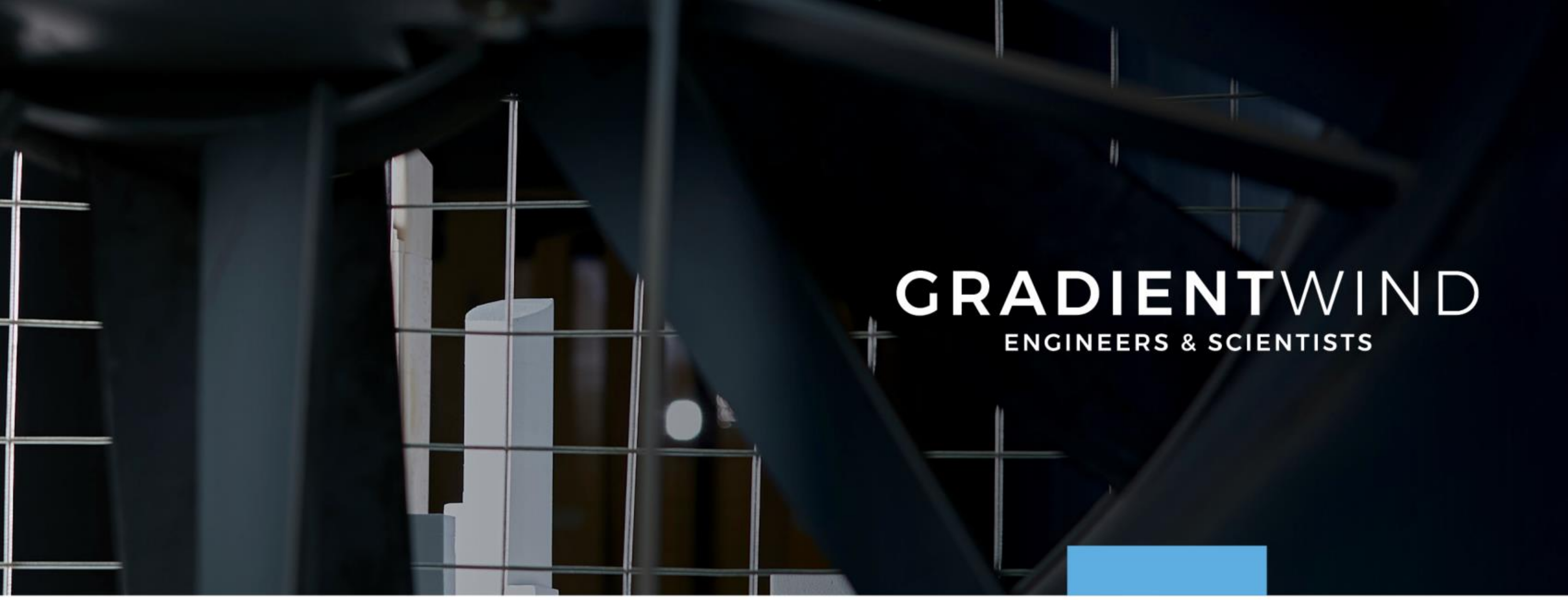
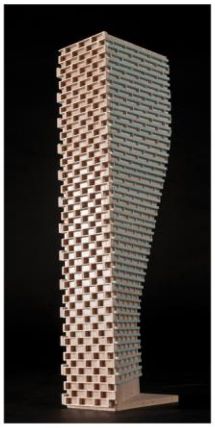
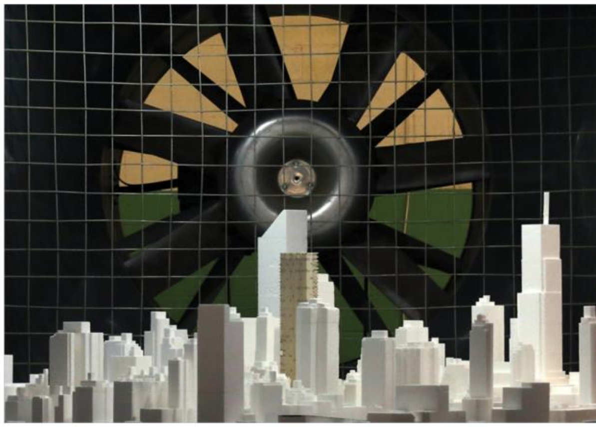


ROADWAY TRAFFIC NOISE ASSESSMENT

620 Bobolink Ridge
Ottawa, Ontario

Report: 21-083–Traffic Noise R2





December 10, 2021

PREPARED FOR
Richcraft Group of Companies
2280 St. Laurent Boulevard, Suite 201
Ottawa, ON K1G 4K1

PREPARED BY
Efser Kara, MSc, LEED GA, Acoustic Scientist
Joshua Foster, P.Eng., Lead Engineer

EXECUTIVE SUMMARY

This report describes a traffic noise assessment undertaken for a proposed subdivision development known as CRT Lands – Block 344, located at 620 Bobolink Ridge in Ottawa, Ontario. The subdivision comprises a rectangular parcel of land and is part of the approved Fernbank Community Design Plan. The development is bounded by Bobolink Ridge to the northwest, Robert Grant Avenue from the north to the southeast, Cope Drive to the southeast/south, and Embankment Street to the west. Throughout this report, the elevation parallel with Bobolink Ridge is referred to as the north elevation.

