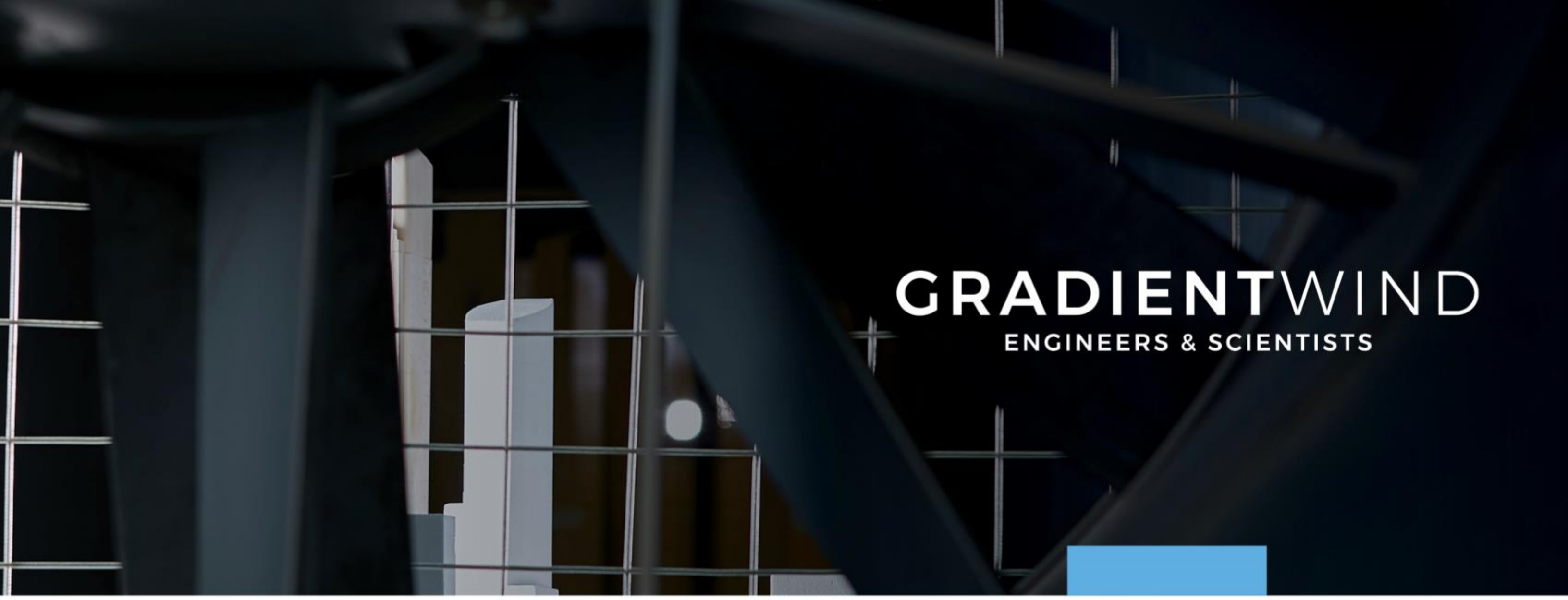
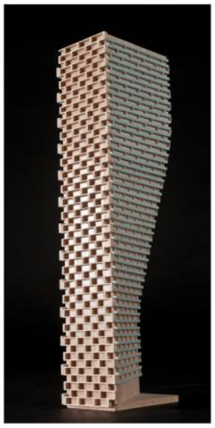


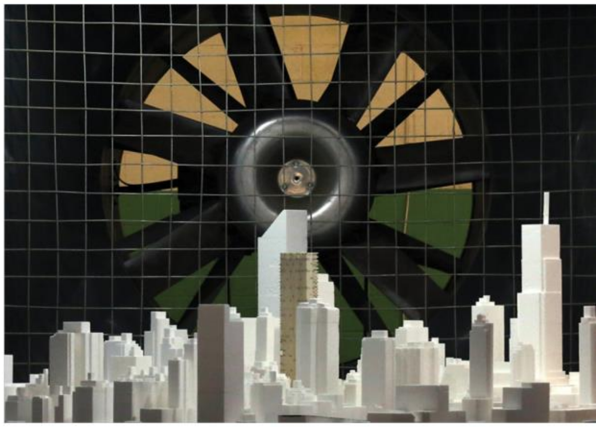
GRADIENTWIND
ENGINEERS & SCIENTISTS

TRANSPORTATION NOISE AND VIBRATION ASSESSMENT

Longfields Station-Block 10
609 Campanale Avenue
Ottawa, Ontario

REPORT: 23-248 – Transportation Noise and Vibration





November 5, 2024

PREPARED FOR
Campanale Group
1187 Bank St., Suite 200
Ottawa, ON K1S 3X7

PREPARED BY
Benjamin Page, AdvDip. Junior Environmental Scientist
Joshua Foster, P.Eng., Principal

EXECUTIVE SUMMARY

This report describes a transportation noise and vibration assessment in support of a Site Plan Control (SPA) application for the proposed development located at 609 Campanale Avenue, in Ottawa Ontario. Known as Block 10, the development is adjacent to the Longfields Transitway Station in the community of Barrhaven. The development comprises a mix-use building which rises to 10 storeys and includes two levels of underground parking. The primary sources of transportation noise include the Transitway (Bus Rapid Transit), the Via Rail Smith Falls rail line, and Longfield Drive. It should be noted the City of Ottawa has plans to convert the Transitway into a Light Rail Transit (LRT) line. The primary sources of ground-borne vibration are the Via Rail Smith Falls rail line and the future Barrhaven LRT. As the site is in proximity to the Via Rail Smith Falls rail line and the future Barrhaven LRT, a ground vibration impact assessment from both rail lines on the proposed development was also conducted following the procedures outlined in the Federal Transit Authorities (FTA) protocol. The site is also within the Noise Exposure Forecast (NEF) 25 contour, and as such noise related to aircraft flyovers is also addressed. Figure 1 illustrates a complete site plan 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 and rail volumes based on Gradient Wind's previously completed environmental noise studies for surrounding developments in the area[1]; (iv) architectural drawings provided by Woodman Architect and Associates Ltd. in May 2024; and (v), ground-borne vibration criteria as specified by the Federal Transit Authority (FTA) Protocol.

The results of the current analysis indicate that noise levels will range between 68 and 45 dBA during the daytime period (07:00-23:00) and between 62 and 39 dBA during the nighttime period (23:00-07:00). The highest noise level (68 dBA) occurs at the northwest façade, which is most exposed to the Transitway and the Via Rail corridor.

[1] GW18-100-EA, Environmental Assessment, Barrhaven LRT and Rail Grade Separations, Ottawa, Ontario, May 27, 2021

The project considers the conversion of the existing Transitway, to an LRT system, known as the future Barrhaven LRT. An additional assessment was conducted to determine the effect of the future Barrhaven LRT on the proposed development. The results of the analysis indicate that noise levels will range between 64 and 39 dBA during the daytime period (07:00-23:00) and between 59 and 35 dBA during the nighttime period (23:00-07:00). The highest noise level (64 dBA) occurs at the northwest façade, which is most exposed to LRT and the Via Rail corridor.

As the noise levels are higher with the BRT in place, noise control measures are based off the BRT system operations. Therefore, upgraded building components and air conditioning will be required as noise levels predicted due to roadway traffic exceed the criteria listed in NPC-300 for building components. This will allow occupants to keep windows closed and maintain a comfortable living environment. A Type D Warning Clause will also be required in all Lease, Purchase and Sale Agreements, as summarized in section 6.

Noise levels at the Level 3 and Level 9 terraces are expected to exceed 55 dBA during the daytime period without a noise barrier. If these areas are to be used as outdoor living areas, noise control measures are required to reduce noise levels as close as possible to 55 dBA where technically and administratively feasible. Further analysis investigated the noise-mitigating impact of raising the perimeter guards from 1 m to 1.5 m above the walking surface. The results of the investigation proved noise levels can be reduced to 55 dBA or below with an appropriate barrier height. Noise levels at the Level 3 OLA can be reduced to 54 dBA by implementing a 1.5m tall barrier surrounding the northeast and northwest perimeters. Noise levels at the Level 9 OLA can be reduced to below 55 dBA by implementing a 1.5 m tall barrier surrounding the southwest and northwest perimeters. Figure 4 illustrates the barrier requirements.

As the development is located on the edge of the NEF/NEP 25 contour, roadway traffic is expected to be the prominent source of noise. Therefore, to ensure the protection of indoor spaces, the more stringent construction requirements from the roadway/railway noise control measures presented in Section 5.2 shall be applied for surface transportation noise. Furthermore, for all units in the development the Warning Clause (Type Aircraft[2]) must be included in all Agreements of Lease, Purchase and Sale.

[2] Appendix D, ENCG

Estimated vibration levels at the foundation nearest to the Via railway corridor are expected to be 0.09mm/s RMS (71 dBV), based on the FTA protocol and an offset distance of 70 m to the nearest track centerline. Details of the calculation are provided in Appendix B. Since predicted vibration levels do not exceed the criterion of 0.10 mm/s RMS at the foundation, concerns due to vibration impacts on the site are not expected. As vibration levels are acceptable, correspondingly, regenerated noise levels are also expected to be acceptable.

Estimated vibration levels at the foundation nearest to the future LRT corridor are expected to be 0.02mm/s RMS (59 dBV), based on the FTA protocol and an offset distance of 37 m to the nearest track centerline. Details of the calculation are provided in Appendix B. Since predicted vibration levels do not exceed the criterion of 0.10 mm/s RMS at the foundation, concerns due to vibration impacts on the site are not expected. As vibration levels are acceptable, correspondingly, regenerated noise levels are also expected to be acceptable.

With regard to stationary noise impacts, Gradient Wind conducted a stationary noise analysis for the 605 Longfields Drive development (see Appendix C), showing that the AC units located on the roof of the building will have no significant impact on the property. Given the current site is farther setback from the stationary sources than the previous developments, noise levels are expected to fall below the ENCG criteria. The Longfields Transitway Station, located Southeast of the proposed development is more than 100 m away. The station does not currently have, nor is it anticipated to have, any significant HVAC equipment. Any noise generated by the station is expected to fall below ambient noise levels. There are no significant sources of stationary noise surrounding the site.

The stationary noise impacts of the development's own mechanical equipment on the surroundings would be considered at the future Site Plan stage once the mechanical design has progressed and equipment has been selected. Any potential impacts can be minimized by judicious selection of mechanical equipment and its location. It is preferable to locate large pieces of equipment, such as cooling towers and make-up air units, on the roof of the towers or in mechanical penthouses. Once the mechanical design of the building has developed sufficiently, it should be reviewed by a qualified acoustical engineer to ensure compliance with NPC-300 sound level limits.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Campanale Group to undertake a transportation noise and vibration assessment in support of a Site Plan Control (SPC) application for the proposed development located on Block 10, adjacent to Longfields Station in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior and interior noise levels generated by local transportation noise and vibration sources.

Our work is based on theoretical noise calculation methods conforming to the City of Ottawa[3] and Ministry of the Environment, Conservation and Parks (MECP)[4] guidelines. Noise calculations were based on architectural drawings provided by Woodman Architect and Associates Ltd. in May 2024, with future vehicular traffic and rail volumes based on Gradient Wind's previously completed environmental noise studies for surrounding developments in the area[5].

2. TERMS OF REFERENCE

The focus of this transportation noise and vibration assessment is the proposed mix-use development located at 609 Campanale Avenue, in Ottawa. The development known as Block 10 is adjacent to the Longfields Transitway Station in Ottawa, Ontario. The subject site is situated on a rectangular parcel of land bounded by Transitway to the northwest, Campanale Avenue to the southeast, and residential developments to the northeast and southwest. The development comprises a mix-use building which rises to 10 storeys and includes two levels of underground parking.

The ground floor comprises retail space to the southeast, an amenity area to the northwest, storage space to the southwest, a garbage room to the northwest, and a central lobby. Vehicular access to underground parking is provided from Campanale Ave. The 3-storey podium portion comprises residential suites and an outdoor amenity terrace on the roof (Level 3). At level 3 the floorplate sets back in all directions to the typical tower floorplate. At level 7 the floorplate sets back from the northeast, accommodating terraces.

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[3] City of Ottawa Environmental Noise Control Guidelines, January 2016
[4] Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013
[5] GW18-100-EA, Environmental Assessment, Barrhaven LRT and Rail Grade Separations, Ottawa, Ontario, May 27, 2021

At level 9 the floor plate sets back in all directions accommodating an outdoor amenity terrace, an indoor amenity, and a mechanical penthouse.

The site is surrounded by a mix of mid and low-rise buildings from the northeast clockwise to the southwest, and mostly low-rise buildings in the remaining compass directions. The primary sources of transportation noise include Transitway (Bus Rapid Transit corridor), the Via Rail Smith Falls rail line, The city has plans to convert the BRT system to and LRT system. The primary sources of ground-borne vibration are the Via Rail Smith Falls rail line and the future Barrhaven LRT. As per the City of Ottawa's Official Plan, the light rail lines are situated within 75 m from the nearest property line. As a result, a ground vibration impact assessment from the light rail system on the proposed development was conducted following the procedures outlined in the Federal Transit Authorities (FTA) protocol. Figure 1 illustrates a complete site plan 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 road and railway traffic, (ii) predict vibration levels on the study building produced from light rail systems, and (iii) ensure that interior and exterior noise and vibration levels do not exceed the allowable limits specified by the City of Ottawa's Environmental Noise Control Guidelines as outlined in Section 4.2.1 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. Indoor noise level criteria due to railway traffic are 5 dB lower.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (ROAD) [6]

Type of Space	Time Period	L_{eq} (dBA)	
		Road	Rail
General offices, reception areas, retail stores, etc.	07:00 – 23:00	50	45
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	40
Sleeping quarters of hotels/motels	23:00 – 07:00	45	40
Sleeping quarters of **residences**, hospitals, nursing/retirement homes, etc.	23:00 – 07:00	40	35

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

[6] Adapted from ENCG 2016 – Tables 2.2b and 2.2c

a standard closed window is capable of providing a minimum 20 dBA noise reduction[7]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[8]. 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[9].

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, mitigation should be provided to reduce noise levels where technically and administratively feasible to acceptable levels at or below the criterion. Furthermore, noise levels at the OLA must not exceed 60 dBA if mitigation can be technically and administratively achieved.

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). This computer program can represent three-dimensional surfaces and the 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 8 receptor locations were identified around the site, as illustrated in Figure 2.

[7] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[8] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[9] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3

Roadway noise calculations were performed by treating each 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 streets was taken to be 92%/8%, respectively.
- Ground surfaces were taken to be reflective due to the presence of hard (paved) ground.
- Topography was assumed to be a flat/gentle slope surrounding the study building.
- For select sources where appropriate, receptors considered the proposed and/or existing buildings as a barrier partially or fully obstructing exposure to the source as illustrated by exposure angles in Figure 3.
- Noise receptors were strategically placed at 8 locations around the study area (see Figure 2).
- Via Rail trains were modelled with an average of 4 cars and 1 locomotive per train (150 km/h).
- Receptor distances and exposure angles are illustrated in Figure 3.

4.2.1 Transportation 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, noise levels at the eight (8) receptors were based on current and proposed traffic information extrapolated from Gradient Wind's previously completed environmental noise studies for surrounding developments in the area[10]. Table 2 (below) summarizes the AADT values used for each roadway included in this assessment.

TABLE 2: TRANSPORTATION TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Via Rail (Smith Falls)	Railway	150	**17/3***
Longfields Station Transitway	Bus Transitway	80	**418/92***
Future Barrhaven LRT	Light Rail Transit	70	**540/60***

*Daytime/Nighttime volumes based on the City of Ottawa's Environmental Assessment for the LRT Project

[10] GW18-100-EA, Environmental Assessment, Barrhaven LRT and Rail Grade Separations, Ottawa, Ontario, May 27, 2021

4.3 Aircraft Noise

4.3.1 Criteria for Aircraft Noise

The ENCG outlines the sound level criteria for aircraft noise based on a site's location near the Ottawa International Airport. The Ottawa Airport Vicinity Development Zone (OAVDZ) is a zone around the airport defined by NEF/NEP contour lines that follow fixed features, such as roads or lot boundaries. NEF/NEP contours reflect the predetermined noise levels which would impact sensitive areas around airports. These contours include the influences of noise levels from aircraft flight, take-off, and ground operations to specific urban areas. Noise generated from aircraft traffic is represented as Effective Perceived Noise Levels (EPNL), a unit of noise measurement that accounts for variations in the human perception of pure tones and noise duration. Recorded noise levels are plotted geographically to generate NEF/NEP contour maps, where lower NEF/NEP levels correspond to lower average outdoor noise levels. The Ottawa Airport Vicinity Development Zone (OAVDZ) represents the 25 NEF/NEP contour. The Ottawa Airport Operating Influence Zone (OAOIZ) represents the NEF/NEP 30 contour, where commercial air traffic may negatively influence noise-sensitive developments. Within the OAOIZ, noise-sensitive development is not permitted, although infill and redevelopment may occur in specific areas within the zone in keeping with the criteria set out in the Official Plan.

According to accepted research[11], Health and Welfare Canada states that people continuously exposed to NEF/NEP values less than 35 will not suffer adverse physical or psychological effects. Sociological surveys[12] have indicated that negative community reactions to noise levels may start at about 25 NEF/NEP. Table 3 identifies the sound level criteria for relevant outdoor and indoor living spaces exposed to aircraft noise.

