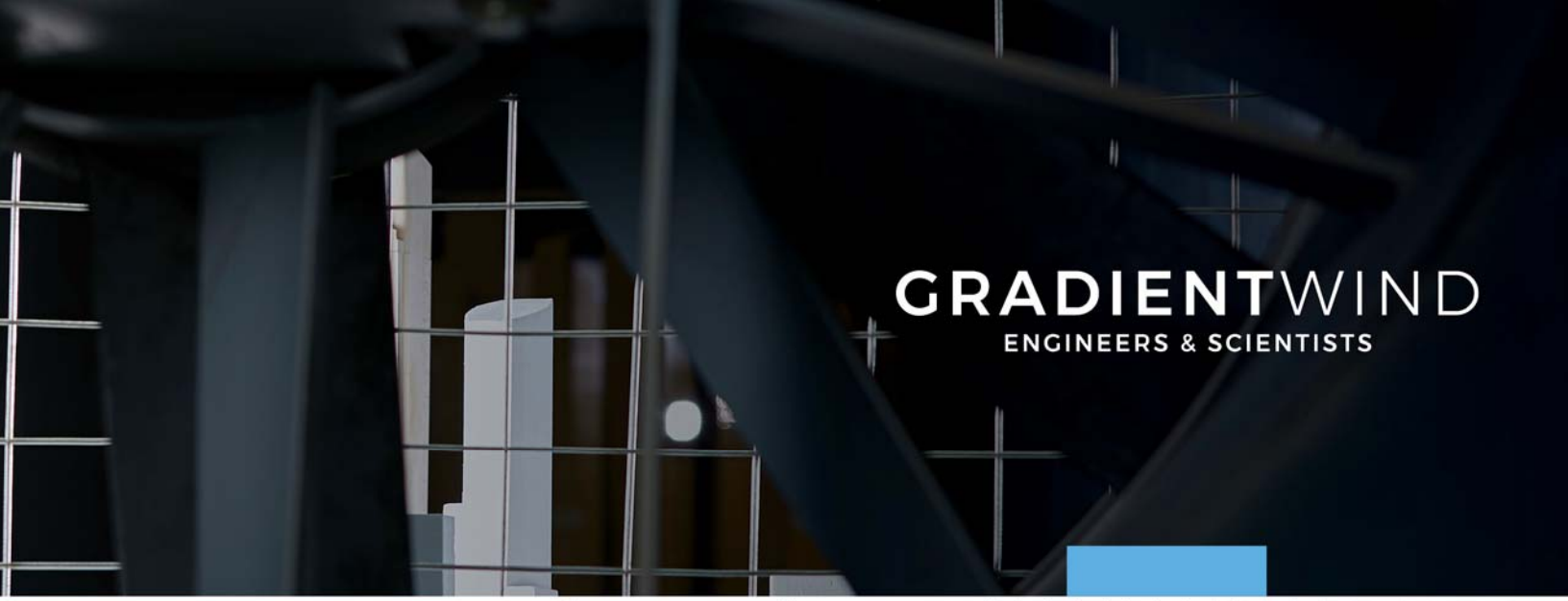
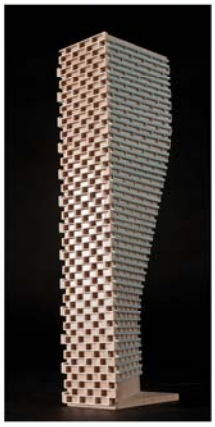


GRADIENTWIND
ENGINEERS & SCIENTISTS

ENVIRONMENTAL NOISE ASSESSMENT

Kinaxis Office Building
Kanata, Ontario

REPORT: GWE19-123 – Environmental Noise



July 9, 2019

PREPARED FOR

Taggart Realty Management
225 Metcalfe Street
Ottawa, ON
K2P 1P9

PREPARED BY

Giuseppe Garro. MASc., Junior Environmental Scientist
Joshua Foster, P.Eng., Principal

EXECUTIVE SUMMARY

This report describes an environmental noise assessment undertaken in support of site plan application for the proposed Kinaxis Office Building located in Kanata, Ontario, as part of the Kanata West Business Park development. The proposed office building is located at the intersection of Campeau Drive and Palladium Drive and will rise approximately twenty-five meters comprising five occupied storeys and a rooftop mechanical penthouse. The office building is sensitive to noise and is the subject of the transportation noise impact assessment. The primary sources of transportation noise are Campeau Drive, Palladium Drive and Highway 417. Furthermore, the nearby hotel and office/medical buildings are identified as noise sensitive receivers and are the subject of a stationary noise impact assessment arising from mechanical equipment serving the proposed building. The primary sources of stationary noise are the rooftop mechanical equipment such as the proposed cooling towers and Make-Up Air (MUA) units, as well as an emergency generator. Figure 1 illustrates a complete site plan with surrounding context.

The environmental noise assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP), and City of Ottawa requirements; (ii) noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG); (iii) future vehicular traffic volumes based on ENCG roadway classifications and theoretical capacities; (iv) architectural drawings prepared by McRobie Architects & Interior Designers, dated June 26, 2019; and (v) preliminary mechanical information received from McKee Engineering dated June 2019.

For road noise, results of the current analysis indicate that noise levels will range between 54 and 67 dBA during the daytime period (07:00-23:00) and between 47 and 59 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e. 67 dBA) occurs along the south and east façades which are nearest and most exposed to the intersection of Campeau Drive and Palladium Drive.

Minimum building construction in all areas is required to satisfy the Ontario Building Code (2012). For the south and east façades, the highest required STC rating for glazing elements, such as vision panels and spandrel panels, was found to be 25. Results of the calculations also indicate the development will require air conditioning (or similar mechanical system), which will maintain a comfortable working environment with inoperable windows. A Warning Clause will also be required to be placed on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

Results of the stationary noise analysis indicate that stationary noise levels from the development's mechanical equipment will fall below ENCG criteria during all hours of the day, given the assumptions specified in Section 4.3.2 and the minimum insertion loss requirements are adhered to. As such, the proposed development is expected to be compatible with the existing and future 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.

Furthermore, a landscaped area is proposed to the north of the building at grade which is not considered a noise sensitive space as per the ENCG. Nonetheless, to reduce sound levels over this area to reasonable levels, recommended insertion loss values are provided for the air handling intake louvers on the north façade of the mechanical penthouse.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Taggart Realty Management to undertake an environmental noise assessment in support of site plan application for the proposed Kinaxis Office Building located in Kanata, Ontario, as part of the Kanata West Business Park development. This report summarizes the methodology, results, and recommendations related to the assessment of exterior and interior noise levels generated by local transportation sources, as well as consideration of stationary impacts from proposed mechanical equipment onto the surrounding area.

Our work is based on theoretical noise calculation methods conforming to the Ministry of the Environment, Conservation and Parks (MECP)[1] guidelines, and City of Ottawa Environmental Noise Control Guidelines[2] (ENCG). Calculations were based on architectural drawings prepared by McRobie Architects & Interior Designers, dated June 26, 2019, preliminary mechanical information received from McKee Engineering dated June 2019, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications and theoretical capacities.

2. TERMS OF REFERENCE

The focus of this environmental noise assessment is the proposed Kinaxis Office Building located in Kanata, Ontario, as part of the Kanata West Business Park development. The proposed development is located at the northwest corner of the intersection of Campeau Drive and Palladium Drive and features a 150,000 square foot office building. The building will rise approximately twenty-five meters comprising five occupied storeys and a rooftop mechanical penthouse. Approximately 540 vehicle parking spaces occupy the area to the north of the building, while land designated for future developments is located toward the north, east, south and west. A landscaped area is proposed to the north of the building at grade; however, it is not considered a noise sensitive space as per the ENCG.

The primary sources of transportation noise are Campeau Drive, Palladium Drive and Highway 417. The primary sources of stationary noise are the rooftop mechanical equipment such as the proposed cooling

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

towers and Make-Up Air (MUA) units, as well as an emergency generator. Figure 1 illustrates a complete site plan with surrounding context.

3. OBJECTIVES

The principal objectives of this study are to (i) calculate the future noise levels on the noise sensitive study building (office) produced by local transportation sources, (ii) calculate future noise levels on surrounding noise sensitive properties produced by stationary noise sources associated with the development, and (iii) ensure that interior and exterior noise levels do not exceed the allowable limits specified by the ENCG as well as the, as outlined in Section 4.2 of this report.

