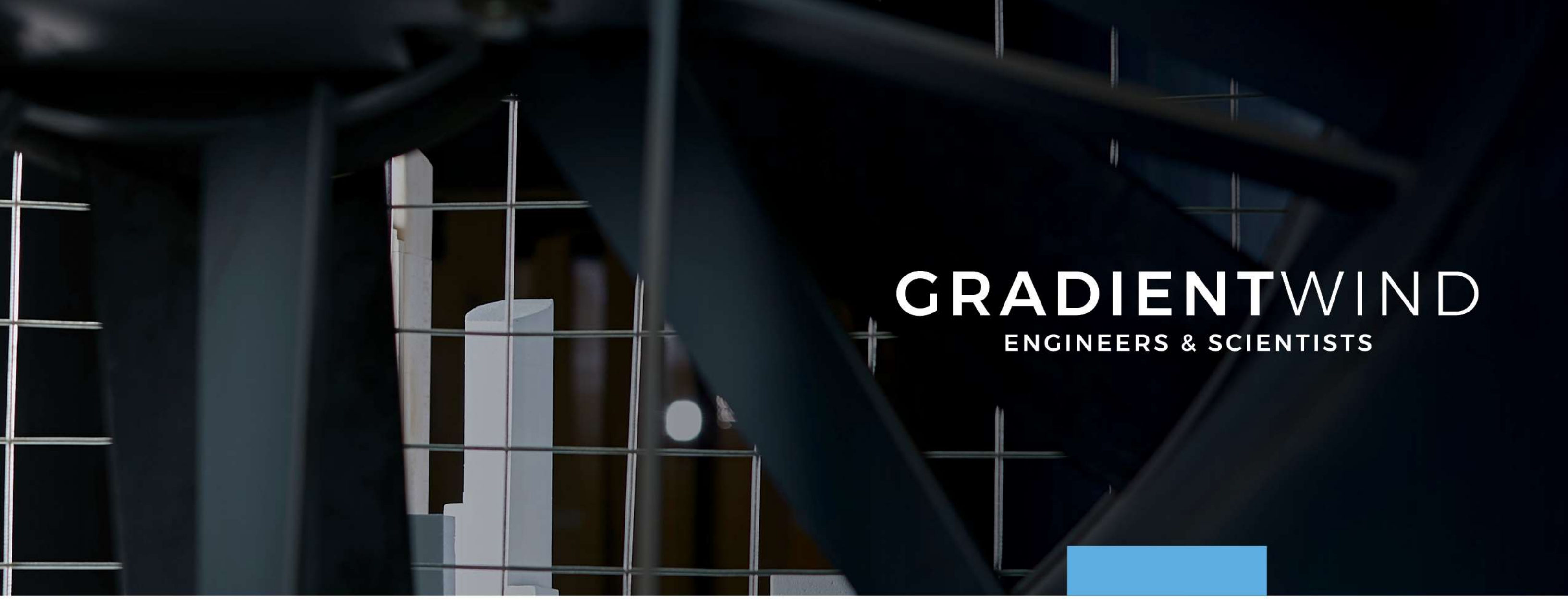
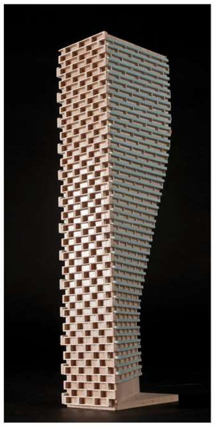
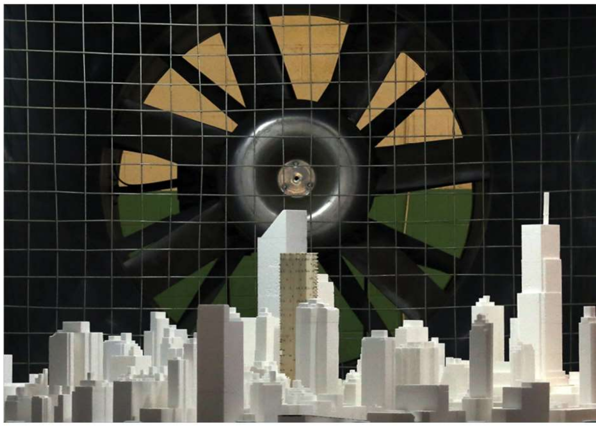


STATIONARY NOISE FEASIBILITY ASSESSMENT

1 Dunbar Court
Ottawa, Ontario

REPORT: GW20-239-Stationary Noise





June 14, 2021

PREPARED FOR
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EXECUTIVE SUMMARY

This report describes a stationary noise feasibility assessment in support of a Site Plan Control (SPC) submission for a proposed development located at 1 Dunbar Court in Ottawa, Ontario. The development comprises a 3-storey residential building with an L-shaped floorplan, situated at the centre of the site surrounded by existing 2-storey townhouse blocks. A 4-storey apartment building is located to the northeast of the site at 57 Bateman Drive. Figure 1 illustrates a site plan with surrounding context.

The assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP) and City of Ottawa requirements; (ii) noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG); (iii) architectural drawings prepared by Jane Thompson Architects received in October 2020, and; (iv) mechanical information provided by Smith + Andersen in April 2021.

Sources of stationary noise were considered for two options provided by the client, varying in equipment type, specifications, and layout. Option 1 is a water-cooled system, with stationary noise sources including a rooftop air handling unit, and cooling tower. Option 2 is an air-cooled system, with stationary noise sources including variable refrigerant volume (VRV) units within an enclosure, and a rooftop air handling unit identical to option 1. Outdoor mechanical equipment is considered in the analysis for its potential stationary noise impacts on the surrounding buildings, and on the building itself.

The results of the current study indicate that noise levels for option 1 are expected to exceed the ENCG noise criteria at multiple points of reception. The cooling tower of option 1 contributes to higher noise levels at points of reception due to its height and location. A possible noise mitigation strategy for Option 1 is the construction of a noise screen surrounding the cooling tower. The noise screen would need to be at least as tall as the unit, contain no gaps, and have a surface density of 20 kg/m^2. Results indicate that noise levels for Option 2 meet the ENCG noise criteria at all points of reception. As such, the proposed development is expected to be compatible with the existing noise sensitive land uses and will satisfy all site plan conditions, according to the selection of Option 2. Therefore, the client has decided to proceed with Option 2. A review of the final equipment selections and locations by a qualified acoustical engineer will be required prior to installation of the equipment.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Jane Thompson Architect to undertake a stationary noise feasibility assessment in support of a Site Plan Control (SPC) submission for the proposed development at 1 Dunbar Court in Ottawa, Ontario. This report summarizes the methodology, results and recommendations related to a stationary noise feasibility assessment.

