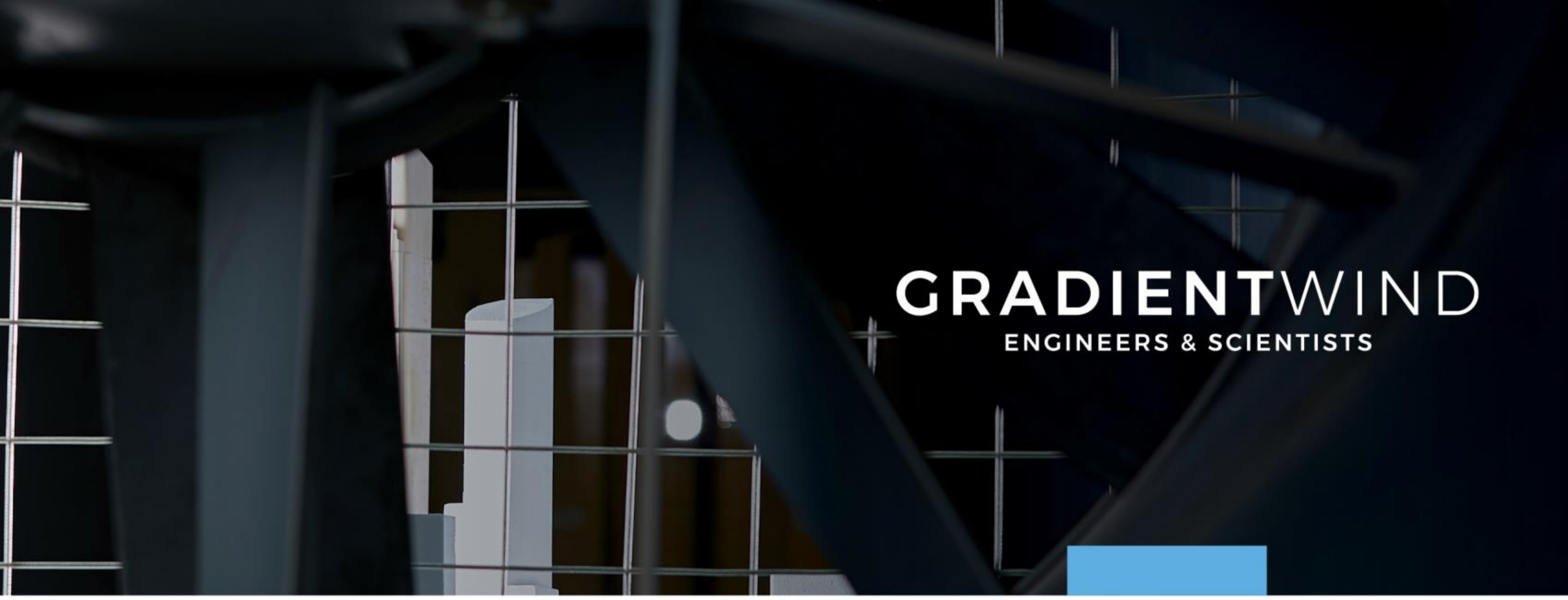
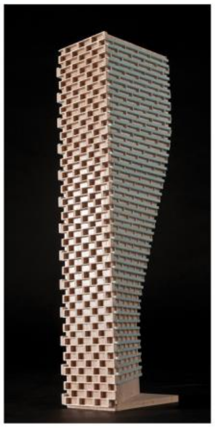
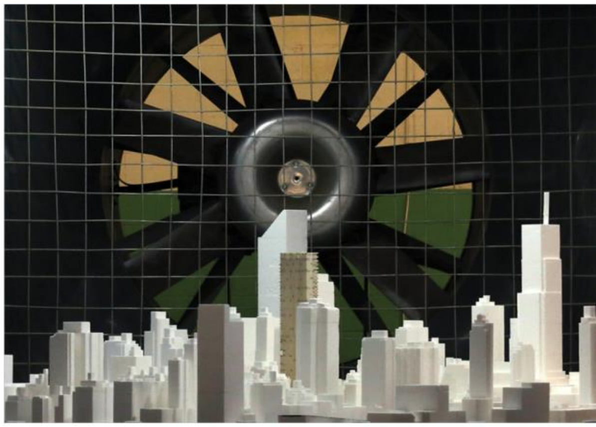


ROADWAY TRAFFIC NOISE FEASIBILITY ASSESSMENT

Lansdowne 2.0
Ottawa, Ontario

Report: 23-053- Traffic Noise Feasibility





June 16, 2023

PREPARED FOR
City of Ottawa
110 Laurier Avenue West
Ottawa, ON K1P 1J1

PREPARED BY
Essraa Alqassab, BASc, Junior Environmental Scientist
Joshua Foster, P.Eng., Principal

EXECUTIVE SUMMARY

This report describes a roadway traffic noise feasibility assessment undertaken for a proposed multi-building development, known as Lansdown 2.0, located east of Bank Street in Ottawa, Ontario. The proposed development comprises three towers rising 40, 36, and 30 stories. This redevelopment will also demolish and re-build the north stadium stands to add additional accessible seating and standing areas. Furthermore, it will also add a partially underground arena / event space east of the stadium, topped with a green roof. The primary sources of roadway traffic noise impacting the site include Bank Street and Queen Elizabeth Driveway. This assessment also considers noise impacts from the stadium and surrounding noise generating spaces. 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 provided by Hobin Architecture in April 2023.

The results of the current analysis indicate that noise levels due to traffic sources at the building façades will range between 50 and 59 dBA during the daytime period (07:00-23:00) and between 42 and 51 dBA during the nighttime period (23:00-07:00). The highest noise level (59 dBA) occurs at the west façade of Tower 1 which is nearest and most exposed to Bank Street. Results indicate that acoustic mitigation will not be required for any of the identified outdoor amenity areas or terraces as noise levels do not exceed 55 dBA.

Noise impacts from the stadium onto the development are expected to reach 75 dBA. As such, upgraded building components will be required at select facades for all towers (see Figure 6). Air conditioning, or a similar mechanical system is also required to ensure a comfortable indoor environment. Type D and Type E Warning Clauses are required to be placed on all Lease, Purchase, and Sale Agreements for all dwellings in the residential towers, as summarized in Section 6.