4. METHODOLOGY

4.1 Background

Noise can be defined as any obtrusive sound. It is created at a source, transmitted through a medium, such as air, and intercepted by a receiver. Noise may be characterized in terms of the power of the source or the sound pressure at a specific distance. While the power of a source is characteristic of that particular source, the sound pressure depends on the location of the receiver and the path that the noise takes to reach the receiver. Measurement of noise is based on the decibel unit, dBA, which is a logarithmic ratio referenced to a standard noise level (2×10^{-5} Pascals). The 'A' suffix refers to a weighting scale, which better represents how the noise is perceived by the human ear. With this scale, a doubling of power results in a 3 dBA increase in measured noise levels and is just perceptible to most people. An increase of 10 dBA is often perceived to be twice as loud.

4.2 Transportation Noise

4.2.1 Criteria for Roadway Traffic Noise

For vehicle traffic, 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 that 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/office 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 50 dBA and 45 dBA for general and semi-private office spaces/conference rooms, respectively, as listed in Table 1. However, to account for deficiencies in building construction and control peak noise, these levels should be targeted toward 47 dBA and 42 dBA respectively.

TABLE 1: INDOOR SOUND LEVEL CRITERIA (ROAD)[3]

Type of Space	Time Period	L_{eq} (dBA)
		Road
General offices, reception areas, retail stores, etc.	07:00 – 23:00	50
Living/dining/den areas of residences, hospitals, schools, nursing/retirement homes, day-care centres, theatres, places of worship, libraries, **individual or semi-private offices, conference rooms**, etc.	07:00 – 23:00	45
Sleeping quarters of hotels/motels	23:00 – 07:00	45
Sleeping quarters of residences, hospitals, nursing/retirement homes, etc.	23:00 – 07:00	40

Predicted noise levels at the plane of window (POW) dictate the action required to achieve the recommended sound levels. An open window is considered to provide a 10 dBA reduction in noise while a standard closed window is capable of providing a minimum 20 dBA noise reduction[4]. 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 normally triggers the need for central air conditioning (or similar systems). Where noise levels exceed 65 dBA daytime and 60 dBA nighttime building components will require higher levels of sound attenuation[5].

4.2.2 Roadway Traffic Volumes

The ENCG dictates that noise calculations should consider future sound levels based on a roadway's classification at the mature state of development. Therefore, traffic volumes are based on the roadway

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

classifications outlined in the City of Ottawa's Official Plan (OP) and Transportation Master Plan[6] which provide additional details on future roadway expansions. Average Annual Daily Traffic (AADT) volumes are then based on data in Table B1 of the ENCG for each roadway classification. Table 2 (below) summarizes the AADT values used for each roadway included in this assessment.

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Campeau Drive	4-Lane Urban Arterial Divided (4-UAD)	60	**35,000**
Palladium Drive	4-Lane Urban Arterial Divided (4-UAD)	60	**35,000**
Highway 417	6-Lane Freeway	100	**109,998**

4.2.3 Theoretical Roadway Noise Predictions

Noise predictions were performed with the aid of the MECP computerized noise assessment program, STAMSON 5.04, for road analysis. Appendix A includes the STAMSON 5.04 input and output data.

Transportation noise calculations were performed by treating each roadway segment as separate line sources of noise. In addition to the traffic volumes summarized in Table 2, theoretical noise predictions were based on the following parameters:

(i) Truck traffic on all roadways was conservatively taken to comprise 5% heavy trucks and 7% medium trucks.
(ii) The day/night split for all streets was taken to be 92%/8%, respectively.
(iii) Ground surfaces were taken to be absorptive and reflective, based in intervening ground characteristics.
(iv) Topography was assumed to be a flat/gentle slope surrounding the study building.
(v) Receptor height was taken to be 16.95 m at the 5th floor Plane of Window (POW).
(vi) Noise receptors were strategically placed at 4 locations around the study area (see Figure 2).
(vii) Receptor distance and exposure angles are outlined in Figure 3-6.

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

4.3 Stationary Noise

4.3.1 Criteria for Stationary Noise

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 as previously mentioned in Section 4.2.1

Noise criteria taken from the ENCG 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"[7]. This applies to the plane of window and outdoor amenity spaces serving the development. 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 a suburban (Class 1) environment at a POR is either the lowest one-hour background noise level due to other sources, or the exclusionary limits outlined in Table 3, whichever is higher.

TABLE 3: EXCLUSIONARY LIMITS FOR CLASS 1 AREA

Time of Day	Class 1	
	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

4.3.2 Assumptions

Preliminary mechanical information for the development has been based on information provided by McKee Engineering, as well as Gradient Wind's experience with similar developments. 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:

[7] NPC – 300, page 14

(i) Sound data for the rooftop cooling towers, air handling units, and emergency generator has been provided by McKee Engineering.

(ii) The air handling units are assumed to operate continuously over a 1-hour period during the daytime and at 50% operation during the nighttime period. The cooling towers were assumed to operate continuously over a 1-hour period during the daytime and nighttime periods.

(iii) The generator will only be tested during the daytime hours (07:00-19:00).

(iv) The generator was modelled with a F231-2 Series acoustically rated enclosure.

(v) Screening effects of parapets have been conservatively excluded from the analysis.

(vi) The cooling towers are located on the 5th storey roof toward the north façade of the mechanical penthouse. Three air handling intake louvers are located along the north and south façades of the mechanical penthouse, as outlined in Figure 8.

(vii) The ground was modelled as being hard (reflective) ground, with the exclusion of the ground surface surrounding the emergency generator which was modelled as soft (absorptive) ground.

(viii) Nighttime sound levels at the Palladium Medical Centre are not considered as the building is not expected to be in operation during this period.

(ix) Recommended insertion loss values are presented in Table 6 for the air handling intake louvers on the north façade of the mechanical penthouse. This will reduce sound levels at the landscaped area along the north façade at grade to reasonable levels.

4.3.3 Determination of Noise Source Power Levels

Preliminary mechanical information for the development has been provided by McKee Engineering. Table 4 summarizes the unmitigated sound power used for each source in the analysis.

TABLE 4: EQUIPMENT SOUND POWER LEVELS, UNMITIGATED (dBA)

Source ID	Description	Height Above Grade (m)	Frequency (Hz)								
			63	125	250	500	1000	2000	4000	8000	Total
S1, S2	Cooling Tower	29.9	77	86	94	94	91	89	87	83	99
S3-S8	MUA	26.5	65	71	82	86	91	92	81	73	96
Gen	Emergency Generator	1.8	77	87	92	96	97	97	94	97	104

4.3.4 Stationary Source Noise Predictions

The impact of the surrounding stationary noise sources on the development 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 MECP as part of Environmental Compliance Approvals applications.

Five individual noise sensor locations were selected in the *Predictor-Lima* model to measure the noise impact at points of reception (POR) and plane of window (POW) during the daytime (07:00 – 19:00) and nighttime (19:00 – 07:00) periods (see Figure 7). POR locations included Outdoor Points of Reception (OPOR) for blocks designated for unknown, future developments and Plane of Windows (POW) of the proposed nearby noise sensitive buildings. All mechanical equipment was represented as point sources in the model, with the exclusion of the MUAs which were modelled as emitting façades. Air temperature, pressure and humidity were set to 10°C, 101.3 kPA and 70%, respectively. Ground absorption over the study area was determined based on topographical features (such as water, concrete, grassland, etc.). A coefficient of 0 was used for hard surfaces, such as concrete and paved areas, and 1 for soft surfaces, such as grass and vegetative areas. Existing and proposed buildings were added to the model to account for screening and reflection effects from building façades. Modelling data can be provided upon request.

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, concrete and masonry walls can achieve STC 50 or more. Curtainwall systems typically provide around STC 35, depending on the glazing elements. 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.

According to the ENCG, when daytime noise levels from road sources at the plane of the window exceed 65 dBA, calculations must be performed to evaluate the sound transmission quality of the building components to ensure acceptable indoor noise levels. The calculation procedure[8] considers:

- Window type and total area as a percentage of total room floor area
- Exterior wall type and total area as a percentage of the total room floor area
- Acoustic absorption characteristics of the room
- Outdoor noise source type and approach geometry
- Indoor sound level criteria, which varies according to the intended use of a space

Based on published research[9], exterior walls possess specific sound attenuation characteristics that are used as a basis for calculating the required STC ratings of windows in the same partition. Due to the limited information available at the time of the study, which was prepared for site plan approval, final detailed floor layouts and building elevations were unavailable and therefore detailed STC calculations could not be performed at this time. As a guideline, the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space (STC = outdoor noise level – targeted indoor noise levels).