The proposed development comprises seven blocks of terrace flats, each with 12 dwelling units, an accessory building, and amenity areas. Amenity areas are provided at grade on the west side of Block 2, on the east side of the accessory building, and at the southeast corner of the study site. These communal areas will be programmed as parks or passive landscaped areas. They are not intended to be used as outdoor living areas (OLA). At the rear of each block, OLAs are provided in the form of a rear yard. Vehicular access (driveways) is provided via Embankment Street with parking provided at grade.

The primary sources of traffic noise on the residential subdivision are Robert Grant Avenue and Cope Drive. Figure 1 illustrates the site location with the 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) concept plans prepared by M. David Blakely Architect Inc., dated September 2021.

The results of the roadway traffic noise calculations are summarized in Table 3 below. The results of the current analysis indicated that noise levels at Plane of Window (POW) receptors will range between 67 and 63 dBA during the daytime period (07:00-23:00) and between 60 and 55 dBA during the nighttime period (23:00-07:00). The highest noise level (67 dBA) occurs at the east façades of Blocks 2, 3, 4, 5, and 6, which are nearest and most exposed to Robert Grant Avenue. Figures 7 and 8 illustrate daytime .and nighttime noise contours without the noise barriers throughout the site at a height of 4.5 m above grade

and Figures 9 and 10 illustrate daytime noise contours with the noise barriers throughout the site at a height of 1.5 m above grade.

The noise levels at the outdoor living areas (OLA), represented by Receptors 8, 9, 11, and 16 (Blocks 5, 3, 1, and 4, respectively) exceed the ENCG criteria. Therefore, a noise barrier investigation was conducted using Predictor-Lima. The result of the noise barrier investigation indicated that a noise barrier with a standard height of 2.2 metres will be required to reduce the noise levels below 60 dBA. The noise barrier should be built with solid elements having a minimum surface mass of 20 kg/m² and contain no gaps. The location of the noise barriers can be seen in Figure 4. The following information will be required by the City for review prior to installation of the barrier:

1. Shop drawings, signed and sealed by a qualified Professional Engineer licenced by the Professional Engineers of Ontario, showing the details of the acoustic barrier systems components, including material specifications.
2. Structural drawing(s), signed by a qualified Professional Engineer licenced by the Professional Engineers of Ontario, showing foundation details and specifying design criteria, climatic design loads, as well as applicable geotechnical data used in the design.
3. Layout plan, and wall elevations, showing proposed colours and patterns.

The results of the analysis also indicated that for Block 1, 2, 3, 4, 5, and 6 central air conditioning or a similar ventilation system, which will allow occupants to keep windows closed and maintain a comfortable living environment, will be required. For Block 7, forced air heating with provision for the installation of central air conditioning will be required (see Figures 5 and 6) for the blocks of the proposed development. Warning Clauses will also be required to be placed on all Lease, Purchase and Sale Agreements for the development, as summarized in Section 6.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Richcraft Group of Companies to undertake a traffic noise assessment for a proposed subdivision development known as CRT Lands – Block 344 located at 620 Bobolink Ridge in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior and interior 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 concept plans prepared by M. David Blakely Architect Inc., dated September 2021, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications and theoretical capacities.

2. TERMS OF REFERENCE

The focus of this traffic noise assessment is a proposed subdivision development known as CRT Lands – Block 344, located at 620 Bobolink Ridge in Ottawa, Ontario. The subdivision comprises a rectangular parcel of land and is part of the approved Fernbank Community Design Plan. The development is bounded by Bobolink Ridge to the northwest, Robert Grant Avenue from the north to the southeast, Cope Drive to the southeast/south, and Embankment Street to the west. Throughout this report, the Bobolink Ridge elevation is referred to as the north elevation.