[11] Report of the Special Meeting on Aircraft Noise in the Vicinity of Aerodromes, Montreal ICAO, 1969.
[12] Noise in Urban and Suburban Areas. Bolt, Beanik and Newman, Inc., Washington, January 1967.

TABLE 3: OUTDOOR AND INDOOR AIRCRAFT SOUND LEVEL CRITERIA[13]

Type of Space	NEF/NEP	Approximate $L_{EQ(24Hr)}$
Outdoor Point of Reception	30	62 dBA
General offices, reception areas, retail stores, etc.	15	47 dBA
Individual or semi-private offices, conference rooms, etc.	10	42 dBA
Living/dining areas of residences, sleeping quarters in hotels/motels, theatres, libraries, schools, day-care centres, places of worship, etc.	5	37 dBA
Sleeping quarters of residences, hospitals, nursing/retirement homes, etc.	0	32dBA

4.4 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 and rail sources at the plane of the window exceed 65 dBA and 60 dBA respectively, calculations must be performed to evaluate the sound transmission quality of the building components to ensure acceptable indoor noise levels. Noise calculations also need to be made when the aircraft noise exposure is above NEF / NEP 30 (Leq-24hr 62). The calculation procedure[14] considers:

[13] Adapted from ENCG – Tables 1.2, 1.3
[14] Building Practice Note: Controlling Sound Transmission into Buildings by J.D. Quirt, National Research Council of Canada, September 1985

- 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 vary according to the intended use of a space

Based on published research[15], 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. Window STC calculations have therefore been based on the following assumptions:

- Bedrooms are assumed to be very absorptive (1.25 absorption coefficient), living rooms are assumed to have an intermediate level of absorption (0.8 absorption coefficient), and retail stores are assumed to have a hard level of absorption (0.5 absorption coefficient).
- Exterior walls will have a minimum STC 45
- Room, window, and wall dimensions are based on the detailed floor plans provided by Woodman Architect and Associates Ltd. in May 2024.

As per NPC 300, the indoor aircraft noise was evaluated by converting the NEF/NEP to 24-hour equivalent sound pressure level. Since the development falls within the NEF 25 contour line, 25 was used as the NEF variable in the following equation NEF = Leq(24) – 32 dBA, used for the conversion. STC calculations were performed based on the method developed by the National Research Council in their Building Practice Note # 56[16].

4.5 Stationary Noise

Gradient Wind has previously completed environmental noise studies for surrounding developments in the area. Below is a list of noise studies completed for Campanale Homes and other developers.

- Transportation Noise & Vibration Assessment 455 Via Verona (GWE15-016 – Noise), dated February 26, 2015

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[15] CMHC, Road & Rail Noise: Effects on Housing
[16] Quirt, J.D. Controlling Sound Transmission into Buildings, National Research Council of Canada, Ottawa September 1985

- Noise Study Amendment Longfields Station Building (GWE16-062 – Detailed STC), dated September 1, 2016
- Transportation Noise Study 619 Longfields Drive (GWE16-116 – Traffic Noise), dated July 7, 2017
- Stationary Noise Assessment 605 Longfields Drive (GWE17-174 – Stationary Noise), dated November 8, 2017

Sources of stationary noise surrounding the subject property originate from the HVAC equipment associated with the 605 Longfields Drive development. Gradient Wind conducted a stationary noise analysis for the 605 Longfields Drive development (see Appendix C), showing that the AC units located on the roof of the building will have no significant impact on the property. Given the current site is farther setback from the stationary sources than the previous developments, noise levels are expected to fall below the ENCG criteria.

4.5.1 Impacts on Surroundings

The stationary noise impacts of the development's own mechanical equipment on the surroundings would be considered at the future Site Plan stage once the mechanical design has progressed and equipment has been selected. Any potential impacts can be minimized by judicious selection of mechanical equipment and its location. It is preferable to locate large pieces of equipment, such as cooling towers and make-up air units, on the roof of the towers or in mechanical penthouses. Once the mechanical design of the building has developed sufficiently, it should be reviewed by a qualified acoustical engineer to ensure compliance with NPC-300 sound level limits.

4.6 Ground Vibration and Ground-borne Noise

Rail systems and heavy vehicles on roadways can produce perceptible levels of ground vibrations, especially when they are in close proximity to residential neighbourhoods or vibration-sensitive buildings. Similar to sound waves in air, vibrations in solids are generated at a source, propagated through a medium, and intercepted by a receiver. In the case of ground vibrations, the medium can be uniform, or more often, a complex layering of soils and rock strata. Also, similar to sound waves in air, ground vibrations produce perceptible motions and regenerated noise known as 'ground-borne noise' when the vibrations encounter a hollow structure such as a building. Ground-borne noise and vibrations are generated when there is excitation of the ground, such as from a train or subway. The repetitive motion of the wheels on the track or rubber tires passing over an uneven surface causes vibration to propagate through the soil. When they encounter a building, vibrations pass along the structure of the building beginning at the foundation and propagating to all floors. The air inside the building excited by the vibrating walls and floors represents regenerated airborne noise. Characteristics of the soil and the building are imparted to the noise, thereby creating a unique noise signature.

Human response to ground vibrations is dependent on the magnitude of the vibrations, which is measured by the root mean square (RMS) of the movement of a particle on a surface. Typical units of ground vibration measures are millimeters per second (mm/s), or inch per second (in/s). Since vibrations can vary over a wide range, it is also convenient to represent them in decibel units, or dBV. In North America, it is common practice to use the reference value of one micro-inch per second (μin/s) to represent vibration levels for this purpose. The threshold level of human perception of vibrations is about 0.10 mm/s RMS or about 72 dBV. Although somewhat variable, the threshold of annoyance for continuous vibrations is 0.5 mm/s RMS (or 85 dBV), five times higher than the perception threshold, whereas the threshold for significant structural damage is 10 mm/s RMS (or 112 dBV), at least one hundred times higher than the perception threshold level.

4.6.1 Ground Vibration Criteria

The Canadian Railway Association and Canadian Association of Municipalities have set standards for new sensitive land developments within 300 metres of a railway right-of-way, as published in their document *Guidelines for New Development in Proximity to Railway Operations*[17] , which indicates that vibration conditions should not exceed 0.14 mm/s RMS averaged over a one-second time period at the first floor and above of the proposed building.

4.6.2 Theoretical Ground Vibration Prediction Procedure

Potential vibration impacts of the trains were predicted using the Federal Transit Authority's (FTA) *Transit Noise and Vibration Impact Assessment*[18] protocol. The FTA general vibration assessment is based on an upper bound generic set of curves that show vibration level attenuation with distance. These curves, illustrated in the figure on the following page, are based on ground vibration measurements at various transit systems throughout North America. Vibration levels at points of reception are adjusted by various factors to incorporate known characteristics of the system being analyzed, such as the operating speed of the vehicle, conditions of the track, construction of the track and geology, as well as the structural type of the impacted building structures. The Via rail vibration impact on the building was determined using a set of curves for Locomotive Powered Passenger or Freight at a speed of 50 mph. Adjustment factors were considered based on the following information:

- The maximum operating speed of the train is 93 mph (150 km/h) at peak.
- The offset distance between the development and the closest track is 70 m.
- The vehicles are assumed to have soft primary suspensions.
- Tracks are welded and in good condition.
- Soil conditions do not efficiently propagate vibrations.
- Type of transit structure is Open Cut.
- The building's foundation coupling is 3-4 Story Masonry.

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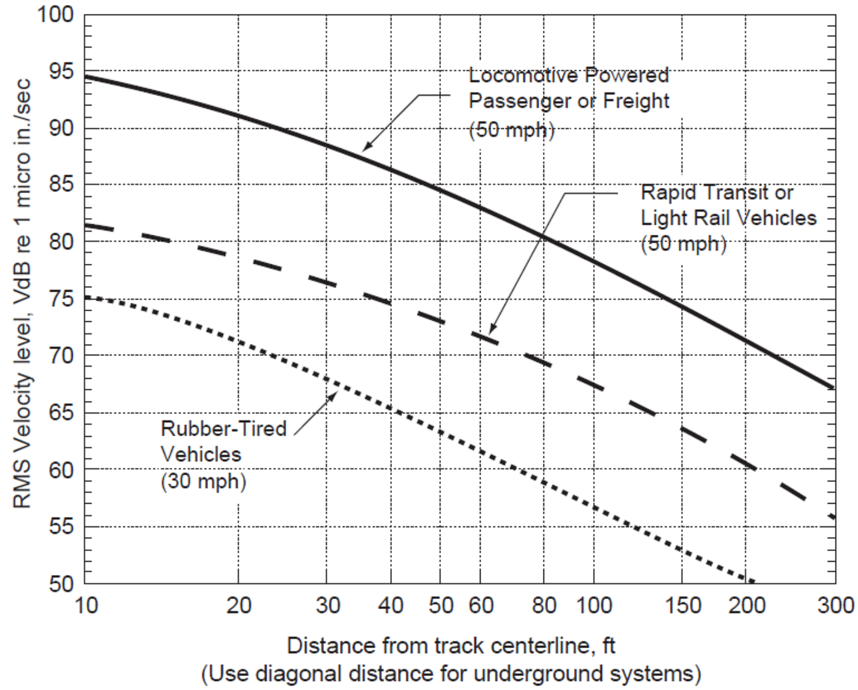
[17] Coulter Associates Limited, J.E. (2013). Guidelines for New Development in Proximity to Railway Operations. Dialog. Page 27, Section 3.3
[18] C. E. Hanson; D. A. Towers; and L. D. Meister, Transit Noise and Vibration Impact Assessment, Federal Transit Administration, May 2006

The LRT vibration impact on the building was determined using a set of curves for Rapid Transit at a speed of 50 mph. Adjustment factors were considered based on the following information:

- The maximum operating speed of the train is 43 mph (70 km/h) at peak.
- The offset distance between the development and the closest track is 37 m.
- The vehicles are assumed to have soft primary suspensions.
- Tracks are welded and in good condition.
- Soil conditions do not efficiently propagate vibrations.
- Type of transit structure is Open Cut.
- The building's foundation coupling is 3-4 Story Masonry.



FTA GENERALIZED CURVES OF VIBRATION LEVELS VERSUS DISTANCE (ADOPTED FROM FIGURE 10-1, FTA TRANSIT NOISE AND VIBRATION IMPACT ASSESSMENT)

5. RESULTS AND DISCUSSION

5.1 Transportation Noise Levels

The results of the transportation noise calculations are summarized in Table 4 below.

TABLE 4: EXTERIOR NOISE LEVELS DUE TO TRANSPORTATION SOURCES

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	Transitway		Via Rail (Smith Falls)		Future Barrhaven LRT		Total Noise Level with BRT (dBA)		Total Noise Level with LRT (dBA)	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
1	9.5	POW 3rd Floor Northeast Façade	60	54	56	52	53	47	**61**	**56**	**58**	**53**
2	25	POW 8th Floor Northeast Façade	61	54	57	52	53	47	**62**	**56**	**58**	**53**
3	25	POW 8th Floor Northwest Façade	67	60	62	58	59	53	**68**	**62**	**64**	**59**
4	25	POW 8th Floor Southwest Façade	62	56	57	53	54	48	**63**	**58**	**59**	**54**
5	25	POW 8th Floor Southeast Façade	44	37	38	34	34	28	**45**	**39**	**39**	**35**
6	28.5	POW 9th Floor Northwest Façade	58	51	60	56	52	46	**62**	**57**	**61**	**56**

TABLE 4 CONTINUED: EXTERIOR NOISE LEVELS DUE TO TRANSPORTATION SOURCES

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	Longfields Station Transitway		Via Rail (Smith Falls)		Future Barrhaven LRT		Total Noise Level without LRT Contribution (dBA)		Total Noise Level with LRT Contribution (dBA)	
			Day	Night	Day	Night	Day	Night	Day	Night	Day	Night
7	9.5	OLA 3rd Floor Northwest Amenity Terrace	59	53	57	52	53	47	**61**	**N/A***	**58**	**N/A***
8	28.5	OLA 9th Floor Southwest Amenity Terrace	57	50	57	52	50	44	**60**	**N/A***	**58**	**N/A***

*Noise levels during the nighttime are not considered as per ENCG

The results of the current analysis indicate that noise levels will range between 68 and 45 dBA during the daytime period (07:00-23:00) and between 62 and 39 dBA during the nighttime period (23:00-07:00). The highest noise level (68 dBA) occurs at the northwest façade, which is most exposed to Longsfields Station Transitway and the Via Rail corridor. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated in Figure 5. Figures 7 and 8 illustrate daytime and nighttime noise contours of the site 4.5m above grade.

The project considers the conversion of the existing Bus Rapid Transit system (BRT), known as Longfields Station Transitway, to an LRT system, known as the future Barrhaven LRT. An additional assessment was conducted to determine the effect of the Future Barrhaven LRT on the proposed development. The results of the analysis indicate that noise levels will range between 64 and 39 dBA during the daytime period (07:00-23:00) and between 59 and 35 dBA during the nighttime period (23:00-07:00). The highest noise level (64 dBA) occurs at the northwest façade, which is most exposed to the future Barrhaven LRT and the Via Rail corridor. Figures 9 and 10 illustrate daytime and nighttime noise contours of the site 4.5m above grade.

Table 5 shows a comparison in results between Predictor-Lima 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. STAMSON input parameters are shown in Appendix A.

TABLE 5: RESULTS OF STAMSON/PREDICTOR-LIMA CORRELATION

Receptor ID	Receptor Height (m)	Receptor Location	STAMSON 5.04 Noise Level With BRT Contribution (dBA)		PREDICTOR-LIMA Noise Level With BRT Contribution (dBA)		STAMSON 5.04 Noise Level with LRT Contribution (dBA)		PREDICTOR-LIMA Noise Level with LRT Contribution (dBA)	
			Day	Night	Day	Night	Day	Night	Day	Night
R1	9.5	POW 3rd Floor Northeast Façade	60	55	61	56	60	55	58	53
R4	25	POW 8th Floor Southwest Façade	60	56	63	58	60	55	59	54
R8	28.5	OLA 9th Floor Southwest Amenity Terrace	57	N/A*	60	N/A*	57	N/A*	58	N/A*

*Noise levels during the nighttime are not considered as per ENCG

5.2 Noise Control Measures

The noise levels predicted due to roadway and railway traffic exceed the criteria listed in Section 4.2 for building components. As discussed in Section 4.4, the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space. STC calculations were performed based on the method developed by the National Research Council in their Building Practice Note # 56[19].

[19] Quirt, J.D. Controlling Sound Transmission into Buildings, National Research Council of Canada, Ottawa September 1985

Detailed STC calculations will be required to be completed prior to the building permit application for each unit type. The STC requirements for the windows are summarized below for various units within the development (see Figure 5):

- **Bedroom Windows**

(i) Bedroom windows facing west will require a minimum STC of 35

(ii) All other bedroom windows are to satisfy Ontario Building Code (OBC 2020) requirements

- **Living Room Windows**

(i) Living room windows facing west will require a minimum STC of 35

(ii) All other living room windows are to satisfy Ontario Building Code (OBC 2020) requirements

- **Exterior Walls**

(i) Exterior wall components on these façades will require a minimum STC of 45, which will be achieved with brick cladding or an acoustical equivalent according to NRC test data[20]

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

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

Results of the calculations also indicate that the development will require central air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. In addition to ventilation requirements, a Type D warning clause will also be required in all Lease, Purchase and Sale Agreements, as summarized in Section 6.

5.3 Noise Barrier Calculation

Noise levels at the Level 3 and Level 9 terraces are expected to exceed 55 dBA during the daytime period without a noise barrier. If these areas are to be used as outdoor living areas, noise control measures are required to reduce noise levels as close as possible to 55 dBA where technically and administratively feasible. Further analysis investigated the noise-mitigating impact of raising the perimeter guards from 1 m to 1.5 m above the walking surface (see Table 6). The results of the investigation proved noise levels can be reduced to 55 dBA or below with an appropriate barrier height. The preferred barrier heights for the amenity spaces are associated with the noise levels in **bold** font. Noise levels at the Level 3 OLA can be reduced to 54 dBA by implementing a 1.5m tall barrier surrounding the northeast and northwest perimeters. Noise levels at the Level 9 OLA can be reduced to 55 dBA by implementing a 1.5 m tall barrier surrounding the southwest, and northwest perimeters. Figure 4 illustrates the barrier requirements.

TABLE 6: RESULTS OF NOISE BARRIER INVESTIGATION

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	Daytime L_{eq} Noise Levels (dBA)			
			No Barrier	With 1 m Barrier	With 1.2 m Barrier	With 1.5 m Barrier
7	9.5	OLA - 3rd Floor Northwest Amenity Terrace	61	58	56	**54**
8	28.5	OLA - 9th Floor Southwest Amenity Terrace	60	57	56	**55**

5.4 Ground Vibrations and Ground-Borne Noise Levels

Estimated vibration levels at the foundation nearest to the Via railway corridor are expected to be 0.09mm/s RMS (71 dBV), based on the FTA protocol and an offset distance of 70 m to the nearest track centerline. Details of the calculation are provided in Appendix B. Since predicted vibration levels do not exceed the criterion of 0.10 mm/s RMS at the foundation, concerns due to vibration impacts on the site are not expected. As vibration levels are acceptable, correspondingly, regenerated noise levels are also expected to be acceptable.