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

5. RESULTS AND DISCUSSION

5.1 Transportation Noise Levels

The results of the roadway noise calculations are summarized in Table 5 below. A complete set of input and output data from all STAMSON 5.04 calculations are available in Appendix A.

TABLE 5: EXTERIOR NOISE LEVELS DUE TO TRANSPORTATION SOURCES

Receptor Number	Height Above Grade (m)	Receptor Location	Noise Level (dBA)	
			Day	Night
1	16.95	5th Floor – East Façade	67	59
2	16.95	5th Floor –South Façade	67	59
3	16.95	5th Floor –South Façade	66	59
4	16.95	5th Floor –West Façade	54	47

For road noise, results of the current analysis indicate that noise levels will range between 54 and 67 dBA during the daytime period (07:00-23:00) and between 47 and 59 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e. 67 dBA) occurs along the south and east façades which are nearest and most exposed to the intersection of Campeau Drive and Palladium Drive.

5.2 Noise Control Measures (Transportation Sources)

The noise levels predicted due to transportation sources exceed the criteria listed in the ENCG 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 = outdoor noise level – targeted indoor noise levels). For the south and east façades, the highest required STC rating for glazing elements, such as vision panels and spandrel panels, was found to be 25. Furthermore, minimum building construction in all areas is required to satisfy the Ontario Building Code (2012).

Results of the calculations also indicate the development will require air conditioning (or similar mechanical system), which will maintain a comfortable working environment with inoperable windows.

The use of central air conditioning is already being considered for the design given the building is designated for office use.

5.3 Stationary Noise Levels

Noise levels produced by the mechanical equipment are presented Table 7 while those due to the emergency generator are presented in Table 8. 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[10] (See NPC-300 C4.5.3). Noise levels at all outdoor points of reception and other plane of window receptors due to the stationary noise sources fall below ENCG criteria provided our assumptions for noise control in Section 4.3.2 and the minimum insertion loss requirements are adhered to. Acoustic mitigation methods such as acoustic louvers/silencers, water silencers, low noise fans, or screens can be applied to mechanical equipment in order to meet the minimum insertion loss requirements described in Table 6 below.

TABLE 6: INSERTION LOSS REQUIREMENTS

Source ID	Frequency (Hz)							
	63	125	250	500	1000	2000	4000	8000
Cooling Tower	-	5	5	8	8	5	-	-
Gen	-	-	-	3	4	5	-	-
MUA	-	-	13	15	19	21	10	-

* Recommended to reduce noise levels at the landscaped area at grade.

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

TABLE 7: NOISE LEVELS FROM HVAC SOURCES

Receptor Number	Height Above Grade (m)	Receptor Location	Noise Level (dBA)		Exclusionary Limits		Meets ENCG Class 1 Criteria	
			Day	Night	Day	Night	Day	Night
R1	4.5	POW – 8600 Campeau Drive	41	39	50	45	**Yes**	**Yes**
R2	10.5	POW – 8600 Campeau Drive	46	43	50	45	**Yes**	**Yes**
R3	1.5	POW – Palladium Medical Centre	44	N/A	50	N/A	**Yes**	**N/A**
R4	1.5	OPOR – Block 20	39	N/A	50	N/A	**Yes**	**N/A**
R5	1.5	OPOR – Block 29	44	N/A	50	N/A	**Yes**	**N/A**

N/A = sound levels during the nighttime are not considered as per ENCG

TABLE 8: NOISE LEVELS FROM EMERGENCY GENERATOR

Receptor Number	Height Above Grade (m)	Receptor Location	Noise Level (dBA)	Sound Level Limits	Meets ENCG Class 1 Criteria
			Day	Day	Day
R1	4.5	POW – 8600 Campeau Drive	55	55	**Yes**
R2	10.5	POW – 8600 Campeau Drive	54	55	**Yes**
R3	1.5	POW – Palladium Medical Centre	46	55	**Yes**
R4	1.5	OPOR – Block 20	24	55	**Yes**
R5	1.5	OPOR – Block 29	53	55	**Yes**

Noise contours along the building façades can be seen in Figures 9-14 for daytime and nighttime conditions at different elevations above grade. The main contributors of noise at these locations are the cooling towers situated on the rooftop.

6. CONCLUSIONS AND RECOMMENDATIONS

For road noise, results of the current analysis indicate that noise levels will range between 54 and 67 dBA during the daytime period (07:00-23:00) and between 47 and 59 dBA during the nighttime period (23:00-07:00). The highest noise level (i.e. 67 dBA) occurs along the south and east façades which are nearest and most exposed to the intersection of Campeau Drive and Palladium Drive.

Minimum building construction in all areas is required to satisfy the Ontario Building Code (2012). For the south and east façades, the highest required STC rating for glazing elements, such as vision panels and spandrel panels, was found to be 25. Results of the calculations also indicate the development will require air conditioning (or similar mechanical system), which will maintain a comfortable working environment with inoperable windows. A Warning Clause will also be required to be placed on all Lease, Purchase and Sale Agreements, as summarized below:

> *"Purchasers/tenants are advised that sound levels due to increasing road traffic will interfere with indoor activities as the sound levels exceed the sound level limits of the City and the Ministry of the Environment, Conservation and Parks.*
>
> *To help address the need for sound attenuation this development includes:*
>
> - *Multi-pane commercial curtain wall system*
>
> *To ensure that provincial sound level limits are not exceeded it is important to maintain these sound attenuation features.*
>
> *This office building has been supplied with a central air conditioning system and other measures which will maintain a comfortable working environment with inoperable windows, while ensuring that the indoor sound levels are within the sound level limits of the City and the Ministry of the Environment, Conservation and Parks."*

Results of the stationary noise analysis indicate that stationary noise levels from the development's mechanical equipment will fall below ENCG criteria during all hours of the day, given the assumptions specified in Section 4.3.2 and the minimum insertion loss requirements are adhered to. As such, the proposed development is expected to be compatible with the existing and future 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.

Furthermore, a landscaped area is proposed to the north of the building at grade which is not considered a noise sensitive space as per the ENCG. Nonetheless, to reduce sound levels over this area to reasonable levels, recommended insertion loss values are provided for the air handling intake louvers on the north façade of the mechanical penthouse.

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.