The present scope of work involves assessing exterior noise levels generated by rooftop air handling equipment. The assessment was performed based on theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MECP) NPC-300[2] guidelines, architectural drawings prepared by Jane Thompson Architect, received in October 2020, mechanical information provided by Smith + Andersen in April 2021, surrounding street layouts obtained from the City of Ottawa, and recent site imagery.

2. TERMS OF REFERENCE

The focus of this stationary noise feasibility assessment is the proposed development at 1 Dunbar Court in Ottawa, Ontario. The development comprises a 3-storey residential building with an L-shaped floorplan, situated at the centre of the site surrounded by existing 2-storey townhouse blocks. A 4-storey apartment building is located to the northeast of the site at 57 Bateman Drive. Figure 1 illustrates the site plan and surrounding context.

Sources of stationary noise were considered for two options provided by the client, varying in equipment type, specifications, and layout. Option 1 is a water-cooled system, with stationary noise sources including a rooftop air handling unit, and cooling tower. Option 2 is an air-cooled system, with stationary noise sources including variable refrigerant volume (VRV) units within an electrically heated enclosure, and a rooftop air handling unit identical to Option 1. Figures 2 and 3 illustrate the location of noise sources included in this study for Options 1 and 2.

[1] City of Ottawa Environmental Noise Control Guidelines, January 2016
[2] Ministry of the Environment, Conservation and Parks (MECP), Environmental Noise Guideline – Publication NPC-300, August 2013

2.1 Assumptions

The mechanical information of the proposed HVAC equipment was based on specifications received from Smith + Andersen for each respective unit. A review of the final equipment selections and locations by a qualified acoustical engineer will be required prior to installation of the equipment. The following assumptions have been made in the analysis:

(i) The location, quantity, and tonnage of units has been based on rooftop planning and corresponding mechanical information provided by Smith + Andersen.

(ii) Sound data for rooftop mechanical units is based on the equipment specifications provided by Smith + Andersen.

(iii) All rooftop mechanical equipment is assumed to operate continuously over a 1-hour period during the daytime and at 50% operation during the nighttime period.

(iv) Screening effects of a 0.7-meter parapet surrounding the rooftop has been included in the modelling.

(v) Noise attenuation of the VRV enclosure has been conservatively excluded in the modelling.

3. OBJECTIVES

The main goals of this work are to (i) calculate the future noise levels on the surrounding dwellings produced by stationary sources and (ii) ensure that exterior noise levels do not exceed the allowable limits specified by the ENCG, as outlined in Section 4 of this report.

4. METHODOLOGY

The impact of the external 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 simulates three-dimensional surfaces and first reflections of sound waves over a suitable spectrum for human hearing. This methodology has been used on numerous assignments and has been accepted by the MECP as part of Environmental Compliance Approvals applications. Twenty-three (23) receptor locations were selected for the study site, as illustrated in Figure 4.

4.1 Perception of Noise

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 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" [3].

4.2 Stationary Noise Criteria

The equivalent sound energy level, L_{eq}, provides a weighted measure of the time varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level, which has the same energy as a time varying noise level over a selected period of time. For stationary sources, the L_{eq} is commonly calculated on an hourly interval, while for roadways, the L_{eq} is calculated on the basis of a 16-hour daytime/8-hour nighttime split.

Noise criteria taken from the ENCG and NPC-300 apply to points of reception (POR). A POR is defined under the ENCG as "any location on a noise sensitive land use where noise from a stationary source is received"[4]. A POR can be located on an existing or zoned for future use premises of permanent or seasonal residences, hotels/motels, nursing/retirement homes, rental residences, hospitals, campgrounds, and noise sensitive buildings such as schools and places of worship. The recommended maximum noise levels for a Class 1 area are outlined in Table 1 below. The study site is considered to be in a Class 1 area because

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

it is in an urban area and is located near the intersection of two arterial roadways. These conditions indicate that the sound field is dominated by manmade sources.

TABLE 1: EXCLUSIONARY LIMITS FOR CLASS 1 AREA

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

4.3 Determination of Noise Source Power Levels

Preliminary mechanical information for the development has been based on manufacturer data received from Smith + Andersen and on Gradient Wind's experience with similar developments. Table 2 summarizes the sound power of each source used in the analysis for options 1 and 2.

TABLE 2: EQUIPMENT SOUND POWER LEVELS (dBA)

Source ID	Description	Height Above Rooftop (m)	Frequency (Hz)								
			63	125	250	500	1000	2000	4000	8000	Total
S1	RTU (Option 1 and 2)	1.2	40	52	70	77	70	69	66	59	79
S2	Cooling Tower (Option 1)	2.7	92	91	86	85	84	82	79	77	89
S3 - S6	VRV Condensing Units (Option 2)	1.5					81				81

4.4 Stationary Source Noise Predictions

The impact of stationary noise sources on nearby residential areas was determined by computer modelling using the software program Predictor-Lima. This program was developed from the International Standards Organization (ISO) standard 9613 Parts 1 and 2 and 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 the Environment, Conservation and Parks (MECP) as part of Environmental Compliance Approval applications.

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

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 (paved surfaces), 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.

TABLE 3: 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

TABLE 4: RECEPTOR LOCATIONS

Receptor Number	Receptor Location	Height Above Grade (m)
R1	POW - 1 Dunbar Court, South Façade	7.5
R2	POW - 1 Dunbar Court, West Façade	7.5
R3	POW - 1 Dunbar Court, North Façade	7.5
R4	POW - 1 Dunbar Court, West Façade	7.5
R5	POW - 1 Dunbar Court, North Façade	7.5
R6	POW- 1 Dunbar Court, East Façade	7.5
R7	POW - 65-71 Dunbar Court, North Façade	4.5
R8	POW - 65-71 Dunbar Court, North Façade	4.5
R9	POW - 57-63 Dunbar Court, North Façade	4.5
R10	POW - 57-63 Dunbar Court, North Façade	4.5
R11	POW - 45-55 Dunbar Court, East Façade	4.5
R12	POW - 45-55 Dunbar Court, East Façade	4.5
R13	POW - 37-43 Dunbar Court, East Façade	4.5
R14	POW - 37-43 Dunbar Court, East Façade	4.5
R15	POW - 27-35 Dunbar Court, East Façade	4.5
R16	POW - 27-35 Dunbar Court, East Façade	4.5
R17	POW - 2-12 Dunbar Court, South Façade	4.5
R18	POW - 2-12 Dunbar Court, South Façade	4.5
R19	POW - 57 Bateman Drive, West Façade	10.5
R20	POW - 57 Bateman Drive, West Façade	10.5
R21	POW - 57 Bateman Drive, West Façade	10.5
R22	OPOR - 57 Bateman Drive	1.5
R23	OPOR - 1 Dunbar Court	1.5

5. RESULTS AND DISCUSSION

Noise levels at nearby receptors for Options 1 and 2 are summarized in Tables 5 and 6, respectively. The sound levels listed in Tables 5 and 6 are based on the assumptions outlined in Section 2.1.

