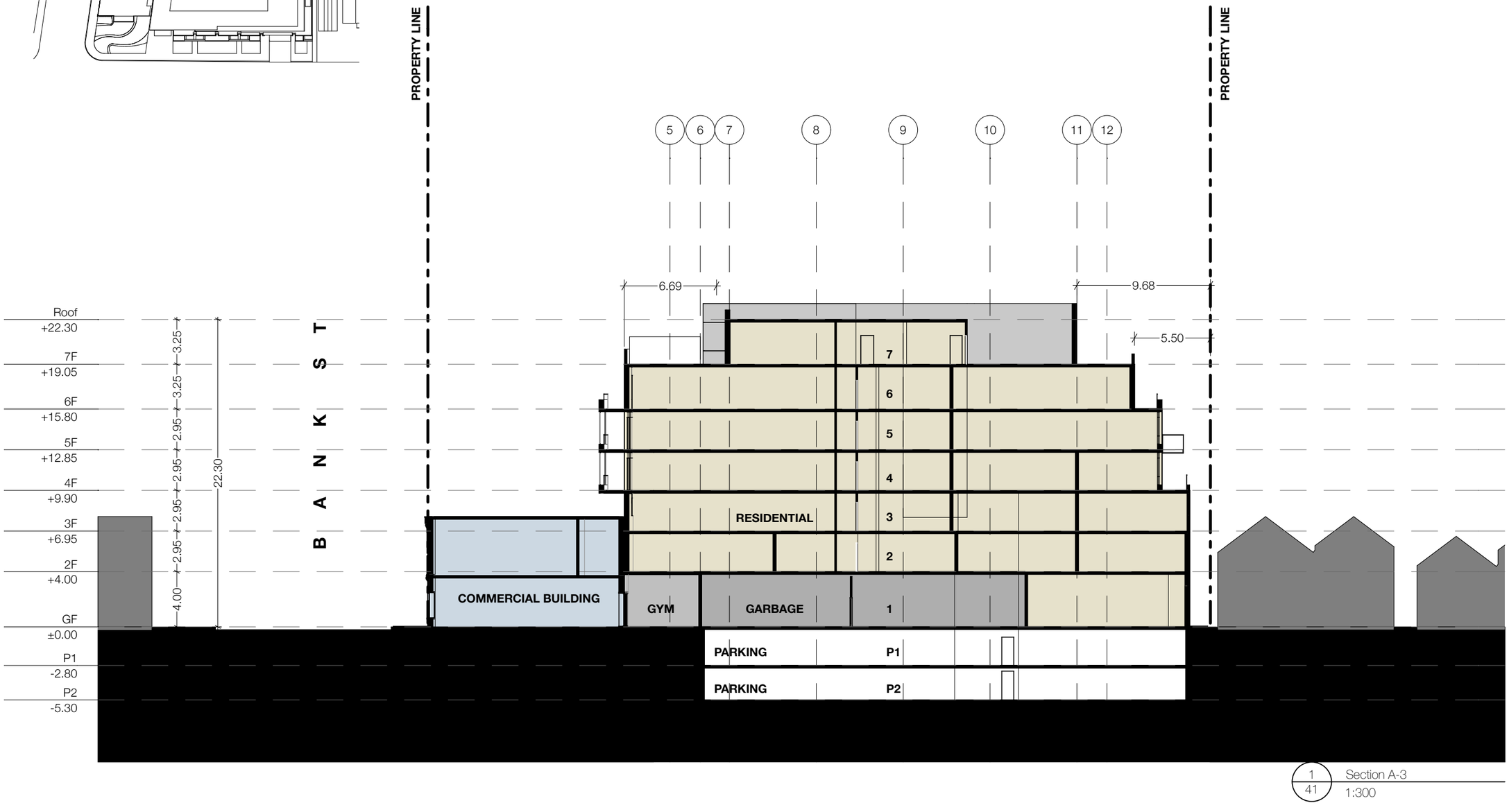
```
STAMSON 5.0         NORMAL REPORT         Date: 26-04-2018 10:19:14
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r7.te                 Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Fifth Avenue (day/night)
-----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Fifth Avenue (day/night)
----------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  19.00 / 19.00  m
Receiver height           :  20.70 / 20.70  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  19.05 m
Barrier receiver distance :   5.00 / 5.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: Bank Street (day/night)
-----------------------------------------------
Car traffic volume  : 24288/2112  veh/TimePeriod  *
Medium truck volume :  1932/168   veh/TimePeriod  *
Heavy truck volume  :  1380/120   veh/TimePeriod  *
Posted speed limit  :    40 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  30000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Bank Street (day/night)
---------------------------------------------
Angle1   Angle2           : -90.00 deg   -8.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  38.00 / 38.00  m
Receiver height           :  20.70 / 20.70  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -8.00 deg
Barrier height            :  19.05 m
Barrier receiver distance :  14.00 / 14.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Fifth Avenue (day)
---------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       20.70 !       15.65 !        15.65

ROAD (0.00 + 50.49 + 0.00) = 50.49 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  63.96   0.00  -1.03   0.00   0.00   0.00 -12.44  50.49
-------------------------------------------------------------------------------

Segment Leq : 50.49 dBA


Results segment # 2: Bank Street (day)
--------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       20.70 !       13.62 !        13.62

ROAD (0.00 + 48.20 + 0.00) = 48.20 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     -8   0.00  69.70   0.00  -4.04  -3.41   0.00   0.00 -14.04  48.20
-------------------------------------------------------------------------------

Segment Leq : 48.20 dBA

Total Leq All Segments: 52.50 dBA
```

```
Results segment # 1: Fifth Avenue (night)
------------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       20.70 !       15.65 !        15.65

ROAD (0.00 + 42.89 + 0.00) = 42.89 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  56.36   0.00  -1.03   0.00   0.00   0.00 -12.44  42.89
-------------------------------------------------------------------------------

Segment Leq : 42.89 dBA


Results segment # 2: Bank Street (night)
----------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       20.70 !       13.62 !        13.62

ROAD (0.00 + 40.60 + 0.00) = 40.60 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     -8   0.00  62.10   0.00  -4.04  -3.41   0.00   0.00 -14.04  40.60
-------------------------------------------------------------------------------

Segment Leq : 40.60 dBA

Total Leq All Segments: 44.90 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 52.50
                           (NIGHT): 44.90
```





1/41 Section A-3
1:300

660R College St [Rear Lane]
Toronto ON M6G 1B8
TACT Architecture Inc.
www.tactarchitecture.com

Section A-3

99 Fifth Avenue Ottawa

Thursday, May 3, 2018

minto TACT ARCHITECTURE