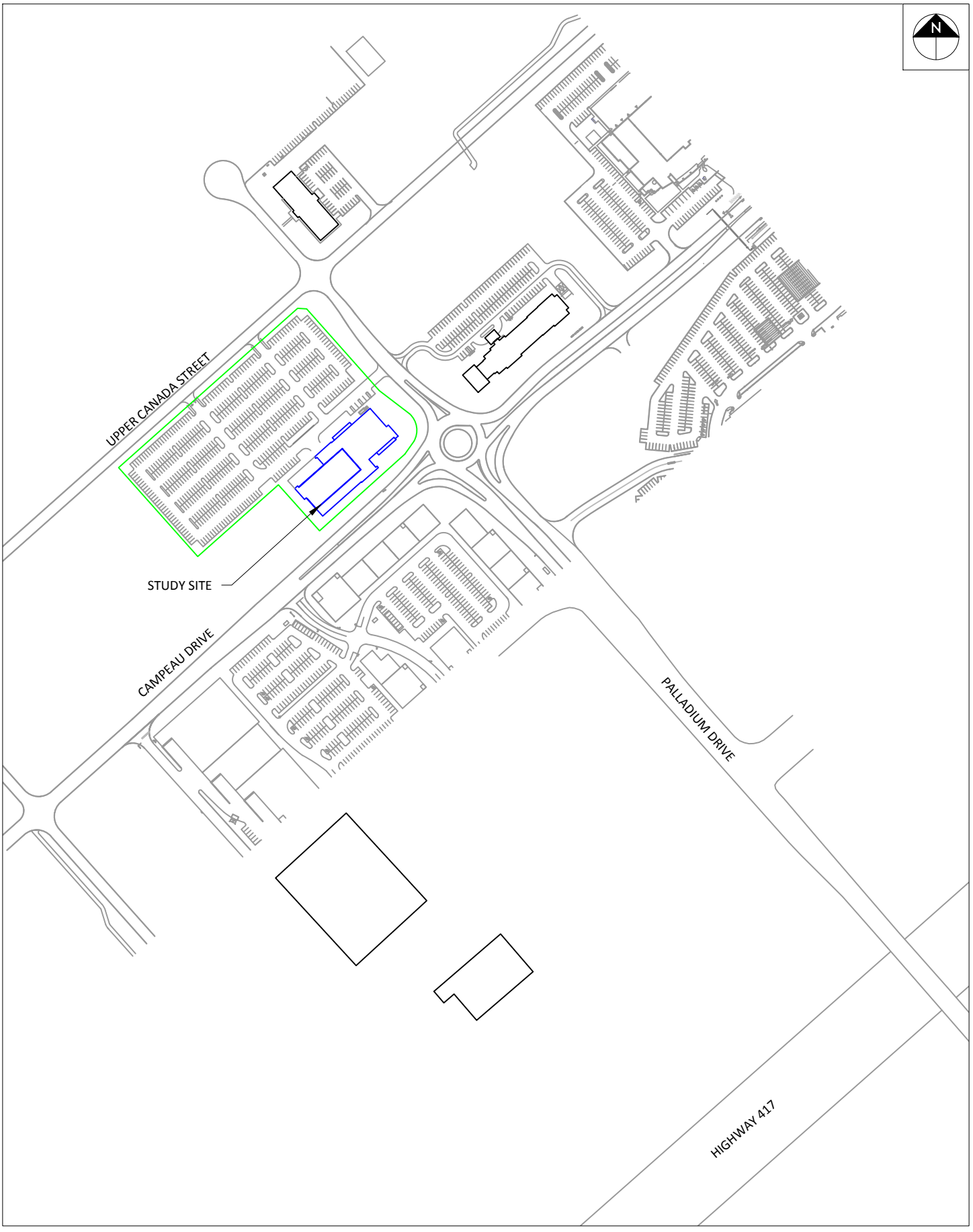
Sincerely,

Gradient Wind Engineering Inc.

Giuseppe Garro, MASc.
Junior Environmental Scientist

Joshua Foster, P.Eng.
Principal

Gradient Wind File #19-123 – Environmental Noise



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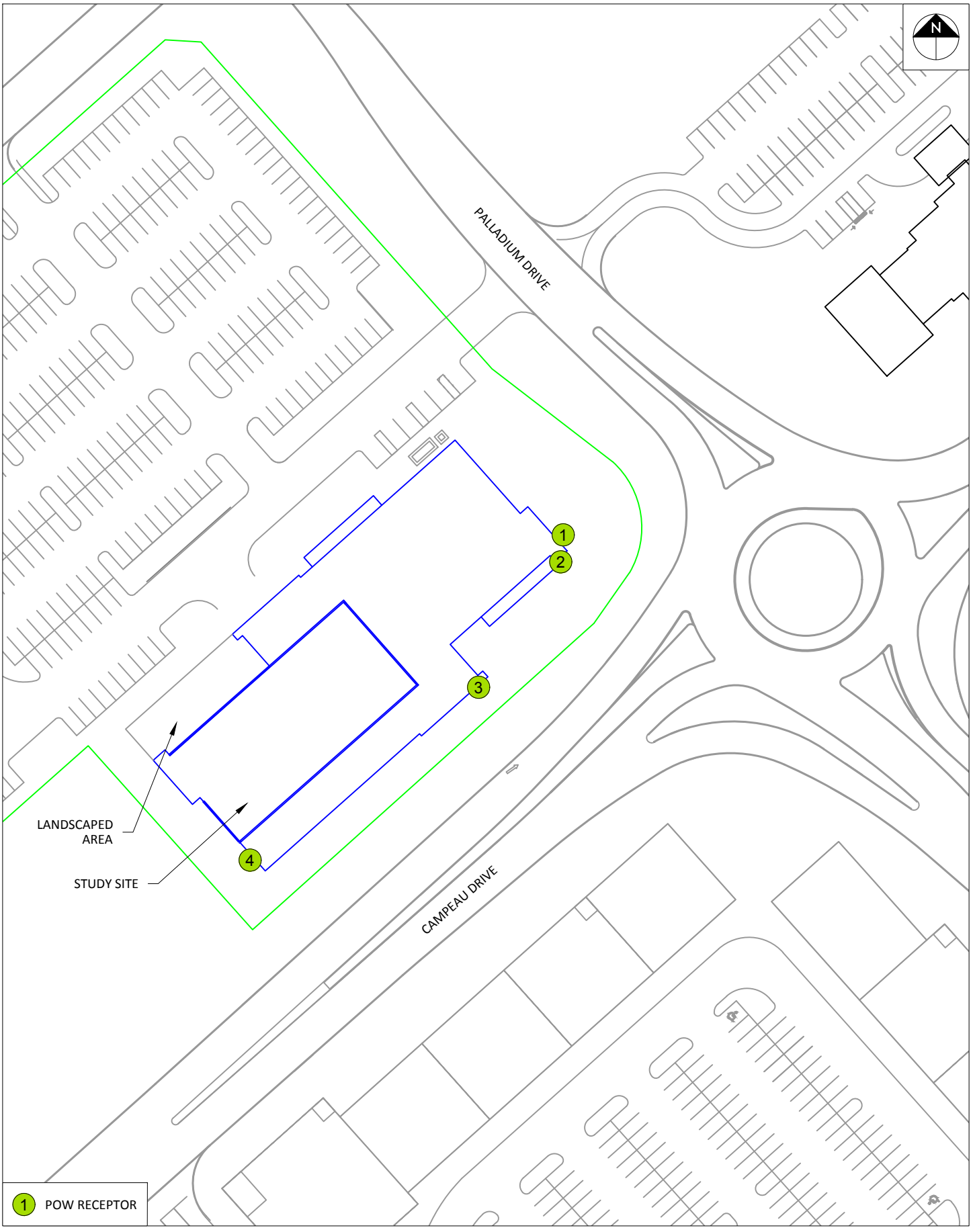
PROJECT	KINAXIS OFFICE BUILDING, OTTAWA ENVIRONMENTAL NOISE ANALYSIS		DESCRIPTION
SCALE	1:4000 (APPROX.)	DRAWING NO. GWE19-123-1	FIGURE 1: SITE PLAN AND SURROUNDING CONTEXT
DATE	JULY 3, 2019	DRAWN BY G.G.	



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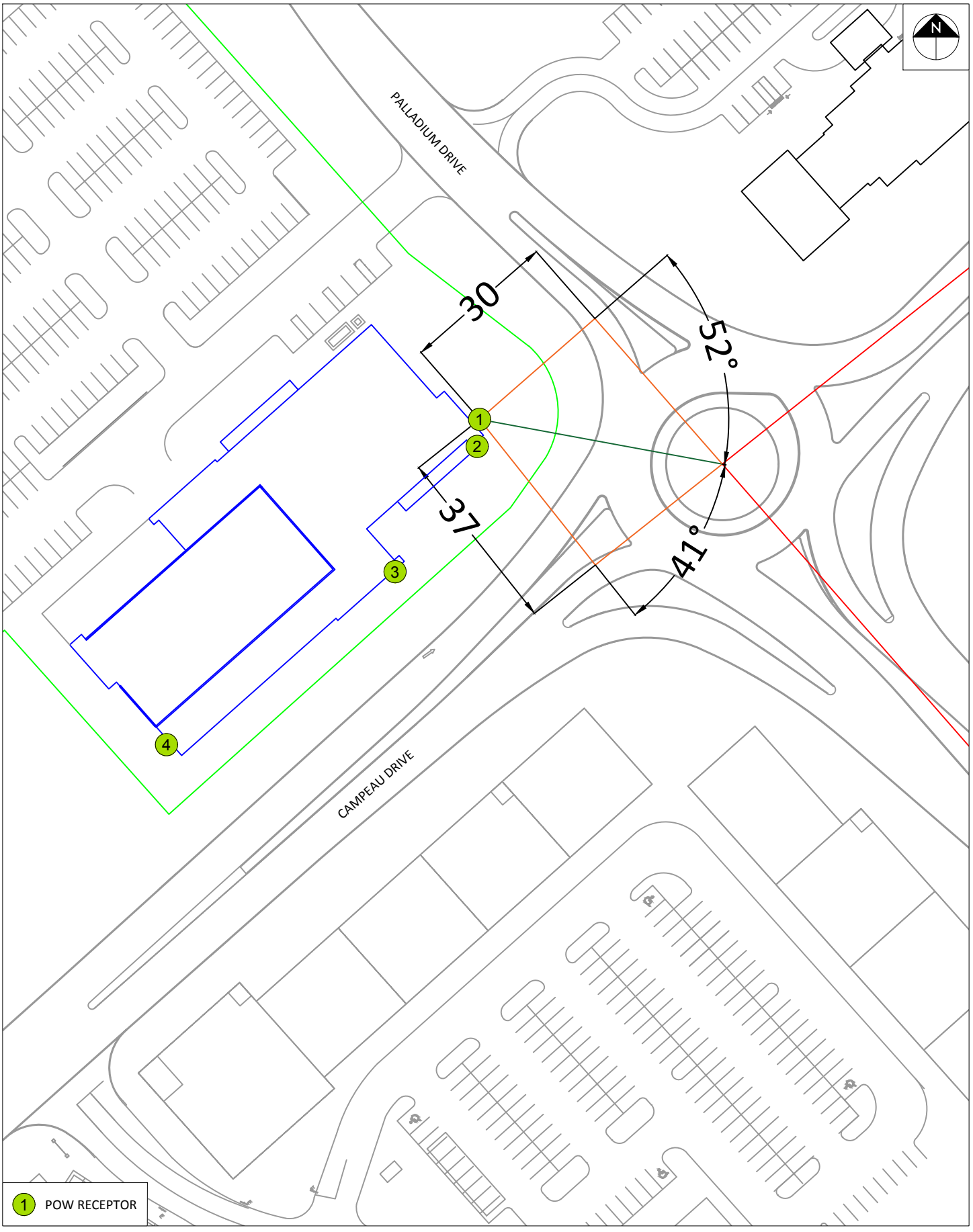
PROJECT	KINAXIS OFFICE BUILDING, OTTAWA ENVIRONMENTAL NOISE ANALYSIS		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GWE19-123-2
DATE	JULY 3, 2019	DRAWN BY	G.G.

