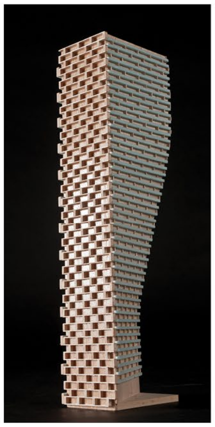
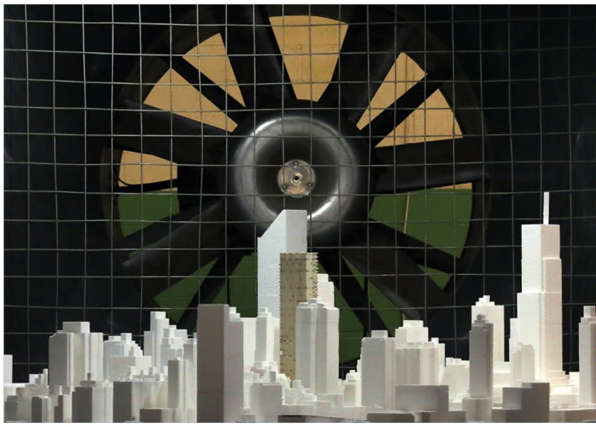
GRADIENTWIND
ENGINEERS & SCIENTISTS

ENVIRONMENTAL NOISE FEASIBILITY ASSESSMENT

245 and 275 Lamarche Avenue (Orleans Village Phase 4)
Ottawa, Ontario

Report: 22-078–Environmental Noise





April 8, 2022

PREPARED FOR
Caivan (Orleans Village 2) Ltd.
2934 Baseline Road, Suite 302
Ottawa, ON K2H 1B2

PREPARED BY
Giuseppe Garro, MASc., Junior Environmental Scientist
Joshua Foster, P.Eng., Lead Engineer

EXECUTIVE SUMMARY

This report describes an environmental noise feasibility assessment undertaken for a proposed subdivision development known as Orleans Village Phase 4. The proposed subdivision is located at the intersection of Innes Road and Lamarche Avenue in Ottawa, Ontario. The subdivision will comprise of traditional townhouse blocks, back-to-back townhouse blocks, rear lane townhouse blocks, and a communal park connected by internal roadways with several on-street parking spaces. The major source of traffic noise impacting the residential subdivision is Innes Road to the north.

This assessment also includes a stationary noise study investigating the noise impacts of the existing Halo car wash facility located northeast of the study site at 3604 Innes Road.

The assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP) NPC-300, Ministry of Transportation Ontario (MTO), and City of Ottawa Environmental Noise Control Guidelines (ENCG) guidelines; (ii) future vehicular traffic volumes corresponding to roadway classification obtained from the City of Ottawa; (iii) stationary noise levels of various equipment associated with the Halo car wash facility based on acoustic measurements conducted on March 15, 2022; and (iv) site plan drawings provided by Caivan Communities in March 2022.

The results of the current analysis indicate that noise levels will range between 45 and 61 dBA during the daytime period (07:00-23:00) and between 40 and 53 dBA during the nighttime period (23:00-07:00). The highest noise level (61 dBA) occurs at the north of the development, which is directly exposed to the noise generated by Innes Road. Figures 7 and 8 illustrate daytime and nighttime noise contours throughout the site at a height of 1.5 m above grade.

Building components with a higher Sound Transmission Class (STC) rating will not be required as noise levels do not exceed 65 dBA during the daytime. However, the results of the calculations indicate that the buildings along the north property line directly exposed to Innes Road will likely require forced air heating with provision for the installation of central air conditioning. Additionally, Warning Clauses will also be required to be placed on all Lease, Purchase and Sale Agreements.

Results of the roadway traffic noise calculations also indicate that outdoor living areas bordering and/or having direct exposure to traffic noise may require noise control measures. Mitigation measures are described in Section 7.1.1, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible. A detailed roadway traffic noise study will be required at a future stage to determine specific noise control measures for the development at the time of registration of subdivision.

With regard to stationary noise, an assessment was conducted to assess the stationary noise impact from the Halo car wash facility located at 3604 Innes Road onto the proposed subdivision. The results indicate that the noise levels produced by daily operations at the facility are expected to exceed ENCG noise level limits. As such, Gradient Wind has proposed three options to address stationary noise impacts from the existing facility. These options involve the inclusion of a barrier along the northeast corner; relocation of the proposed park area to the northeast corner of the site; and the pursuit of a Class 4 designation. As the project progresses, the preferred option can be further explored in future subsequent studies. It should be noted, should the development comprise of other forms of housing or types of ownership, such as stacked condos and/or mid-rise apartment buildings, the impacted buildings surrounding the car wash would require similar noise mitigation measures.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Caivan (Orleans Village 2) Ltd. to undertake an environmental noise feasibility assessment for a proposed subdivision development known as Orleans Village Phase 4. The proposed subdivision is located at the intersection of Innes Road and Lamarche Avenue 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 and stationary noise sources.

This assessment is based on theoretical noise calculation methods conforming to the Ministry of the Environment, Conservation and Parks (MECP) NPC-300[1], Ministry of Transportation Ontario (MTO)[2], and City of Ottawa Environmental Noise Control Guidelines (ENCG)[3] guidelines. Noise calculations were based on site plan drawings provided by Caivan Communities in March 2022, with future traffic volumes corresponding to roadway classification and theoretical roadway capacities, and recent satellite imagery. Stationary noise levels of various equipment associated with the Halo car wash facility were based on acoustic measurements conducted on March 15, 2022.

2. TERMS OF REFERENCE

The focus of this environmental noise feasibility assessment is a proposed residential development known as Orleans Village Phase 4 in Ottawa, Ontario. The proposed subdivision is located on a nearly rectangular parcel of land at the intersection of Innes Road and Lamarche Avenue. The site is boarded by low-rise residential land to the north and south, commercial land to the east, and Lamarche Avenue to the west. The subdivision will comprise of traditional townhouse blocks, back-to-back townhouse blocks, rear lane townhouse blocks, and a communal park connected by internal roadways with several on-street parking spaces.

Gradient Wind considered all relevant noise sources affecting the site, such as roadway traffic noise and stationary noise. The major source of traffic noise impacting the residential subdivision is Innes Road to

---

[1] Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013
[2] Ministry of Transportation Ontario, "*Environmental Guide for Noise*", February 2022
[3] City of Ottawa Environmental Noise Control Guidelines, January 2016

the north. The primary source of stationary noise impacting the site is the existing Halo car wash facility located to the northeast at 3604 Innes Road. Figure 1 illustrate the site location with surrounding context.

3. OBJECTIVES

The principal objectives of this feasibility study are to (i) calculate the future noise levels on the study buildings produced by local roadway traffic, (ii) calculate stationary noise impacts on the proposed development generated by the existing Halo car wash facility, and (iii) explore potential noise mitigation 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.

5. ROADWAY TRAFFIC NOISE

5.1 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, as listed in Table 1.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (ROAD) [4]

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[5]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[6]. 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[7].

The sound level criterion for Outdoor Living Areas (OLA) is 55 dBA, which applies during the daytime (07:00 to 23:00). As per ENCG, parks are not defined as Outdoor Living Areas or noise sensitive spaces. Predicted noise levels at the outdoor living areas (rear yards) dictate the action required to achieve the recommended sound levels. According to the ENCG, if an area is to be used as an OLA, noise control

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

measures are required to reduce the L_{eq} to 55 dBA. This is typically done with noise control measures outlined in Section 7.1.1.