With regards to noise impacts from the multi-level entertainment venue, located at levels P1-1B, significant sound isolation will be required by a "Room within a Room" system. This isolation system will help keep noise from the venue space from impacting the surrounding noise sensitive spaces and keep ambient noise levels inside to a low level. The construction of the venue space could be as follows: the floor could be isolated, jack up slab, the interior walls would be built of double row studs with the first row of studs built on top of the isolation slab. The second row of studs would be on the surrounding structure. A suspended ceiling would be hung using isolation hangers. Noise generated from pedestrians congregating at the music venue entrances, exhibition Way, Aberdeen Pavilion, the new event center, or any near-by entertainment venue, is not expected to be a major concern, and would blend in with the existing vibrant establishments already on site.

Stationary noise impacts from mechanical equipment serving surrounding buildings are not expected to be a concern due to the size of the equipment and the setback distance. With regards to stationary noise impacts from the development onto the environment, a stationary noise study is recommended for the site during the detailed design once mechanical plans for the proposed development become available. This study would assess impacts of stationary noise from rooftop mechanical units serving the proposed towers on surrounding noise sensitive areas and each other. As the mechanical equipment will primarily reside in the mechanical level located on the high roof, noise levels on the surrounding noise sensitive properties are expected to be negligible. Noise impacts can generally be minimized by judicious selection and placement of the equipment.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by the City of Ottawa to undertake a roadway traffic noise feasibility assessment for a proposed multi-building development, known as Lansdown 2.0. This report summarizes the methodology, results, and recommendations related to the assessment of exterior noise levels generated by local roadway traffic.

Our work is based on 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 provided by Hobin Architecture, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The proposed Zoning By-law & Official Plan Amendments for Lansdowne 2.0 represent the next step in the evolution and progression of Lansdowne towards a redevelopment approach that will allow the site to succeed as an important residential, sports, culture, recreation, commercial, and entertainment destination, and a more vibrant day-to day hub for Ottawa.

The work described below requires both an Official Plan and Zoning By-law Amendment to align the proposed development plan with the City's planning policy framework. In general, the proposed development includes two components – a public infrastructure component and a private infrastructure component.

These two principal components are advanced through a number of important elements, including:

- Increase residential density to foster daily vibrancy to the area through proposing three high-rise towers including a combination of condominium and rental including affordable housing units.
    - The private infrastructure component could include up to 1,200 new residential units on-site, which could be provided in three new towers atop the proposed retail podium.

---

[1] City of Ottawa Environmental Noise Control Guidelines, January 2016
[2] Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013

    - The proposed heights of the towers as per the 2022 Council-endorsed concept are 29, 34, and 40 storeys, with the proposed maximum height limited to 40 storeys. Approximately 739 new parking spaces could be provided for the new residential units and located within the underground parking lot and within Level 1 and Level 1.5 (mezzanine) of the podium and north stadium stands.
- Add mixed-used retail space through replacing the current 3,809m² (41,000 ft²) retail space attached to the arena/stadium complex along Exhibition Way, with 9,290m² (100,000 ft²) of new mixed-use retail space in the podium of the new residential towers.
    - The new north stadium stands will be integrated with a new retail podium, which will provide additional retail options to the existing Lansdowne Park, enhance the existing public realm along Exhibition Way, and enhance the protected viewpoint of Aberdeen Pavilion from Bank Street.
- Replace the existing City facilities on-site through proposing a new 5,500-seat standalone multipurpose Event Centre and a re-designed and reconstructed 12,000-seat north stadium stands.
    - The public infrastructure component will include a new event centre which is intended to replace the existing 9,500 seat TD Place Arena which is located within the north stadium stands.
    - In addition to the new event centre, the north stadium stands will be replaced with 11,200 new seats, which will accommodate 12,000 spectators with additional standing-only areas.
- Consolidate service access & loading through including a common access point for service & loading is provided for the Event Centre, Stadium, Residential and Retail.
- Facilitate City-led enhancements to the public realm and programming as per the direction of the Lansdowne Guiding Principles which will form an important part of Lansdowne 2.0.

Overall, the proposal intends to re-visit the form and function of Lansdowne, and specifically Exhibition Way, as a place of exhibition, open to the City as a whole that fosters public gathering, vibrancy, and a centre of activity for the City. There will be a continued focus on placemaking, and the careful integration and enhancement of all new features with the objectives of the existing site – including a shared commitment to recognizing and celebrating Algonquin history, art and culture, respecting heritage building views, animating Exhibition Way, providing access to the Great Lawn, and preserving an incorporating existing public and private components of Lansdowne today.

3. OBJECTIVES

The principal objectives of this study are to (i) calculate the future noise levels on the study buildings produced by local roadway traffic and surrounding noise-generating spaces, and (ii) explore potential noise mitigation options, where required.

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 surface roadway traffic noise, 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 impact on residential buildings. The City of Ottawa's Environmental Noise Control Guidelines (ENCG) specifies that the recommended indoor noise limit range (that is relevant to this study) is 50, 45 and 40 dBA for retail space, living rooms and sleeping quarters, respectively, for roadway traffic as listed in Table 1.

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

Type of Space	Time Period	L_{eq} (dBA)
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 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 triggers the need for forced air heating with provision for central air conditioning. Where noise levels exceed 65 dBA daytime and 60 dBA nighttime, air conditioning will be required and 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 (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.

4.2.2 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

[3] Adapted from ENCG 2016 – Tables 2.2b and 2.2c
[4] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[5] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[6] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

classifications outlined in the City of Ottawa's Official Plan (OP) and Transportation Master Plan[7] which 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 (below) summarizes the AADT values used for each roadway included in this assessment.

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Bank Street	4-Lane Arterial (Undivided)	40	**30,000**
Queen Elizabeth Driveway	2-Lane Urban Collector	40	**8,000**

4.2.3 Theoretical Roadway Noise Predictions

Noise predictions were determined by computer modelling using two programs: Predictor-Lima and STAMSON 5.04. To provide a general understanding of noise across the site, the employed software program was Predictor-Lima, which incorporates the United States Federal Highway Administration's (FHWA) Transportation Noise Model (TNM) 2.5. This computer program is capable of representing three-dimensional surface and first reflections of sound waves over a suitable spectrum for human hearing. A receptor grid was placed across the subject site, along with a number of discrete receptors at key sensitive areas. Although this program is useful for outputting noise contours, it is not the approved calculation method for roadway predictions by the City of Ottawa. Therefore, the results were confirmed by performing discrete noise calculations with the MECP computerized noise assessment program, STAMSON 5.04, at two sample receptor locations. Receptor distances and exposure angles are illustrated in Figure 3. Appendix A includes the STAMSON 5.04 input and output data.