FIGURE 2:
TRAFFIC NOISE RECEPTOR LOCATIONS



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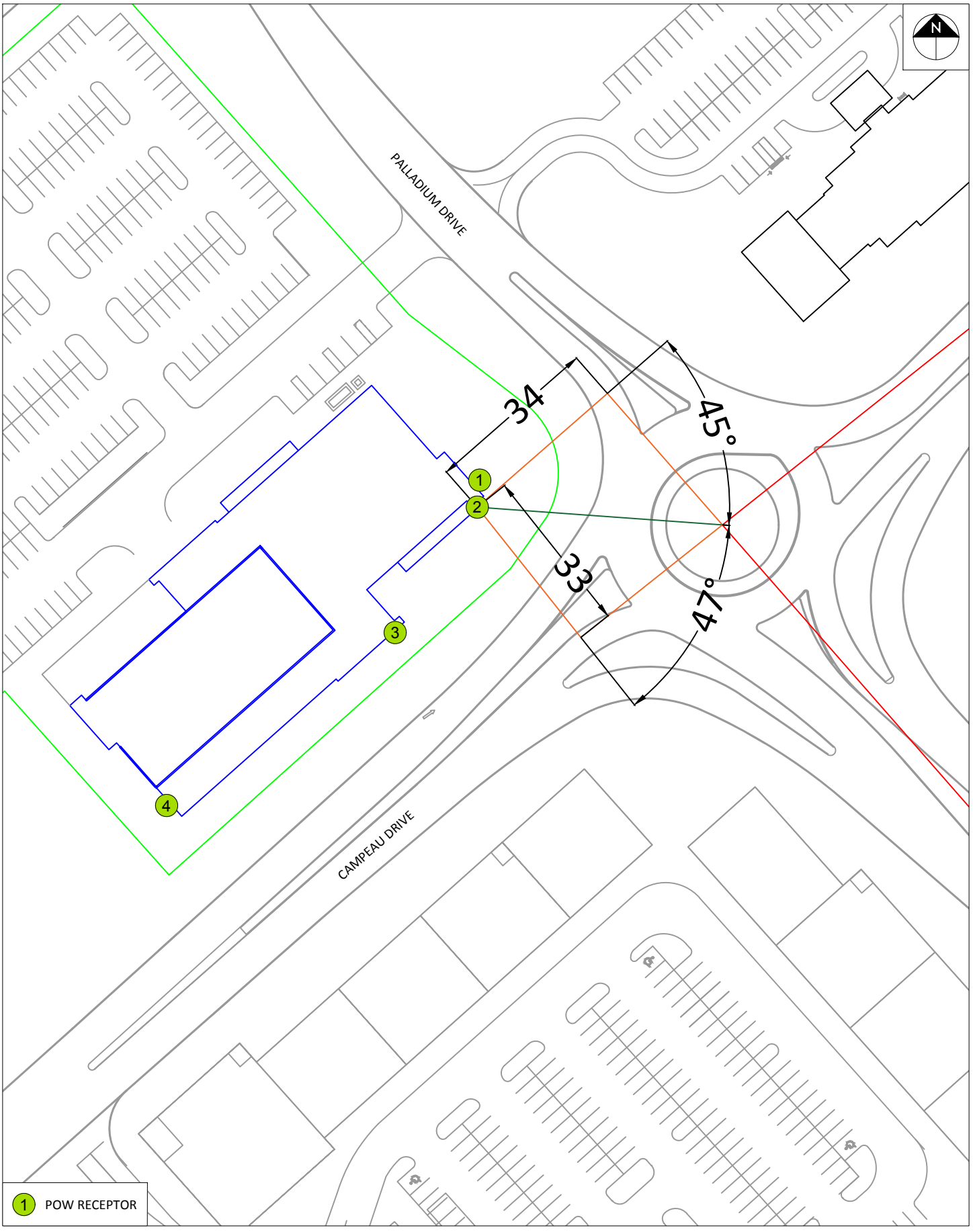
PROJECT	KINAXIS OFFICE BUILDING, OTTAWA ENVIRONMENTAL NOISE ANALYSIS
SCALE	1:1000 (APPROX.)
DRAWING NO.	GWE19-123-3
DATE	JULY 3, 2019
DRAWN BY	G.G.

DESCRIPTION

FIGURE 3:
STAMSON INPUT PARAMETERS - RECEPTOR 1



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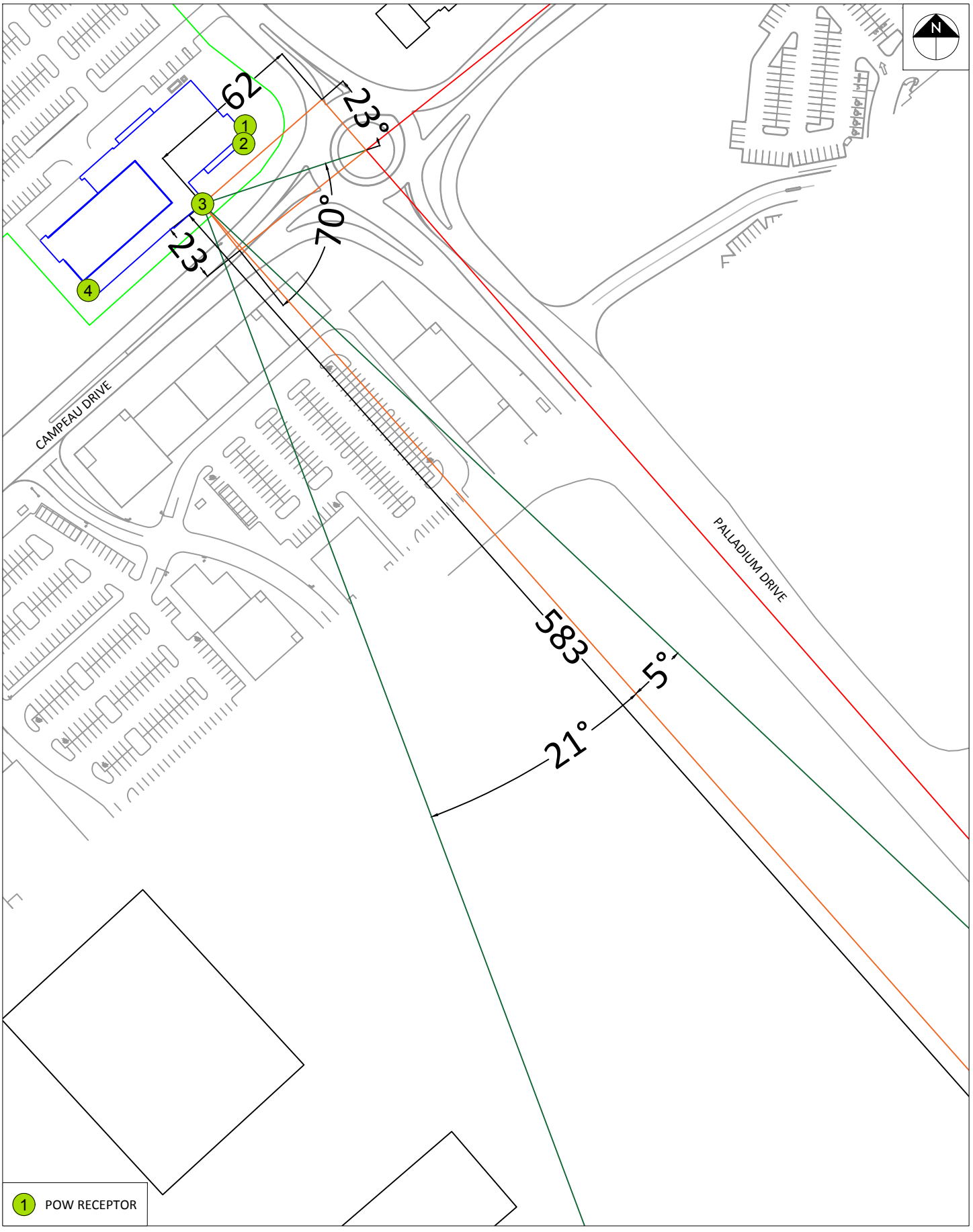
PROJECT	KINAXIS OFFICE BUILDING, OTTAWA ENVIRONMENTAL NOISE ANALYSIS		DESCRIPTION
SCALE	1:4000 (APPROX.)	DRAWING NO. GWE19-123-4	FIGURE 4: STAMSON INPUT PARAMETERS - RECEPTOR 2
DATE	JULY 3, 2019	DRAWN BY G.G.	