TABLE 5: OPTION 1 NOISE LEVELS FROM STATIONARY SOURCES

Receptor Number	Receptor Location	Noise Level (dBA)		Sound Level Limits		Meets ENCG Class 1 Criteria	
		Day	Night	Day	Night	Day	Night
R1	POW - 1 Dunbar Court	43	40	50	45	YES	YES
R2	POW - 1 Dunbar Court	40	37	50	45	YES	YES
R3	POW - 1 Dunbar Court0	46	43	50	45	YES	YES
R4	POW - 1 Dunbar Court	57	54	50	45	NO	NO
R5	POW - 1 Dunbar Court	39	36	50	45	YES	YES
R6	POW - 1 Dunbar Court	39	36	50	45	YES	YES
R7	POW - 65-71 Dunbar Court	36	33	50	45	YES	YES
R8	POW - 65-71 Dunbar Court	40	37	50	45	YES	YES
R9	POW - 57-63 Dunbar Court	46	43	50	45	YES	YES
R10	POW - 57-63 Dunbar Court	46	43	50	45	YES	YES
R11	POW - 45-55 Dunbar Court	43	40	50	45	YES	YES
R12	POW - 45-55 Dunbar Court	41	38	50	45	YES	YES
R13	POW - 37-43 Dunbar Court	44	41	50	45	YES	YES
R14	POW - 37-43 Dunbar Court	43	40	50	45	YES	YES
R15	POW - 27-35 Dunbar Court	45	42	50	45	YES	YES
R16	POW - 27-35 Dunbar Court	48	45	50	45	YES	YES
R17	POW - 2-12 Dunbar Court	51	48	50	45	NO	NO
R18	POW - 2-12 Dunbar Court	38	35	50	45	YES	YES
R19	POW - 57 Bateman Drive	48	45	50	45	YES	YES
R20	POW - 57 Bateman Drive	49	46	50	45	YES	NO
R21	POW - 57 Bateman Drive	46	43	50	45	YES	YES
R22	OPOR - 57 Bateman Drive	39	N/A*	50	N/A*	YES	N/A*
R23	OPOR - 1 Dunbar Court	48	N/A*	50	N/A*	YES	N/A*

*Nighttime noise levels are not considered at OPOR receptors as per the ENCG guidelines

TABLE 6: OPTION 2 NOISE LEVELS FROM STATIONARY SOURCES

Receptor Number	Receptor Location	Noise Level (dBA)		Sound Level Limits		Meets ENCG Class 1 Criteria	
		Day	Night	Day	Night	Day	Night
R1	POW - 1 Dunbar Court	40	37	50	45	YES	YES
R2	POW - 1 Dunbar Court	34	31	50	45	YES	YES
R3	POW - 1 Dunbar Court	38	35	50	45	YES	YES
R4	POW - 1 Dunbar Court	39	36	50	45	YES	YES
R5	POW - 1 Dunbar Court	41	38	50	45	YES	YES
R6	POW- 1 Dunbar Court	39	36	50	45	YES	YES
R7	POW - 65-71 Dunbar Court	32	28	50	45	YES	YES
R8	POW - 65-71 Dunbar Court	37	34	50	45	YES	YES
R9	POW - 57-63 Dunbar Court	40	37	50	45	YES	YES
R10	POW - 57-63 Dunbar Court	39	36	50	45	YES	YES
R11	POW - 45-55 Dunbar Court	37	34	50	45	YES	YES
R12	POW - 45-55 Dunbar Court	37	34	50	45	YES	YES
R13	POW - 37-43 Dunbar Court	39	36	50	45	YES	YES
R14	POW - 37-43 Dunbar Court	39	36	50	45	YES	YES
R15	POW - 27-35 Dunbar Court	38	35	50	45	YES	YES
R16	POW - 27-35 Dunbar Court	38	35	50	45	YES	YES
R17	POW - 2-12 Dunbar Court	40	36	50	45	YES	YES
R18	POW - 2-12 Dunbar Court	33	30	50	45	YES	YES
R19	POW - 57 Bateman Drive	42	39	50	45	YES	YES
R20	POW - 57 Bateman Drive	45	42	50	45	YES	YES
R21	POW - 57 Bateman Drive	41	38	50	45	YES	YES
R22	OPOR - 57 Bateman Drive	33	N/A*	50	N/A*	YES	N/A*
R23	OPOR - 1 Dunbar Court	38	N/A*	50	N/A*	YES	N/A*

*Nighttime noise levels are not considered at OPOR receptors as per the ENCG guidelines

As Table 5 summarizes, Option 1 noise levels exceed ENCG criteria at Receptors 4, 17, and 20. As Table 6 summarizes, Option 2 noise levels meet ENCG criteria at all points of reception. Noise contours at 7.5 meters above grade can be seen in Figures 5-8 for daytime and nighttime conditions of Options 1 and 2, respectively.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current study indicate that noise levels for Option 1 are expected to exceed the ENCG noise criteria at multiple points of reception. The cooling tower of Option 1 contributes to higher noise levels at the points of reception, due primarily to its height and location. A possible noise mitigation strategy for Option 1 is the construction of a noise screen surrounding the cooling tower. The noise screen would need to be at least as tall as the unit, contain no gaps, and have a surface density of 20 kg/m^2.

Results indicate that noise levels for Option 2 meet the ENCG noise criteria at all points of reception. As such, the proposed development is expected to be compatible with the existing noise sensitive land uses and will satisfy all site plan conditions, according to the selection of Option 2. Therefore, the client has decided to proceed with Option 2. A review of the final equipment selections and locations by a qualified acoustical engineer will be required prior to installation of the equipment.

