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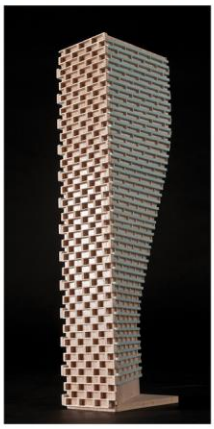
STATIONARY NOISE ASSESSMENT

1385 Woodroffe Avenue
Ottawa, Ontario

GRADIENT WIND REPORT: 19-027-Stationary Noise



June 24, 2019

PREPARED FOR

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EXECUTIVE SUMMARY

This report describes a stationary noise assessment performed for the proposed Algonquin College Athletics Recreation Complex located at 1385 Woodroffe Avenue in Ottawa, Ontario. The facility resides within Algonquin college which is located to the west of Algonquin College Students Common area (Building E) and is on the north corner of the Woodroffe Campus of Algonquin College. The Athletics Recreation Complex (ARC) comprises of three gymnasiums, indoor running track, fitness facilities, a bowling alley, areas for climbing and billiards, lounging area, therapy rooms administration spaces and other indoor amenity areas. Sources of stationary noise include rooftop air handling equipment, HVAC equipment, emergency generators, cooling towers and exhaust fans. 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 (MOECP) and City of Ottawa requirements; (ii) noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG), and; (iii) architectural drawings prepared by HOK Architects Corporation dated June 2019, and preliminary mechanical information provided by WSP.

The results of the current assessment indicate that noise levels at nearby points of reception are expected to fall below the ENCG noise criteria, provided that the assumptions for noise control as outlined in Section 2.1 are adhered to during the detailed design process. As such, the proposed development is expected to be compatible with the existing noise sensitive land uses and will satisfy all site plan conditions. Since this report is based on preliminary information, a review of the final equipment selections and locations by a qualified acoustical engineer will be required prior to installation of the equipment.

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1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by HOK Architects, on behalf of Algonquin College, to undertake a stationary noise assessment for the proposed Algonquin College Athletics Recreation Complex located at 1385 Woodroffe Avenue in Ottawa, Ontario. This report summarizes the methodology, results and recommendations related to a stationary noise assessment.

The present scope of work involves assessing exterior noise levels generated by rooftop HVAC equipment, emergency generators, and cooling towers. 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 HOK Architects Corporation dated June 2019, preliminary mechanical information provided by WSP and assumed by Gradient Wind based on experience with similar projects, surrounding street layouts obtained from the City of Ottawa, and recent site imagery.

2. TERMS OF REFERENCE

The focus of this stationary noise assessment is the proposed Algonquin College Athletics Recreation Complex development located at 1385 Woodroffe Avenue in Ottawa, Ontario. The development is located on the north corner of the Woodroffe campus at Algonquin College and is the east of the Algonquin College Student Commons Building (Building E).

The Athletics Recreation Complex (ARC) development comprises of three gymnasiums, indoor running track, fitness facilities, a bowling alley, areas for climbing and billiards, lounging area, therapy rooms administration spaces and other indoor amenity areas. The study site is surrounded by residential dorms, academic areas and residential neighbourhoods that consist of mechanical stationary noise equipment. Figure 1 illustrates the site plan and surrounding context.

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

The facility is considered to operate during the daytime period, from 07:00-19:00. Sources of stationary noise include rooftop HVAC equipment, emergency generators, and cooling towers. Figure 2 illustrates the location of all noise sources included in this study.

2.1 Assumptions

Preliminary mechanical information for the development has been based on information provided by WSP. Where sound data was not provided, Gradient Wind assumed sound power levels for the proposed equipment based on experience with similar developments. Once sound data for the equipment has been determined, these should be forwarded to gradient Wind for review. 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) Where available, sound data for rooftop units are based on manufacturer's data provided by WSP.
(ii) The rooftop mechanical units are assumed to operate continuously over a 1-hour period during the daytime period and at 50% during the nighttime period.
(iii) The generator at grade will only be tested during the daytime hours (07:00-19:00).
(iv) The generator was modelled with a F001 Level 2.0 acoustically rated enclosure.
(v) Screening effects of proposed barrier surrounding the rooftop mechanical area was included in the modelling.
(vi) Screening effects of parapets were conservatively excluded from the analysis.
(vii) The ground region was modelled as reflective ground due to the presence of hard ground (pavement).
(viii) 10 receptors were strategically placed on and around the development at noise sensitive areas including the existing student residence and neighborhood to the northeast.