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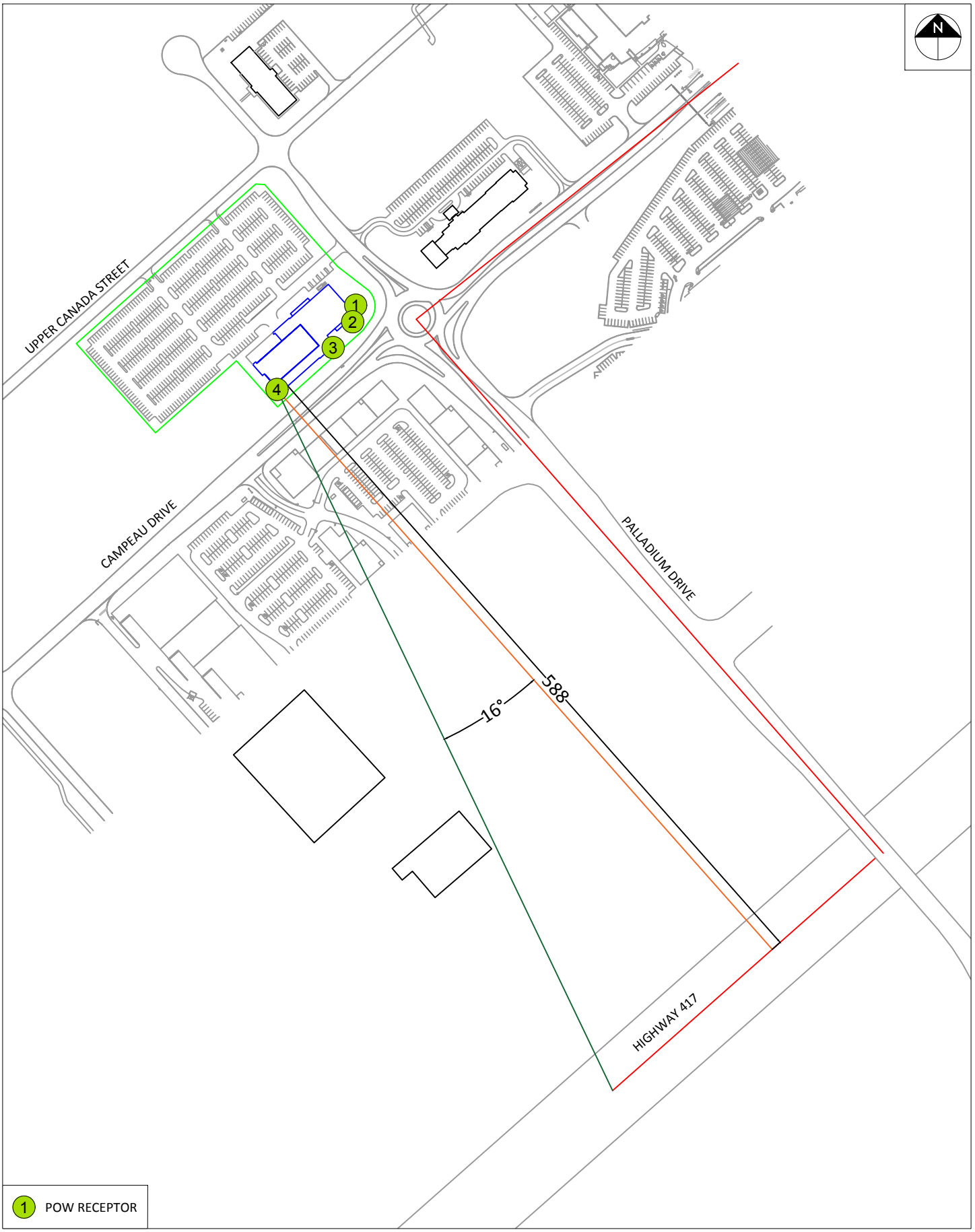
PROJECT	KINAXIS OFFICE BUILDING, OTTAWA ENVIRONMENTAL NOISE ANALYSIS		
SCALE	1:2000 (APPROX.)	DRAWING NO.	GWE19-123-5
DATE	JULY 3, 2019	DRAWN BY	G.G.

DESCRIPTION

FIGURE 5:
STAMSON INPUT PARAMETERS - RECEPTOR 3



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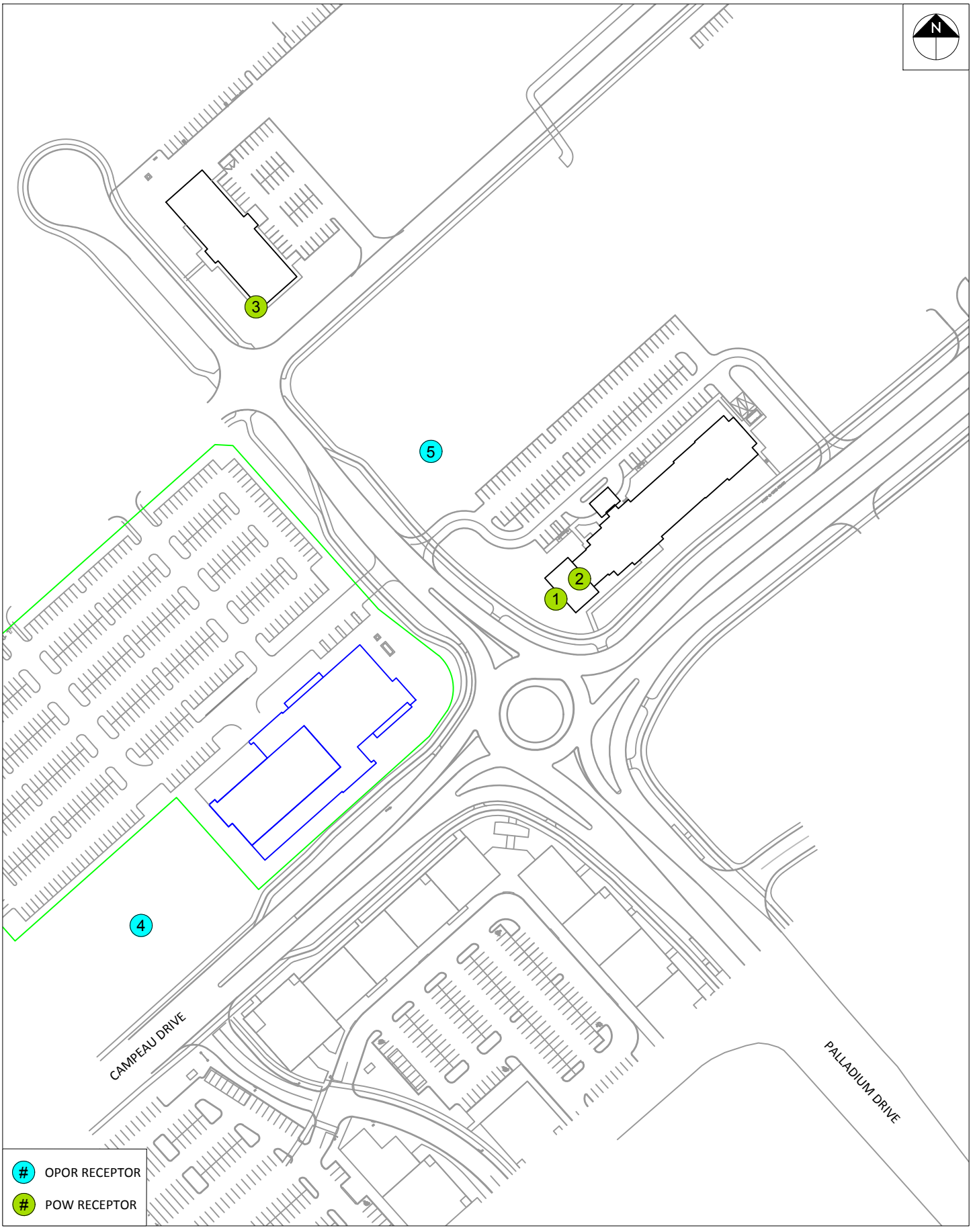
PROJECT	KINAXIS OFFICE BUILDING, OTTAWA ENVIRONMENTAL NOISE ANALYSIS		DESCRIPTION
SCALE	1:4000 (APPROX.)	DRAWING NO.	GWE19-123-6
DATE	JULY 3, 2019	DRAWN BY	G.G.