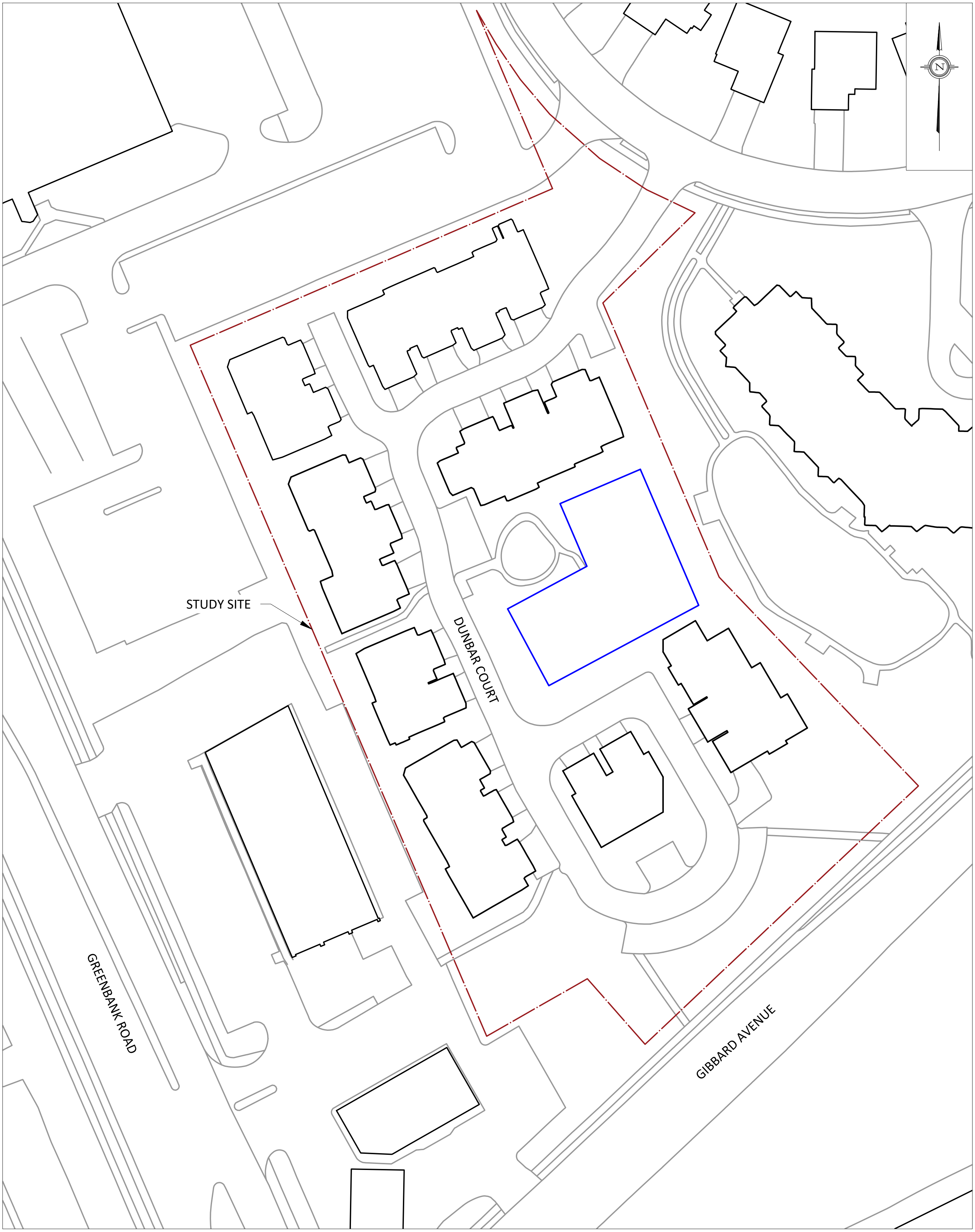
This concludes our assessment and report. If you have any questions or wish to discuss our findings, please advise us. In the interim, we thank you for the opportunity to be of service.
Sincerely,

Gradient Wind Engineering Inc.

Tanyon Matheson-Fitchett, B.Eng.
Junior Environmental Scientist

Joshua Foster, P.Eng.
Principal

Gradient Wind File #20-239 – Stationary Noise



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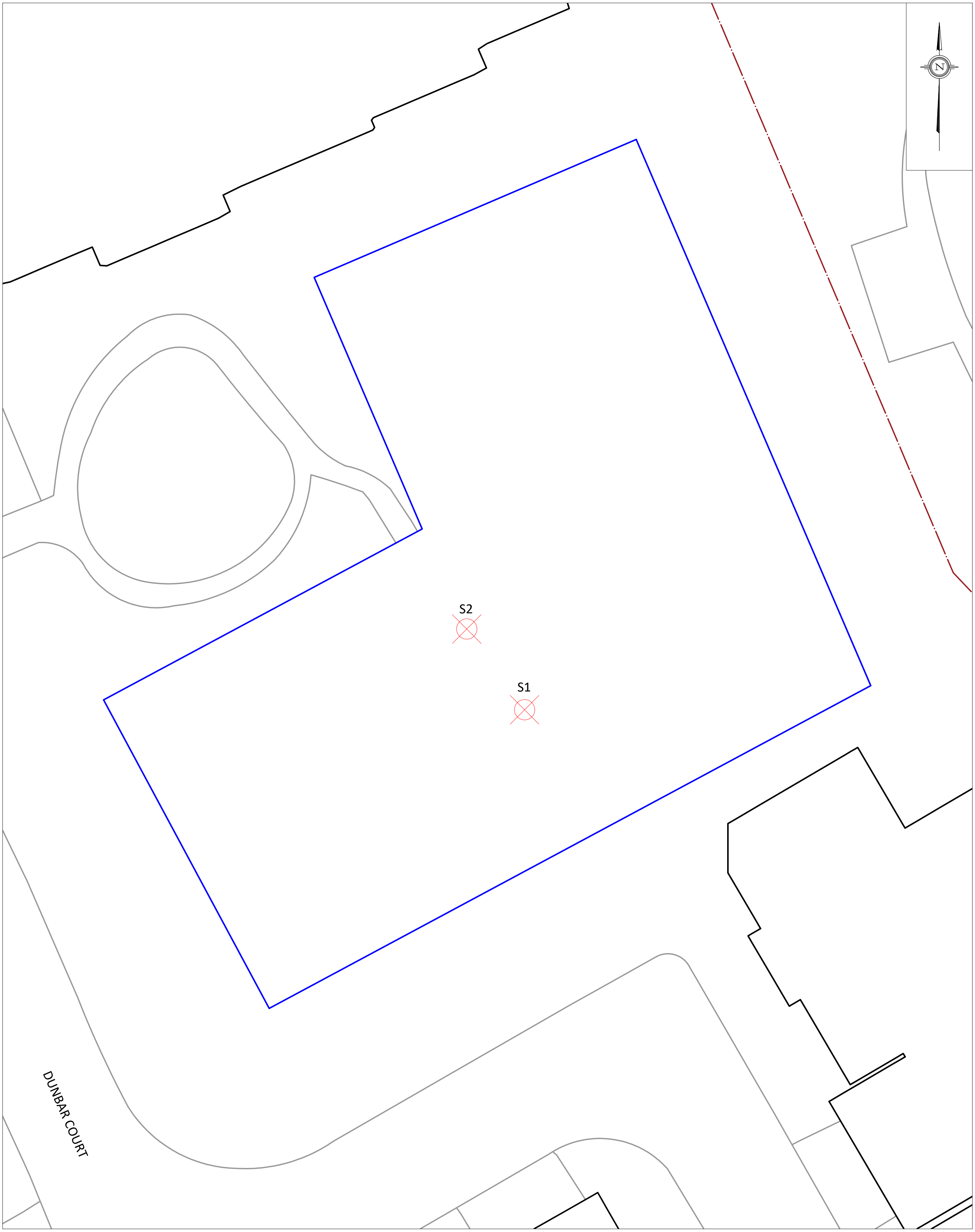
PROJECT	1 DUNBAR COURT, OTTAWA STATIONARY NOISE FEASIBILITY ASSESSMENT		
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW20-239-1
DATE	MAY 19, 2021	DRAWN BY	T.M.F.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