The proposed development comprises seven blocks of townhouses, each with 12 units, an accessory building, and outdoor amenity areas. Amenity areas are provided at grade on the west side of Block 2, on the east side of the accessory building, and at the southeast corner of the study site. These communal areas will be programmed as parks or passive landscaped areas. They are not intended to be used as outdoor living areas (OLA). At the rear of each block, OLAs are provided in the form of a rear yard. Vehicular access (driveways) is provided via Embankment Street with parking provided at grade. The

[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

proposed development is surrounded by low-rise residential buildings to the east, future low-rise residential buildings to the north and west, and an open area to the south.

The primary sources of traffic noise on the residential subdivision are Robert Grant Avenue and Cope Drive. Figure 1 illustrates the site location with the surrounding context.

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 (ii) ensure that interior and exterior noise levels do not exceed the allowable limits specified by the City of Ottawa's Environmental Noise Control Guidelines as outlined in Section 4.2 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 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 45 and 40 dBA for living rooms and sleeping quarters respectively for roadway 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 (OLA) is 55 dBA, which applies during the daytime (07:00 to 23:00). When noise levels exceed 55 dBA but are less than 60 dBA, mitigation should be provided to reduce noise levels where technically and administratively feasible to acceptable levels at or below the

[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] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[6] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

criterion. Where noise levels exceed 60 dBA noise mitigation is required. If these measures are not provided, prospective purchasers or tenants should be informed of potential noise problems by a warning clause.

4.2.2 Theoretical Roadway Noise Predictions

The impact of transportation noise sources on the development was determined by computer modelling. Transportation noise source modelling is based on the software program *Predictor-Lima* which utilizes the United States Federal Highway Administration's Traffic Noise Model (TNM) to represent the roadway line sources. The TNM model is also being accepted in the updated Environmental Guide for Noise of Ontario, 2021 by the Ministry of Transportation (MTO)[7]. This computer program can represent three-dimensional surfaces and first reflections of sound waves over a suitable spectrum for human hearing. A set of comparative calculations were performed in the current Ontario traffic noise prediction model STAMSON for comparisons to Predictor simulation results. The STAMSON model is, however, older and requires each receptor to be calculated separately. STAMSON also does not accurately account for building reflections and multiple screening elements, and curved road geometry. A total of six-teen (16) receptor locations were identified around the site, as illustrated in Figure 2.

Roadway noise calculations were performed by treating each road segment as separate line sources of noise, and by using existing and proposed 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 for all roads was taken to be 92% / 8%, respectively.
- The ground surface was modelled as absorptive where grass and foliage (soft ground) are present, and as reflective where pavement and concrete are present (hard ground).
- Topography was assumed to be a flat/gentle slope throughout the study site.

[7] Ministry of Transportation, Environmental Guide for Noise, 2021. Retrieved from https://prod-environmental-registry.s3.amazonaws.com/2021-08/Environmental%20Guide%20for%20Noise%20 2021%20%28Aug%202021 %29.pdf

- Nine (9) receptor locations were chosen at the façades of the dwellings as Plane of Window (POW) receptors at two different heights above grade; 4.5 and 7.5 metres (see Figure 2).
- Seven (7) receptor locations were chosen as OLA receptors at 1.5 metres above grade (see Figure 2).
- One (1) OLA and Four (4) POW receptors with direct exposure from Robert Grant Avenue and Cope Drive were calculated in STAMSON in order to display the correlation between the Predictor and STAMSON calculation results. The receptor distances to roadway traffic sources and exposure angles are illustrated in Figure 3.
- The intermediate surface in the STAMSON calculations was taken as absorptive due to the presence of lawn at the immediate area of the receptors.

4.2.3 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[8] 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. Robert Grant Avenue is currently being classified as a 2-lane urban arterial road with a 60 km/hr posted speed limit in the current Ottawa Road Network Maps. However, The Fernbank Community Design Plan (CDP) indicates Robert Grant Avenue will be widened to accommodate bus transit lanes at the centre as part of the West Transit Way Connections (Terry Fox Dr to Fernbank Rd). A study by Delcan Transportation indicates that the 2031 projected daytime-peak-hour BRT traffic volume at the Robert Grant Avenue section of the West Transitway is 20. As the future bus volume is low, the bus traffic is calculated as part of the heavy traffic and Robert Grant Avenue is considered as a 4-lane Urban Arterial-Divided in this study. The Fernbank Community Design Plan (CDP) shows Cope Drive as a collector road. Table 2 (below) summarizes the AADT values used for each roadway included in this assessment.

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

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Robert Grant Avenue	4-Lane Urban Arterial-Divided (4-UAD)	60	**35,000**
Cope Drive	2-Lane Major Collector (2-UMCU)	50	**12,000**

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, brick veneer walls can achieve STC 50 or more. Standard commercially sided exterior metal stud walls have around STC 45. 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 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 are achieved. The calculation procedure[9] 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[10], 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

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

information available at the time of the study, detailed floor layouts 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).