Roadway noise calculations were performed by treating each road segment as a separate line source of noise, and by using existing buildings as noise barriers. In addition to the traffic volumes summarized in Table 1, theoretical noise predictions were based on the following parameters:

- The day/night split was taken to be 92%/8% respectively for all streets.

[7] City of Ottawa Transportation Master Plan, November 2013

- Truck traffic on all roadways was taken to comprise 5% heavy trucks and 7% medium trucks, as per ENCG requirements for noise level predictions.
- Ground surfaces were taken to be reflective due to the presence of hard (paved) ground.
- Topography was assumed to be flat/gentle slope surrounding the subject site.
- Noise receptors were strategically placed at 14 locations around the study area, see Figure 2.
- Receptor distances and exposure angles used in the STAMSON calculations are illustrated in Figure 3.

4.3 Noise Impacts from the Stadium

Crowd noise impacts from the stadium have been considered in this analysis. According to *Crowd Noise Measurements and Simulation in Large Stadium Using Beamforming*[8], crowd noise levels at a typical football game ranges between 95 to 105 dBA, with occasional peaks approaching 110 dB. The maximum peak has been used in the analysis for conservatism. The noise level is then extrapolated to the Plane of Window of the south façade, with a setback distance of 16 m using standard outdoor noise propagation calculations consistent with ISO 9613. Results are detailed in Section 5.2

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

The results of the current analysis indicate that noise levels at the building façades will range between 50 and 59 dBA during the daytime period (07:00-23:00) and between 42 and 51 dBA during the nighttime period (23:00-07:00). The highest noise level (59 dBA) occurs at the west façade of Tower 1 which is nearest and most exposed to Bank Street. Figures 4 and 5 illustrate daytime and nighttime noise contours throughout the site 40 m above grade.

Results also indicate that acoustic mitigation will not be required for any of the identified outdoor living areas as noise levels do not exceed 55 dBA. Results can be seen in Table 3.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC

[8] *Crowd Noise Measurements and Simulation in Large Stadium Using Beamforming, University of Michigan, February 2008*

Receptor Number	Absolute Receptor Height (m)	Receptor Location	Noise Level (dBA)	
			Day	Night
R1	23.3	POW – Tower 1, Podium – West Façade	53	45
R2	23.3	POW – Tower 1, Podium – North Façade	53	46
R3	125.3	POW – Tower 1, Level 40 – West Façade	59	51
R4	125.3	POW – Tower 1, Level 40 – North Façade	58	50
R5	125.3	POW – Tower 1, Level 40 – South Façade	56	49
R6	23.3	POW – Tower 3, Podium – East Façade	50	42
R7	92.3	POW – Tower 3, Level 30 – East Façade	52	45
R8	92.3	POW – Tower 3, Level 30 – North Façade	51	43
R9	1.5	OLA – Outdoor Amenity at Level 2 (between Tower 2/3)	21	N/A
R10	1.5	OLA –Tower 1 Level 4 Terraces	53	N/A
R11	1.5	OLA –Tower 1 Level 4 Terraces	23	N/A
R12	1.5	OLA –Tower 2 Level 4 Terraces	26	N/A
R13	1.5	OLA –Tower 3, Level 7 Terraces (potential)	48	N/A
R14	107.3	POW – Tower 2, Level 36 – North Façade	53	45

*Above podium roof

Table 4 shows a comparison between the calculated noise levels using Predictor-Lima and STAMSON. Noise levels calculated in STAMSON were found to have good correlation with Predictor-Lima and variability between the two programs was within an acceptable level of ±1-3dBA. Appendix A includes the STAMSON 5.04 input and output data.

TABLE 4: RESULT CORRELATION BETWEEN PREDICTOR AND STAMSON

Receptor Number	Receptor Location	Absolute Receptor Height (m)	STAMSON 5.04 Noise Level (dBA)		PREDICTOR-LIMA Noise Level (dBA)	
			Day	Night	Day	Night
R3	Tower 1, Level 40 – West Façade	125.3	62	54	59	51
R4	Tower 1, Level 40 – North Façade	125.3	59	52	58	50

5.2 Noise Impacts from Surrounding Noise-Generating Spaces

Results of the analysis show that the crowd noise impacts from the stadium onto the mixed-use towers is approximately 75 dBA outside the window. Since the targeted indoor noise levels for bedrooms/living rooms/retail spaces are: 40, 45, and 50 dBA, respectively, minimum window STC requirements have been estimated based on the difference between the outdoor noise level and the targeted indoor noise level. Facades that require upgraded window components are detailed in Table 5 and Figure 6:

TABLE 5: MINIMUM WINDOW STC REQUIRMENTS

Tower	Façade	Minimum STC
Tower 1 / 2 / 3 podium	South, East, West	35
Tower 1		
Tower 2		
Tower 3		

Furthermore, the development will also require air conditioning, or a similar system, to ensure a comfortable indoor environment. Warning Clauses will be required to be placed to be placed on all Lease, Purchase, and Sale Agreements, as detailed in Section 6.

With regards to noise impacts from the multi-level entertainment venue, located at levels P1-1B, significant sound isolation will be required by a “Room within a Room” system. This isolation system will help keep noise from the venue space from impacting the surrounding noise sensitive spaces and keep ambient noise levels inside to a low level. The construction of the venue space could be as follows: the floor could be isolated, jack up slab, the interior walls would be built of double row studs with the first row of studs built on top of the isolation slab. The second row of studs would be on the surrounding structure. A suspended ceiling would be hung using isolation hangers. Noise generated from pedestrians congregating at the music venue entrances, exhibition Way, Aberdeen Pavilion, the new event center, or any near-by entertainment venue, is not expected to be a major concern, and would blend in with the existing vibrant establishments already on site.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels at the building façades will range between 50 and 59 dBA during the daytime period (07:00-23:00) and between 42 and 51 dBA during the nighttime period (23:00-07:00). The highest noise level (59 dBA) occurs at the west façade of Tower 1 which is nearest and most exposed to Bank Street. Results indicate that acoustic mitigation will not be required for any of the identified outdoor amenity areas or terraces as noise levels do not exceed 55 dBA.