Estimated vibration levels at the foundation nearest to the future LRT corridor are expected to be 0.02mm/s RMS (59 dBV), based on the FTA protocol and an offset distance of 37 m to the nearest track centerline. Details of the calculation are provided in Appendix B. Since predicted vibration levels do not exceed the criterion of 0.10 mm/s RMS at the foundation, concerns due to vibration impacts on the site are not expected. As vibration levels are acceptable, correspondingly, regenerated noise levels are also expected to be acceptable.

5.5 Aircraft Noise

As indicated in Figure 6, all residential units of the new development are located between the 25 NEF/NEP and the Ottawa Airport Operating Influence Zone (OAOIZ), NEF/NEP 30 contour. As stated in section 4.4, noise calculations are required when the aircraft noise exposure is above NEF / NEP 30 (Leq-24hr 62). Although, due to the site's location and information from previous assessments done in the area, aircraft noise calculations were considered. As discussed in Section 4.4, the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space. STC calculations were performed based on the method developed by the National Research Council in their Building Practice Note # 56[21].

Detailed STC calculations will be required to be completed prior to the building permit application for each unit type. The STC requirements for the windows are summarized below for various units within the development (see Figure 5):

- **Bedroom Windows**

(iii) Bedroom windows facing west will require a minimum STC of 20

(iv) All other bedroom windows are to satisfy Ontario Building Code (OBC 2020) requirements

- **Living Room Windows**

(iii) Living room windows facing west will require a minimum STC of 18

[21] Quirt, J.D. Controlling Sound Transmission into Buildings, National Research Council of Canada, Ottawa September 1985

(iv) All other living room windows are to satisfy Ontario Building Code (OBC 2020) requirements

- **Exterior Walls**

(ii) Exterior wall components on these façades will require a minimum STC of 45, which will be achieved with brick cladding or an acoustical equivalent according to NRC test data[22]

As the development is located on the edge of the NEF/NEP 25 contour, roadway traffic is expected to be the prominent source of noise. Therefore, to ensure the protection of indoor spaces, the more stringent construction requirements from the roadway/railway noise control measures presented in Section 5.2 shall be applied for surface transportation noise. Furthermore, for all units in the development the Warning Clause (Type Aircraft[23]) must be included in all Agreements of Lease, Purchase and Sale.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 68 and 45 dBA during the daytime period (07:00-23:00) and between 62 and 39 dBA during the nighttime period (23:00-07:00). The highest noise level (68 dBA) occurs at the northwest façade, which is most exposed to Longsfields Station Transitway and the Via Rail corridor. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated in Figure 5.

The project considers the conversion of the existing Bus Rapid Transit system (BRT), known as Longfields Station Transitway, to an LRT system, known as the future Barrhaven LRT. An additional assessment was conducted to determine the effect of the Future Barrhaven LRT on the proposed development. The results of the analysis indicate that noise levels will range between 64 and 39 dBA during the daytime period (07:00-23:00) and between 59 and 35 dBA during the nighttime period (23:00-07:00). The highest noise level (64 dBA) occurs at the northwest façade, which is most exposed to Longsfields Station Transitway and the Via Rail corridor.

Regarding the current study site, noise levels fall between 68 dBA and 45 dBA during the daytime period. Therefore, upgraded building components and air conditioning will be required as noise levels predicted

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

due to roadway traffic exceed the criteria listed in NPC-300 for building components. This will allow occupants to keep windows closed and maintain a comfortable living environment.

A Type D Warning Clause will also be required in all Lease, Purchase and Sale Agreements, as summarized 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 adjacent to a future proposed LRT line and station, the Rail Construction Program Office recommends that the warning clause identified below be included in all Lease, Purchase and Sale Agreements.

"The Owner hereby acknowledges and agrees:

i) *The proximity of the proposed development of the lands described in Schedule "A" hereto (the "Lands") to the City's existing and future transit operations, may result in noise, vibration, electromagnetic interferences, stray current transmissions, smoke and particulate matter (collectively referred to as "Interferences") to the development;*

ii) *It has been advised by the City to apply reasonable attenuation measures with respect to the level of the Interferences on and within the Lands and the proposed development; and*

iii) *The Owner acknowledges and agrees all agreements of purchase and sale and lease agreements, and all information on all plans and documents used for marketing purposes, for the whole or any part of the subject lands, shall contain the following clauses which shall also be incorporated in all transfer/deeds and leases from the Owner so that the clauses shall be covenants running with the lands for the benefit of the owner of the adjacent road:*

‘The Transferee/Lessee for himself, his heirs, executors, administrators, successors and assigns acknowledges being advised that a public transit light-rail rapid transit system (LRT) is proposed to be located in proximity to the subject lands, and the construction, operation and maintenance of the LRT may result in environmental impacts including, but not limited to noise, vibration, electromagnetic interferences, stray current transmissions, smoke and particulate matter (collectively referred to as the Interferences) to the subject lands. The Transferee/Lessee acknowledges and agrees that despite the inclusion of noise control features within the subject lands, Interferences may continue to be of concern, occasionally interfering with some activities of the occupants on the subject lands.

The Transferee covenants with the Transferor and the Lessee covenants with the Lessor that the above clauses verbatim shall be included in all subsequent lease agreements, agreements of purchase and sale and deeds conveying the lands described herein, which covenants shall run with the lands and are for the benefit of the owner of the adjacent road.’"

As the development is within 300 meters of the VIA Rail line, the following Warning Clause will be included in all Agreements of Lease, Purchase, and Sale:

“VIA Rail Canada or their assigns or successors in interest have rights-of-way within 300 meters from the land subject hereof. There may be alteration to or expansions of the railway facilities on such rights-of-way in the future including the possibility that the railway or its assigns or successors as aforesaid may expand its operations, which expansion may affect the living environment of the residents in the vicinity, notwithstanding the inclusion of any noise and vibration attenuating measures in the design of the development and individual dwellings. The railways will not be responsible for any complaints or claims arising from use of such facilities and/or operations on, over or under the aforesaid rights-of-way.”

As the development is located on the edge of the NEF/NEP 25 contour, roadway traffic is expected to be the prominent source of noise. Therefore, to ensure the protection of indoor spaces, the more stringent construction requirements from the roadway/railway noise control measures presented in Section 5.2 shall be applied for surface transportation noise. Furthermore, for all units in the development the Warning Clause (Type Aircraft[24]) must be included in all Agreements of Lease, Purchase and Sale.

> *"Purchasers/building occupants are forewarned that this property/dwelling unit is located in a noise sensitive area due to its proximity to Ottawa Macdonald-Cartier International Airport.In order to reduce the impact of aircraft noise in the indoor spaces, the unit has been designed and built to meet provincial standards for noise control by the use of components and building systems that provide sound attenuation. In addition to the building components (i.e. walls, windows, doors, ceiling-roof), since the benefit of sound attenuation is lost when windows or doors are left open, this unit has been fitted with a forced air heating system, all components of which are sized to accommodate the future installation of central air conditioning-by the owner/occupant.*
>
> *Despite the inclusion of noise control features within the dwelling unit, noise due to aircraft operations may continue to interfere with some indoor activities and with outdoor activities, particularly during the summer months. The purchaser/building occupant is further advised that the Airport is open and operates 24 hours a day and that changes to operations or expansion of the airport facilities, including the construction of new runways, may affect the living environment of the residents of this property/area.*
>
> *The Ottawa MacDonald-Cartier International Airport Authority, its acoustical consultants and the Municipality are not responsible if, regardless of the implementation of noise control features, the purchaser/occupant of this dwelling finds that the indoor noise levels due to aircraft operations continue to be of concern or are offensive."*

Noise levels at the Level 3 and Level 9 terraces are expected to exceed 55 dBA during the daytime period without a noise barrier. If these areas are to be used as outdoor living areas, noise control measures are required to reduce noise levels as close as possible to 55 dBA where technically and administratively

[24] Appendix D, ENCG

feasible. Further analysis investigated the noise-mitigating impact of raising the perimeter guards from 1 m to 1.5 m above the walking surface. The results of the investigation proved noise levels can be reduced to 55 dBA or below with an appropriate barrier height. Noise levels at the Level 3 OLA can be reduced to 54 dBA by implementing a 1.5m tall barrier surrounding the northeast and northwest perimeters. Noise levels at the Level 9 OLA can be reduced to below 55 dBA by implementing a 1 m tall barrier surrounding the southwest and northwest perimeters. Figure 4 illustrates the barrier requirements. The guard must be constructed from materials having a minimum surface density of 20 kg/m^2 (STC rating of 30) and contain no gaps. The design of the guardrail will conform to the requirements outlined in Part 5 of the ENCG.

Estimated vibration levels at the foundation nearest to the Via railway corridor are expected to be 0.09mm/s RMS (71 dBV), based on the FTA protocol and an offset distance of 70 m to the nearest track centerline. Details of the calculation are provided in Appendix B. Since predicted vibration levels do not exceed the criterion of 0.10 mm/s RMS at the foundation, concerns due to vibration impacts on the site are not expected. As vibration levels are acceptable, correspondingly, regenerated noise levels are also expected to be acceptable.

Estimated vibration levels at the foundation nearest to the future LRT corridor are expected to be 0.02mm/s RMS (59 dBV), based on the FTA protocol and an offset distance of 37 m to the nearest track centerline. Details of the calculation are provided in Appendix B. Since predicted vibration levels do not exceed the criterion of 0.10 mm/s RMS at the foundation, concerns due to vibration impacts on the site are not expected. As vibration levels are acceptable, correspondingly, regenerated noise levels are also expected to be acceptable.

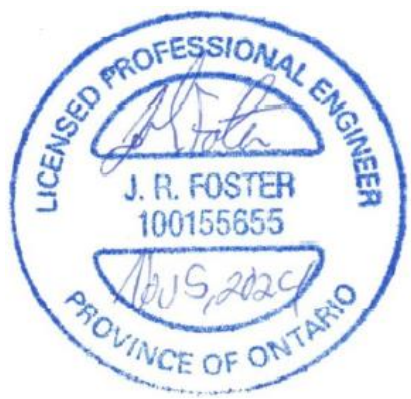
With regard to stationary noise impacts, Gradient Wind conducted a stationary noise analysis for the 605 Longfields Drive development (see Appendix C), showing that the AC units located on the roof of the building will have no significant impact on the property. Given the current site is farther setback from the stationary sources than the previous developments, noise levels are expected to fall below the ENCG criteria.

The stationary noise impacts of the development's own mechanical equipment on the surroundings would be considered at the future Site Plan stage once the mechanical design has progressed and equipment has been selected. Any potential impacts can be minimized by judicious selection of mechanical equipment and its location. It is preferable to locate large pieces of equipment, such as cooling towers and make-up air units, on the roof of the towers or in mechanical penthouses. Once the mechanical design of the building has developed sufficiently, it should be reviewed by a qualified acoustical engineer to ensure compliance with NPC-300 sound level limits.

This concludes our transportation noise and vibration 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,

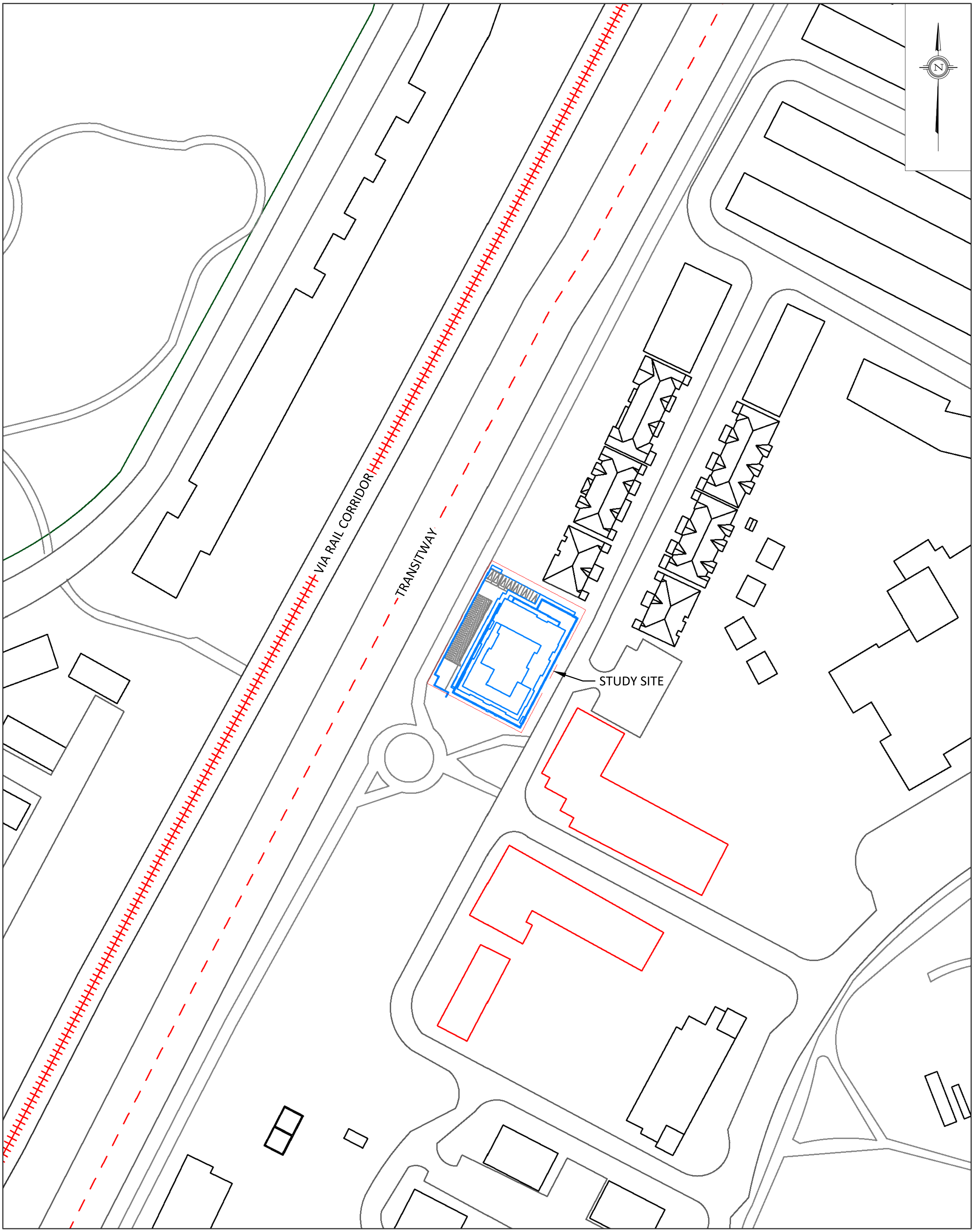
Gradient Wind Engineering Inc.



Benjamin Page, AdvDip.
Junior Environmental Scientist

Joshua Foster, P.Eng.
Principal

Gradient Wind File #23-248-Transportation Noise and Vibration



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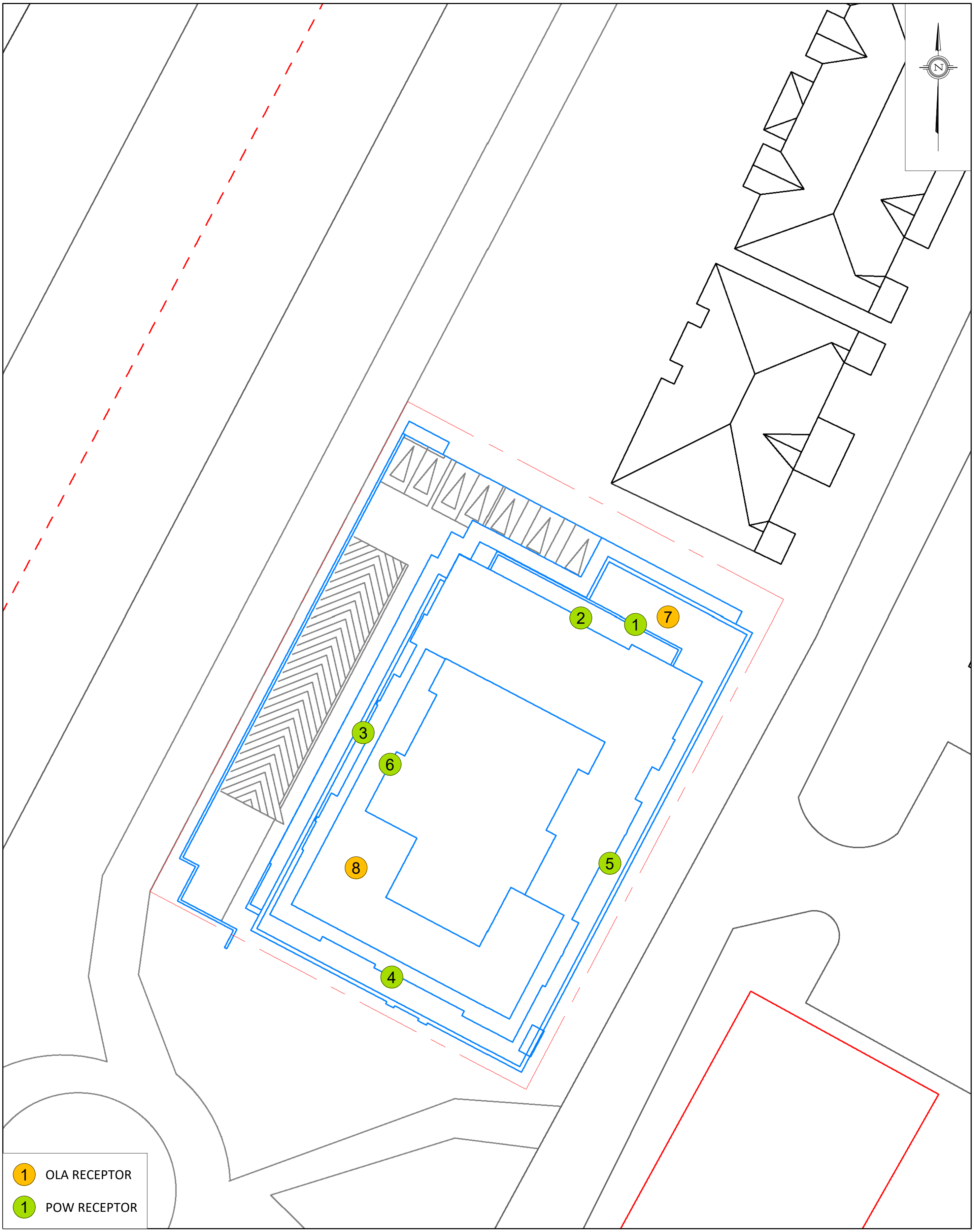
PROJECT LONGFIELDS STATION - BLOCK 10, OTTAWA TRANSPORTATION AND GROUND VIBRATIONS NOISE STUDY		DESCRIPTION
SCALE 1:2000	DRAWING NO. 23-248-NOISE-FIG1	FIGURE 1: PROPOSED SITE PLAN AND SURROUNDING CONTEXT
DATE NOVEMBER 5, 2024	DRAWN BY B.P.	