As such, when noise levels at the POWs and OLAs exceed the criteria, specific Warning Clause requirements may apply. As this is a preliminary assessment where the subdivision design is subject to change, noise control recommendations are of a general nature. Specific mitigation requirements would be the work of a future study as the subdivision design progresses.

5.2 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)[8]. 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 twenty-one 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 was taken to be 92% / 8% respectively for all streets.

[8] Ministry of Transportation Ontario, "*Environmental Guide for Noise*", February 2022

- Receptor heights taken to be 7.5 m, 4.5 m and 1.5 m above grade, representative of the third level Plane of Window (POW), second level POW, and at-grade amenity areas, 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).
- The study site was treated as having flat or gently sloping topography.
- Massing associated with the study site was included as potential noise screening elements.
- An existing perimeter fence along the west and south property line of the Halo car wash facility. This fence was modelled with an average reflectivity coefficient of 0.5 as the fence had several gaps between each vertical wood plank (see Appendix B).
- Twenty-one receptors were strategically placed throughout the study area.
- Relevant blocks are labeled 1-11 as the drawings did not include block annotations at the time of the assessment.

5.3 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[9] 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
Innes Road	4-Lane Urban Arterial Divided (4-UAD)	60	**35,000**

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

6. STATIONARY NOISE

6.1 Stationary Noise Source Assessment and Criteria

The equivalent sound energy level, L_{eq}, provides a weighted 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 selected period of time. For stationary sources, the L_{eq} is commonly calculated on an hourly interval, while for roadways, the L_{eq} is calculated on the basis of a 16-hour daytime/8-hour nighttime split.

Noise criteria taken from the ENCG and NPC-300 apply to points of reception (POR). A POR is defined under the ENCG as "any location on a noise-sensitive land use where noise from a stationary source is received"[10]. A POR can be located on an existing or zoned for future use premises of permanent or seasonal residences, hotels/motels, nursing/retirement homes, rental residences, hospitals, campgrounds, and noise-sensitive buildings such as schools and daycares. As the site is bordered by an arterial road, the area is considered as a Class 1 area as per the ENCG. The applicable sound level limit is the higher of the exclusionary limit outlined in Table 3, or background noise levels generated by other sources, such as roadway traffic. For this study, the sound level limits outlined in Table 3 were applied.

TABLE 3: EXCLUSIONARY LIMITS FOR CLASS 1 AREA

Time of Day	Outdoor Points of Reception	Plane of Window
07:00 – 19:00	50	50
19:00 – 23:00	50	50
23:00 – 07:00	N/A	45

[10] City of Ottawa Environmental Noise Guidelines, page 9

6.2 Stationary Noise Assessment

Assessment of noise from existing surrounding buildings was performed through on-site measurements and predictive methods. A site visit was conducted on March 15, 2022 between 10:00 and 13:00 to measure the noise level emissions of stationary sources. The primary source of stationary noise identified on-site was the Halo car wash facility located at 3604 Innes Road. No other residential/industrial/commercial sources were observed.

6.2.1 On-Site Noise Measurements - Halo Car Wash Facility

Noise measurements of the car wash facility were conducted using a Brüel & Kjær (B&K) integrating sound level meter Type 2250, equipped with a Type 4189 Class 1 microphone. The meter was mounted on a tripod with the microphone set at a height of approximately 1.5 m above grade in a free-field environment greater than 1 meter away from reflective surfaces. A single operator was present within 7 m behind the noise meter. A total of 4 measurement locations were chosen in order to determine the sound pressure levels due to the sources associated with the facility. The parameters investigated included the equivalent 1-hour sound pressure level (LA_{eq}), minimum A-weighted sound level (LAS_{min}), LA90, and LA10. The parameters are defined as follows:

LA_{eq} – A-weighted equivalent continuous sound level

LAS_{min} – A-weighted minimum slow response sound level

LA90 – A-weighted sound level just exceeded for 90% of the measurement period

LA10 – A-weighted sound level just exceeded for 10% of the measurement period

At each location, the meter was set to slow response and continuous sound recordings were conducted for over 20 minutes[11]. A plan of the measurement locations is illustrated in Figure 4. Photographs of the measurement location and placement of the sound level meter at grade are presented in Appendix B. Weather conditions were suitable for sound measurements with no precipitation present. The air temperature was approximately 2 degrees Celsius with little to no wind present.

[11] Publication NPC-103 – Procedures, Section 4.4(f)

The Halo car wash comprises approximately 20 self-serve vacuum stations and a concrete structure with an exhaust vent along the west property line. The remaining portion of the land is dedicated to the automatic car wash tunnel (oriented north-south), and access laneways with payment terminals. All components of the tunnel structure are enclosed with the exception of a few exhaust vents. The tunnel entrance (north façade) and exit (south façade) are equipped with automatic door mechanisms that open and close as the cars pass through the tunnel.

During the site visit, the noise emanating from the facility was perceived as quasi-steady state to steady-state depending on the operations taking place. The noise signature is best categorized as a “white-noise /broadband” noise signature. As such, correction factors outlined in NPC-104 – Sound Level Adjustments were not applicable.

During the site visit, noise measurements were conducted along the west and east perimeter of the facility. The three measurements conducted west of the facility considered the partial blockage from the existing perimeter fencing (approximately 2.2m in height). Noise from this side was dominated by noise from the self-serve vacuum stations and the concrete structure exhaust vent. The measurement conducted east of the facility did not have any obstructions between the source and receiver. Noise at this location was dominated by the noise from the tunnel exit blower when the door was fully open. During the visit, the exit door was open approximately 85-90% of the time.

During the visit, roadway noise from Innes Road was perceived as “barely audible to inaudible” compared to existing stationary noise. Therefore, the dominant source of noise impacting the proposed development was confirmed to be the Halo car wash facility. It should be noted that unavoidable transient construction noise was being generated at a nearby construction site during the measurement period. Calculations described in a subsequent section utilized the LA90 noise parameter as it best represents steady-state noise from the Halo facility independent of other noise sources.

6.2.2 Determination of Stationary Noise Sound Power Levels

Gradient Wind performed a stationary noise analysis using the Predictor-Lima software program to approximate the sound power levels of the dominant noise sources of the Halo car wash facility based on collected noise measurements. This computer program is capable of representing three-dimensional surfaces and first reflections of sound waves over a suitable spectrum for human hearing. For stationary noise the ISO 9613 - Calculation method was used. The vacuum stations were modelled as an area source, the concrete structure exhaust fan was modelled as a point source, and the tunnel blower was modeled as an emitting façade (see Figure 4).

Table 4 outlines the investigated noise parameters collected during the site visit. As previously mentioned, the sound power levels of the car wash equipment were determined using LA90 measured at the receptor locations and calculated using Equation 1 and 2 (sample calculation illustrated in Appendix C). LA90 represents the A-weighted sound level just exceeded for 90% of the measurement period at each measurement location, which is a conservative approximation to the steady state sound levels produced by the car wash equipment alone during times when noise from external sources were at their lowest.

TABLE 4: NOISE PARAMATERS FROM ON-SITE MEASUREMENTS

Receptor Number	Measurement Location	Approx. Source Receptor Distance (m)	Time of Measurement	Duration of Measurement (Min)	Sound Pressure Level			
					LA_{eq} (dBA)	LAS_{min} (dBA)	LA10 (dBA)	LA90 (dBA)
1	Caivan Property - Northeast Corner	7	10:30	21	56	51	58	**54***
2	Caivan Property - East Side	7	11:00	23	55	52	57	**53***
3	Caivan Property - Southeast Corner	7	11:25	21	52	48	53	**50***
4	Access Road - East of Halo Car Wash	35	12:00	27	67	53	70**	**61**

*Dominant source is the vacuum stand area and concrete structure exhaust vent. Used to calculate the average sound power level via Equation 2.