Noise impacts from the stadium onto the development are expected to reach 75 dBA. As such, upgraded building components will be required at select facades for all towers (see Figure 6). Air conditioning, or a similar mechanical system is also required to ensure a comfortable indoor environment. Warning Clause Type D will be required to be placed on all Lease, Purchase, and Sale Agreements for all towers, as seen below:

Type D:

> *"This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."*

As the development is in close proximity to the stadium, a Warning Clause Type E is required, as seen below:

Type E:

> *"Purchasers/tenants are advised that due to the proximity of the adjacent entertainment facility noise from the stadium and event centre may at times be audible."*

With regards to noise impacts from the multi-level entertainment venue, located at levels P1-1B, significant sound isolation will be required by a “Room within a Room” system. This isolation system will help keep noise from the venue space from impacting the surrounding noise sensitive spaces and keep ambient noise levels inside to a low level. The construction of the venue space could be as follows: the floor could be isolated, jack up slab, the interior walls would be built of double row studs with the first row of studs built on top of the isolation slab. The second row of studs would be on the surrounding structure. A suspended ceiling would be hung using isolation hangers. Noise generated from pedestrians congregating at the music venue entrances, exhibition Way, Aberdeen Pavilion, the new event center, or any near-by entertainment venue, is not expected to be a major concern, and would blend in with the existing vibrant establishments already on site.

Stationary noise impacts from mechanical equipment serving surrounding buildings are not expected to be a concern due to the size of the equipment and the setback distance. With regards to stationary noise impacts from the development onto the environment, a stationary noise study is recommended for the site during the detailed design once mechanical plans for the proposed development become available. This study would assess impacts of stationary noise from rooftop mechanical units serving the proposed towers on surrounding noise sensitive areas. As the mechanical equipment will primarily reside in the mechanical level located on the high roof, noise levels on the surrounding noise sensitive properties are expected to be negligible. Noise impacts can generally be minimized by judicious selection and placement of the equipment.

This concludes our roadway traffic noise feasibility 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.

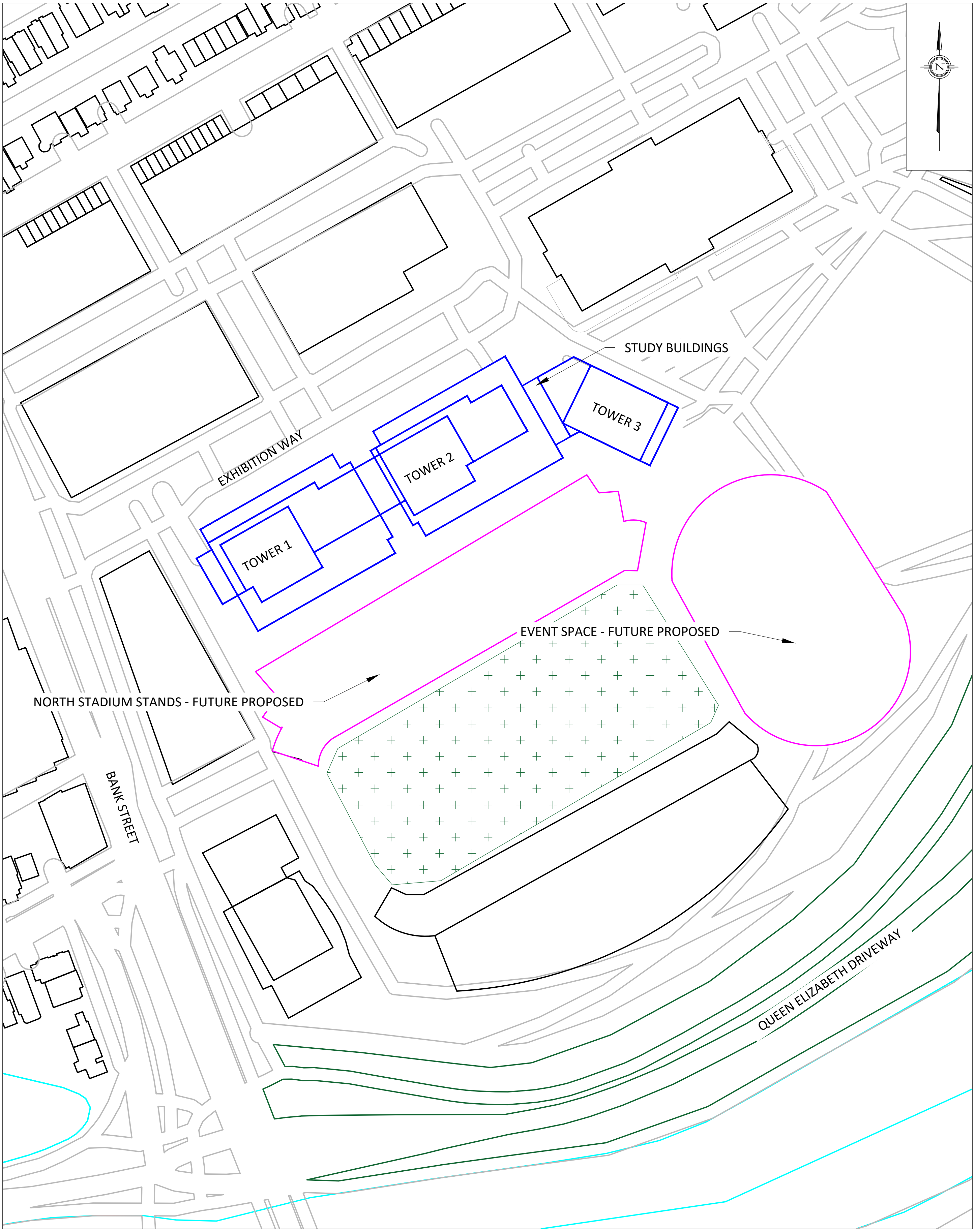
Sincerely,

Gradient Wind Engineering Inc.