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. Ten receptor locations were selected for the study site, as illustrated in Figure 3.

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 NPC-300 as "a source of sound or combination of sources of sound that are included and normally operated within the property lines of a facility and includes the premises of a person as one stationary source, unless the dominant source of sound on those premises is 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,

[3] NPC – 300, page 16

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 outdoor points of reception (POR). A POR is defined under NPC-300 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, camp grounds, and noise sensitive buildings such as schools and places of worship. The recommended maximum noise levels for a Class 1 area in a suburban environment adjacent to arterial roadways at a POR are outlined in Table 1 below. The study site is considered to be in a Class 1 area because it is located at the intersection of two arterial roadways, Woodroffe Avenue and Baseline Road. 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 Gradient Wind's experience with similar developments. Table 2 summarizes the sound power of each source used in the analysis.

[4] NPC – 300, page 14

TABLE 2: EQUIPMENT SOUND POWER LEVELS (dBA)

Source ID	Description	Height Above Grade/ Roof (m)	Frequency (Hz)								
			63	125	250	500	1000	2000	4000	8000	Total
S1-S6	MUA	2.9	67	78	88	93	94	92	87	80	99
S7, S8	Cooling Tower	4.57	79	87	95	96	94	89	84	78	101
Gen	Emergency Generator	2.4	59	77	86	94	96	96	91	86	101

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 (MOECP) as part of Environmental Compliance Approval 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/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 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 are typical settings that have been based on ISO 9613 standards and guidance from the MOECP.

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. A Predictor-Lima sample output is available in Appendix A. Further modelling data is available upon request.

TABLE 3: RECEPTOR LOCATIONS

Receptor Number	Receptor Location	Height Above Grade (m)
R1	POW – Residence Building	13.5
R2	POW – Residence Building	13.5
R3	POW – Residence Building	13.5
R4	POW – 11 DeerField Drive	4.5
R5	POW – 11 DeerField Drive	4.5
R6	OPOR – 11 DeerField Drive	1.5
R7	POW – Building P	1.5
R8	POW – Building P	7.5
R9	POW – Applied Arts Building	7.5
R10	OPOR – ARC	1.5

TABLE 4: CALCULATION SETTINGS

Parameter	Setting
Meteorological correction method	Single value for C0
Value C0	2.0
Default ground attenuation factor	0
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 the mechanical equipment are presented Table 5 while those due to the emergency generator are presented in Table 6. Emergency generators are only tested during the daytime period (07:00 – 19:00). Therefore, the criterion is 55 dBA. The emergency generator was evaluated separately from other sources of noise[5] (See NPC-300 C4.5.3). Noise levels at all outdoor points of reception and other plane of window receptors due to the generator fall below ENCG criteria provided our assumptions for noise control in Section 2.1 are adhered to.

TABLE 5: NOISE LEVELS FROM HVAC STATIONARY SOURCES

Receptor Number	Plane of Window Receptor Location	Noise Level (dBA)		Sound Level Limits		Meets ENCG Class 4 Criteria	
		Day	Night	Day	Night	Day	Night
R1	POW – Residence Building	46	43	50	45	Yes	Yes
R2	POW – Residence Building	48	45	50	45	Yes	Yes
R3	POW – Residence Building	48	45	50	45	Yes	Yes
R4	POW – 11 DeerField Drive	43	40	50	45	Yes	Yes
R5	POW – 11 DeerField Drive	45	42	50	45	Yes	Yes
R6	OPOR – 11 DeerField Drive	43	40	50	-	Yes	-
R7	POW – Building P	47	44	50	45	Yes	Yes
R8	POW – Building P	48	45	50	45	Yes	Yes
R9	POW – Applied Arts Building	48	45	50	45	Yes	Yes
R10	OPOR – ARC	48	45	50	-	Yes	-