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PROJECT: LONGFIELDS STATION - BLOCK 10, OTTAWA TRANSPORTATION AND GROUND VIBRATIONS NOISE STUDY		DESCRIPTION: FIGURE 2: RECEPTOR LOCATIONS
SCALE: 1:500	DRAWING NO.: 23-248-NOISE-FIG2	
DATE: NOVEMBER 5, 2024	DRAWN BY: B.P.	

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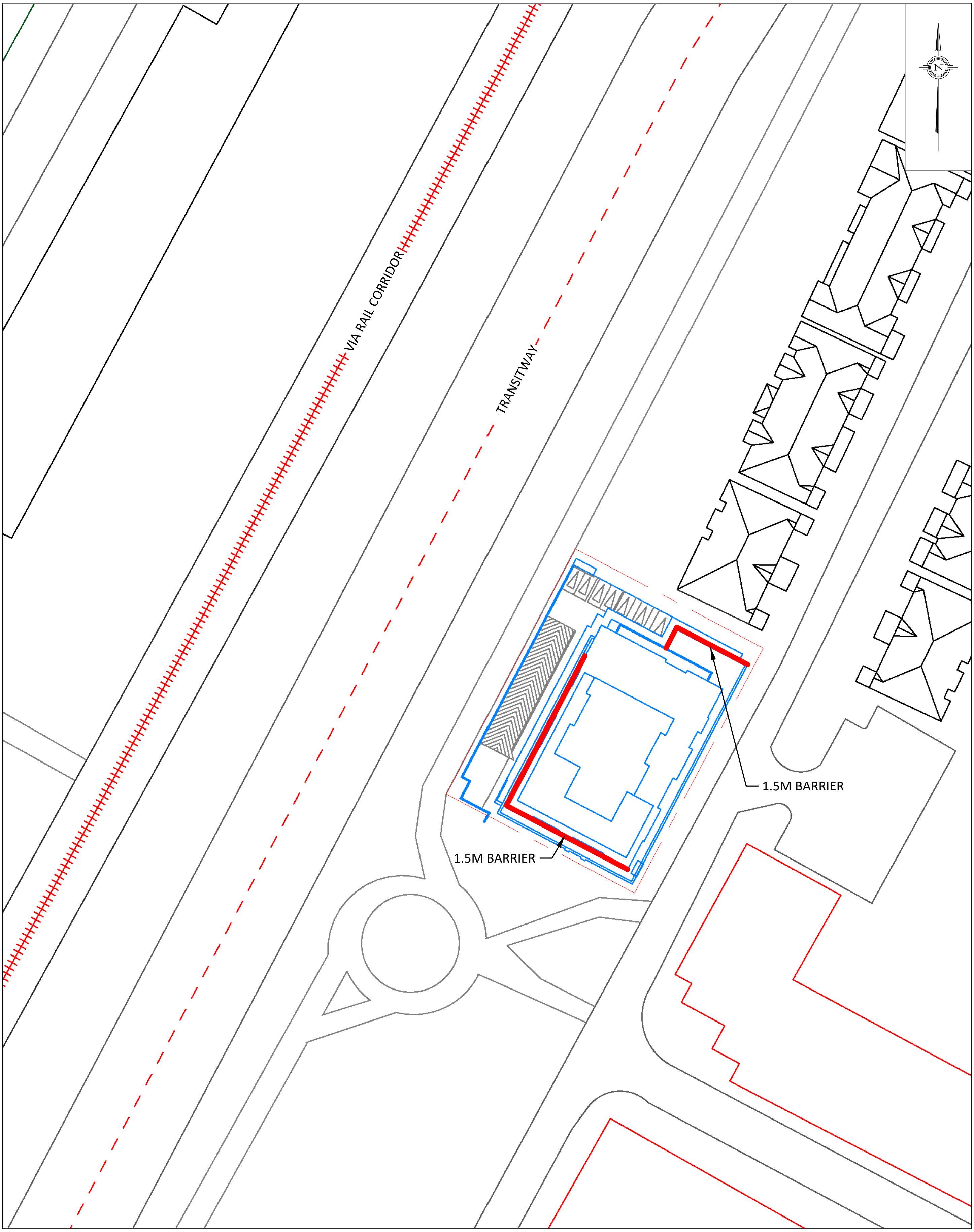
PROJECT: LONGFIELDS STATION - BLOCK 10, OTTAWA TRANSPORTATION AND GROUND VIBRATIONS NOISE STUDY		DESCRIPTION: FIGURE 3: STAMSON 5.04 INPUT DATA
SCALE: 1:1000	DRAWING NO.: 23-248-NOISE-FIG3	
DATE: NOVEMBER 5, 2024	DRAWN BY: B.P.	



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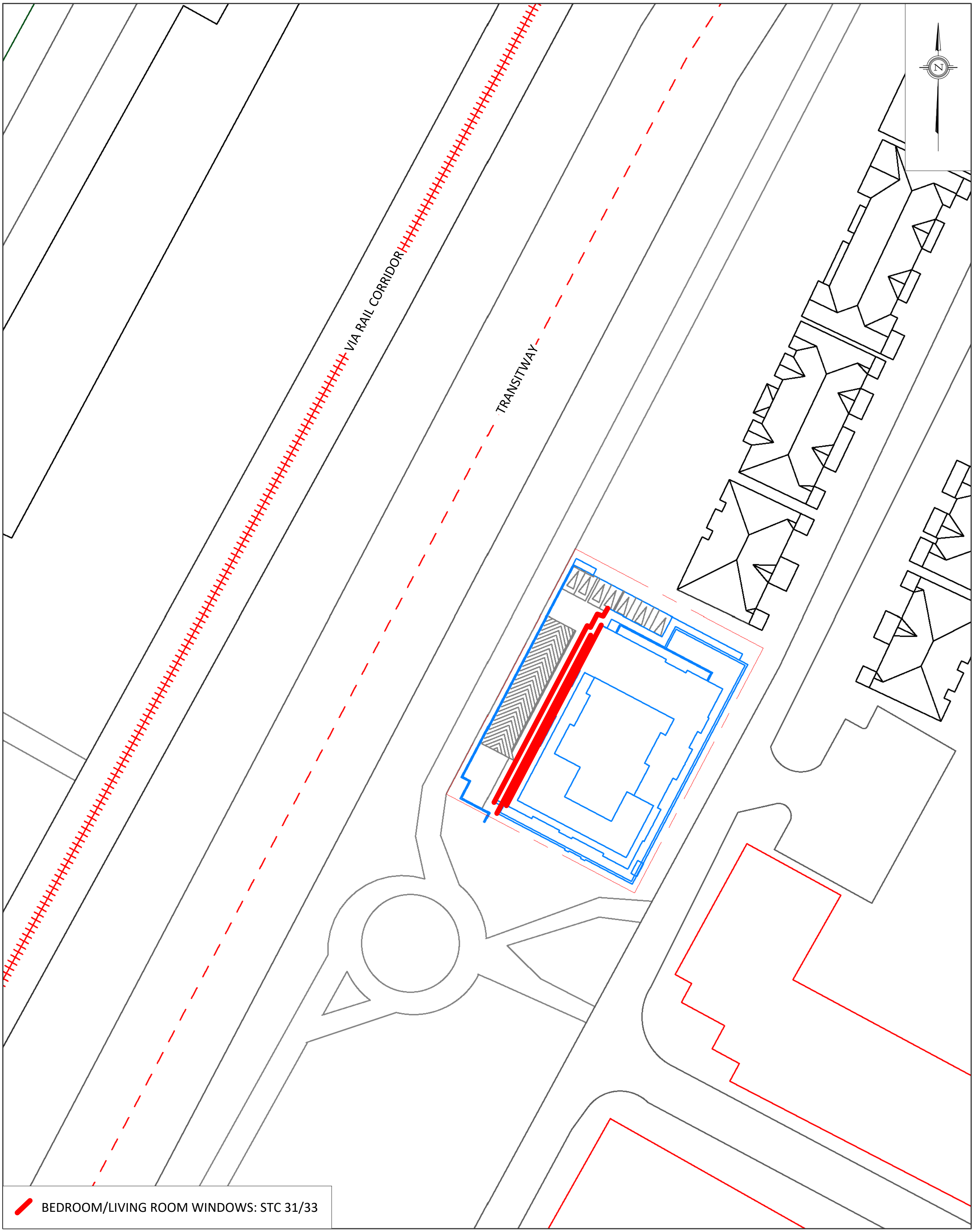
SCALE	1:1000	DRAWING NO.	23-248-NOISE-FIG4
DATE	NOVEMBER 5, 2024	DRAWN BY	B.P.

DESCRIPTION

FIGURE 4:
PROPOSED BARRIER LOCATIONS



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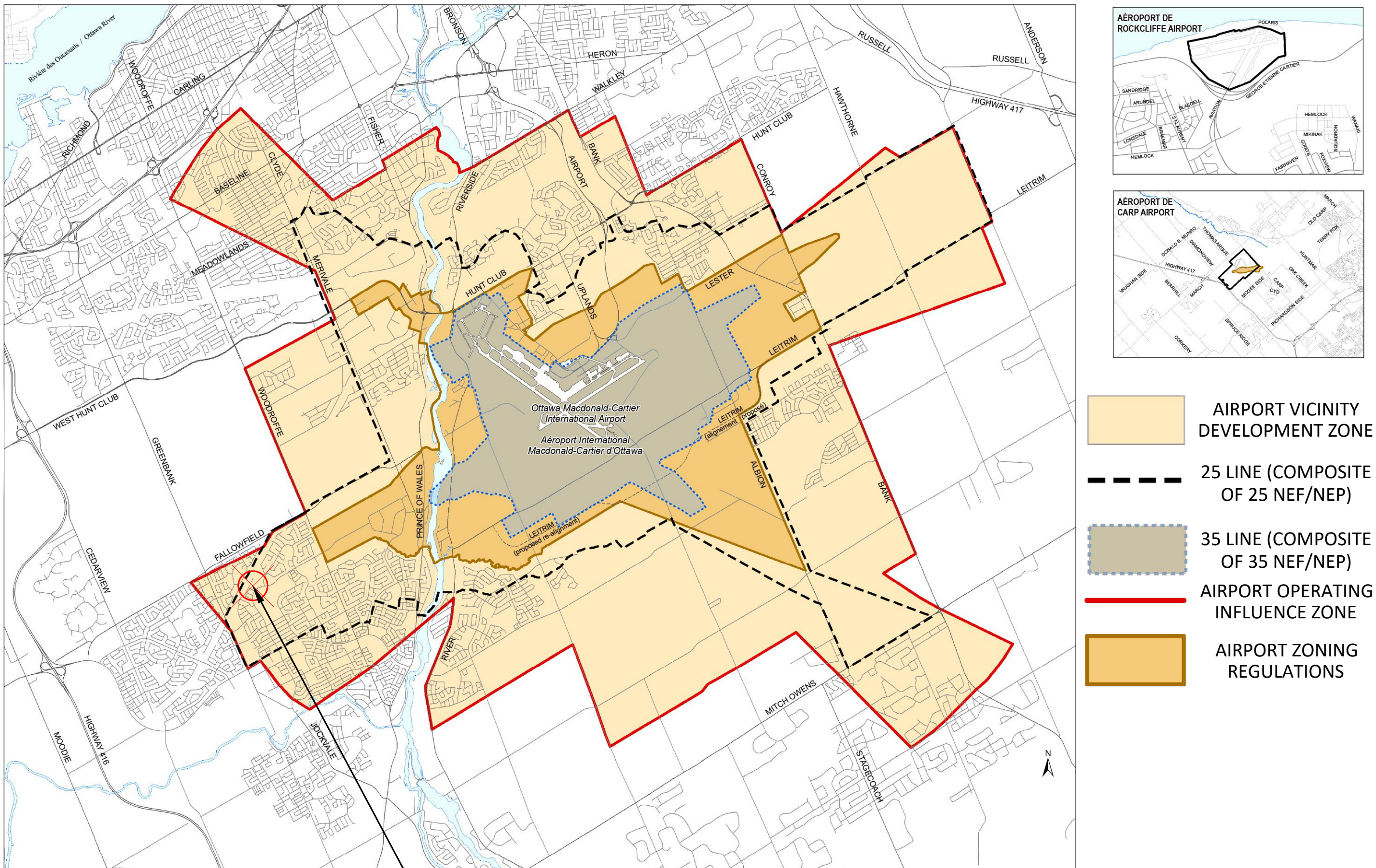
PROJECT: LONGFIELDS STATION - BLOCK 10, OTTAWA TRANSPORTATION AND GROUND VIBRATIONS NOISE STUDY		DESCRIPTION: FIGURE 5: STC REQUIREMENTS
SCALE: 1:1000	DRAWING NO.: 23-248-NOISE-FIG5	
DATE: NOVEMBER 5, 2024	DRAWN BY: B.P.	



LONGFIELDS STATION - BLOCK 10

GRADIENTWIND ENGINEERS & SCIENTISTS 127 WALGREEN ROAD, OTTAWA, ON 613 836 0934 • GRADIENTWIND.COM	PROJECT LONGFIELDS STATION - BLOCK 10, OTTAWA TRANSPORTATION AND GROUND VIBRATIONS NOISE STUDY		DESCRIPTION FIGURE 6 DEVELOPMENT LOCATION IN REFERENCE TO THE OTTAWA AIRPORT OPERATING INFLUENCE ZONE
	SCALE 1:1000	DRAWING NO. 23-248-NOISE-FIG6	
	DATE NOVEMBER 5, 2024	DRAWN BY B.P.	