LICENSED PROFESSIONAL ENGINEER
J. R. FOSTER
100155655
June 16, 2023
PROVINCE OF ONTARIO

Essraa Alqassab, BASc
Junior Environmental Scientist
Gradient Wind File 23-053- Traffic Noise Feasibility

Joshua Foster, P.Eng.
Lead Engineer

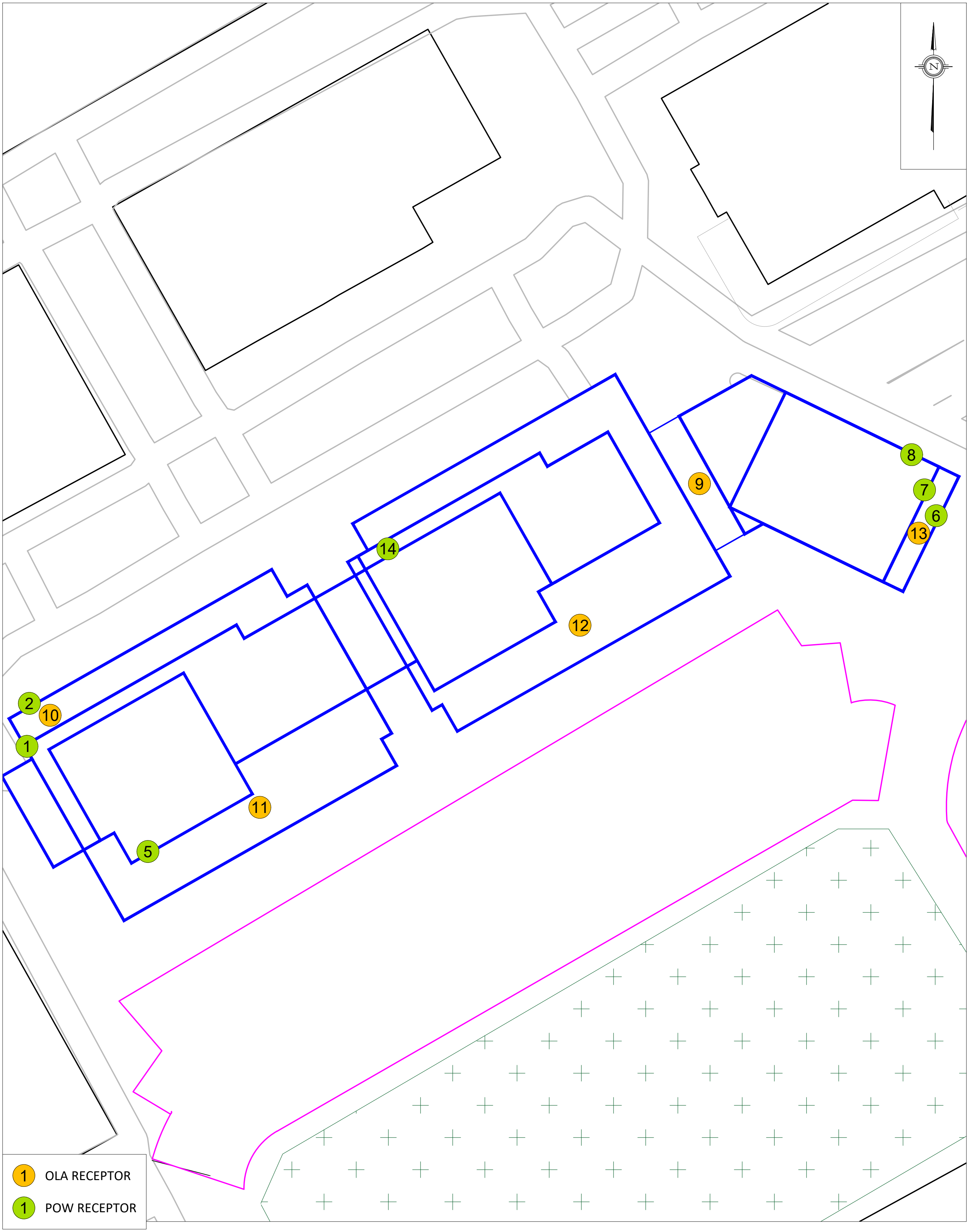


GRADIENTWIND
ENGINEERS & SCIENTISTS
127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	LANSDOWNE 2.0, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		
SCALE	1:2000 (APPROX.)	DRAWING NO.	GW23-053-1
DATE	APRIL 27, 2023	DRAWN BY	E.A.

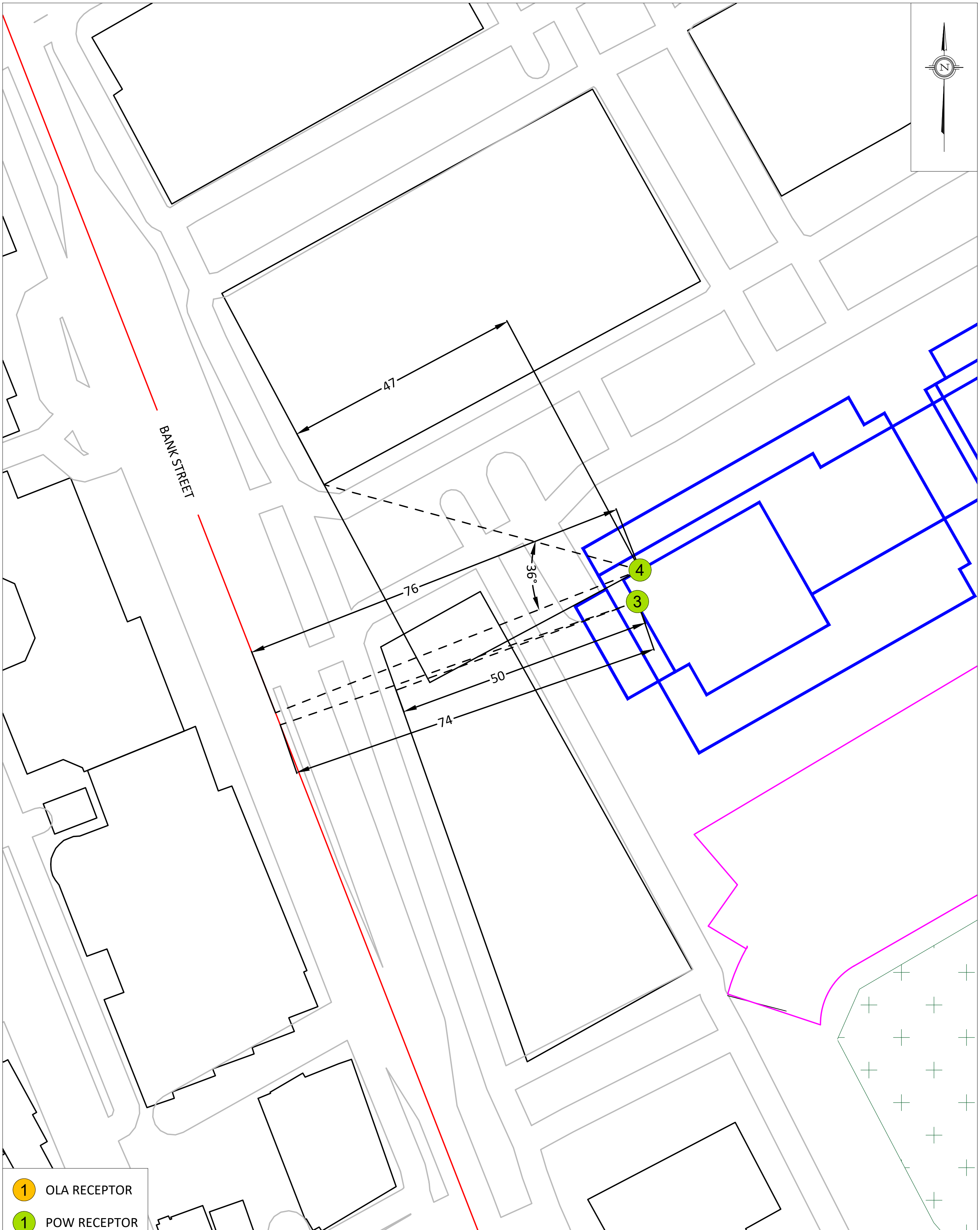
DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