FIGURE 6:
STAMSON INPUT PARAMETERS - RECEPTOR 4



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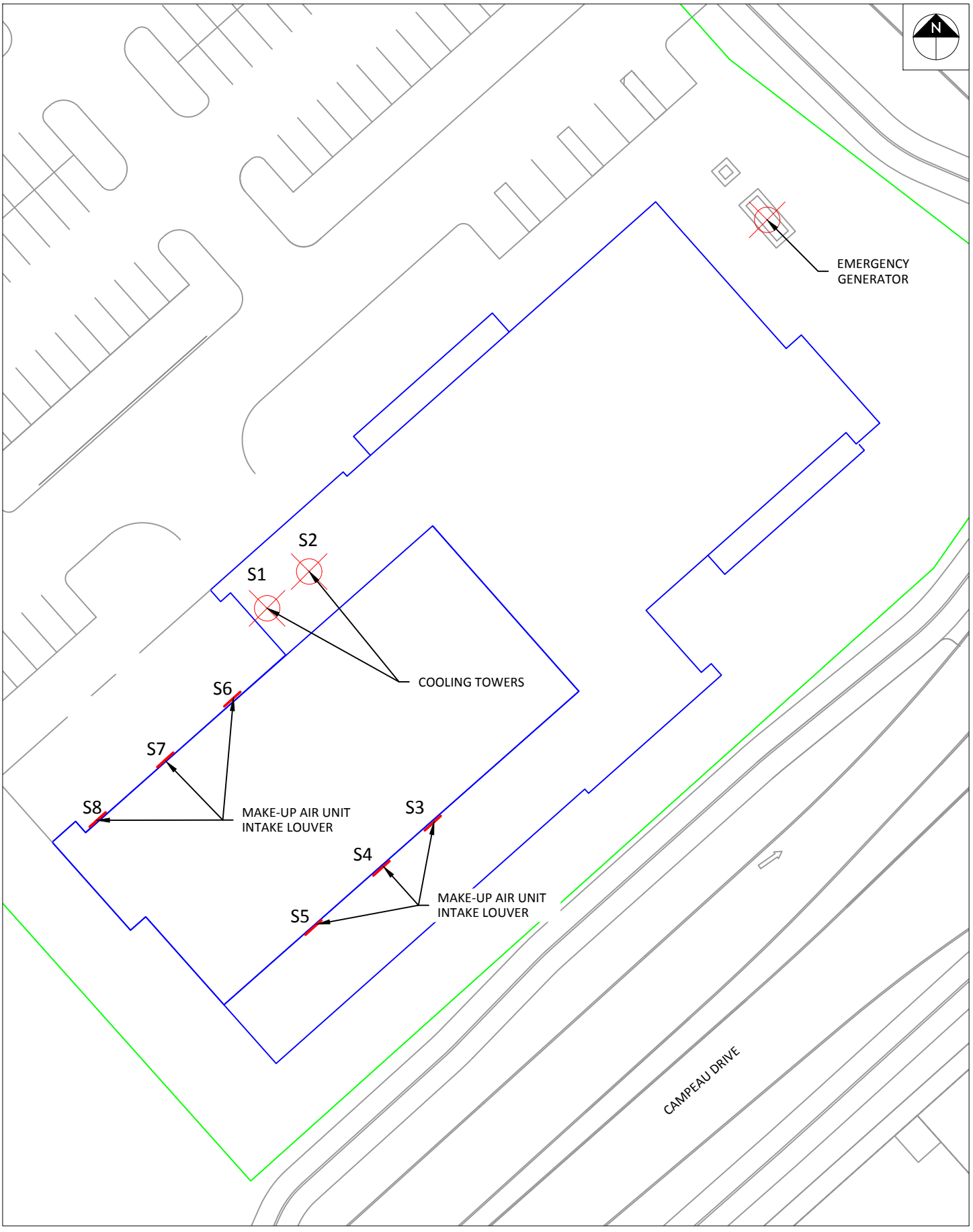
PROJECT	KINAXIS OFFICE BUILDING, OTTAWA ENVIRONMENTAL NOISE ANALYSIS
SCALE	1:2000 (APPROX.)
DRAWING NO.	GWE19-123-7
DATE	JULY 3, 2019
DRAWN BY	G.G.

DESCRIPTION

FIGURE 7:
STATIONARY NOISE RECEPTOR LOCATIONS



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PROJECT	KINAXIS OFFICE BUILDING, OTTAWA ENVIRONMENTAL NOISE ANALYSIS		DESCRIPTION
SCALE	1:500 (APPROX.)	DRAWING NO.	GWE19-123-8
DATE	JULY 3, 2019	DRAWN BY	G.G.

FIGURE 8:
STATIONARY NOISE SOURCE LOCATIONS

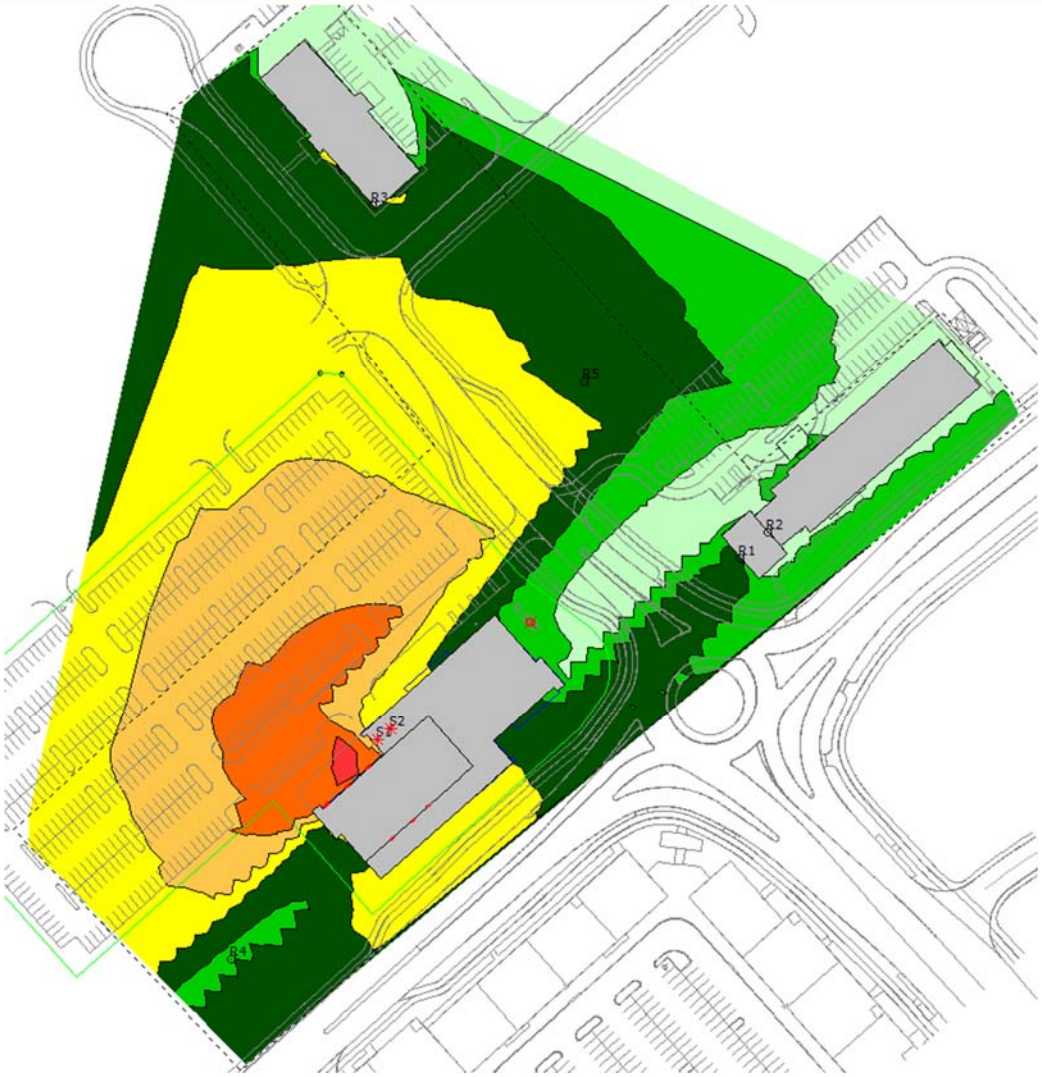


FIGURE 9: STATIONARY NOISE CONTOURS 1.5 METERS ABOVE GRADE (DAYTIME PERIOD)