[5] Environmental Noise Guideline "Stationary and Transportation Sources – Approval and Planning" NPC-300

TABLE 6: NOISE LEVELS FROM EMERGENCY GENERATOR

Receptor Number	Plane of Window Receptor Location	Noise Level (dBA)	Sound Level Limits	Meets ENCG Class 1 Criteria
		Day	Day	Day
R1	POW – Residence Building	37	55	Yes
R2	POW – Residence Building	53	55	Yes
R3	POW – Residence Building	53	55	Yes
R4	POW – 11 DeerField Drive	52	55	Yes
R5	POW – 11 DeerField Drive	55	55	Yes
R6	OPOR – 11 DeerField Drive	55	55	Yes
R7	POW – Building P	22	55	Yes
R8	POW – Building P	19	55	Yes
R9	POW – Applied Arts Building	20	55	Yes
R10	OPOR – ARC	27	55	Yes

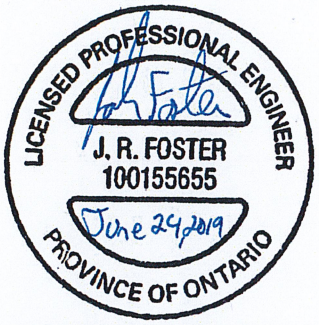
6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current study indicate that noise levels at nearby points of reception are expected to fall below the ENCG noise criteria, provided that the assumptions for noise control as outlined in Section 2.1 are adhered to during the detailed design process. As such, the proposed development is expected to be compatible with the existing noise sensitive land uses. 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.



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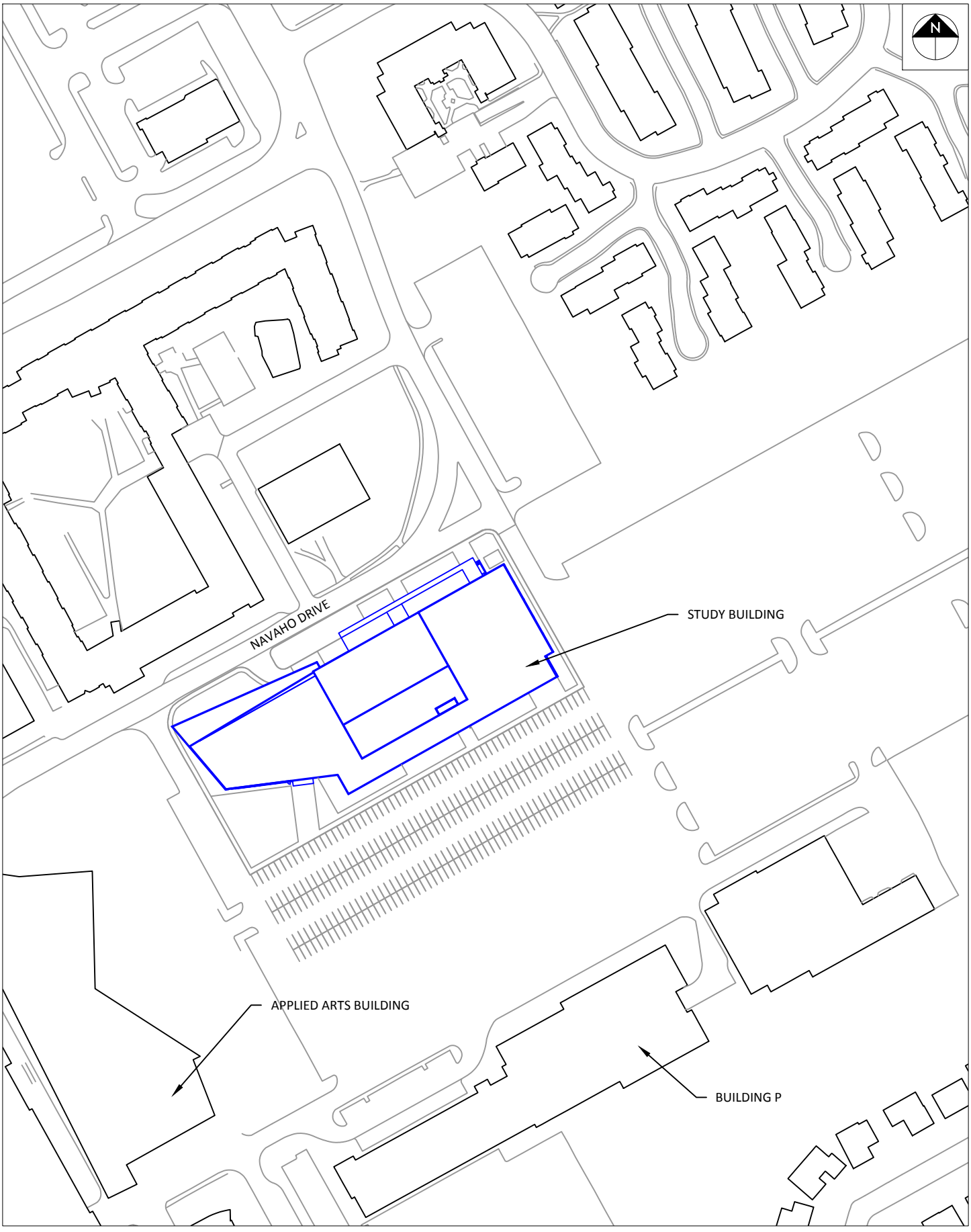