**Resultant LA10 due to transient construction noise located southeast of the measurement location.

$$L_W = LA90 + \left|10\log\left(\frac{Q}{4\pi r^2}\right)\right| \quad (1)$$

Where the parameters are:

- L_w = Sound power level of the car wash equipment (dBA)
- $LA90$ = A-weighted sound level just exceeded for 90% of the measurement period (dBA)
- Q = Directivity Factor (Half Sphere Q = 2)
- r = Distance from stationary source to noise measurement location (m)

The average sound power level of the car wash equipment was calculated using Equation 2:

$$L_{w_{avg}} = 10log\left(\frac{1}{3}\left(10^{\frac{L_{w1}}{10}} + 10^{\frac{L_{w2}}{10}} + 10^{\frac{L_{w3}}{10}}\right)\right) \quad (2)$$

Where the parameters are:

- $L_{w_{avg}}$ = Average sound power level (dBA)
- L_w = Sound power level of the car wash equipment (dBA)

As a result, Table 5 summarizes the approximated sound power levels of the Halo car wash equipment which best corelate with the on-site noise measurements. The sound power levels summarized below were incorporated into a separate Predictor-Lima stationary noise model to assess the noise impacts of the car wash facility across the entire study site.

TABLE 5: EQUIPMENT SOUND POWER LEVELS (dBA)

Source ID	Description	Height Above Rooftop/Grade (m)	Frequency (Hz)								
			63	125	250	500	1000	2000	4000	8000	Total
S1	Vacuum Area 1	1	-	-	-	-	92	-	-	-	**92**
S2	Vacuum Area 2	1	-	-	-	-	93	-	-	-	**93**
S3	Exhaust Vent	0.5	-	-	-	-	81	-	-	-	**81**
S4	Tunnel Exit Blower	1.5*	-	-	-	-	98	-	-	-	**98**

*Approximate midpoint of the door opening.

6.2.3 Stationary Noise Assumptions

The following assumptions have been made in the analysis:

- The Halo car wash facility operates during the daytime period only (7:00-21:00) as per their website. As such, the equipment is assumed to operate 100% per 1-hour period during the daytime only.
- Receptor heights taken to be 7.5 m, 4.5 m and 1.5 m above grade, representative of the third level Plane of Window (POW), second level POW, and at-grade amenity areas, 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).
- The study site was treated as having flat or gently sloping topography.
- Massing associated with the study site was included as potential noise screening elements.
- An existing perimeter fence along the west and south property line of the Halo car wash facility. This fence was modelled with an average reflectivity coefficient of 0.5 as the fence had several gaps between each vertical wood plank (see Appendix B).
- Twenty-one receptors were strategically placed throughout the study area (see Figure 5).
- Relevant blocks are labeled 1-11 as the drawings did not include block annotations at the time of the assessment.

7. ROADWAY TRAFFIC NOISE RESULTS

7.1 Roadway Traffic Noise Levels

The results of the roadway traffic noise calculations are summarized in Table 6. The results of the current analysis indicate that noise levels will range between 45 and 61 dBA during the daytime period (07:00-23:00) and between 40 and 53 dBA during the nighttime period (23:00-07:00). The highest noise level (61 dBA) occurs at the north of the development, which is directly exposed to the noise generated by Innes Road. Noise contours for the roadway traffic noise calculations covering the entire study site are shown in Figures 7 and 8 for the daytime and nighttime periods, respectively.

Table 7 provides a comparison between 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 ±1-3 dBA. Appendix A contains a set of input and output data from all STAMSON 5.04 calculations.

TABLE 6: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC SOURCES

Receptor ID	Receptor Location	Receptor Height (m)	PREDICTOR-LIMA Noise Level (dBA)	
			Day	Night
R1	POW - Block 1 - West Facade	4.5	59	52
R2	POW - Block 1 - North Facade	4.5	60	53
R3	POW - Block 3 - North Facade	4.5	60	53
R4	POW - Block 4 - Northeast Facade	4.5	59	51
R5	POW - Block 4 - Northeast Facade	4.5	57	49
R6	POW - Block 4 - Southeast Facade	4.5	47	40
R7	POW - Block 5 - East Facade	4.5	52	44
R8	POW - Block 5 - East Facade	4.5	51	44
R9	POW - Block 6 - East Facade	4.5	51	43
R10	POW - Block 7 - East Facade	4.5	50	43
R11	POW - Block 8 - West Facade	4.5	57	49
R12	POW - Block 9 - North Facade	7.5	50	43
R13	POW - Block 11 - North Facade	7.5	49	42
R14	OLA - Block 1 - Rear Yard	1.5	61	N/A*
R15	OLA - Block 3 - Rear Yard	1.5	60	N/A*
R16	OLA - Block 4 - Rear Yard	1.5	59	N/A*
R17	OLA - Block 4 - Rear Yard	1.5	56	N/A*
R18	OLA - Block 5 - Rear Yard	1.5	48	N/A*
R19	OLA - Block 5 - Rear Yard	1.5	45	N/A*
R20	OLA - Block 6 - Rear Yard	1.5	46	N/A*
R21	OLA - Block 7 - Rear Yard	1.5	46	N/A*

*Noise levels during the nighttime are not considered for OLAs

TABLE 7: RESULT CORRELATION WITH STAMSON

Receptor Number	Receptor Location	Receptor Height (m)	STAMSON 5.04 Noise Level (dBA)		PREDICTOR-LIMA Noise Level (dBA)	
			Day	Night	Day	Night
R1	POW - Block 1 - West Facade	4.5	58	51	59	52
R3	POW - Block 3 - North Facade	4.5	59	51	60	53

7.1.1 Transportation Noise Control Measures

The noise levels predicted due to roadway traffic exceed the criteria listed in the ENCG for potential outdoor living areas (OLA) and Plan of Windows. Based on expected noise levels, blocks along the north property line in the dark orange and red regions in Figures 7 and 8 will likely require forced air heating with provisions for central air conditioning. Warning Clauses will also be required on purchase, sale, and lease agreements. As noise levels do not exceed 65 dBA during the daytime, updated building components are not required.

Regarding OLAs, noise control measures as described below (subscribing to Table 2.3a in the ENCG and listed in order of preference) will be required to reduce the L_{eq} to 55 dBA at some receptors:

- Distance setback with soft ground
- Insertion of noise insensitive land uses between the source and sensitive points of reception
- Orientation of buildings to provide sheltered zones in rear yards
- Shared outdoor amenity areas
- Earth berms (sound barriers)
- Acoustic barriers

Examining the noise control measures listed above, these conclusions consider the possibility that not all of the proposed buildings will be oriented to provide screening elements for outdoor living areas against roadway traffic sources. Distance setback, insertion of non-noise sensitive land uses, and building orientation to provide sheltered zones in rear yards may not be feasible due to the requirements of the Community Development Plan. It is also not feasible to have shared outdoor amenity areas for this development with respect to rear yards, as this would have a significant impact on marketability. Therefore, the most feasible measures are insertion of earth berms or acoustic wall barriers between the sensitive rear yards and sources of transportation noise. The use of earth berms or acoustic barriers will depend on the grading plan when it becomes available. Both options have the ability to reduce OLA noise levels to below 55 dBA. Potential noise barrier locations can be seen in Figure 3. Actual noise barrier locations will be addressed at a future stage during subdivision registration.