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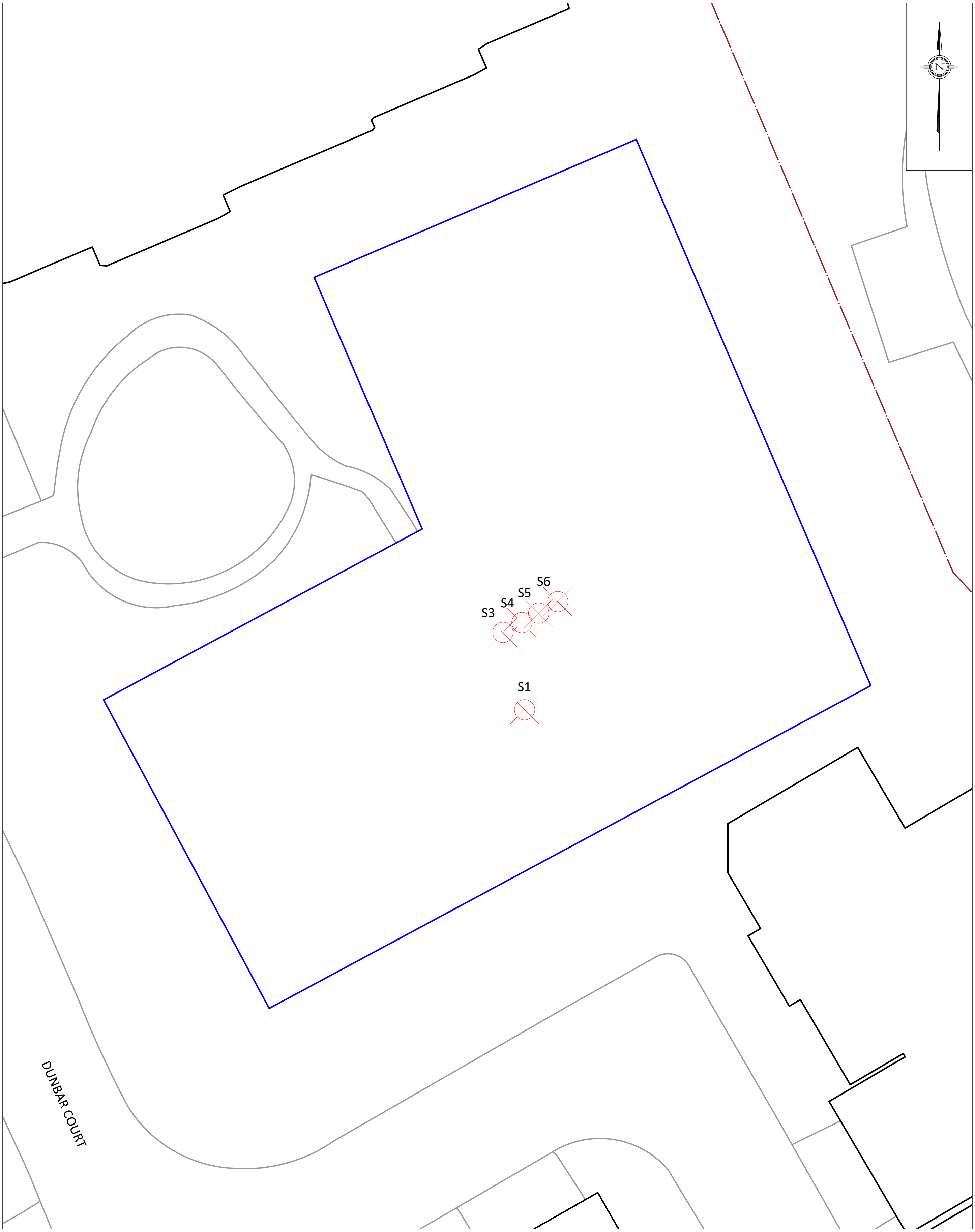
SCALE	1:250 (APPROX.)	DRAWING NO.	GW20-239-2
DATE	MAY 19, 2021	DRAWN BY	T.M.F.