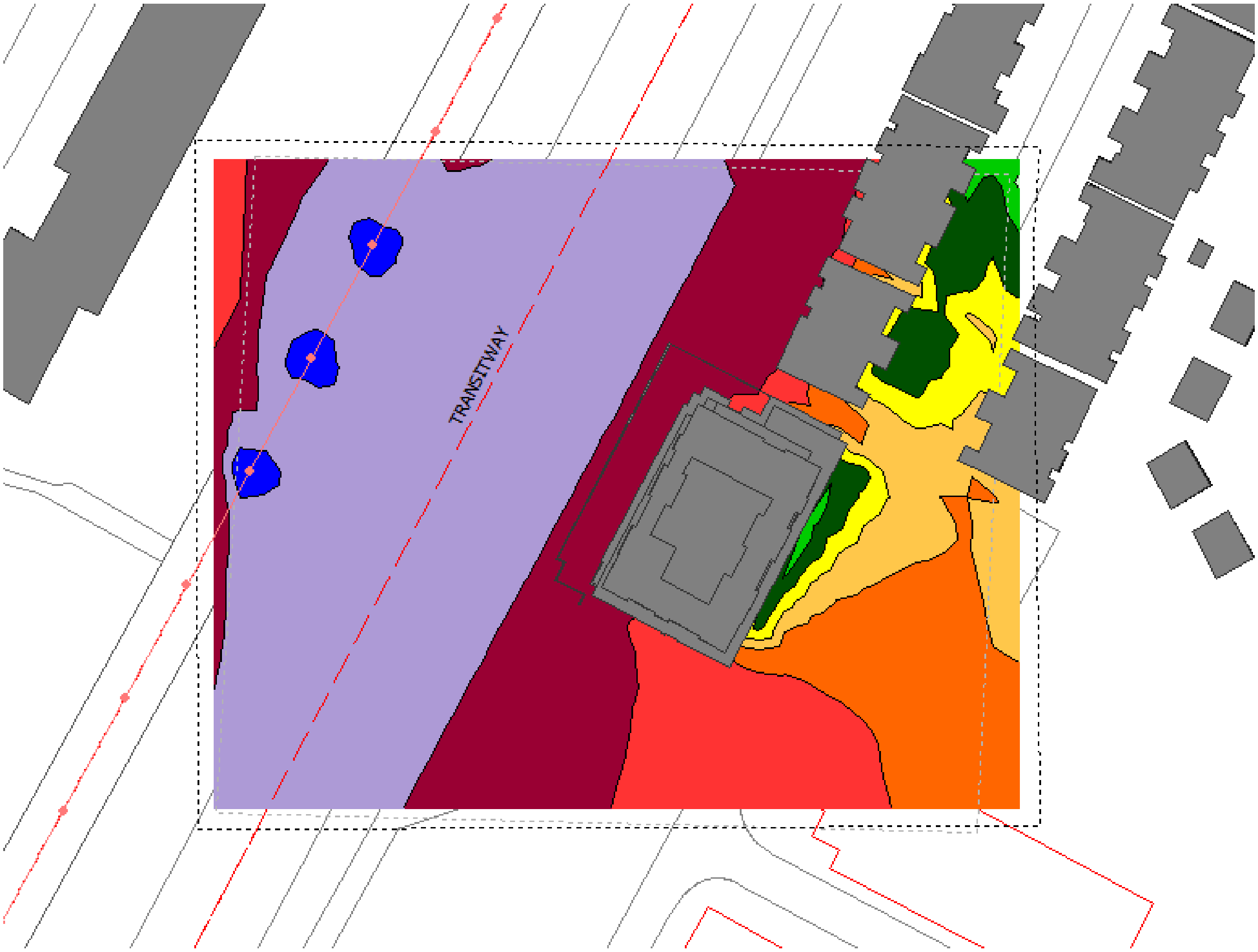


FIGURE 7: DAYTIME NOISE CONTOURS (4.5M ABOVE GRADE)

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

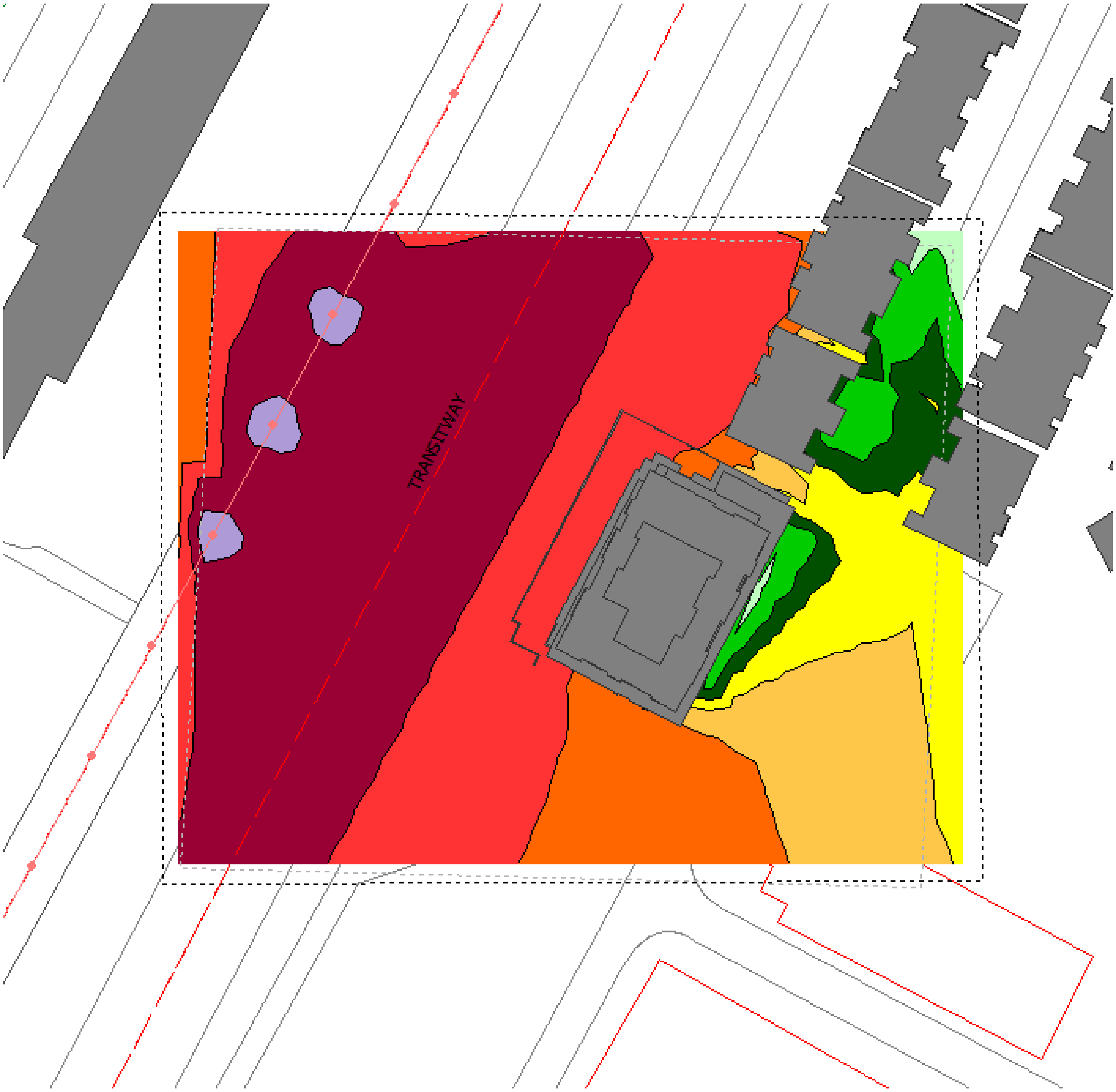
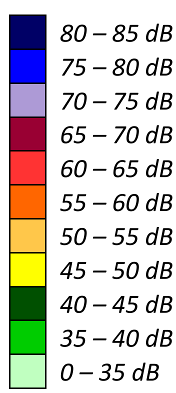


FIGURE 8: NIGHTTIME NOISE CONTOURS (4.5M ABOVE GRADE)



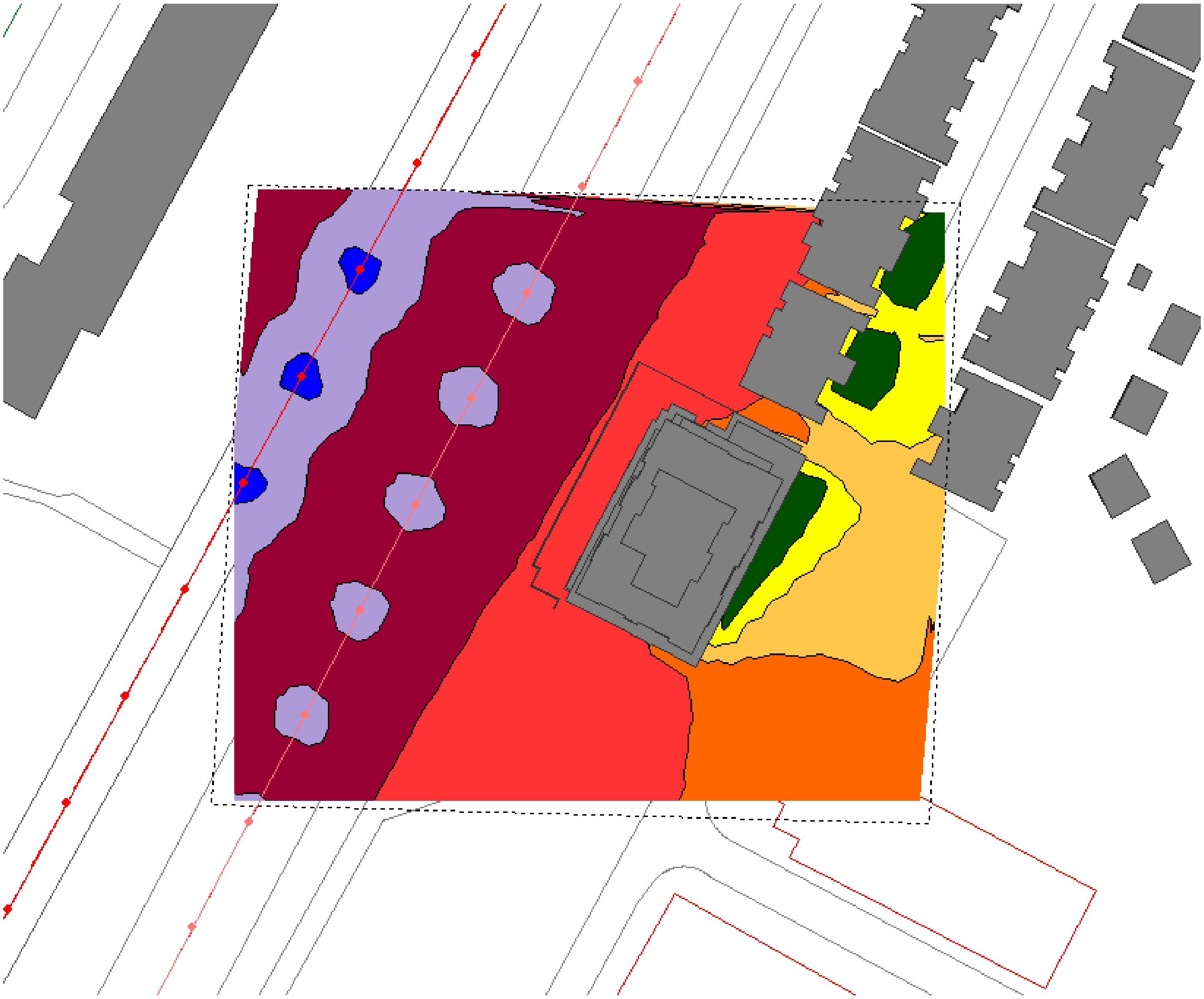


FIGURE 9: DAYTIME NOISE CONTOURS (4.5M ABOVE GRADE)

	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

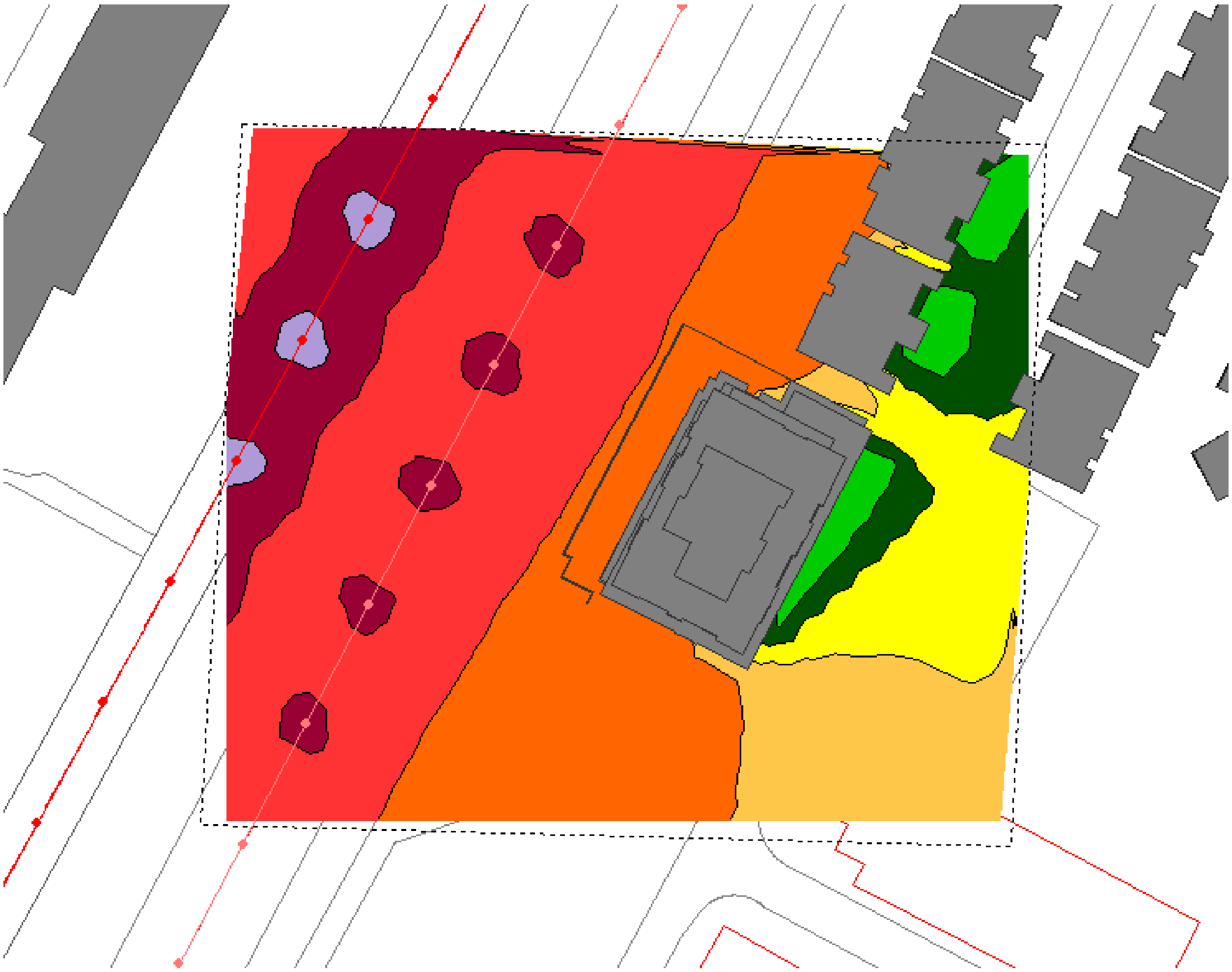
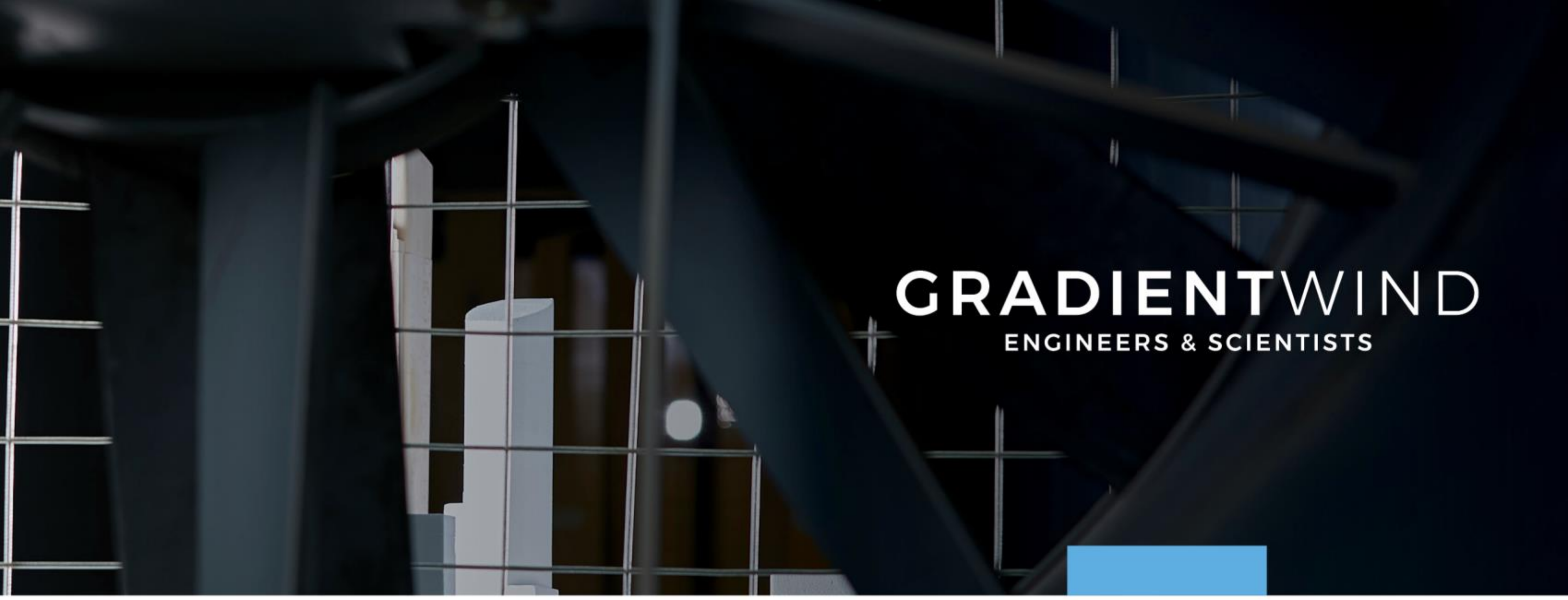


FIGURE 10: NIGHTTIME NOISE CONTOURS (4.5M ABOVE GRADE)

	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

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```
STAMSON 5.0          NORMAL REPORT         Date: 13-05-2024 15:43:21
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R1.te                     Time Period: Day/Night 16/8 hours
Description:

Rail data, segment # 1: Via Rail (day/night)
--------------------------------------------
Train             ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type              !              !(km/h) !/Train!/Train! type !weld
------------------+-------------+--------+------+------+------+----
  1. Diesel       !  17.0/3.0   ! 150.0 !  1.0 !  4.0 !Diesel!  No

Data for Segment # 1: Via Rail (day/night)
------------------------------------------
Angle1   Angle2            :   0.00 deg   90.00 deg
Wood depth                 :      0        (No woods.)
No of house rows           :      0 / 0
Surface                    :      2        (Reflective ground surface)
Receiver source distance   :  88.00 / 88.00  m
Receiver height            :   9.50 / 9.50   m
Topography                 :      1        (Flat/gentle slope; no barrier)
No Whistle
Reference angle            :   0.00