8. STATIONARY NOISE MEASUREMENT RESULTS

8.1 Stationary Noise Levels

With the inclusion of the approximated car wash sound power levels summarized in Table 5, the predicted noise levels on the proposed development are presented in Table 8. The results of the current analysis indicate that noise levels will range between 20 and 63 dBA during the daytime period (07:00-23:00). The highest noise level (63 dBA) occurs at the northeast façade of Block 4, which is directly exposed to noise generated by the car wash facility. Noise contours covering the study site are shown in Figure 9. The contours depict noise levels at select receptors along the north and east perimeters of the site exceed the ENCG Class 1 stationary noise criteria.

TABLE 8: EXTERIOR NOISE LEVELS DUE TO STATIONARY NOISE SOURCES

Receptor ID	Receptor Location	Receptor Height Above Grade (m)	PREDICTOR-LIMA Noise Level (dBA)	Sound Level Limits (dBA)	Meets ENCG Criteria
			Day	Day	Day
R1	POW - Block 1 - West Facade	4.5	20	50	Yes
R2	POW - Block 1 - North Facade	4.5	29	50	Yes
R3	POW - Block 3 - North Facade	4.5	42	50	Yes
R4	POW - Block 4 - Northeast Facade	4.5	53	50	**No**
R5	POW - Block 4 - Northeast Facade	4.5	63	50	**No**
R6	POW - Block 4 - Southeast Facade	4.5	62	50	**No**
R7	POW - Block 5 - East Facade	4.5	61	50	**No**
R8	POW - Block 5 - East Facade	4.5	56	50	**No**
R9	POW - Block 6 - East Facade	4.5	52	50	**No**
R10	POW - Block 7 - East Facade	4.5	49	50	Yes
R11	POW - Block 8 - West Facade	4.5	21	50	Yes
R12	POW - Block 9 - North Facade	7.5	36	50	Yes
R13	POW - Block 11 - North Facade	7.5	54	50	**No**
R14	OLA - Block 1 - Rear Yard	1.5	26	50	Yes
R15	OLA - Block 3 - Rear Yard	1.5	41	50	Yes
R16	OLA - Block 4 - Rear Yard	1.5	53	50	**No**
R17	OLA - Block 4 - Rear Yard	1.5	52	50	**No**
R18	OLA - Block 5 - Rear Yard	1.5	49	50	Yes
R19	OLA - Block 5 - Rear Yard	1.5	45	50	Yes
R20	OLA - Block 6 - Rear Yard	1.5	44	50	Yes
R21	OLA - Block 7 - Rear Yard	1.5	42	50	Yes

8.1.1 Stationary Noise Control Measures

The noise levels predicted due to existing stationary noise sources exceed the criteria listed in the ENCG for potential outdoor living areas (OLA) and Plan of Windows (POW). With that notion, Gradient Wind proposes three feasible mitigation strategies/options in an effort facilitate compatibility with existing and future land uses.

A high-level summary of the three options are presented below in order of preference. As the project progresses, the preferred option can be further explored in future subsequent studies (i.e., Registration of Subdivision Application):

OPTION 1

This option involves the inclusion of a 5m earth berm and noise barrier combination along the northeast corner of the site. The primary benefit of this option is that it does not deviate far from the current design layout and allows for noise levels to meet the ENCG Class 1 criteria. This option is depicted in Figure 6.

Caivan Communities intends to implement higher STC rated materials (i.e., wall, roof, and glazing components) for the impacted townhouse blocks to bring interior noise levels to an appropriate level. Typically, upgraded construction materials are associated with higher STC ratings which reduce overall indoor noise levels caused by exterior noise sources at the POW (i.e., traffic noise and/or stationary noise).

Should Caivan proceed with implementing upgraded materials, it is expected that indoor noise levels will be reduced to acceptable levels to facilitate a comfortable indoor environment. Upgraded materials would also reduce the height of the noise wall presented in Option 1 such that it will only be required to mitigate noise at the rear yards. Further analyses would need to be conducted to determine suitable construction assembly of materials. It should be noted, should the development comprise of other forms of housing or types of ownership, such as stacked condos and/or mid-rise apartment buildings, the impacted buildings surrounding the car wash would require similar noise mitigation measures.

OPTION 2

This option involves increasing the separation distance between the car wash facility and future noise sensitive dwellings. This can be achieved by relocating the park area to the northeast corner of the site to facilitate a buffer region between the source and receivers.

OPTION 3

This option involves classifying the site, or a portion of the site, as a Class 4 area. A Class 4 designation is typically reserved for cases with extenuating circumstances that make it unfeasible to mitigate existing stationary noise levels at or below Class 1 criteria. A Class 4 classification is primarily intended for a proposed noise sensitive development in proximity to existing, lawfully established stationary source(s) by allowing higher sound levels to be considered. However, this option requires approval by the City of Ottawa council.

9. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 45 and 61 dBA during the daytime period (07:00-23:00) and between 40 and 53 dBA during the nighttime period (23:00-07:00). The highest noise level (61 dBA) occurs at the north of the development, which is directly exposed to the noise generated by Innes Road. Figures 7 and 8 illustrate daytime and nighttime noise contours throughout the site at a height of 1.5 m above grade.

Building components with a higher Sound Transmission Class (STC) rating will not be required as noise levels do not exceed 65 dBA during the daytime. However. The results of the calculations indicate that the buildings along the north property line directly exposed to Innes Road will likely require forced air heating with provision for the installation of central air conditioning. Additionally, Warning Clauses will also be required on all Lease, Purchase and Sale Agreements.

Results of the roadway traffic noise calculations also indicate that outdoor living areas bordering and/or having direct exposure to traffic noise may require noise control measures. Mitigation measures are described in Section 7.1.1, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible. A detailed roadway traffic noise study will be required to determine specific noise control measures for the development.

With regard to stationary noise, an assessment was conducted to assess the stationary noise impact from the Halo car wash facility located at 3604 Innes Road onto the proposed subdivision. The results indicate that the noise levels produced by daily operations at the facility are expected to exceed ENCG noise level limits. As such, Gradient Wind has proposed three options to address stationary noise impacts from the existing facility. These options involve the inclusion of a barrier along the northeast corner; relocation of the proposed park area to the northeast corner of the site; and the pursuit of a Class 4 designation. As the project progresses, the preferred option can be further explored in future subsequent studies. It should be noted, should the development comprise of other forms of housing or types of ownership, such as stacked condos and/or mid-rise apartment buildings, the impacted buildings surrounding the car wash would require similar noise mitigation measures.

This concludes our environmental 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.