5. RESULTS

5.1 Roadway Traffic Noise Levels

The results of the roadway traffic noise calculations are summarized in Table 3 below. The results of the current analysis indicated that noise levels at Plane of Window (POW) receptors will range between 67 and 63 dBA during the daytime period (07:00-23:00) and between 60 and 55 dBA during the nighttime period (23:00-07:00). The highest noise level (67 dBA) occurs at the east façades of Blocks 2, 3, 4, 5, and 6, which are nearest and most exposed to Robert Grant Avenue. Figures 7 and 8 illustrate daytime .and nighttime noise contours without the noise barriers throughout the site at a height of 4.5 m above grade and Figures 9 and 10 illustrate daytime noise contours with the noise barriers throughout the site at a height of 1.5 m above grade.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC

Receptor ID	Receptor Location	Receptor Height (m)	PREDICTOR-LIMA Noise Level (dBA)	
			Day	Night
R1	POW – Block 7 South Façade	4.5	63	55
		7.5	63	55
R2	POW – Block 6 East Façade	4.5	65	58
		7.5	65	58
R3	POW – Block 5 East Façade	4.5	66	59
		7.5	67	59
R4	POW – Block 2 East Façade	4.5	67	60
		7.5	67	60
R5	POW – Block 1 East Façade	4.5	66	59
		7.5	66	59

TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC (CONT.)

Receptor ID	Receptor Location	Receptor Height (m)	PREDICTOR-LIMA Noise Level (dBA)	
			Day	Night
R6	POW – Block 1 North Façade	4.5	63	55
		7.5	63	55
R7	OLA – Block 7 North Backyard	1.5	56	N/A*
R8	OLA – Block 5 North Backyard	1.5	66	N/A*
R9	OLA – Block 3 North Backyard	1.5	66	N/A*
R10	OLA – Block 2 West Backyard	1.5	53	N/A*
R11	OLA – Block 1 South Backyard	1.5	64	N/A*
R12	POW – Block 6 East Façade	4.5	67	59
		7.5	67	59
R13	POW – Block 4 East Façade	4.5	66	59
		7.5	67	59
R14	POW – Block 3 East Façade	4.5	67	60
		7.5	67	60
R15	OLA – Block 6 West Backyard	1.5	56	N/A*
R16	OLA – Block 4 South Backyard	1.5	65	N/A*

* Outdoor Living Areas (OLA) during the nighttime are not considered as per the ENCG

Table 4 shows a comparison of results from Predictor and STAMSON. Noise levels calculated in STAMSON were found to have a good correlation with Predictor-Lima and variability between the two programs was within an acceptable level of ±0-3 dBA.

TABLE 4: RESULT CORRELATION WITH STAMSON

Receptor ID	Receptor Location	Receptor Height (m)	STAMSON 5.04 Noise Level (dBA)		PREDICTOR-LIMA Noise Level (dBA)	
			Day	Night	Day	Night
R1	POW – Block 7 South Façade	4.5	66	58	63	55
R2	POW – Block 6 East Façade	4.5	67	59	65	58
R3	POW – Block 5 East Façade	4.5	67	59	66	59
R4	POW – Block 2 East Façade	4.5	67	59	67	60
R9	OLA – Block 3 North Backyard	1.5	66	N/A*	66	N/A*

* Outdoor Living Areas (OLA) during the nighttime are not considered as per the ENCG.

Upgraded building components will be required where noise levels exceed 65 dBA (see Figure 6). Building components compliant with the Ontario Building Code (OBC 2012) will be sufficient for the remaining dwellings of the development. The noise levels at the OLA receptors, represented by Receptors 8, 9, 11, and 16 (the OLA of Blocks 5, 3, 1, and 4, respectively) exceed the ENCG criteria. A noise barrier investigation was conducted using Predictor (see Section 5.3).

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 4.2.1, the anticipated STC requirements for windows and walls have been estimated based on the overall noise reduction required for each intended use of space (STC = Outdoor Noise Level – Targeted Indoor Noise Levels). The STC requirements for the windows are summarized below for various units within the development (see Figure 6):

- **Bedroom Windows**
  - (i) Bedroom windows of Blocks 4 and 6 facing north and east, Block 3 facing east and south, Blocks 2 and 5 facing east will require a minimum STC of 30
  - (ii) Bedroom windows of Block 1 facing east will require a minimum STC of 29
  - (iii) All other bedroom windows are to satisfy Ontario Building Code (OBC 2012) requirements

- **Living Room Windows**
  - (i) Living room windows of Blocks 4 and 6 facing north and east, Block 3 facing east and south, Blocks 2 and 5 facing east will require a minimum STC of 25
  - (ii) Living room windows of Block 1 facing east will require a minimum STC of 24
  - (iii) All other living room windows are to satisfy Ontario Building Code (OBC 2012) requirements

- **Exterior Walls**
  - (i) Exterior wall components on the facades mentioned above will require a minimum STC of 45, which will be achieved with brick cladding or an acoustical equivalent according to NRC test data.[11]

Exterior wall components on these façades are recommended to have a minimum STC of 45, which is achievable with a wood frame exterior wall construction with resilient channel placed on the inside of the studs and using two layers of 16 mm gypsum board. Alternatively, a brick cladding could be used. A review of window supplier literature indicates that the specified STC ratings can be achieved by a variety of window systems that have a combination of glass thickness and inter-pane spacing. 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.