GRADIENTWIND
ENGINEERS & SCIENTISTS
127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	LANSDOWNE 2.0, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO. GW23-053-2	FIGURE 2: RECEPTOR LOCATIONS
DATE	APRIL 27, 2023	DRAWN BY E.A.	



GRADIENTWIND
ENGINEERS & SCIENTISTS
127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT		DESCRIPTION
LANSDOWNE 2.0, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		FIGURE 3: STAMSON PARAMETERS
SCALE 1:1000 (APPROX.)	DRAWING NO. GW23-053-3	
DATE APRIL 27, 2023	DRAWN BY E.A.	

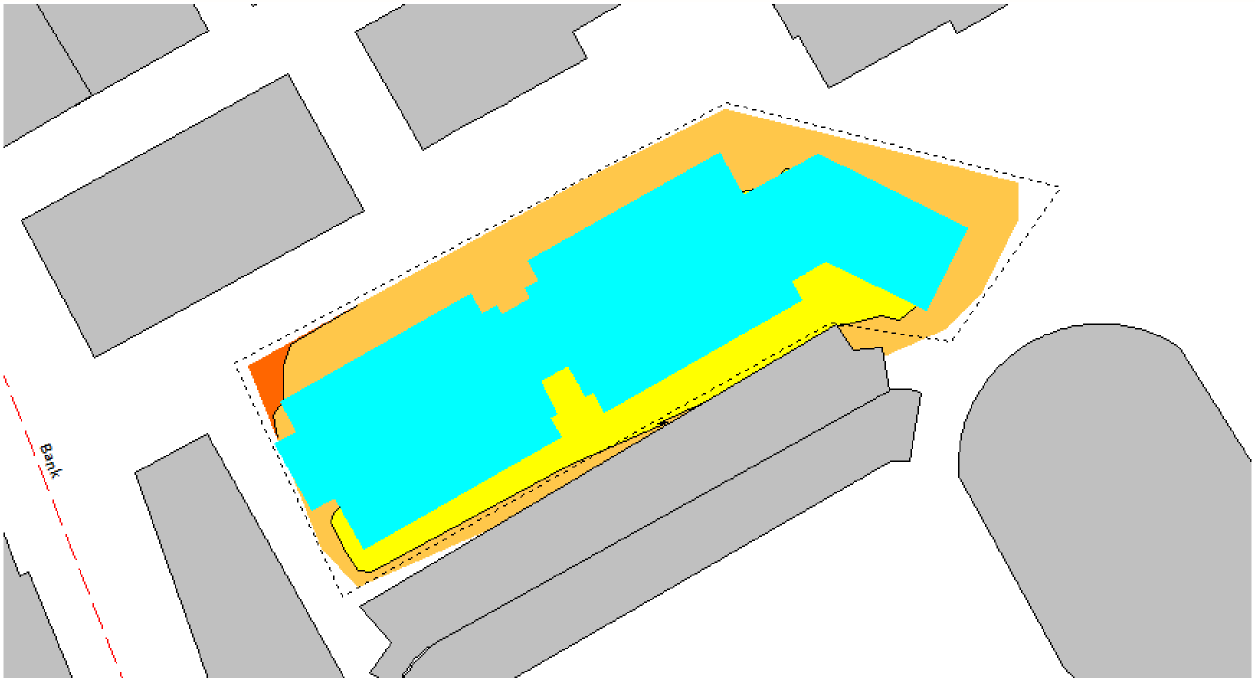


FIGURE 4: DAYTIME TRAFFIC NOISE CONTOURS (40 M ABOVE GRADE)

80 – 85 dB
75 – 80 dB
70 – 75 dB
65 – 70 dB
60 – 65 dB
55 – 60 dB
50 – 55 dB
45 – 50 dB
40 – 45 dB
35 – 40 dB
0 – 35 dB