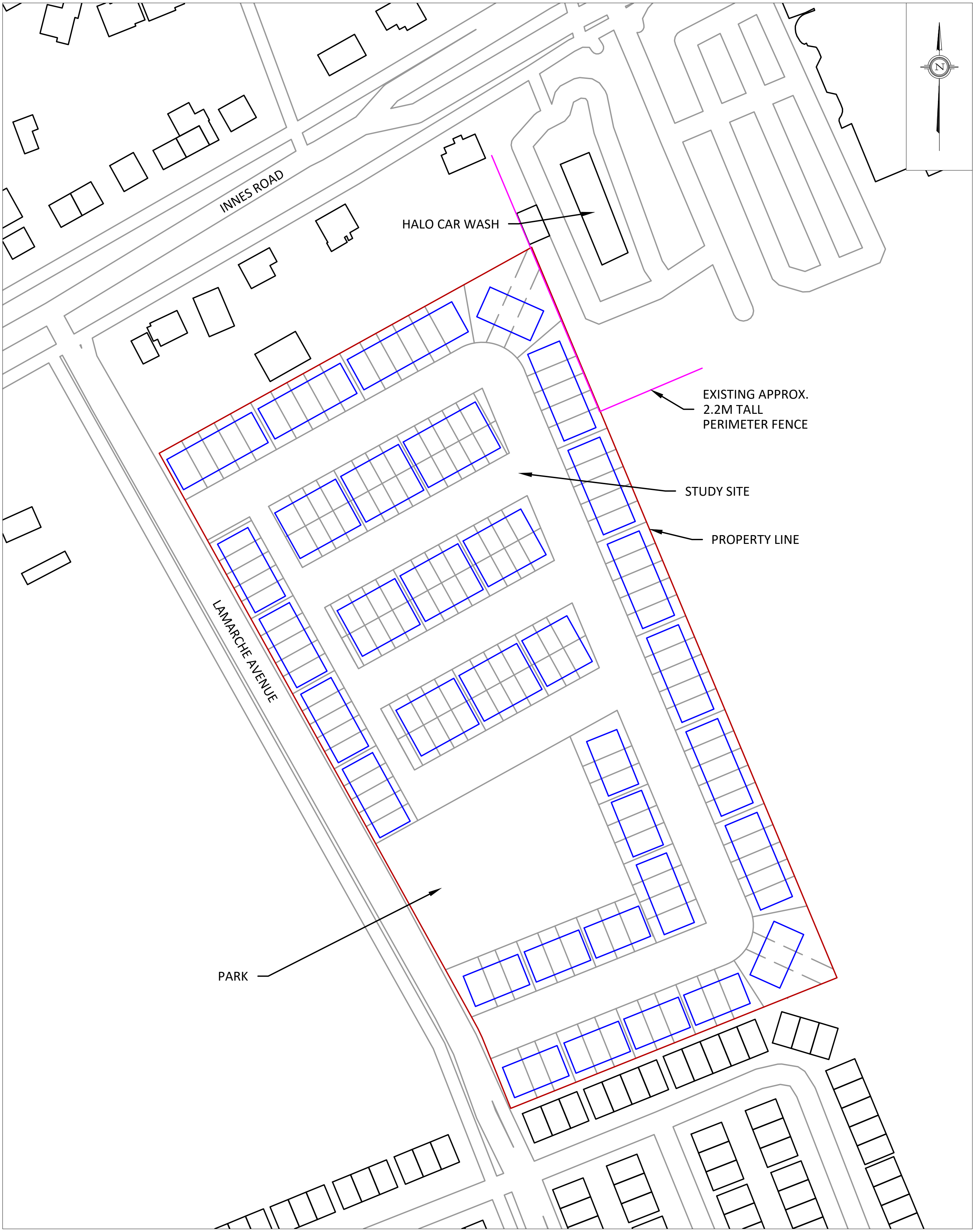
Sincerely,

Gradient Wind Engineering Inc.

Giuseppe Garro, MASc.
Junior Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

GW22-078 – Environmental Noise Feasibility



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

PROJECT		DESCRIPTION
ORLEANS VILLAGE PHASE 4, OTTAWA ENVIRONMENTAL NOISE FEASIBILITY ASSESSMENT		FIGURE 1: SITE PLAN AND SURROUNDING CONTEXT
SCALE: 1:2000 (APPROX.)	DRAWING NO.: GW22-078-1	
DATE: MARCH 29, 2022	DRAWN BY: G.G.	

GRADIENTWIND
ENGINEERS & SCIENTISTS

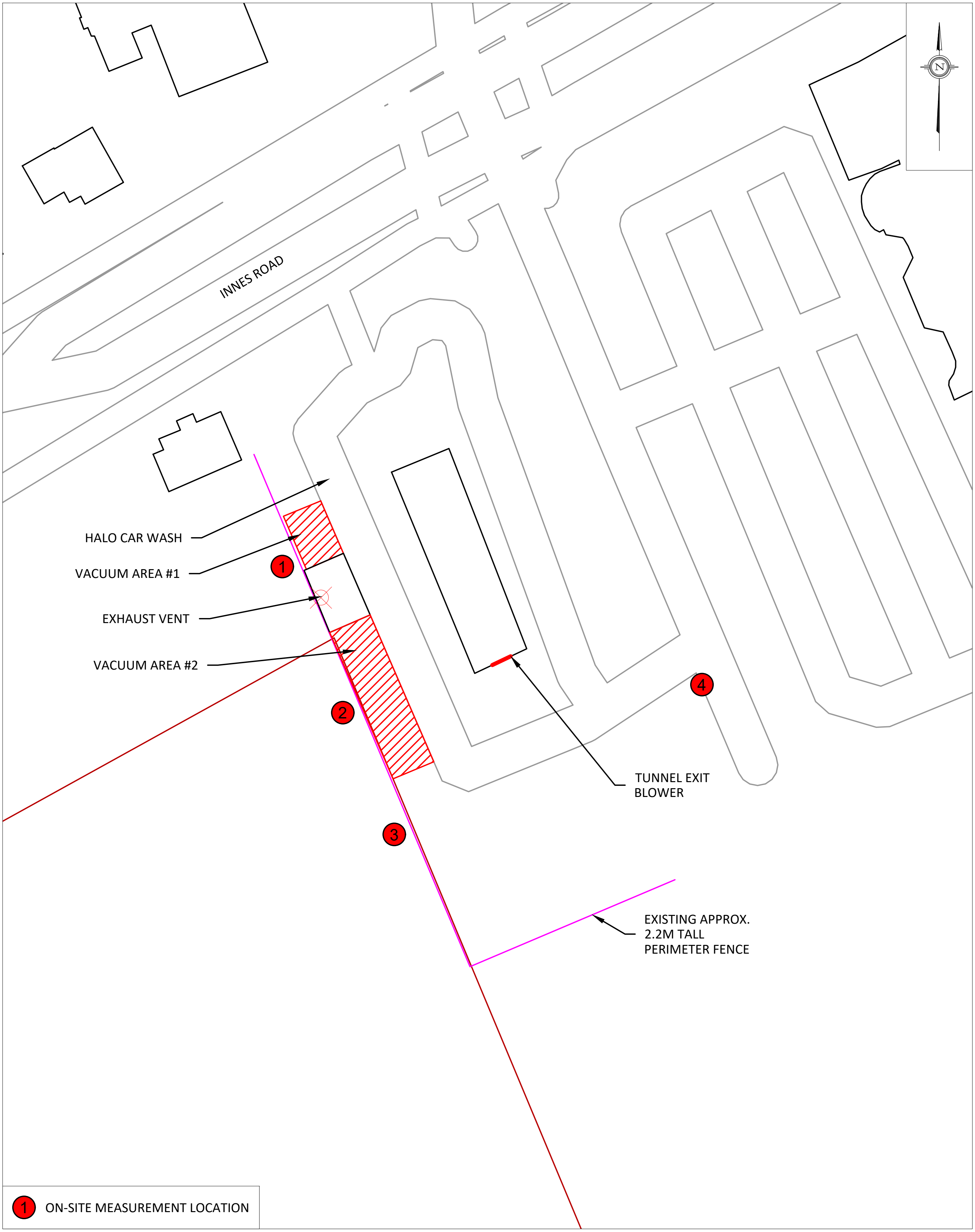
127 WALGREEN ROAD , OTTAWA, ON
613 836 0934 • GRADIENTWIND.COM

PROJECT	ORLEANS VILLAGE PHASE 4, OTTAWA ENVIRONMENTAL NOISE FEASIBILITY ASSESSMENT		
SCALE	1:1250 (APPROX.)	DRAWING NO.	GW22-078-2
DATE	MARCH 29, 2022	DRAWN BY	G.G.