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

5.3 Noise Barrier Calculation

When OLA noise levels exceed 55 dBA and are less than or equal to 60 dBA, mitigation should be considered to reduce noise levels to 55 dBA if technically, economically, and administratively feasible. If noise levels exceed 60 dBA, mitigation must be provided to reduce noise levels below 60 dBA. Our preliminary analysis showed that reducing the noise levels to 55 dBA would not be feasible. Further analysis of noise barriers showed that the Outdoor Living Area (OLA) noise levels only exceed 60 dBA at Receptors 8, 9, 11, and 16; the OLA of Blocks 5, 3, 1, and 4, respectively. The result of the noise barrier investigation indicated that installation of a noise barrier with a height of 2.2 metres will be required to reduce the noise levels below 60 dBA. The noise barrier should be built with solid elements having a minimum surface mass of 20 kg/m² and contain no gaps. Table 5 summarizes the results of the barrier investigation. The location of the noise barriers can be seen in Figure 4.

TABLE 5: RESULTS OF NOISE BARRIER INVESTIGATION

Receptor ID	Barrier Height Above Grade (m)	Above Grade Receptor Height (m)	Receptor Location	Daytime L_{eq} Noise Levels (dBA)	
				Without Barrier	With Barrier
R8	2.2	1.5	OLA – Block 5 North Backyard	66	55
R9	2.2	1.5	OLA – Block 3 North Backyard	66	55
R11	2.2	1.5	OLA – Block 1 South Backyard	64	53
R16	2.2	1.5	OLA – Block 4 South Backyard	65	53

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the roadway traffic noise calculations are summarized in Table 3 below. The results of the current analysis indicated that noise levels at Plane of Window (POW) receptors will range between 67 and 63 dBA during the daytime period (07:00-23:00) and between 60 and 55 dBA during the nighttime period (23:00-07:00). The highest noise level (67 dBA) occurs at the east façades of Blocks 2, 3, 4, 5, and 6, which are nearest and most exposed to Robert Grant Avenue. Figures 7 and 8 illustrate daytime .and nighttime noise contours without the noise barriers throughout the site at a height of 4.5 m above grade and Figures 9 and 10 illustrate daytime noise contours with the noise barriers throughout the site at a height of 1.5 m above grade.

The noise levels at the outdoor living areas (OLA), represented by Receptors 8, 9, 11, and 16 (Blocks 5, 3, 1, and 4, respectively) exceed the ENCG criteria. Therefore, a noise barrier investigation was conducted using Predictor-Lima. The result of the noise barrier investigation indicated that a noise barrier with a standard height of 2.2 metres will be required to reduce the noise levels below 60 dBA. The noise barrier should be built with solid elements having a minimum surface mass of 20 kg/m² and contain no gaps. The location of the noise barriers can be seen in Figure 4. The following information will be required by the City for review prior to installation of the barrier:

4. Shop drawings, signed and sealed by a qualified Professional Engineer licenced by the Professional Engineers of Ontario, showing the details of the acoustic barrier systems components, including material specifications.
5. Structural drawing(s), signed by a qualified Professional Engineer licenced by the Professional Engineers of Ontario, showing foundation details and specifying design criteria, climatic design loads, as well as applicable geotechnical data used in the design.
6. Layout plan, and wall elevations, showing proposed colours and patterns.

The results of the analysis also indicated that for Block 1, 2, 3, 4, 5, and 6 central air conditioning or a similar ventilation system, which will allow occupants to keep windows closed and maintain a comfortable living environment, will be required. For Block 7, forced air heating with provision for the installation of central air conditioning will be required (see Figures 5 and 6) for the blocks of the proposed development.

Warning Clauses will also be required to be placed on all Lease, Purchase and Sale Agreements for the development.

Type B and Type D Warning Clauses will be required for Blocks 1, 3, 4 & 5:

"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 road traffic may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the Municipality and the Ministry of the Environment."

"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."

Type D Warning Clauses will be required for Blocks 2 & 6:

"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."