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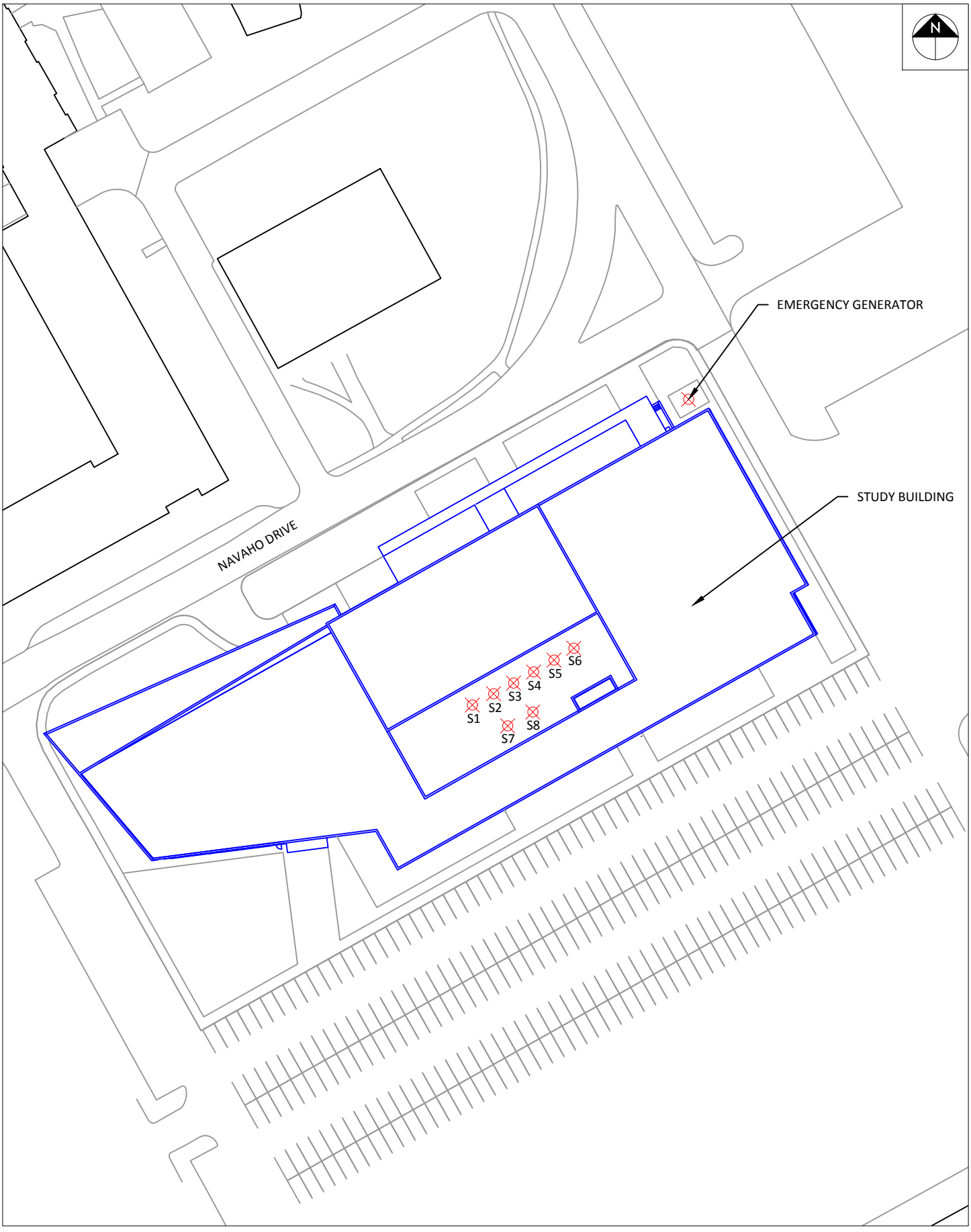
PROJECT	1385 WOODROFFE AVENUE - STATIONARY NOISE STUDY		
SCALE	1:2000 (APPROX.)	DRAWING NO.	GWE19-027
DATE	JUNE 24, 2019	DRAWN BY	G.G.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