DESCRIPTION

FIGURE 2:
TRANSPORTATION NOISE: RECEPTOR LOCATIONS

GRADIENTWIND ENGINEERS & SCIENTISTS 127 WALGREEN ROAD , OTTAWA, ON 613 836 0934 • GRADIENTWIND.COM	PROJECT: ORLEANS VILLAGE PHASE 4, OTTAWA ENVIRONMENTAL NOISE FEASIBILITY ASSESSMENT		DESCRIPTION: FIGURE 3: TRANSPORTATION NOISE: POTENTIAL NOISE BARRIER LOCATIONS
	SCALE: 1:1000 (APPROX.)	DRAWING NO.: GW22-078-3	
	DATE: MARCH 29, 2022	DRAWN BY: G.G.	



GRADIENTWIND
ENGINEERS & SCIENTISTS

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

PROJECT	ORLEANS VILLAGE PHASE 4, OTTAWA ENVIRONMENTAL NOISE FEASIBILITY ASSESSMENT		
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW22-078-4
DATE	MARCH 29, 2022	DRAWN BY	G.G.

DESCRIPTION

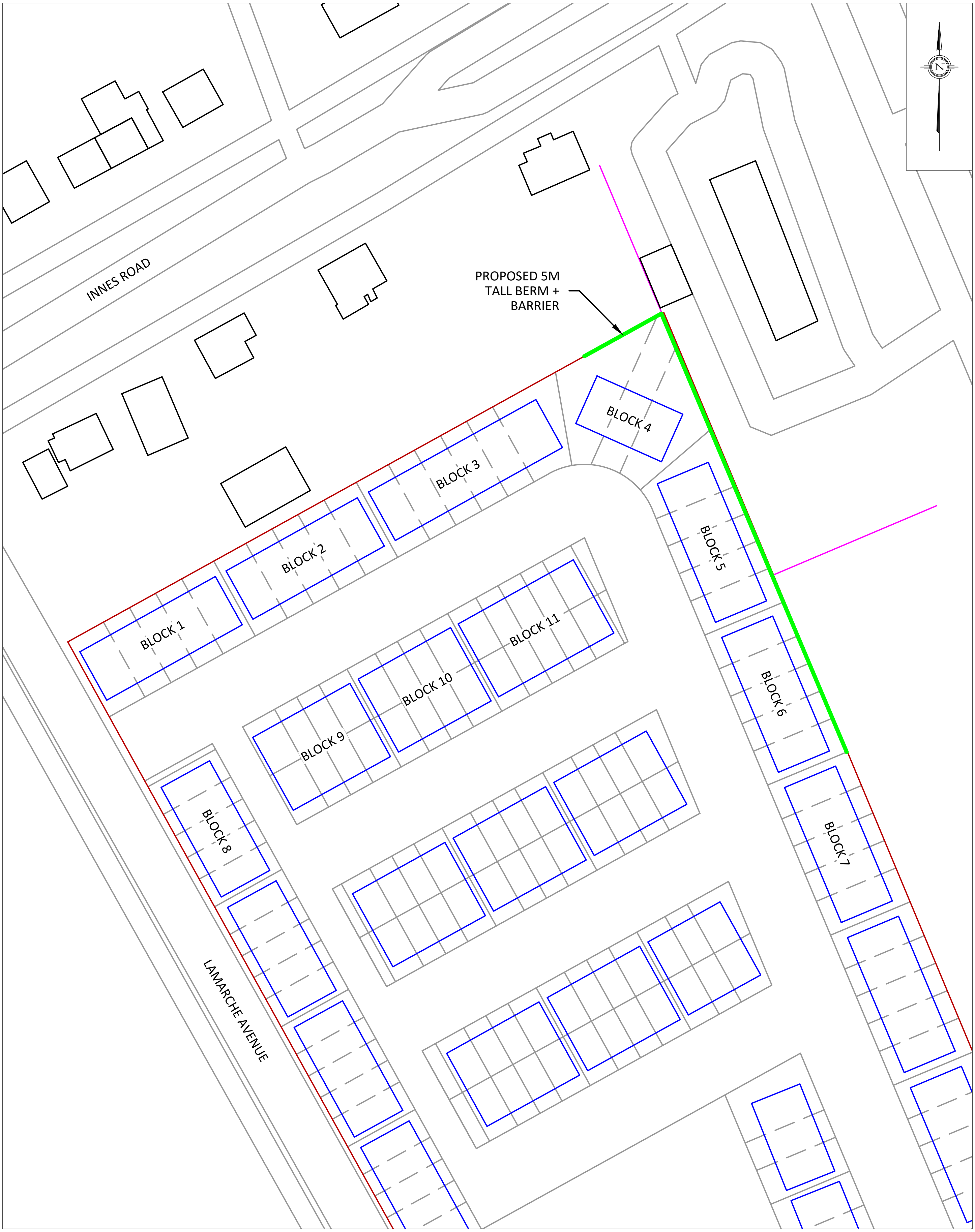
FIGURE 4:
STATIONARY NOISE SOURCES AND ON-SITE MEASUREMENT LOCATIONS

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

PROJECT	ORLEANS VILLAGE PHASE 4, OTTAWA ENVIRONMENTAL NOISE FEASIBILITY ASSESSMENT		
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW22-078-5
DATE	MARCH 29, 2022	DRAWN BY	G.G.

DESCRIPTION

FIGURE 5:
STATIONARY NOISE: RECEPTOR LOCATIONS



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

PROJECT	ORLEANS VILLAGE PHASE 4, OTTAWA ENVIRONMENTAL NOISE FEASIBILITY ASSESSMENT		
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW22-078-6
DATE	MARCH 29, 2022	DRAWN BY	G.G.

DESCRIPTION

FIGURE 6:
STATIONARY NOISE: OPTION 1 MITIGATION STRATEGY

FIGURE 7: DAYTIME TRAFFIC NOISE CONTOURS
(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 8: NIGHTTIME TRAFFIC NOISE CONTOURS (1.5 M ABOVE GRADE)