DESCRIPTION

FIGURE 2:
OPTION 1 SOURCE LOCATIONS



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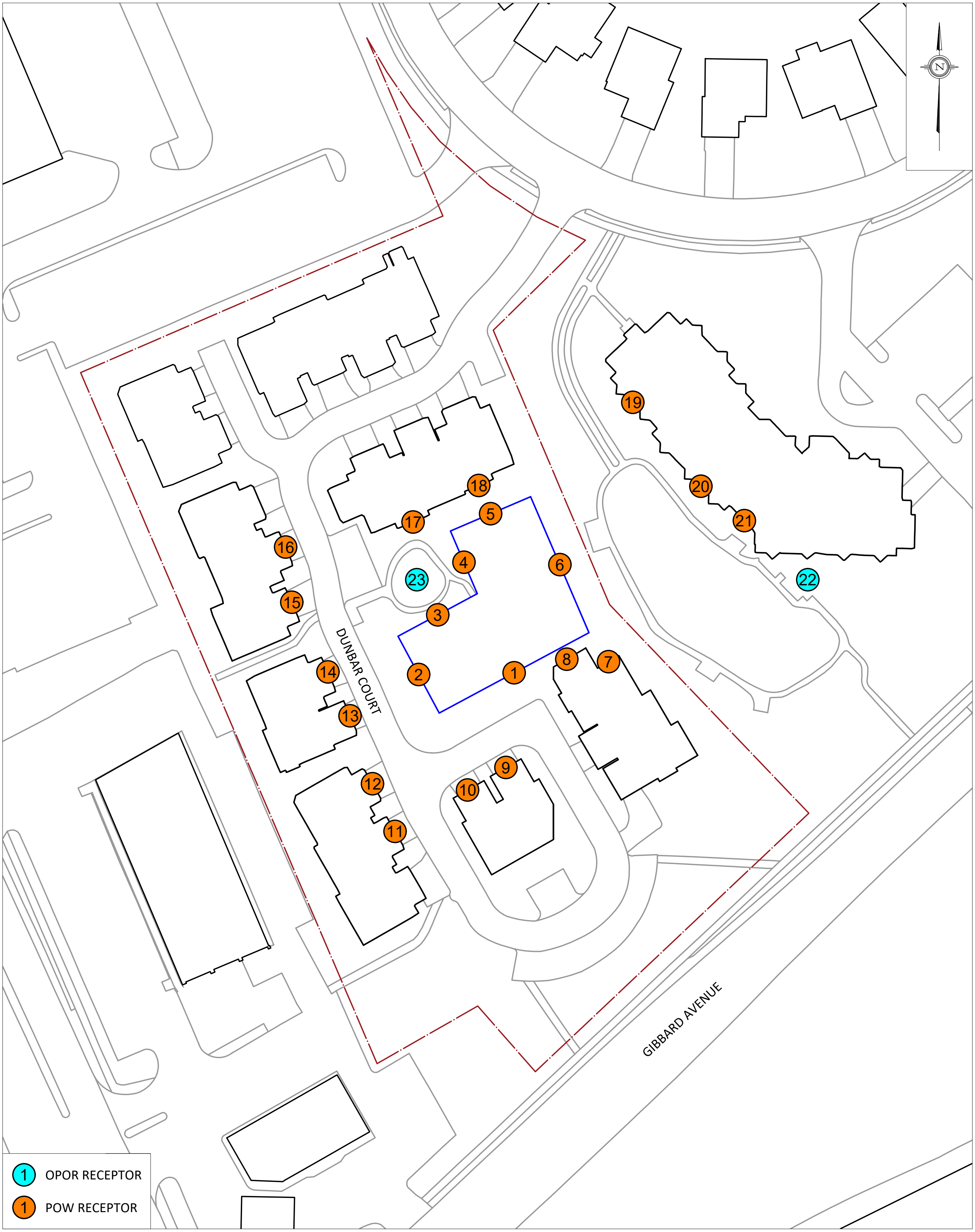
SCALE	1:250 (APPROX.)	DRAWING NO.	GW20-239-3
DATE	MAY 19, 2021	DRAWN BY	T.M.F.

DESCRIPTION

FIGURE 3:
OPTION 2 SOURCE LOCATIONS



GRADIENTWIND ENGINEERS & SCIENTISTS	PROJECT: 1 DUNBAR COURT, OTTAWA STATIONARY NOISE FEASIBILITY ASSESSMENT		DESCRIPTION
127 WALGREEN ROAD , OTTAWA, ON 613 836 0934 • GRADIENTWIND.COM	SCALE: 1:1000 (APPROX.)	DRAWING NO.: GW20-239-4	FIGURE 4: RECEPTOR LOCATIONS
	DATE: MAY 19, 2021	DRAWN BY: T.M.F.	

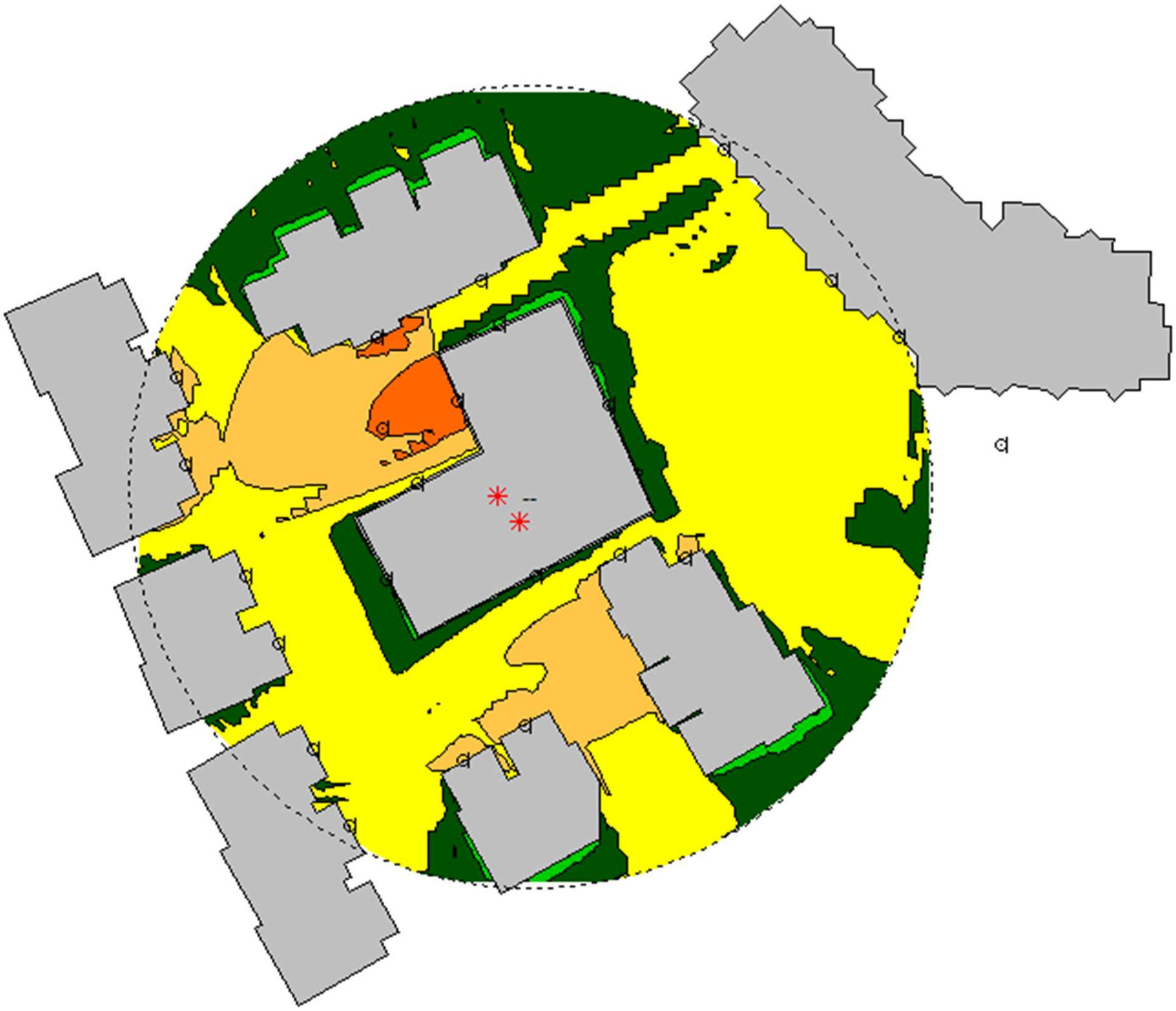
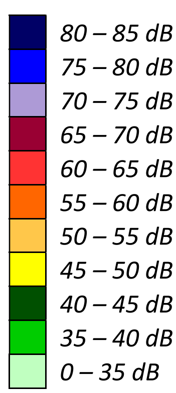