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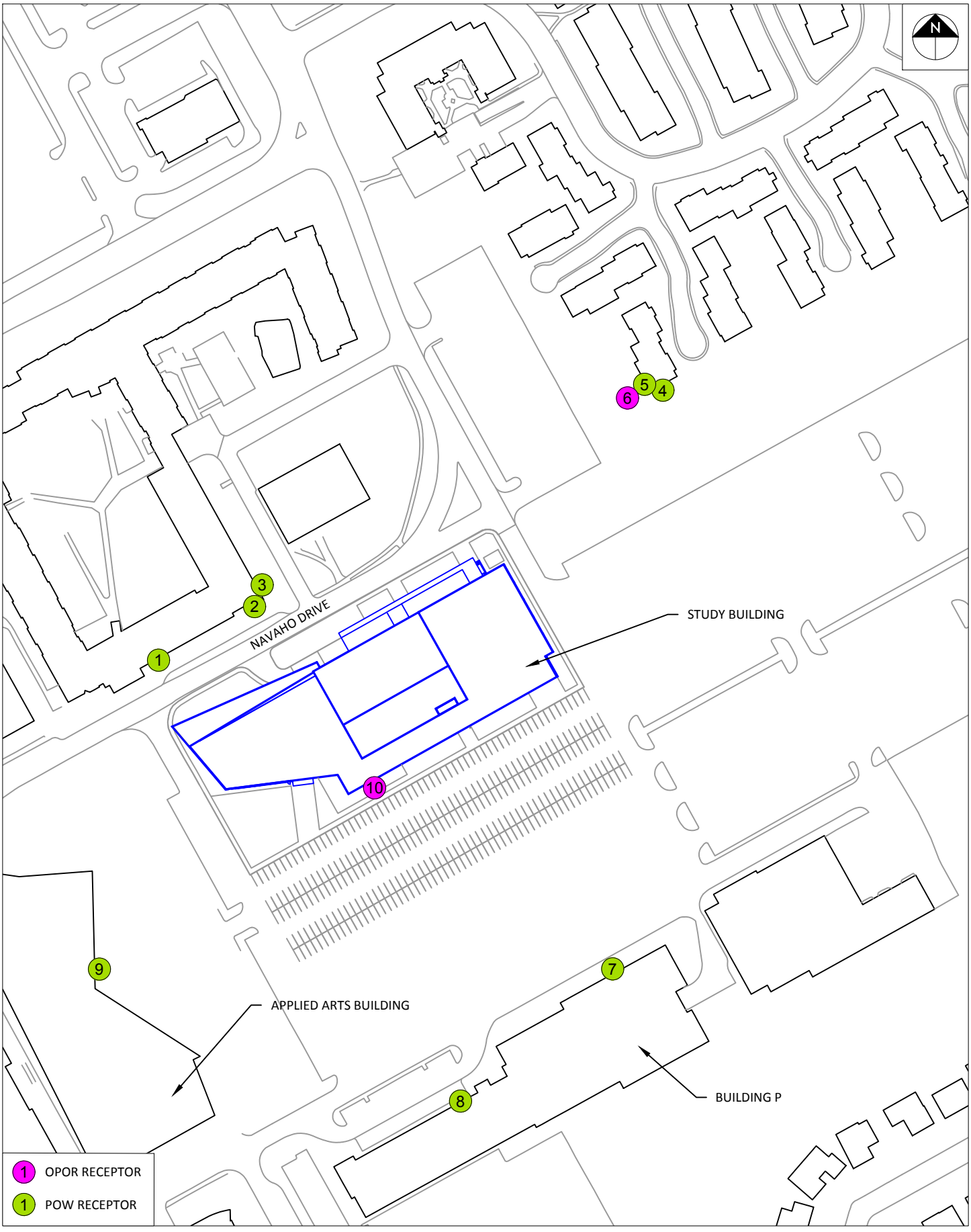
DESCRIPTION