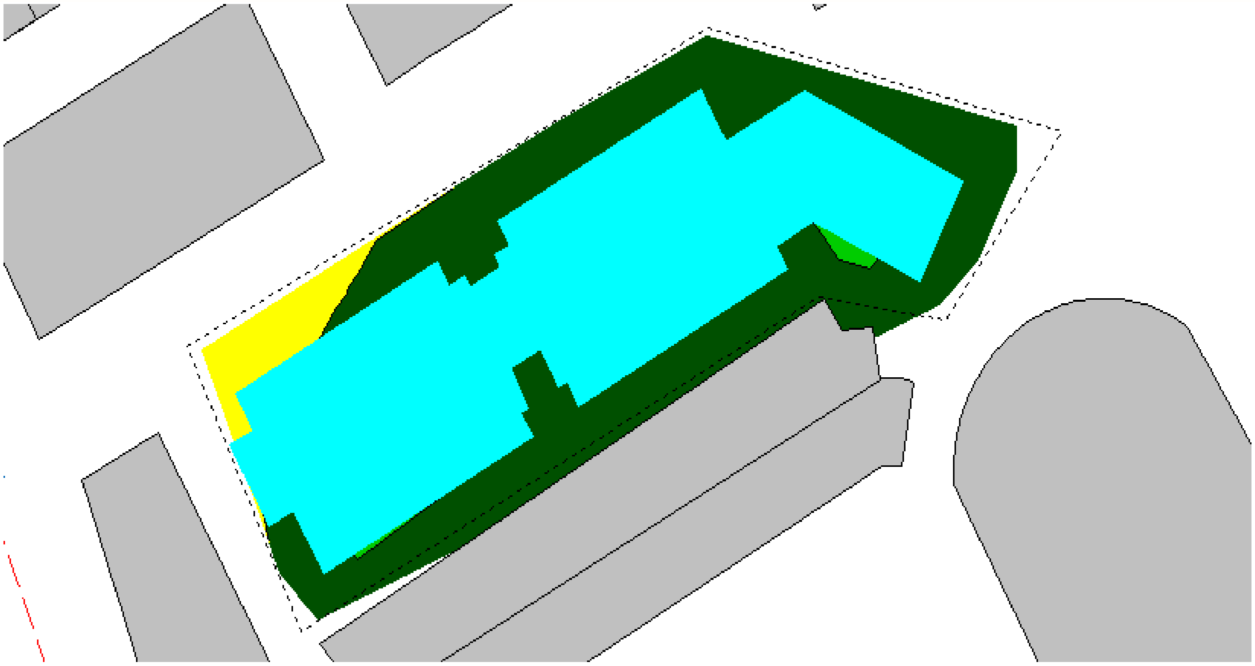
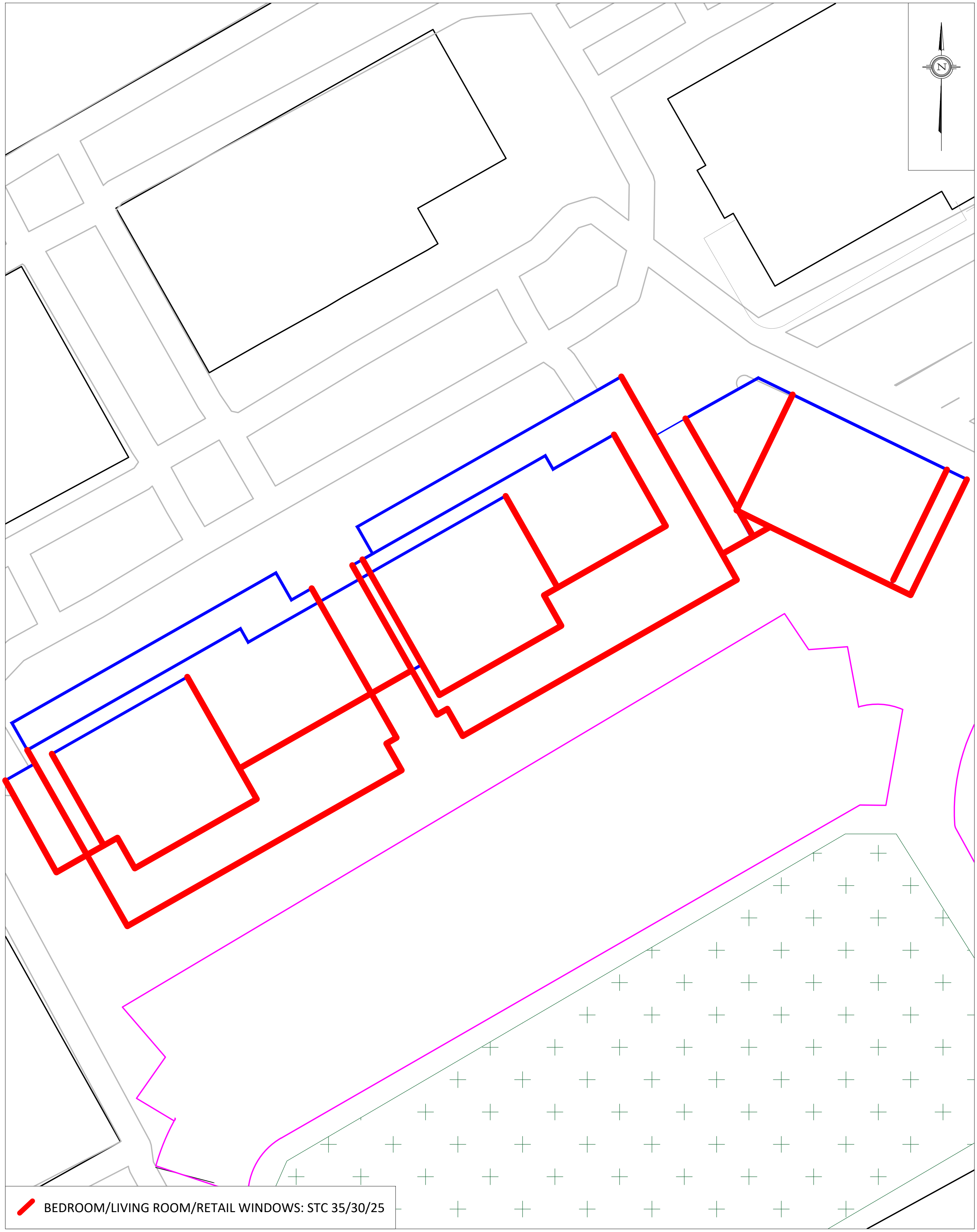


**FIGURE 5: NIGHTTIME TRAFFIC NOISE CONTOURS
(40 M ABOVE GRADE)**

80 – 85 dB
75 – 80 dB
70 – 75 dB
65 – 70 dB
60 – 65 dB
55 – 60 dB
50 – 55 dB
45 – 50 dB
40 – 45 dB
35 – 40 dB
0 – 35 dB