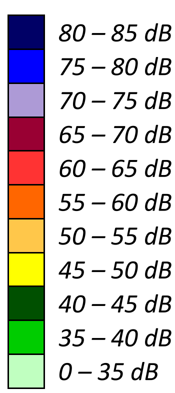
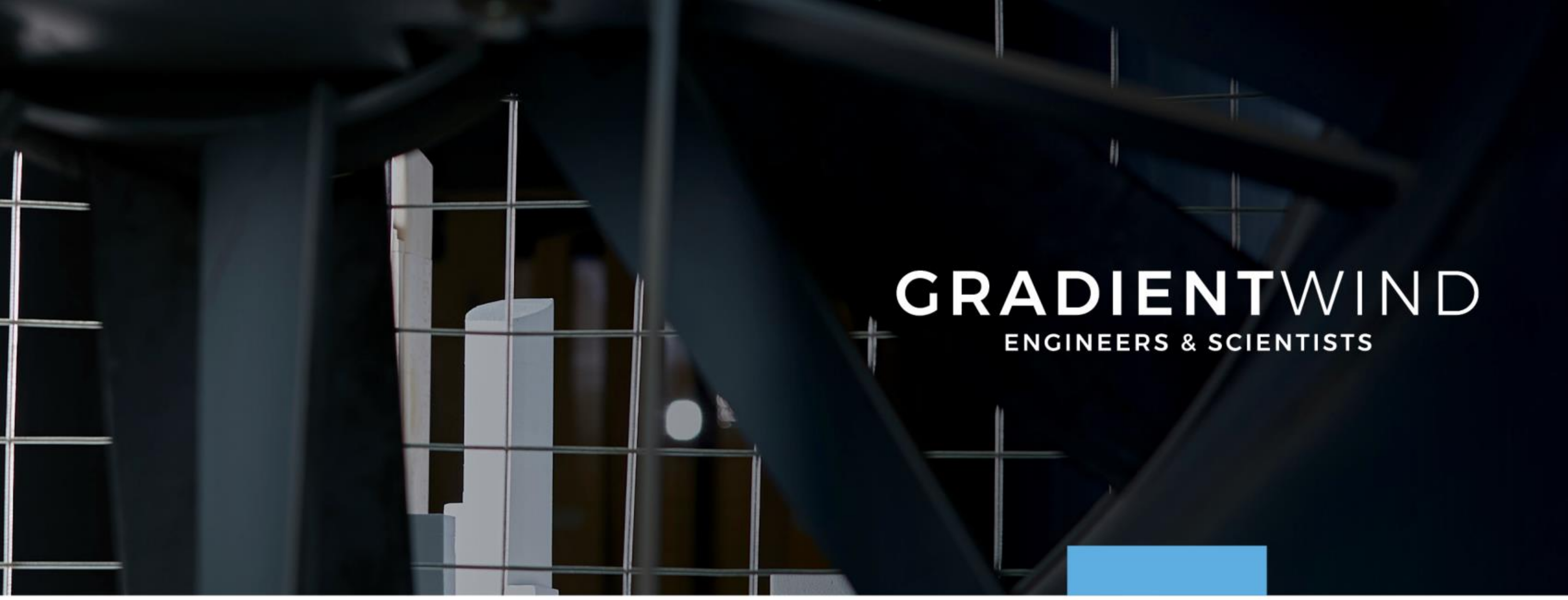


FIGURE 9: DAYTIME STATIONARY NOISE CONTOURS (1.5 M ABOVE GRADE)

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



APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
GRADIENTWIND.COM

```
 STAMSON 5.0        NORMAL REPORT        Date: 29-03-2022 21:02:22
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: IR (day/night)
--------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 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):  35000
    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: IR (day/night)
------------------------------------
Angle1   Angle2            : -90.00 deg   0.00 deg
Wood depth                 :      0       (No woods.)
No of house rows           :      0 / 0
Surface                    :      1       (Absorptive ground surface)
Receiver source distance   :  78.00 / 78.00  m
Receiver height            :   4.50 / 4.50   m
Topography                 :      1       (Flat/gentle slope; no barrier)
Reference angle            :   0.00

Results segment # 1: IR (day)
-----------------------------

Source height = 1.50 m

ROAD (0.00 + 58.12 + 0.00) = 58.12 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
   -90      0   0.57  73.68   0.00 -11.24  -4.31   0.00   0.00   0.00
58.12
--------------------------------------------------------------------------
--
```

```
Segment Leq : 58.12 dBA

Total Leq All Segments: 58.12 dBA

Results segment # 1: IR (night)
-------------------------------

Source height = 1.50 m

ROAD (0.00 + 50.52 + 0.00) = 50.52 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-----------------------------------------------------------------------
--
   -90      0   0.57  66.08   0.00 -11.24  -4.31   0.00   0.00   0.00
50.52
-----------------------------------------------------------------------
--

Segment Leq : 50.52 dBA

Total Leq All Segments: 50.52 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 58.12
                         (NIGHT): 50.52
```

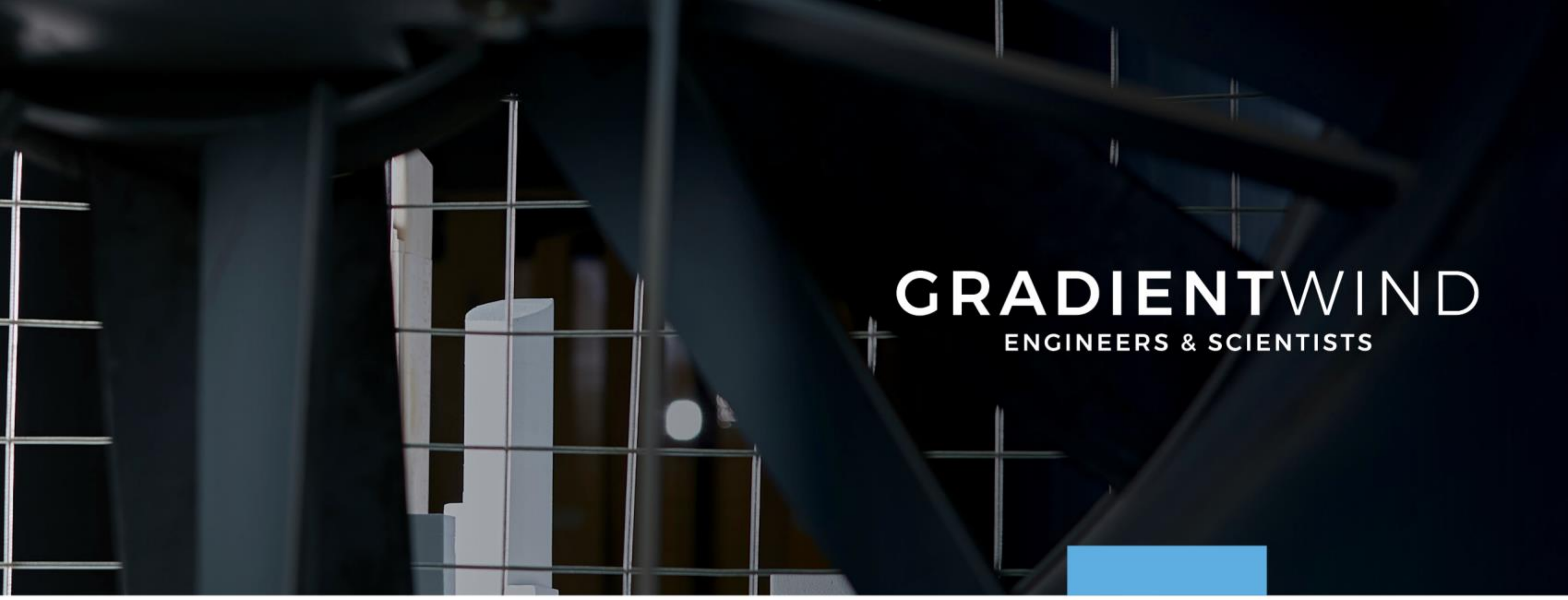
```
STAMSON 5.0        NORMAL REPORT        Date: 29-03-2022 21:02:36
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: IR (day/night)
--------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 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):  35000
    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: IR (day/night)
------------------------------------
Angle1   Angle2            : -90.00 deg   90.00 deg
Wood depth                 :      0       (No woods.)
No of house rows           :      1 / 1
House density              :     48 %
Surface                    :      1       (Absorptive ground surface)
Receiver source distance   :  77.00 / 77.00  m
Receiver height            :   4.50 / 4.50   m
Topography                 :      1       (Flat/gentle slope; no barrier)
Reference angle            :   0.00

Results segment # 1: IR (day)
-----------------------------

Source height = 1.50 m

ROAD (0.00 + 58.67 + 0.00) = 58.67 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
   -90     90   0.57  73.68   0.00 -11.15  -1.30   0.00  -2.55   0.00
58.67
--------------------------------------------------------------------------
--
```