Type C Warning Clause will be required for Block 7:

"This dwelling unit has been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air conditioning by the occupant in low and medium density developments 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."

This concludes our roadway traffic noise 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,

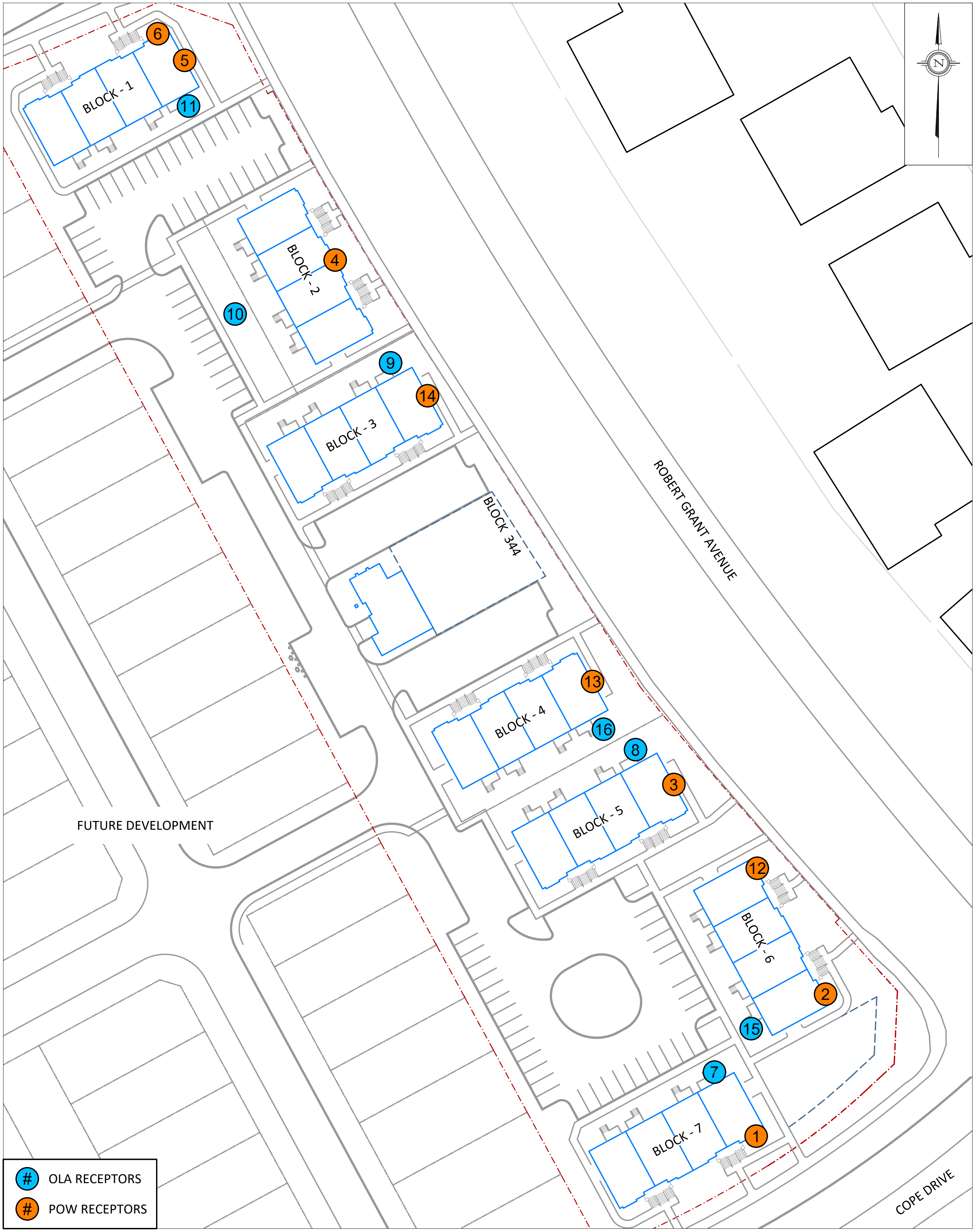
Gradient Wind Engineering Inc.