FIGURE 5: OPTION 1 DAYTIME NOISE CONTOURS (7.5M ABOVE GRADE)



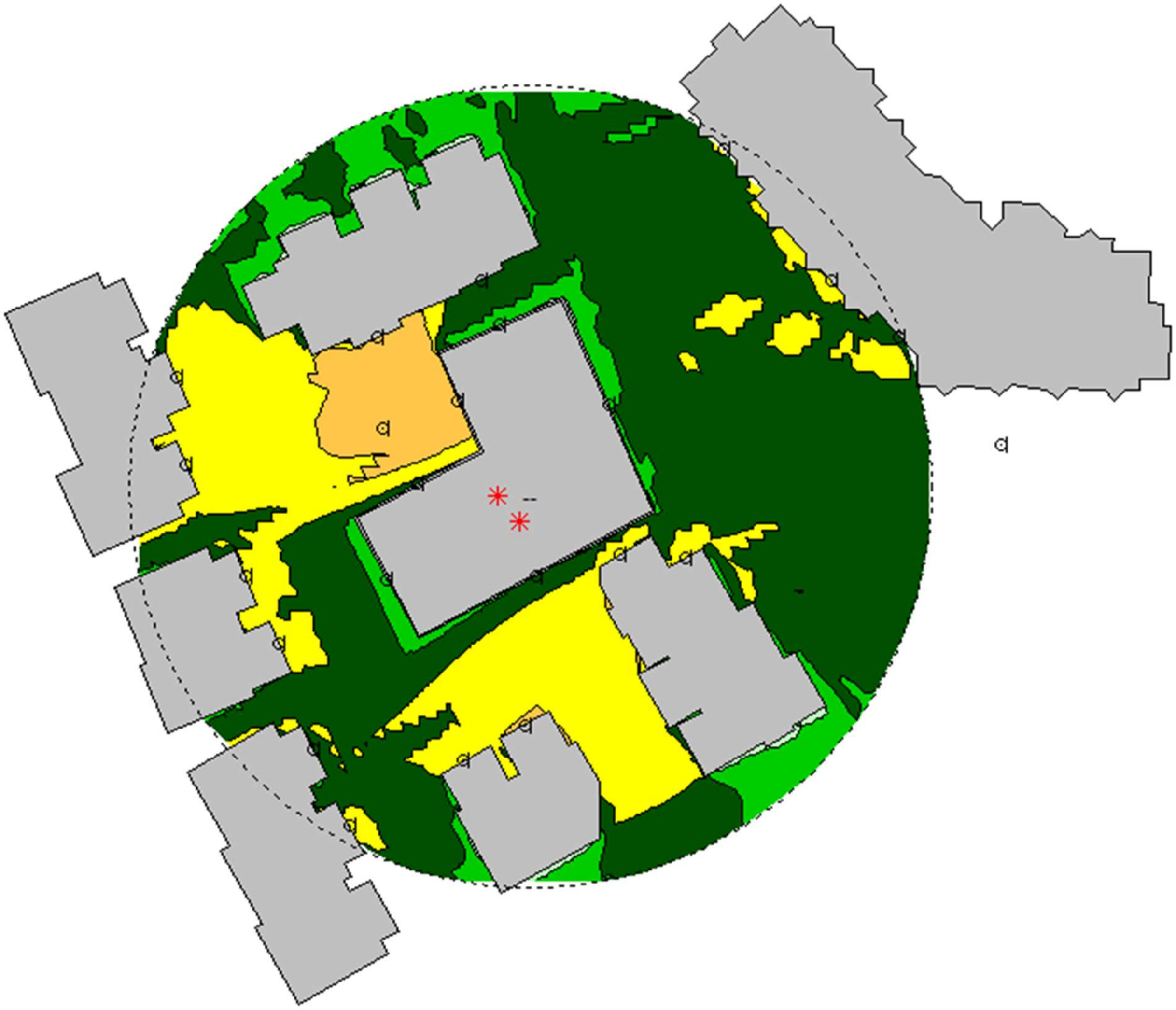
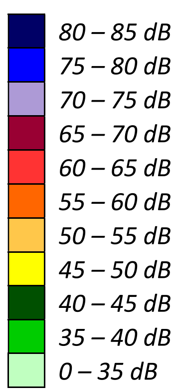


FIGURE 6: OPTION 1 NIGHTTIME NOISE CONTOURS (7.5M ABOVE GRADE)