FIGURE 2:
STATIONARY NOISE SOURCE LOCATIONS



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DATE	JUNE 24, 2019	DRAWN BY	G.G.

DESCRIPTION

FIGURE 3:
RECEPTOR LOCATIONS

APPENDIX A

PREDICTOR - LIMA SAMPLE OUTPUT

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Cross section for receiver R3 (Id=-13) and source Gen (Id=43506)

ItemType	Id	Distance	X	Y	Hgrnd	Height	GrndFact	Cluster
Receiver	R3	0	363155.6	5023752	86	13.5	0	
L(wr)	--	59	77	86	94	96	96	91
A(ground)	-3	-3	-3	-3	-3	-3	-3	-3
A(barrier)	0	0	0	0	0	0	0	0
A(veg)	0	0	0	0	0	0	0	0
A(sit)	0	0	0	0	0	0	0	0
A(bld)	0	0	0	0	0	0	0	0
A(air)	0	0.01	0.04	0.1	0.18	0.34	0.91	3.07
A(geo)	50.43	50.43	50.43	50.43	50.43	50.43	50.43	50.43
C(meteo)	0	0	0	0	0	0	0	0
L(p)	--	11.56	29.53	38.47	46.39	48.23	47.67	40.5

Cross section for receiver R3 (Id=-13) and source Gen [Reflection in facade SPLINE (Id=3)]

ItemType	Id	Distance	X	Y	Hgrnd	Height	GrndFact	Cluster
Receiver	R3	0	363155.6	5023752	86	13.5	0	
L(wr)	--	59	77	86	94	96	96	91
A(ground)	-3	-3	-3	-3	-3	-3	-3	-3
A(barrier)	7.8	7.83	7.89	8.01	8.23	8.65	9.37	10.54
A(veg)	0	0	0	0	0	0	0	0
A(sit)	0	0	0	0	0	0	0	0
A(bld)	0	0	0	0	0	0	0	0
A(air)	0	0.01	0.04	0.1	0.19	0.35	0.93	3.16
A(geo)	50.68	50.68	50.68	50.68	50.68	50.68	50.68	50.68
A(refl)	--	--	--	-0.97	-0.97	-0.97	-0.97	-0.97
C(meteo)	0	0	0	0	0	0	0	0
L(p)	--	--	--	29.24	36.94	38.35	37.05	28.65

Height	Source	Per	LAeq	32	63	125	250
13.5	Gen	1	53.37 --		11.56	29.53	38.96
13.5	Gen	2	--	--	--	--	--
13.5	Gen	3	--	--	--	--	--
13.5	Gen	4	--	--	--	--	--

Height	Per	LAeq	32	63	125	250	500
13.5	1	53.37 --		11.56	29.53	38.96	46.86
13.5	2	--	--	--	--	--	--
13.5	3	--	--	--	--	--	--
13.5	4	--	--	--	--	--	--

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