Efser Kara, MSc, LEED GA
Acoustic Scientist

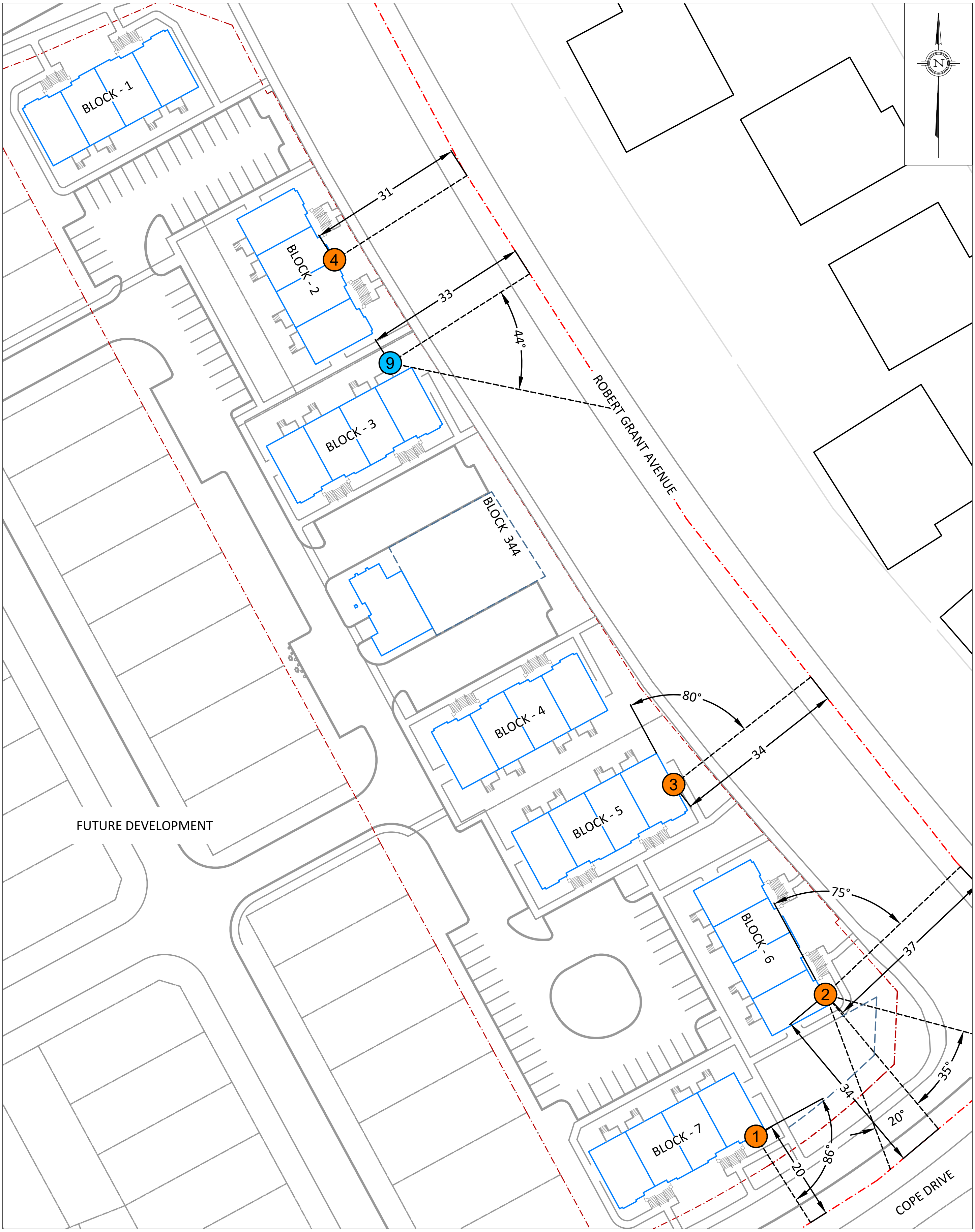
Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File #21-083-Traffic Noise R2

GRADIENTWIND ENGINEERS & SCIENTISTS 127 WALGREEN ROAD , OTTAWA, ON 613 836 0934 • GRADIENTWIND.COM	PROJECT: 620 BOBOLINK RIDGE, STITTSVILLE OTTAWA TRAFFIC NOISE ASSESSMENT		DESCRIPTION: FIGURE 1: SITE PLAN AND SURROUNDING CONTEXT
	SCALE: 1:2000 (APPROX.)	DRAWING NO.: GW21-083-1	
	DATE: OCTOBER 13, 2021	DRAWN BY: E.K.	



GRADIENTWIND ENGINEERS & SCIENTISTS 127 WALGREEN ROAD , OTTAWA, ON 613 836 0934 • GRADIENTWIND.COM	PROJECT: 620 BOBOLINK RIDGE, STITTSVILLE OTTAWA TRAFFIC NOISE ASSESSMENT		DESCRIPTION: FIGURE 2: RECEPTOR LOCATIONS
	SCALE: 1:1000 (APPROX.)	DRAWING NO.: GW21-083-2	
	DATE: OCTOBER 13, 2021	DRAWN BY: E.K.	