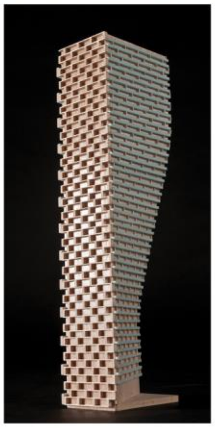
```
Segment Leq : 58.67 dBA

Total Leq All Segments: 58.67 dBA

Results segment # 1: IR (night)
-------------------------------

Source height = 1.50 m

ROAD (0.00 + 51.07 + 0.00) = 51.07 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
--------------------------------------------------------------------------
--
   -90     90   0.57  66.08   0.00 -11.15  -1.30   0.00  -2.55   0.00
51.07
--------------------------------------------------------------------------
--

Segment Leq : 51.07 dBA

Total Leq All Segments: 51.07 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 58.67
                         (NIGHT): 51.07
```

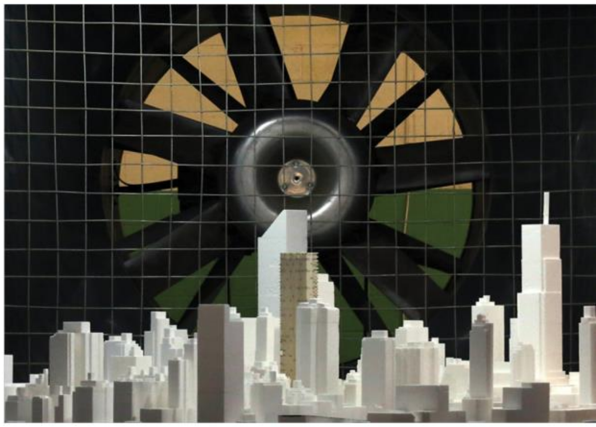
GRADIENTWIND
ENGINEERS & SCIENTISTS

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

PROJECT	ORLEANS VILLAGE PHASE 4, OTTAWA ENVIRONMENTAL NOISE FEASIBILITY ASSESSMENT
SCALE	1:1250 (APPROX.)
DRAWING NO.	GW22-078-A1
DATE	MARCH 29, 2022
DRAWN BY	G.G.
DESCRIPTION	FIGURE A1: TRANSPORTATION NOISE: STAMSON INPUT PARAMETERS







APPENDIX B

SITE VISIT PHOTOGRAPHS

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
GRADIENTWIND.COM

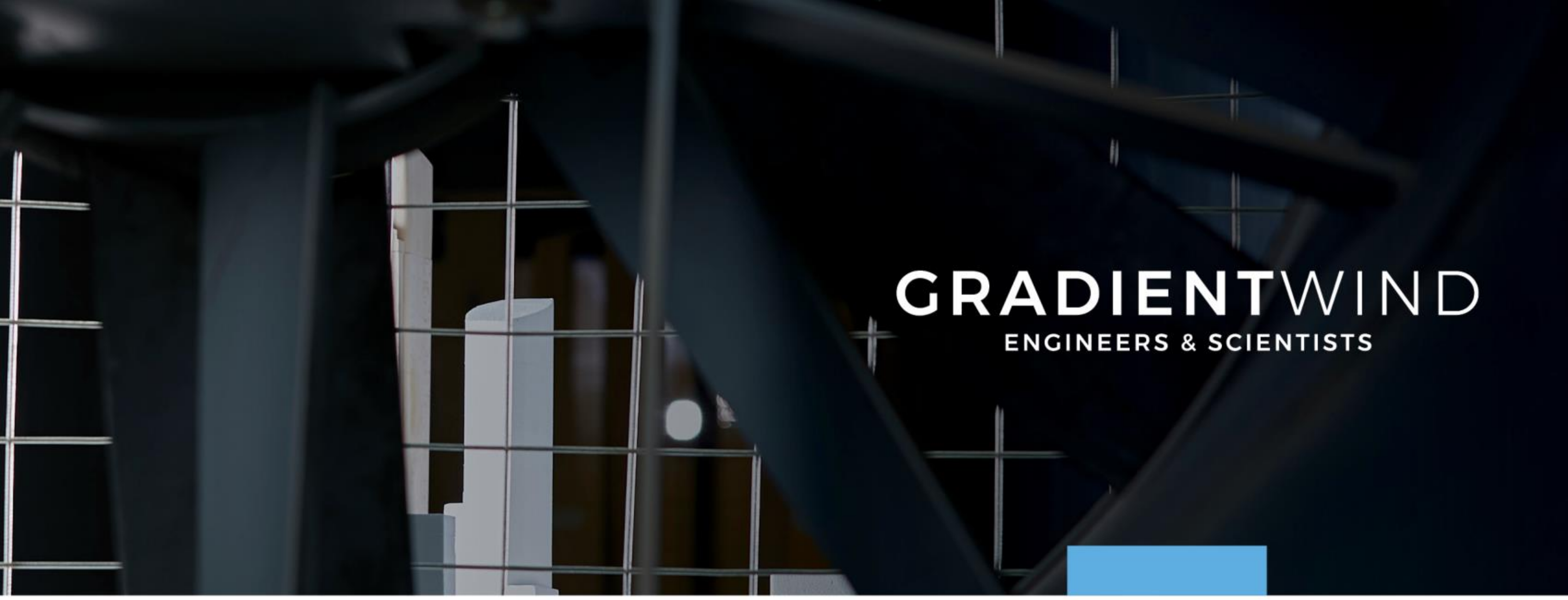
PHOTOGRAPH 1: RECEPTOR 1 LOCATION

PHOTOGRAPH 2: RECEPTOR 2 LOCATION

PHOTOGRAPH 3: RECEPTOR 3 LOCATION

PHOTOGRAPH 4: RECEPTOR 4 LOCATION

PHOTOGRAPH 5: EXISTING PERIMETER FENCE GAPS BETWEEN WOOD PLANKS



APPENDIX C

SAMPLE CALCULATIONS

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
GRADIENTWIND.COM

PROJECTING NOISE VALUES OF THE CAR WASH TO THE DEVELOPMENT

				Sound Pressure Level		
RECEPTOR	**Measurement Location**	**Approx. Source Receptor Distance [m]**	**Duration [min]**	**Laeq [dBA]**	**LA90 [dBA]**	**Dominant Source**
1	P1 - Caivan Property - Northeast Corner	7	21	56	54	Vacuum Area / Vacuum Service Building Exhaust Vent
2	P2 - Caivan Property - East Side	7	23	55	53	
3	P3 - Caivan Property - Southeast Corner	7	21	52	50	
4	P4 - Access Road - East of Halo Car Wash	35	27	67	61	Car Wash Blower

Approximated Sound Power Level of the Vacuum Area

RECEPTOR	**Measurement Location**	**Approx. Source Receptor Distance [m]**	**LA90 [dBA]**	**Calculated Sound Power Level [dBA]**	**Average Sound Power Level of the Power Plant [dBA]**	**Corrected Sound Power Level to Remove Mitigation Effect from Existing Perimeter Fence [dBA]**
1	P1 - Caivan Property - Northeast Corner	7	54	79	78	92/93
2	P2 - Caivan Property - East Side	7	53	78		
3	P3 - Caivan Property - Southeast Corner	7	50	75		

Approximated sound power level of the Car Wash Blower

RECEPTOR	**Measurement Location**	**Approx. Source Receptor Distance [m]**	**LA90 [dBA]**	**Calculated Sound Power Level [dBA]**
4	P4 - Access Road - East of Halo Car Wash	35	61	100