Results segment # 1: Via Rail (day)
-----------------------------------

LOCOMOTIVE (0.00 + 57.55 + 0.00) = 57.55 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
     0     90   0.00  68.24  -7.68  -3.01   0.00   0.00   0.00  57.55
----------------------------------------------------------------------

WHEEL (0.00 + 50.63 + 0.00) = 50.63 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
     0     90   0.00  61.32  -7.68  -3.01   0.00   0.00   0.00  50.63
----------------------------------------------------------------------

Segment Leq : 58.35 dBA

Total Leq All Segments: 58.35 dBA
```

```
Results segment # 1: Via Rail (night)
-------------------------------------

LOCOMOTIVE (0.00 + 53.03 + 0.00) = 53.03 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
     0     90   0.00  63.72  -7.68  -3.01   0.00   0.00   0.00  53.03
----------------------------------------------------------------------

WHEEL (0.00 + 46.10 + 0.00) = 46.10 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
     0     90   0.00  56.80  -7.68  -3.01   0.00   0.00   0.00  46.10
----------------------------------------------------------------------

Segment Leq : 53.83 dBA

Total Leq All Segments: 53.83 dBA

RT/Custom data, segment # 1: Transitway (day/night)
---------------------------------------------------
1 - Bus:
Traffic volume    :   418/92    veh/TimePeriod
Speed             :    80 km/h

Data for Segment # 1: Transitway (day/night)
--------------------------------------------
Angle1   Angle2          :   0.00 deg   90.00 deg
Wood depth               :      0        (No woods.)
No of house rows         :      0 / 0
Surface                  :      2        (Reflective ground surface)
Receiver source distance :  56.00 / 56.00  m
Receiver height          :   9.50 / 9.50   m
Topography               :      1        (Flat/gentle slope; no barrier)
Reference angle          :   0.00

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

Source height = 0.50 m

RT/Custom (0.00 + 54.08 + 0.00) = 54.08 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
     0     90   0.00  62.82  -5.72  -3.01   0.00   0.00   0.00  54.08
----------------------------------------------------------------------

Segment Leq : 54.08 dBA

Total Leq All Segments: 54.08 dBA
```

```
Results segment # 1: Transitway (night)
---------------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 50.52 + 0.00) = 50.52 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
     0     90   0.00  59.25  -5.72  -3.01   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): 59.73
                         (NIGHT): 55.49
```

```
STAMSON 5.0        NORMAL REPORT        Date: 13-05-2024 15:47:54
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R4.te                Time Period: Day/Night 16/8 hours
Description:

Rail data, segment # 1: Via Rail (day/night)
--------------------------------------------
Train            ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type             !              !(km/h) !/Train!/Train! type !weld
-----------------+-------------+--------+------+------+------+----
  1. Diesel      !  17.0/3.0    ! 150.0 !  1.0 !  4.0 !Diesel!  No

Data for Segment # 1: Via Rail (day/night)
------------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  84.00 / 84.00  m
Receiver height           :  25.00 / 25.00  m
Topography                :      1       (Flat/gentle slope; no barrier)
No Whistle
Reference angle           :   0.00

Results segment # 1: Via Rail (day)
-----------------------------------

LOCOMOTIVE (0.00 + 57.75 + 0.00) = 57.75 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90      0   0.00  68.24  -7.48  -3.01   0.00   0.00   0.00  57.75
----------------------------------------------------------------------

WHEEL (0.00 + 50.83 + 0.00) = 50.83 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90      0   0.00  61.32  -7.48  -3.01   0.00   0.00   0.00  50.83
----------------------------------------------------------------------

Segment Leq : 58.55 dBA

Total Leq All Segments: 58.55 dBA
```

```
Results segment # 1: Via Rail (night)
-------------------------------------

LOCOMOTIVE (0.00 + 53.23 + 0.00) = 53.23 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90      0   0.00  63.72  -7.48  -3.01   0.00   0.00   0.00  53.23
----------------------------------------------------------------------

WHEEL (0.00 + 46.30 + 0.00) = 46.30 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90      0   0.00  56.80  -7.48  -3.01   0.00   0.00   0.00  46.30
----------------------------------------------------------------------

Segment Leq : 54.03 dBA

Total Leq All Segments: 54.03 dBA

RT/Custom data, segment # 1: Transitway (day/night)
---------------------------------------------------
1 - Bus:
Traffic volume    :   418/92    veh/TimePeriod
Speed             :    80 km/h

Data for Segment # 1: Transitway (day/night)
--------------------------------------------
Angle1   Angle2            : -90.00 deg   0.00 deg
Wood depth                 :      0       (No woods.)
No of house rows           :      0 / 0
Surface                    :      2       (Reflective ground surface)
Receiver source distance   :  51.00 / 51.00  m
Receiver height            :  25.00 / 25.00  m
Topography                 :      1       (Flat/gentle slope; no barrier)
Reference angle            :   0.00

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

Source height = 0.50 m

RT/Custom (0.00 + 54.49 + 0.00) = 54.49 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90      0   0.00  62.82  -5.31  -3.01   0.00   0.00   0.00  54.49
----------------------------------------------------------------------

Segment Leq : 54.49 dBA

Total Leq All Segments: 54.49 dBA
```

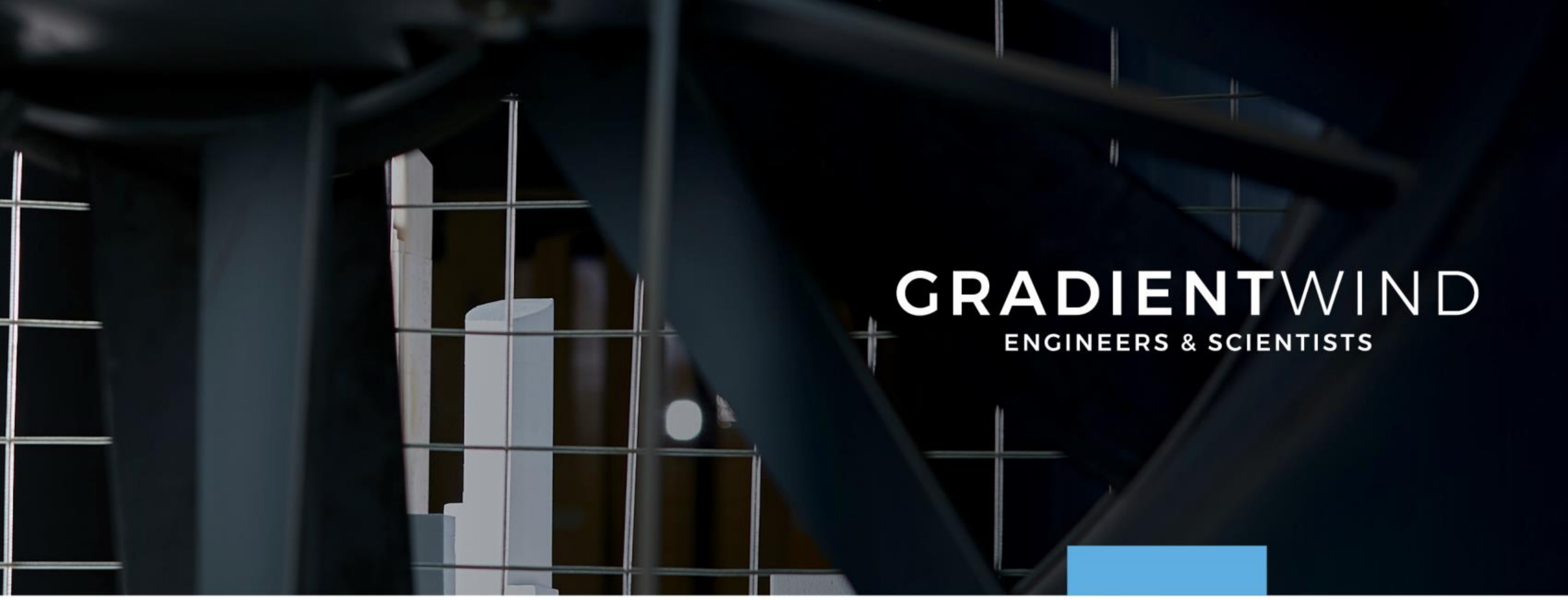
```
Results segment # 1: Transitway (night)
---------------------------------------

Source height = 0.50 m

RT/Custom (0.00 + 50.93 + 0.00) = 50.93 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-----------------------------------------------------------------------
   -90      0   0.00  59.25  -5.31  -3.01   0.00   0.00   0.00  50.93
-----------------------------------------------------------------------

Segment Leq : 50.93 dBA

Total Leq All Segments: 50.93 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 59.99
                         (NIGHT): 55.76
```

```
STAMSON 5.0        NORMAL REPORT        Date: 13-05-2024 15:50:54
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R8.te                Time Period: Day/Night 16/8 hours
Description:

Rail data, segment # 1: Via Rail (day/night)
--------------------------------------------
Train             ! Trains       ! Speed !# loc !# Cars! Eng  !Cont
Type              !              !(km/h) !/Train!/Train! type !weld
-----------------+-------------+--------+------+------+------+----
  1. Diesel       !  17.0/3.0    ! 150.0 !  1.0 !  4.0 !Diesel!  No

Data for Segment # 1: Via Rail (day/night)
------------------------------------------
Angle1   Angle2           : -90.00 deg   71.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  75.00 / 75.00  m
Receiver height           :  27.80 / 27.80  m
Topography                :      2       (Flat/gentle slope; with barrier)
No Whistle
Barrier angle1            : -90.00 deg   Angle2 : 71.00 deg
Barrier height            :  26.30 m
Barrier receiver distance :   5.00 / 5.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

Results segment # 1: Via Rail (day)
-----------------------------------

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver     ! Barrier      ! Elevation of
Height   (m) ! Height   (m) ! Height   (m) ! Barrier Top   (m)
------------+-------------+-------------+--------------
       4.00 !       27.80 !       26.21 !        26.21
       0.50 !       27.80 !       25.98 !        25.98

LOCOMOTIVE (0.00 + 55.74 + 0.00) = 55.74 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     71   0.00  68.24  -6.99  -0.48   0.00   0.00  -5.03  55.74
----------------------------------------------------------------------
```

```
WHEEL (0.00 + 48.52 + 0.00) = 48.52 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     71   0.00  61.32  -6.99  -0.48   0.00   0.00  -5.33  48.52
----------------------------------------------------------------------

Segment Leq : 56.49 dBA

Total Leq All Segments: 56.49 dBA

Results segment # 1: Via Rail (night)
-------------------------------------

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+---------------
       4.00 !       27.80 !       26.21 !        26.21
       0.50 !       27.80 !       25.98 !        25.98

LOCOMOTIVE (0.00 + 51.22 + 0.00) = 51.22 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     71   0.00  63.72  -6.99  -0.48   0.00   0.00  -5.03  51.22
----------------------------------------------------------------------

WHEEL (0.00 + 43.99 + 0.00) = 43.99 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     71   0.00  56.80  -6.99  -0.48   0.00   0.00  -5.33  43.99
----------------------------------------------------------------------

Segment Leq : 51.97 dBA

Total Leq All Segments: 51.97 dBA

RT/Custom data, segment # 1: Transitway (day/night)
---------------------------------------------------
1 - Bus:
Traffic volume    :   418/92    veh/TimePeriod
Speed             :    80  km/h
```

```
Data for Segment # 1: Transitway (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   71.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  42.00 / 42.00  m
Receiver height           :  27.80 / 27.80  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 71.00 deg
Barrier height            :  26.30 m
Barrier receiver distance :   5.00 / 5.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00

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

Source height = 0.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       0.50 !       27.80 !       24.55 !        24.55

RT/Custom (0.00 + 48.12 + 0.00) = 48.12 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     71   0.00  62.82  -4.47  -0.48   0.00   0.00  -9.74  48.12
----------------------------------------------------------------------

Segment Leq : 48.12 dBA

Total Leq All Segments: 48.12 dBA
```

```
Results segment # 1: Transitway (night)
---------------------------------------

Source height = 0.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       0.50 !       27.80 !       24.55 !        24.55

RT/Custom (0.00 + 44.56 + 0.00) = 44.56 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
----------------------------------------------------------------------
   -90     71   0.00  59.25  -4.47  -0.48   0.00   0.00  -9.74  44.56
----------------------------------------------------------------------