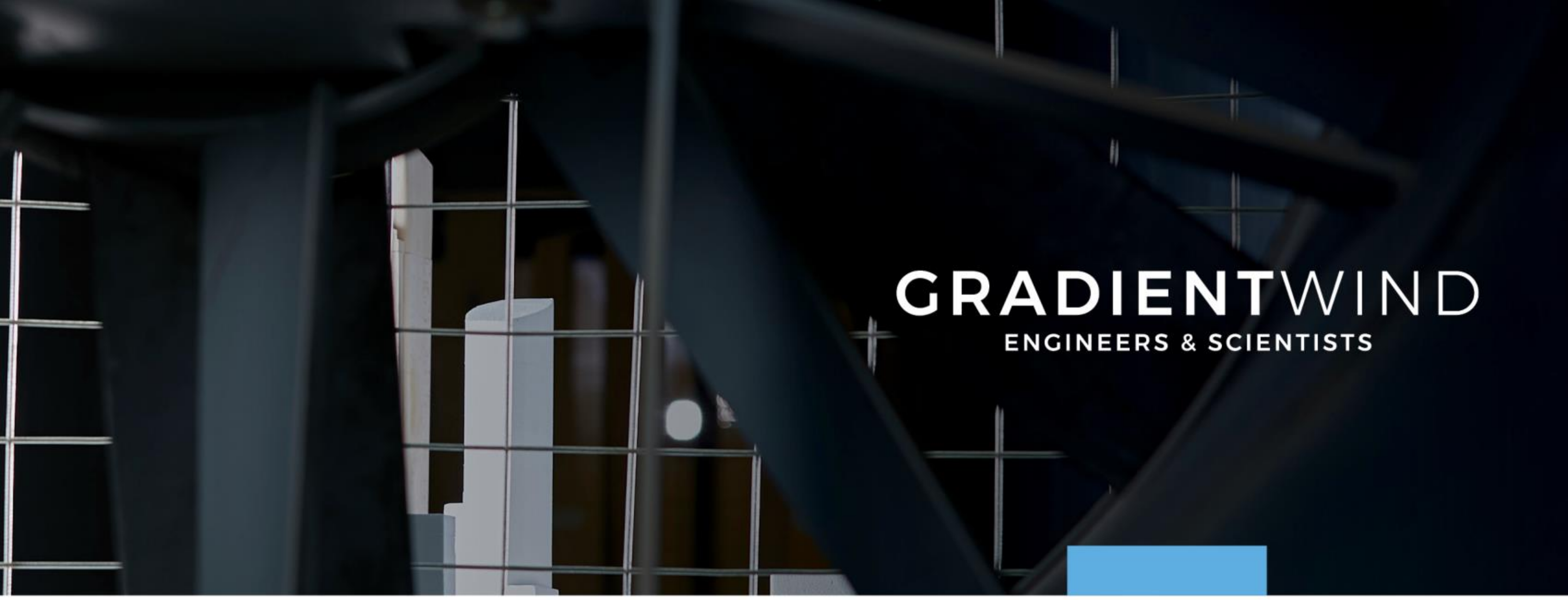


GRADIENTWIND
ENGINEERS & SCIENTISTS
127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	LANSDOWNE 2.0, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW23-053-6
DATE	APRIL 27, 2023	DRAWN BY	E.A.

DESCRIPTION

FIGURE 6:
STC RECOMMENDATIONS



APPENDIX A

STAMSON CALCULATIONS

```
STAMSON 5.0        NORMAL REPORT        Date: 27-04-2023 11:19:19
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Bank (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 (day/night)
--------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  80.00 / 80.00  m
Receiver height           : 125.30 / 125.30 m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 50.00 deg
Barrier height            :  26.00 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 (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 !       125.30 !        86.61 !         86.61

ROAD (0.00 + 61.33 + 55.89) = 62.43 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
------------------------------------------------------------------------
--
   -90     50   0.00  69.70   0.00  -7.27  -1.09   0.00   0.00  -0.00
61.33*
   -90     50   0.00  69.70   0.00  -7.27  -1.09   0.00   0.00   0.00
61.33
------------------------------------------------------------------------
--
    50     90   0.00  69.70   0.00  -7.27  -6.53   0.00   0.00   0.00
55.89
------------------------------------------------------------------------
--

 * Bright Zone !

Segment Leq : 62.43 dBA

Total Leq All Segments: 62.43 dBA


Results segment # 1: Bank (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 !       125.30 !        86.61 !         86.61

ROAD (0.00 + 53.74 + 48.30) = 54.83 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
------------------------------------------------------------------------
--
   -90     50   0.00  62.10   0.00  -7.27  -1.09   0.00   0.00  -0.00
53.73*
   -90     50   0.00  62.10   0.00  -7.27  -1.09   0.00   0.00   0.00
53.74
------------------------------------------------------------------------
--
```

```
    50     90   0.00  62.10   0.00  -7.27  -6.53   0.00   0.00   0.00
48.30
--------------------------------------------------------------------------
--

 * Bright Zone !

Segment Leq : 54.83 dBA

Total Leq All Segments: 54.83 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 62.43
                         (NIGHT): 54.83
```

```
STAMSON 5.0        NORMAL REPORT        Date: 27-04-2023 11:25:57
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Bank (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 (day/night)
--------------------------------------
Angle1   Angle2           :   0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  76.00 / 76.00  m
Receiver height           : 125.30 / 125.30 m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :  36.00 deg   Angle2 : 90.00 deg
Barrier height            :  15.00 m
Barrier receiver distance :  47.00 / 47.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00


Results segment # 1: Bank (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 !      125.30 !       48.74 !        48.74

ROAD (55.66 + 57.42 + 0.00) = 59.64 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
     0     36   0.00  69.70   0.00  -7.05  -6.99   0.00   0.00   0.00
55.66
--------------------------------------------------------------------------
--
    36     90   0.00  69.70   0.00  -7.05  -5.23   0.00   0.00  -0.02
57.40*
    36     90   0.00  69.70   0.00  -7.05  -5.23   0.00   0.00   0.00
57.42
--------------------------------------------------------------------------
--

 * Bright Zone !

Segment Leq : 59.64 dBA

Total Leq All Segments: 59.64 dBA


Results segment # 1: Bank (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 !      125.30 !       48.74 !        48.74

ROAD (48.06 + 49.82 + 0.00) = 52.04 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
     0     36   0.00  62.10   0.00  -7.05  -6.99   0.00   0.00   0.00
48.06
--------------------------------------------------------------------------
--
    36     90   0.00  62.10   0.00  -7.05  -5.23   0.00   0.00  -0.02
49.80*
```

```
    36      90    0.00   62.10    0.00  -7.05  -5.23    0.00    0.00    0.00
49.82
--------------------------------------------------------------------------------
--

 * Bright Zone !

Segment Leq : 52.04 dBA

Total Leq All Segments: 52.04 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 59.64
                          (NIGHT): 52.04
```