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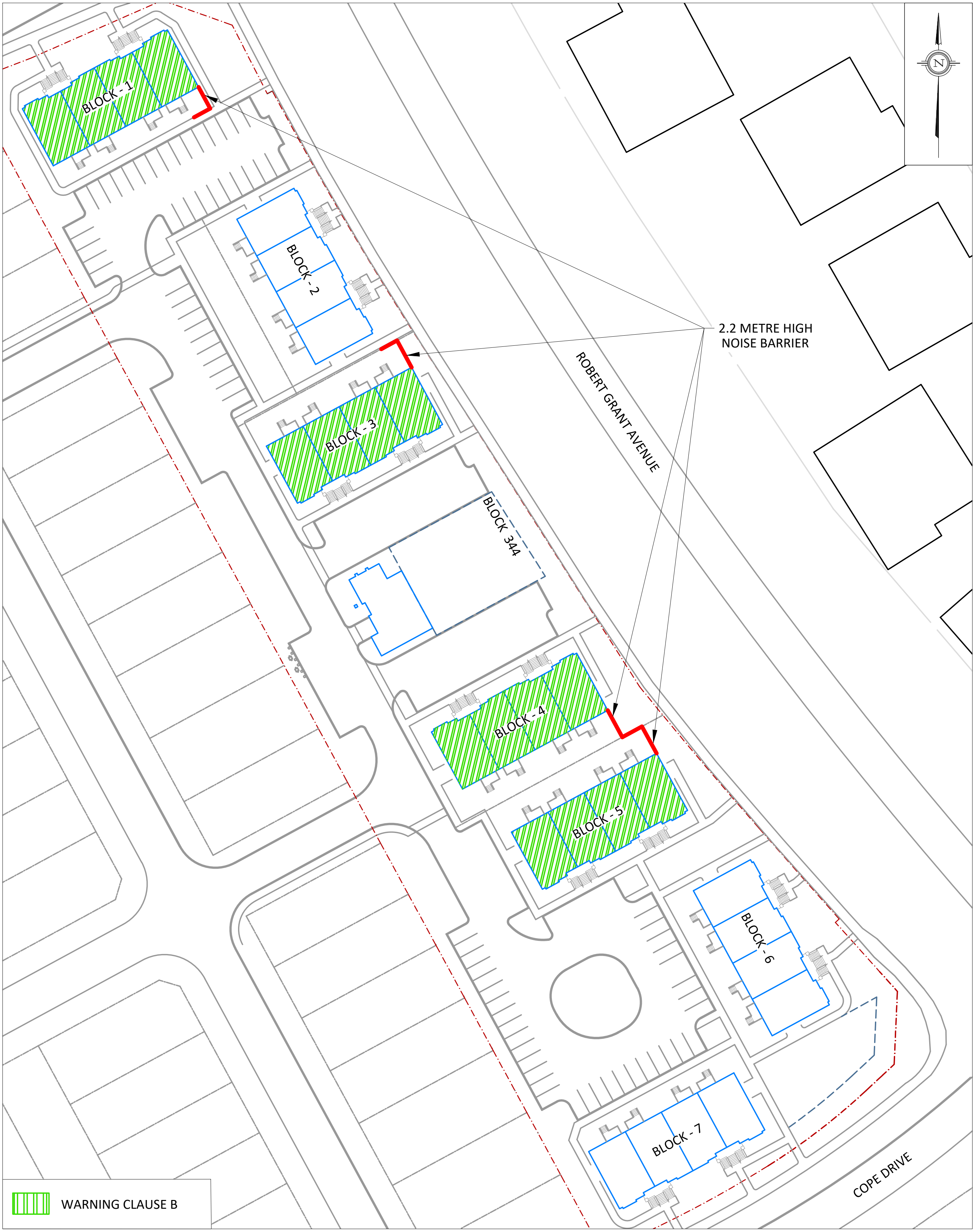
PROJECT	620 BOBOLINK RIDGE, STITTSVILLE OTTAWA TRAFFIC NOISE ASSESSMENT		
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW21-083-3
DATE	OCTOBER 13, 2021	DRAWN BY	E.K.

DESCRIPTION

FIGURE 3:
STAMSON INPUT DATA
FOR RECEPTORS 1, 2, 3, 4, & 9



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DESCRIPTION

FIGURE 5:
VENTILATION REQUIREMENTS

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DESCRIPTION

FIGURE 6:
STC REQUIREMENTS

FIGURE 7: DAYTIME TRAFFIC NOISE CONTOURS (4.5 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 8: NIGHTTIME TRAFFIC NOISE CONTOURS
(4.5 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 9: DAYTIME TRAFFIC NOISE CONTOURS WITH NOISE BARRIERS (1.5 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 10: NIGHTTIME TRAFFIC NOISE CONTOURS WITH NOISE BARRIERS (1.5 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*