Segment Leq : 44.56 dBA

Total Leq All Segments: 44.56 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 57.08
                         (NIGHT): 52.69
```



APPENDIX B

FTA VIBRATION & GROUND-BORNE NOISE CALCULATIONS

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

GW23-248 16-May-24

Via Rail Possible Vibration Impacts on Longfields Drive - Block 10, Ottawa, ON
Predicted using FTA General Assesment

150 km/h 93 mph

	Distance	
	(m)	(ft)
Via Rail	70.0	230

Vibration

From FTA Manual Fig 10-1

Vibration Levels at distance from track	70	dBV re 1 micro in/sec	

Adjustment Factors FTA Table 10-1

Speed reference 50 mph	7	Speed Limit of 150 km/h (93 mph)	
Vehicle Parameters	0	Assume Soft primary suspension, Weels run true	
Track Condition	0	None	
Track Treatments	0	None	
Type of Transit Structure	0	At-grade	
Efficient vibration Propagation	0	None	
Vibration Levels at Fdn	77		0.177
Coupling to Building Foundation	-10	3-4 Story Masonry	
Floor to Floor Attenuation	-2.0	3rd Floor Occupied	
Amplification of Floor and Walls	6		
Total Vibration Level	71	dBV or	0.09 mm/s
Noise Level in dBA	36	dBA	

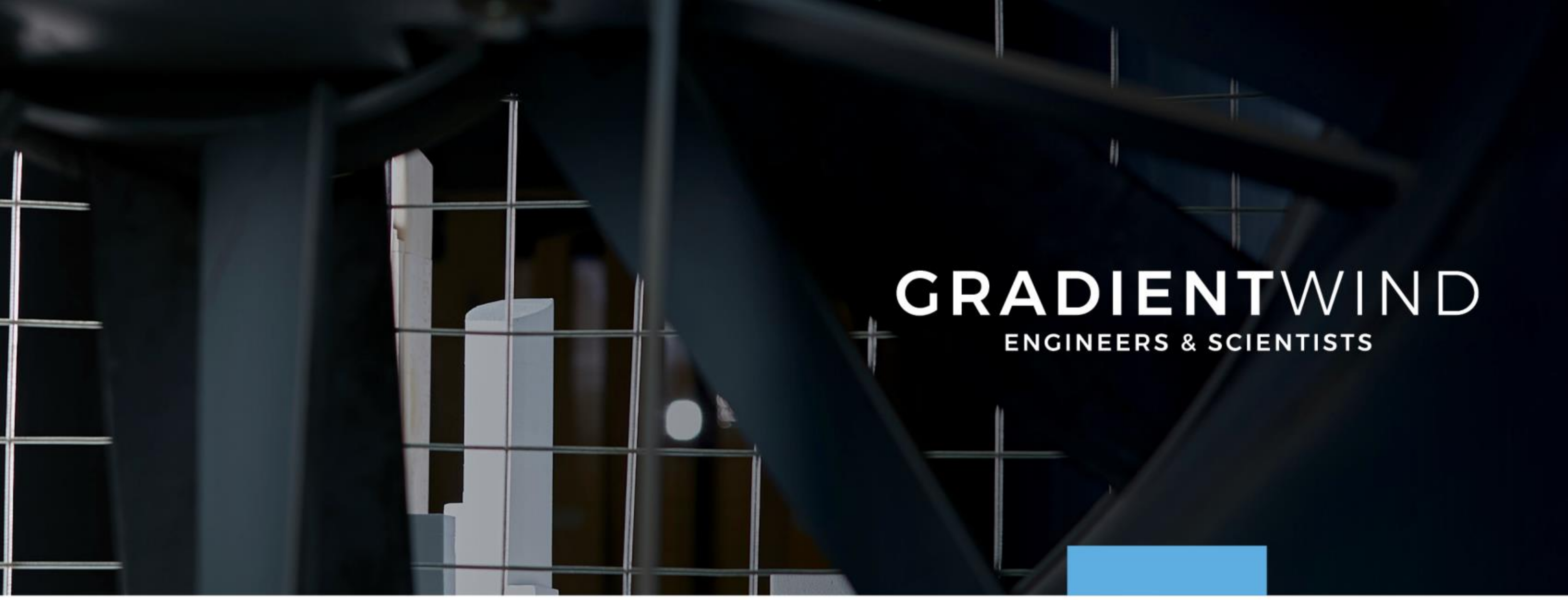
Future Barrhaven LRT Possible Vibration Impacts on Longfields Drive - Block 10, Ottawa, ON
Predicted using FTA General Assesment

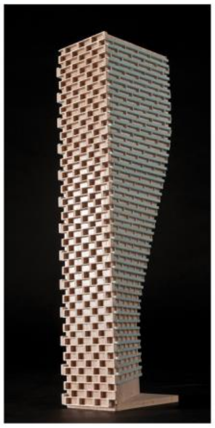
70 km/h 43 mph

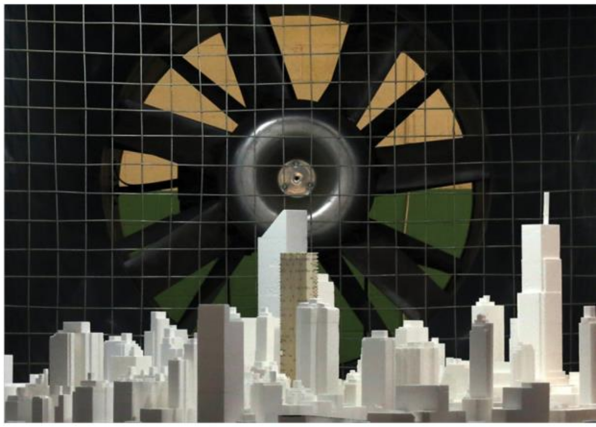
	Distance	
	(m)	(ft)
LRT	37.0	121

Vibration

From FTA Manual Fig 10-1		
Vibration Levels at distance from track	66	dBV re 1 micro in/sec
Adjustment Factors FTA Table 10-1		
Speed reference 50 mph	-1	Speed Limit of 70 km/h (43 mph)
Vehicle Parameters	0	Assume Soft primary suspension, Weels run true
Track Condition	0	None
Track Treatments	0	None
Type of Transit Structure	0	At-grade
Efficient vibration Propagation	0	None
Vibration Levels at Fdn	65	0.043
Coupling to Building Foundation	-10	3-4 Story Masonry
Floor to Floor Attenuation	-2.0	3rd Floor Occupied
Amplification of Floor and Walls	6	
Total Vibration Level	59	dBV or 0.02 mm/s
Noise Level in dBA	24	dBA







APPENDIX C

SUPPORTING INFORMATION

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

Stationary Noise Assessment

605 Longfields Drive

Ottawa, Ontario

REPORT: GWE17-174 - Stationary Noise

Prepared For:

Anthony Johnston
Campanale Homes
1187 Bank Street
Ottawa, Ontario
K1S 3X7

Prepared By:

Omar Daher, B.Eng., EIT, Junior Environmental Scientist
Joshua Foster, P.Eng., Partner

November 8, 2017

127 Walgreen Road, Ottawa, Ontario K0A 1L0
T (613) 836-0934 ● www.gradientwind.com

EXECUTIVE SUMMARY

This document describes a stationary noise assessment performed for a proposed commercial retail development located at the intersection of Longfields Drive and Via Modugno Place in Ottawa, Ontario. The proposed 1-storey building is expected to rise approximately 4-metres in height. Figure 1 illustrates a site plan with surrounding context. The primary sources of noise from the development are ground-level mechanical equipment.

The assessment is based on: (i) theoretical noise prediction methods that conform to the Ministry of the Environment and Climate Change (MOECC) and City of Ottawa requirements; (ii) stationary noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG); and (iii) architectural drawings provided by Paul A. Cooper Architect and mechanical equipment information provided by Campanale Homes.

Our stationary noise assessment for the proposed commercial development indicates that, provided equipment selections and locations are similar to the assumptions and recommendations in this report, noise levels at nearby points of reception are expected to fall below City of Ottawa's ENCG limits. Since the noise levels fall below the ENCG criteria, the proposed development is expected to be compatible with the existing and future noise sensitive land uses.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (GWE) was retained by Campanale Homes to undertake a stationary noise assessment for a proposed commercial development located at the intersection of Longfields Drive and Via Modugno Place in Ottawa, Ontario. This report focuses on the noise impacts from mechanical equipment on nearby noise sensitive areas. This study is based on architectural drawings provided by Paul A. Cooper Architect, and mechanical equipment information provided by Campanale Homes, and recent aerial imagery.

2. TERMS OF REFERENCE

The focus of this stationary noise assessment is a proposed 1-storey commercial development located in Barrhaven, Ontario. The proposed building is to contain 15 retail units, and be approximately 4 metres in height. The site is surrounded by institutional land use to the northeast and residential in all other directions. The development is located at the intersection of Longfields Drive and Via Modugno Place. The closest points of reception are located on a school to the northeast of the development. Figure 1 illustrates a complete site plan with surrounding context.

2.1 Equipment

Mechanical information for the development has been provided by Campanale Homes for the project. This study is based on available information at the time of the study, any changes to equipment selection and locations will require review by an acoustical engineer prior to installation. Our assessment is based on the following information:

(i) The locations and quantity of the HVAC equipment have been specified by Campanale Homes. All HVAC equipment is located at ground level at the rear façade of the property.

(ii) The sound data of the HVAC equipment have been provided by Campanale Homes

(iii) During daytime, and evening (07:00 to 23:00) and nighttime periods (23:00 to 7:00), all the HVAC equipment in the building are assumed to be in full operation

The equipment considered in the model consisted of:

(i) S1-S10: Condenser Units (York Affinity Model YXV48B21S)

(ii) S11: Condenser Units (York Affinity Model YXV60B21S)

(iii) S12-15: Condenser Units (York Affinity Model YXV36B21S)

Figure 2 illustrates the location of all stationary noise sources within the development.

3. OBJECTIVES

The main goals of the work are to assess the anticipated noise impacts from ground-level HVAC equipment on nearby noise sensitive receptors and, where necessary, describe noise control measures to ensure the development can operate in the area in compliance with the City of Ottawa's ENCG[1].

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 source, the sound pressure depends on the location of the receiver and the path that the noise takes to reach the receiver. Its measurement 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 represents the noise perceived by the human ear. With this scale, a doubling of sound power at the source results in a 3 dBA increase in measured noise levels at the receiver, and is just perceptible to most people. An increase of 10 dBA is often perceived to be twice as loud.

Stationary sources are defined in the City of Ottawa's ENCG as: "*all sources of sound and vibration, whether fixed or mobile, that exist or operate on a premises, property or facility. The combined sound and vibration levels of which are emitted beyond the property boundary of the premises, property or facility, unless the source(s) is (are) due to construction*". The guidelines do not apply to gas stations, and

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

occasional movement of vehicles on property, such as infrequent deliveries of goods to convenience stores[2].

4.2 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 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 apply to outdoor points of reception (POR) and Plane of Window (POW) receivers. A point of reception is defined under ENCG as "*any location on a noise sensitive land use where noise from a stationary source is received*". 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, camp grounds, and noise sensitive buildings such as schools, places of worship and daycare facilities. According to the ENCG, the recommended maximum noise level for an suburban (Class 2) environment at a POR is either the lowest one-hour background noise level due to other sources, or the exclusionary limits outlined in Table 1, whichever is higher. As the site is located at the intersection of an arterial road, ambient noise levels are expected to persist into the evening period. As per the ENCG requirements, developments within Barrhaven are considered Class II acoustical environments. For these reasons, we considered the site to be situated in a Class 2 urban environment.