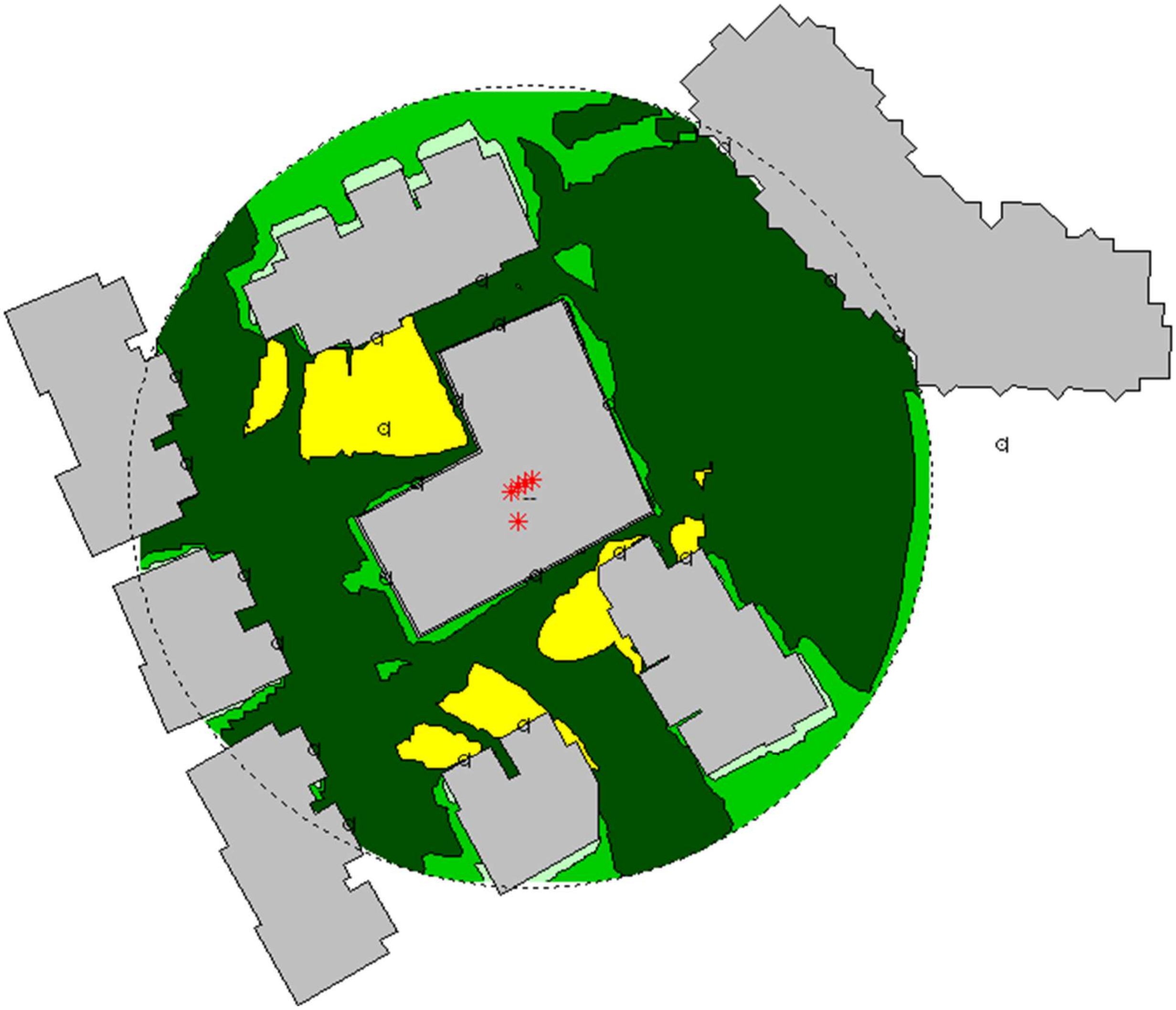


FIGURE 7: OPTION 2 DAYTIME NOISE CONTOURS (7.5M ABOVE GRADE)

	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

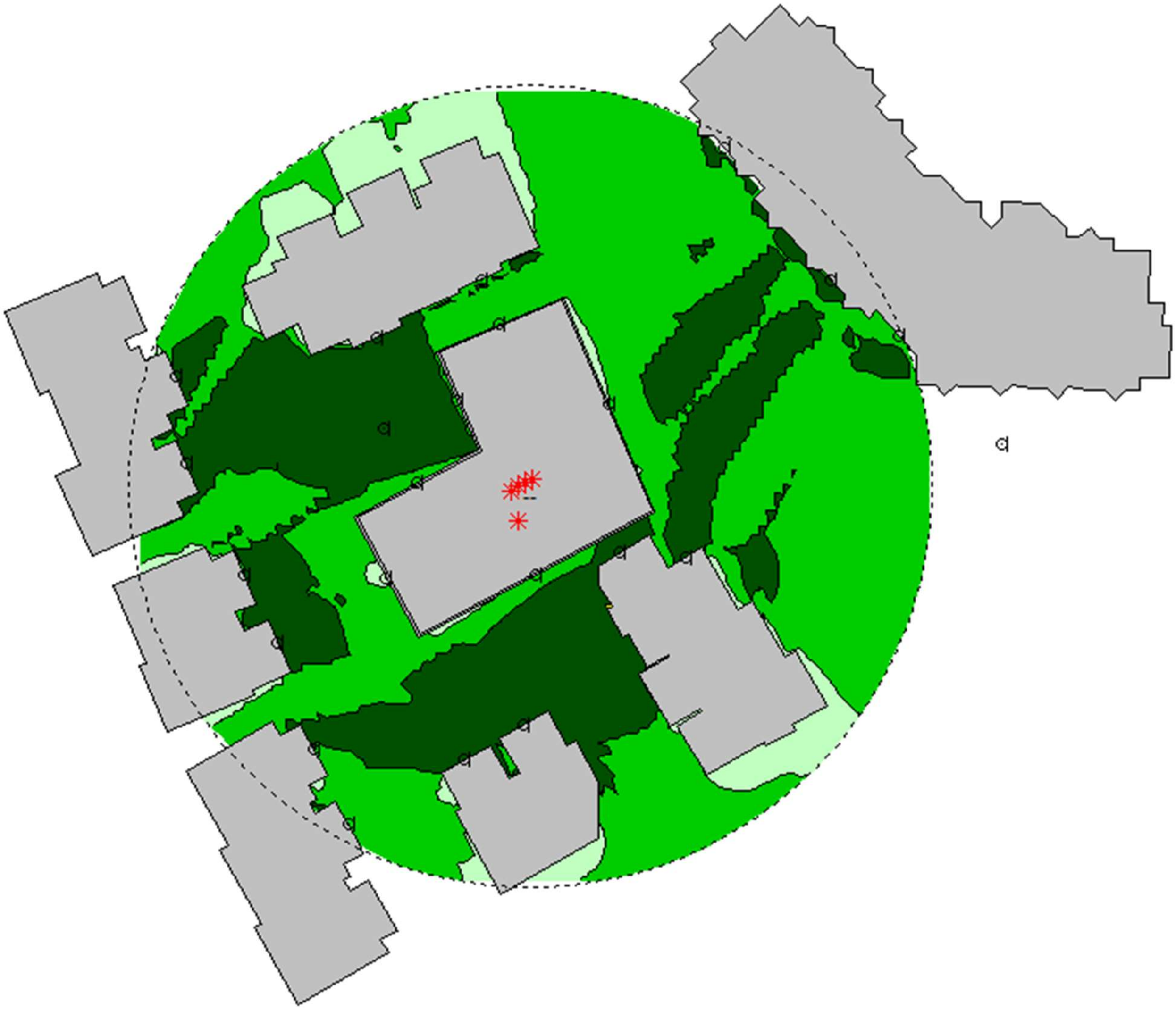


FIGURE 8: OPTION 2 NIGHTTIME NOISE CONTOURS (7.5M ABOVE GRADE)