[2] City of Ottawa Environmental Noise Control Guidelines, January 2016 – Section 3.0

TABLE 1: EXCLUSIONARY LIMITS FOR CLASS 2 AREA

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

4.3 Determination of Noise Source Power Levels

Sound power data for the ground-level HVAC equipment were provided by Campanale Homes. Equipment on the ground includes 15 Condenser Units consisting of 3-models. Table 2 summarizes the sound power levels of each source assumed in our analysis. The information is based on manufactures' data of the proposed equipment. Figure 2 illustrates the location of all stationary sources on the study building.

TABLE 2: EQUIPMENT SOUND POWER LEVELS (dBA)

Source ID	Height above grade (m)	Description	Frequency (Hz)								
			63	125	250	500	1000	2000	4000	8000	Total
S1-S10	1.1	York Affinity – YXV48B21S	46	57	62	68	69	65	60	53	73
S11	1.2	York Affinity – YXV60B21S	49	60	64	69	70	66	62	54	74
S12-S15	1.0	York Affinity – YXV36B21S	45	59	60	68	69	66	60	52	73

4.4 Stationary Source Noise Predictions

The impact of the stationary noise sources on the nearby residential areas was determined by computer modelling. Stationary noise source modelling is based on the software program Predictor-Lima, developed from the International Standards Organization (ISO) standard 9613 Parts 1 and 2. This computer program is capable of representing three-dimensional surfaces and first reflections of sound waves over a suitable spectrum for human hearing. The methodology has been used on numerous assignments, and has been accepted by the Ministry of Environment and Climate Change (MOECC) as part of Environmental Compliance Approvals applications.

A total of 10 receptor locations were chosen around the site to measure the noise impact at points of reception (POR) during the daytime and evening period (07:00 – 23:00), as well as the nighttime period (23:00 – 07:00), as illustrated in Figure 3. POR locations included outdoor points of reception (OPOR) and the plane of windows (POW) of the adjacent residential properties and school properties. Sensor locations are described in Table 3 and illustrated in Figure 3. All units were represented as point sources in the Predictor model. Table 4 below contains Predictor-Lima calculation settings. These settings are typical and have been based on ISO 9613 standards and guidance from the MOECC.

Ground absorption over the study area was determined based on topographical features (such as water, concrete, grassland, etc.). An absorption value of 0 is representative of hard ground, while a value of 1 represents grass and similar soft surface conditions. Existing and proposed buildings were added to the model to account for screening and reflection effects from building façades. Further modelling data is available upon request.

TABLE 3: RECEPTOR LOCATIONS

Receptor Number	Location	Height Above Grade (m)
R1A	POW – 615 Longfields West Façade – 2nd Floor	4.5
R1B	POW – 615 Longfields West Façade – 4th Floor	10.5
R2A	POW – 615 Longfields North Façade – 2nd Floor	4.5
R2B	POW – 615 Longfields North Façade – 4th Floor	10.5
R3	POW – 600 Via Campanale – 2nd Floor	4.5
R4	POW – 601 Via Campanale – 2nd Floor	4.5
R5	OPOR – 601 Via Campanale – OLA	1.5
R6	POW – 601 Longfields Drive West Facade – 1st Floor	1.5
R7	OPOR – 601 Longfields Drive – OLA Rear of School	1.5
R8	OPOR – 601 Longfields Drive – OLA Playground	1.5
R9	POW – 601 Longfields Drive – Portables	1.5
R10	OPOR – 601 Longfields Drive – OLA Soccer Field	1.5

TABLE 4: CALCULATION SETTINGS

Parameter	Setting
Meteorological correction method	Single value for C0
Value C0	2.0
Default ground attenuation factor	1
Ground attenuation factor for roadways and paved areas	0
Temperature (K)	283.15
Pressure (kPa)	101.33
Air humidity (%)	70

5. RESULTS AND DISCUSSION

Noise levels produced by HVAC equipment at all outdoor points of reception and other plane of window receptors fall below the ENCG criteria. Equipment operations were assumed to be continuous during the daytime, evening and nighttime for all sources. The nighttime period has the more stringent criteria. The results for noise levels due to HVAC equipment are presented in Table 5 and 6, while noise contours are illustrated in Figures 4-5 for 1.5 metres and 4.5 metres above grade, respectively.

The development is expected to be compatible with the existing and future noise sensitive land uses, provided that the assumptions are consistent with Section 2.1 and 4.3 with respect to HVAC equipment.

TABLE 5: NOISE LEVELS FROM HVAC EQUIPMENT (1.5 M ABOVE GRADE)

Receptor Number	Receptor Location	1-HR L_{eq} (dBA)	ENCG Criteria (dBA)	Meets ENCG
		Daytime/Evening/ Nighttime	Nighttime	
R1A	POW – 615 Longfields West Façade – 2nd Floor	24	45	Yes
R1B	POW – 615 Longfields West Façade – 4th Floor	25	45	Yes
R2A	POW – 615 Longfields North Façade – 2nd Floor	25	45	Yes
R2B	POW – 615 Longfields North Façade – 4th Floor	26	45	Yes
R3	POW – 600 Via Campanale	31	45	Yes
R4	POW – 601 Via Campanale	37	45	Yes
R5	OPOR – 601 Via Campanale – OLA	35	45	Yes
R6	POW – 601 Longfields Drive	34	45	Yes
R7	OPOR – 601 Longfields Drive – OLA Rear of School	33	45	Yes
R8	OPOR – 601 Longfields Drive – OLA Playground	39	45	Yes
R9	POW – 601 Longfields Drive – Portables	37	45	Yes
R10	OPOR – 601 Longfields Drive – OLA Soccer Field	42	45	Yes

TABLE 6: NOISE LEVELS FROM HVAC EQUIPMENT (4.5 M ABOVE GRADE)

Receptor Number	Receptor Location	1-HR L_{eq} (dBA)	ENCG Criteria (dBA)	Meets ENCG
		Daytime/Evening/ Nighttime	Nighttime	
R1A	POW – 615 Longfields West Façade – 2nd Floor	24	45	Yes
R1B	POW – 615 Longfields West Façade – 4th Floor	25	45	Yes
R2A	POW – 615 Longfields North Façade – 2nd Floor	25	45	Yes
R2B	POW – 615 Longfields North Façade – 4th Floor	26	45	Yes
R3	POW – 600 Via Campanale	31	45	Yes
R4	POW – 601 Via Campanale	37	45	Yes
R5	OPOR – 601 Via Campanale – OLA	35	45	Yes
R6	POW – 601 Longfields Drive	34	45	Yes
R7	OPOR – 601 Longfields Drive – OLA Rear of School	33	45	Yes
R8	OPOR – 601 Longfields Drive – OLA Playground	39	45	Yes
R9	POW – 601 Longfields Drive – Portables	37	45	Yes
R10	OPOR – 601 Longfields Drive – OLA Soccer Field	42	45	Yes

6. CONCLUSIONS AND RECOMMENDATIONS

Our stationary noise assessment for the proposed commercial development indicates that, provided equipment selections and locations are similar to the assumptions and recommendations in this report, noise levels at nearby points of reception are expected to fall below the City of Ottawa's Environmental Noise Control Guidelines (ENCG). Since the noise levels fall below the ENCG criteria, the proposed development is expected to be compatible with the existing and future noise sensitive land uses.

As this study is based on available information at the time of the study, any changes to equipment selection and locations should be reviewed by an acoustical engineer prior to installation.

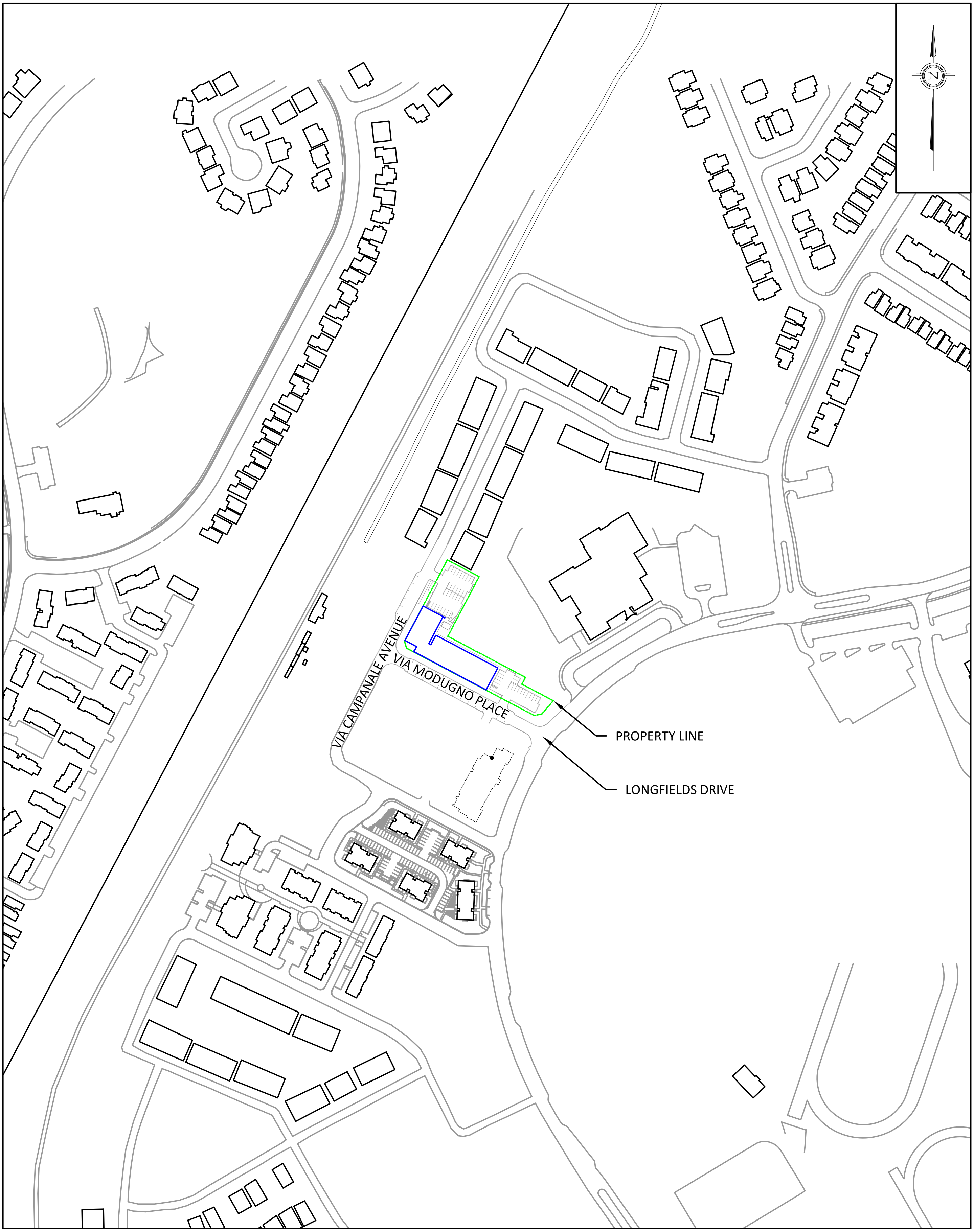
This concludes our assessment and report. If you have any questions or wish to discuss our findings, please advise us. In the interim, we thank you for the opportunity to be of service.

Yours truly,

Gradient Wind Engineering Inc.

Joshua Foster, P.Eng.
Partner
GWE17-174 - Stationary Noise

Omar Daher, B.Eng, EIT,
Junior Environmental Scientist



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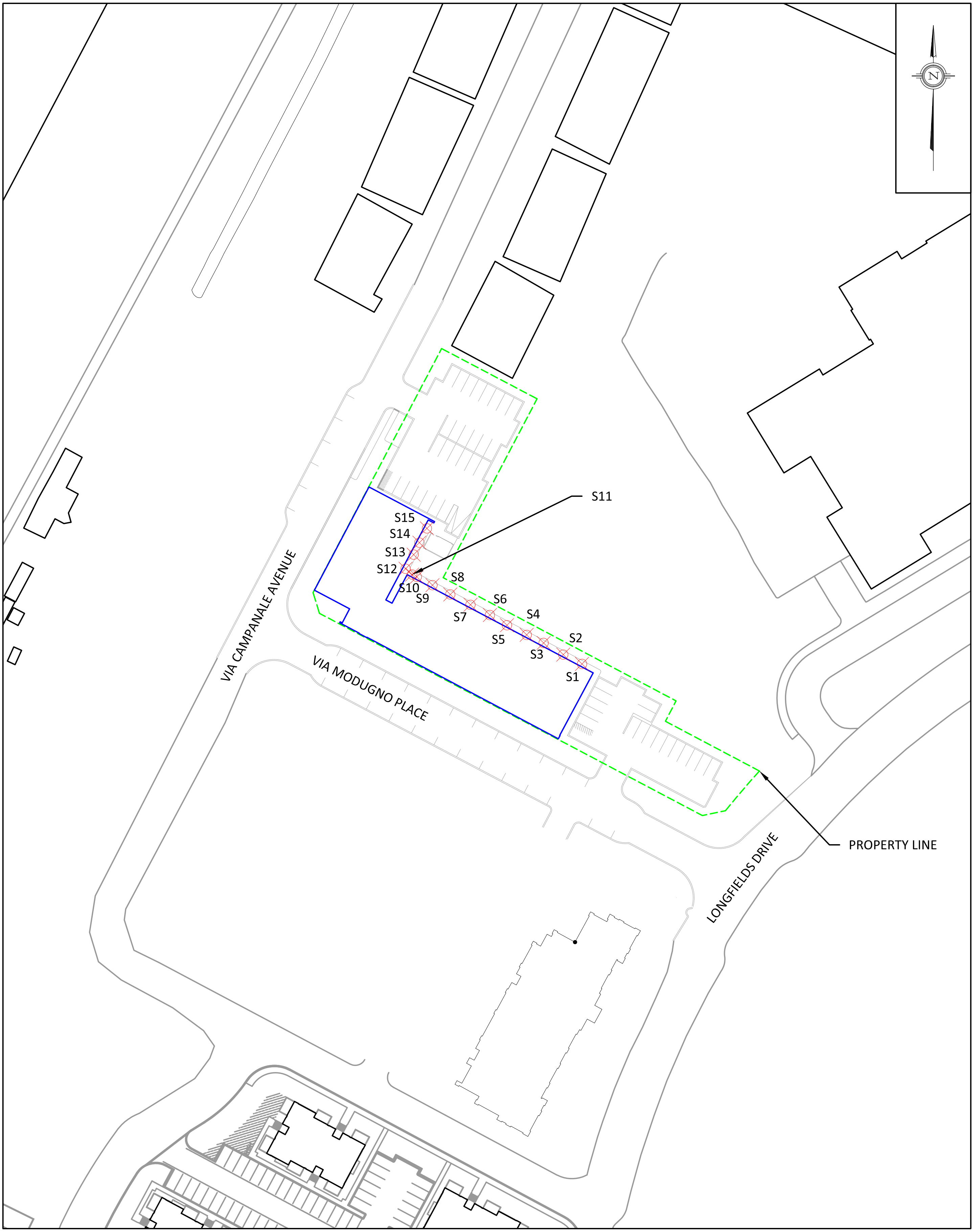
Ottawa, Ontario
(613) 836 0934
GRADIENT WIND ENGINEERING INC

PROJECT	605 LONGFIELDS DRIVE - STATIONARY NOISE ASSESSMENT		
SCALE	1:4000 (APPROX.)	DRAWING NO.	GWE17-174-1
DATE	NOVEMBER 8, 2017	DRAWN BY	O.D

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



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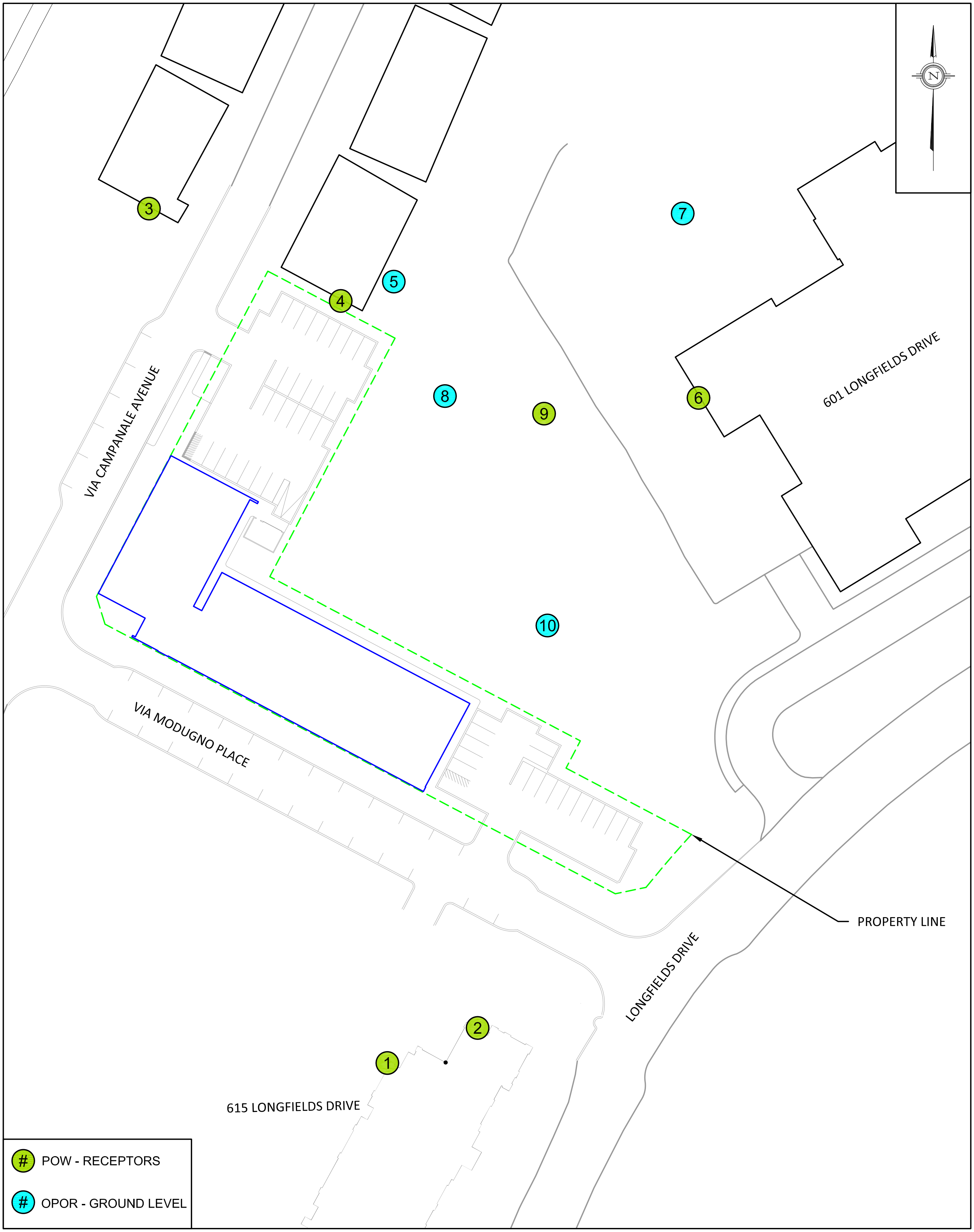
PROJECT: 605 LONGFIELDS DRIVE - STATIONARY NOISE ASSESSMENT		DESCRIPTION: FIGURE 2: SOURCE LOCATIONS
SCALE: 1:750 (APPROX.)	DRAWING NO.: GWE17-174-2	
DATE: NOVEMBER 8, 2017	DRAWN BY: O.D	



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PROJECT 605 LONGFIELDS DRIVE - STATIONARY NOISE ASSESSMENT		DESCRIPTION FIGURE 3: RECEPTOR LOCATIONS
SCALE 1:1000 (APPROX.)	DRAWING NO. GWE17-174-3	
DATE NOVEMBER 8, 2017	DRAWN BY O.D	

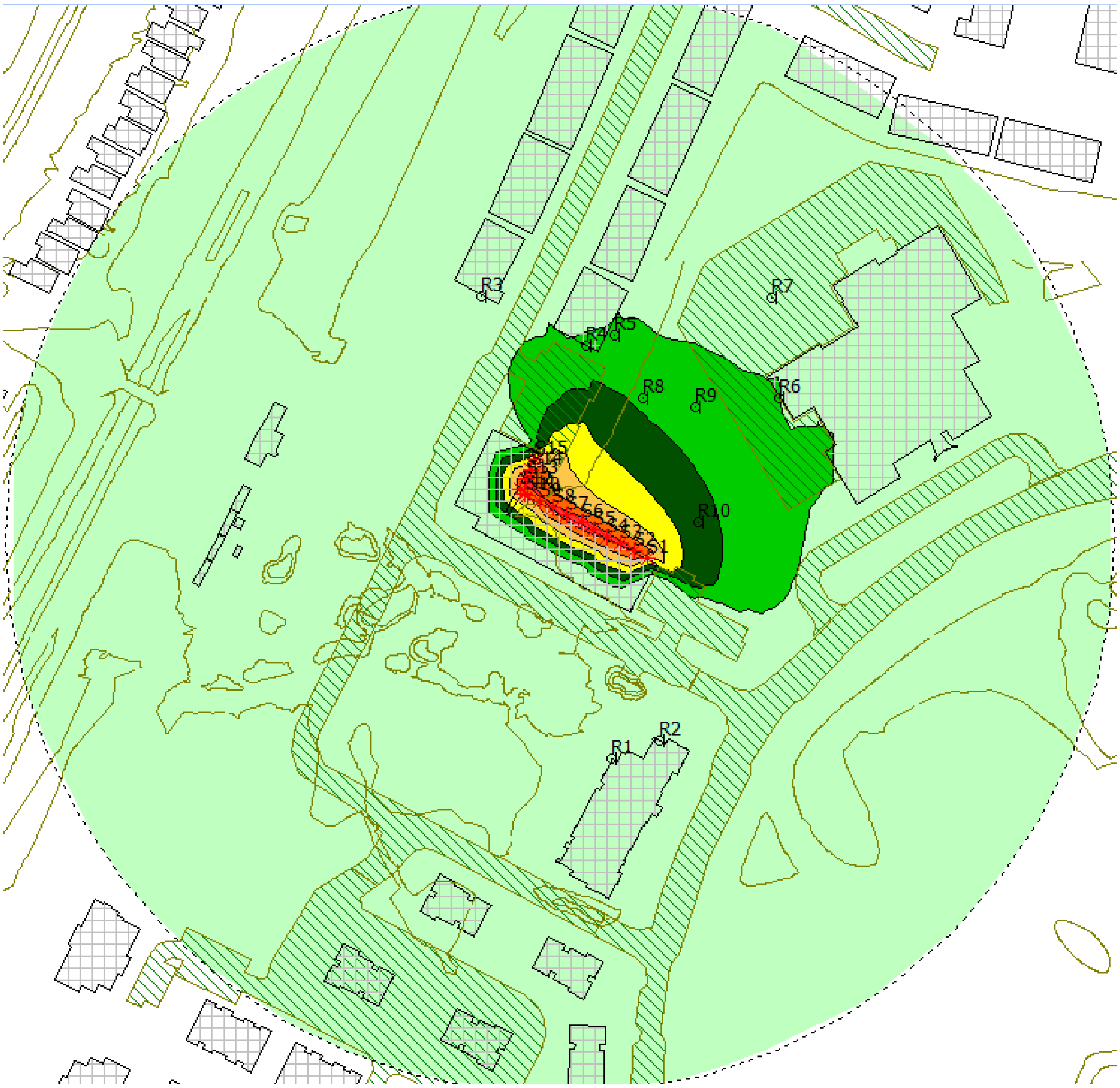
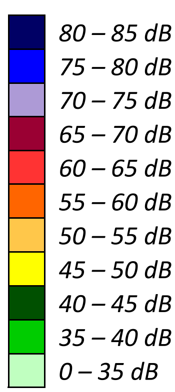


FIGURE 4: DAYTIME/EVENING/NIGHTTIME NOISE CONTOURS AT 1.5 M ABOVE GRADE (HVAC EQUIPMENT)



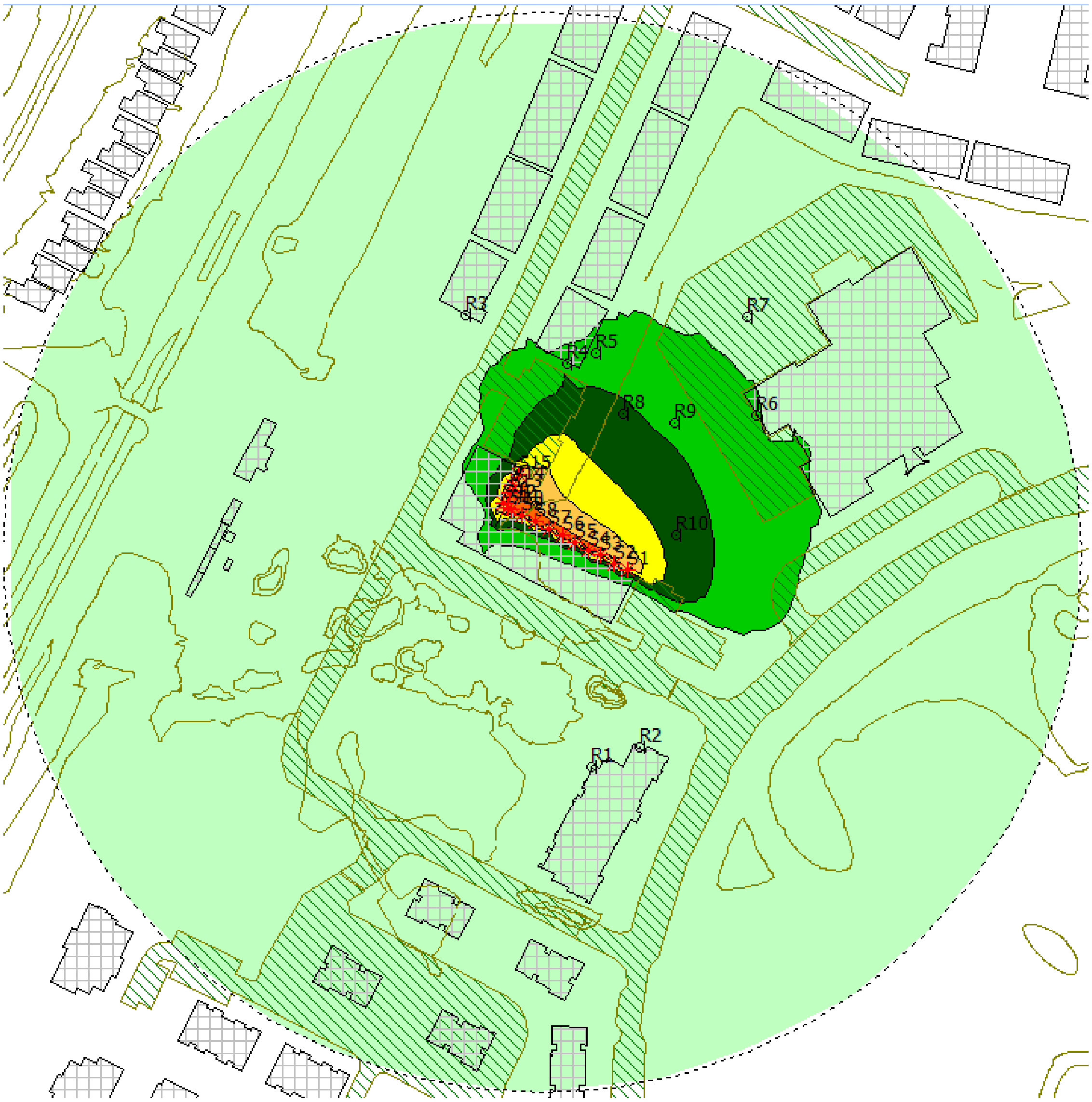


FIGURE 5: DAYTIME/EVENING/NIGHTTIME NOISE CONTOURS AT 4.5 M ABOVE GRADE (HVAC EQUIPMENT)