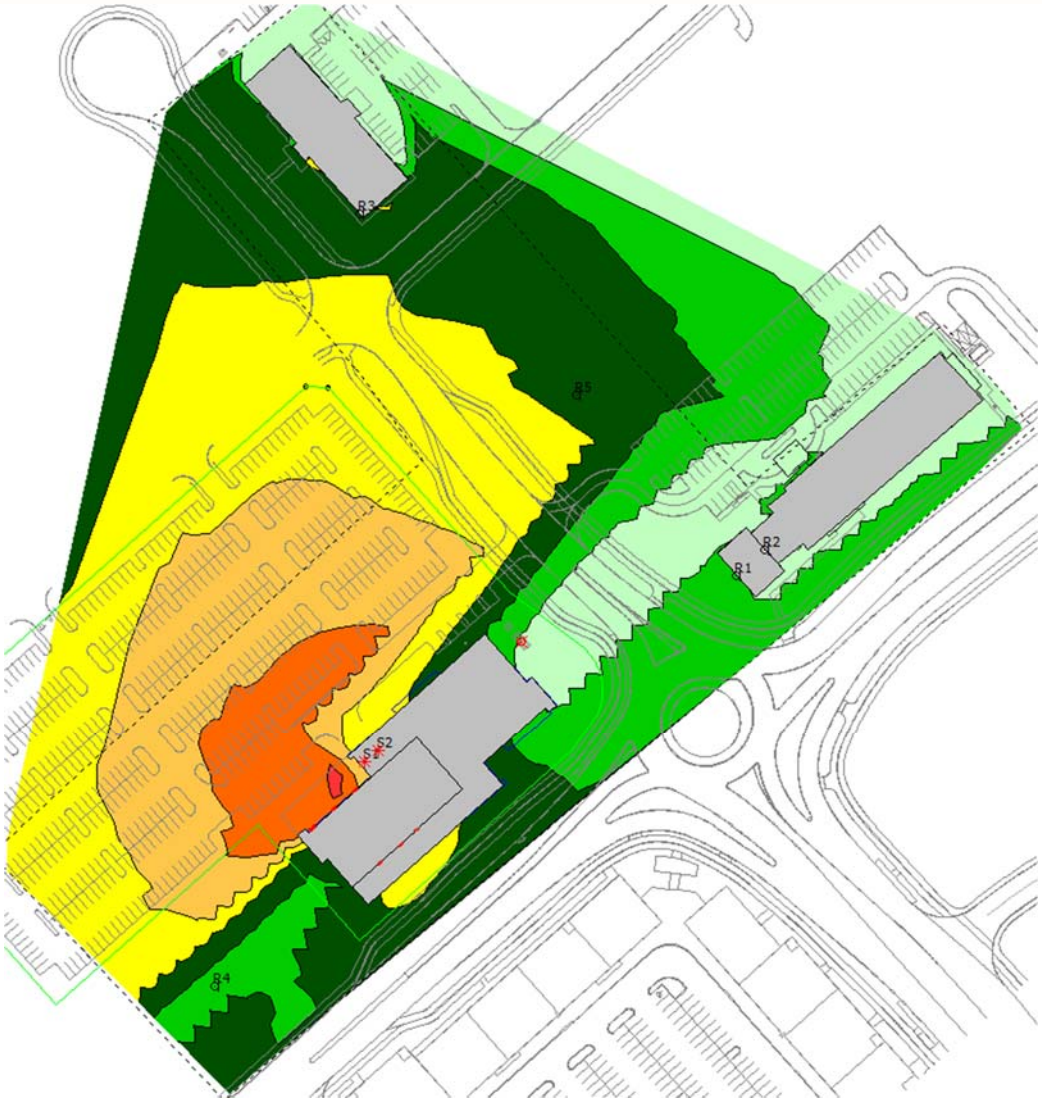


FIGURE 10: STATIONARY NOISE CONTOURS 1.5 METERS ABOVE GRADE (NIGHTTIME PERIOD)

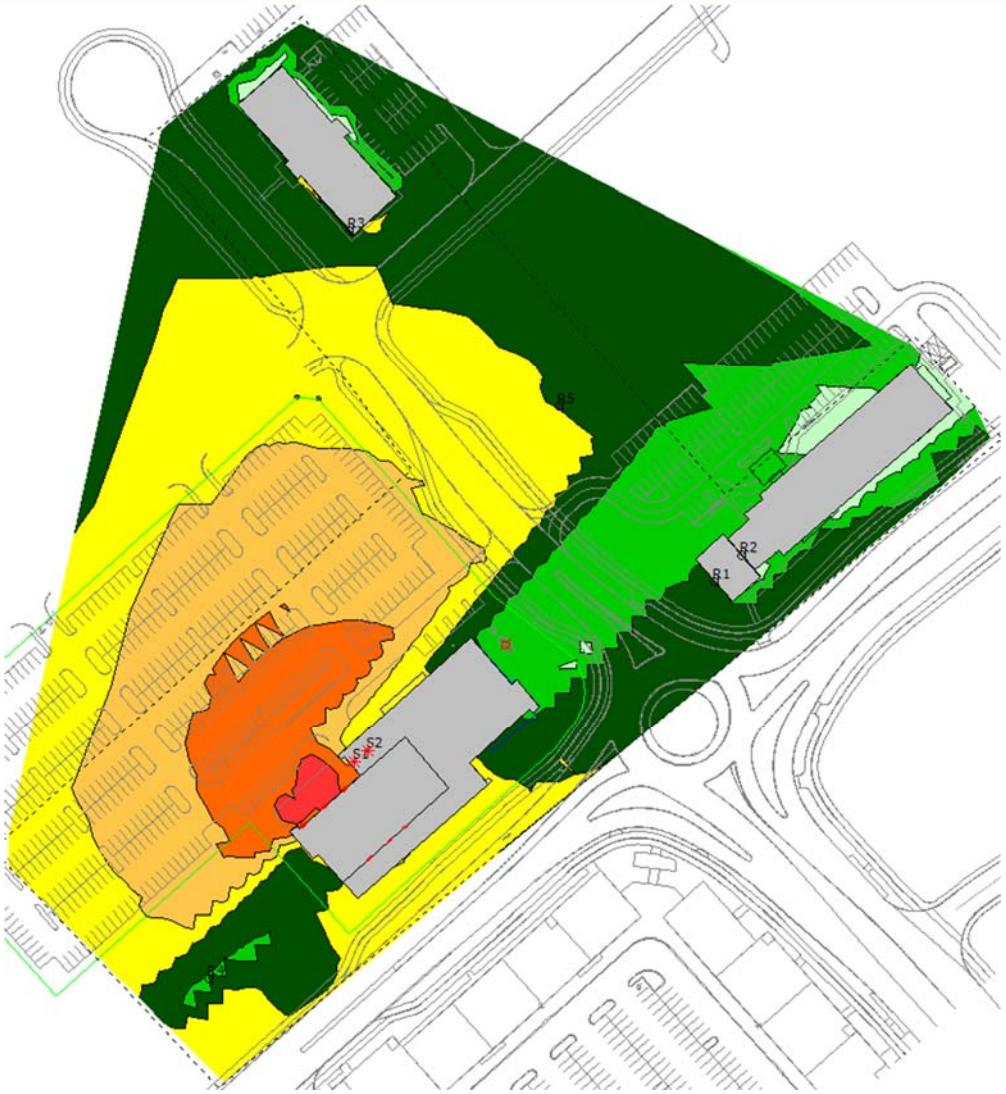


FIGURE 11: STATIONARY NOISE CONTOURS 4.5 METERS ABOVE GRADE (DAYTIME PERIOD)

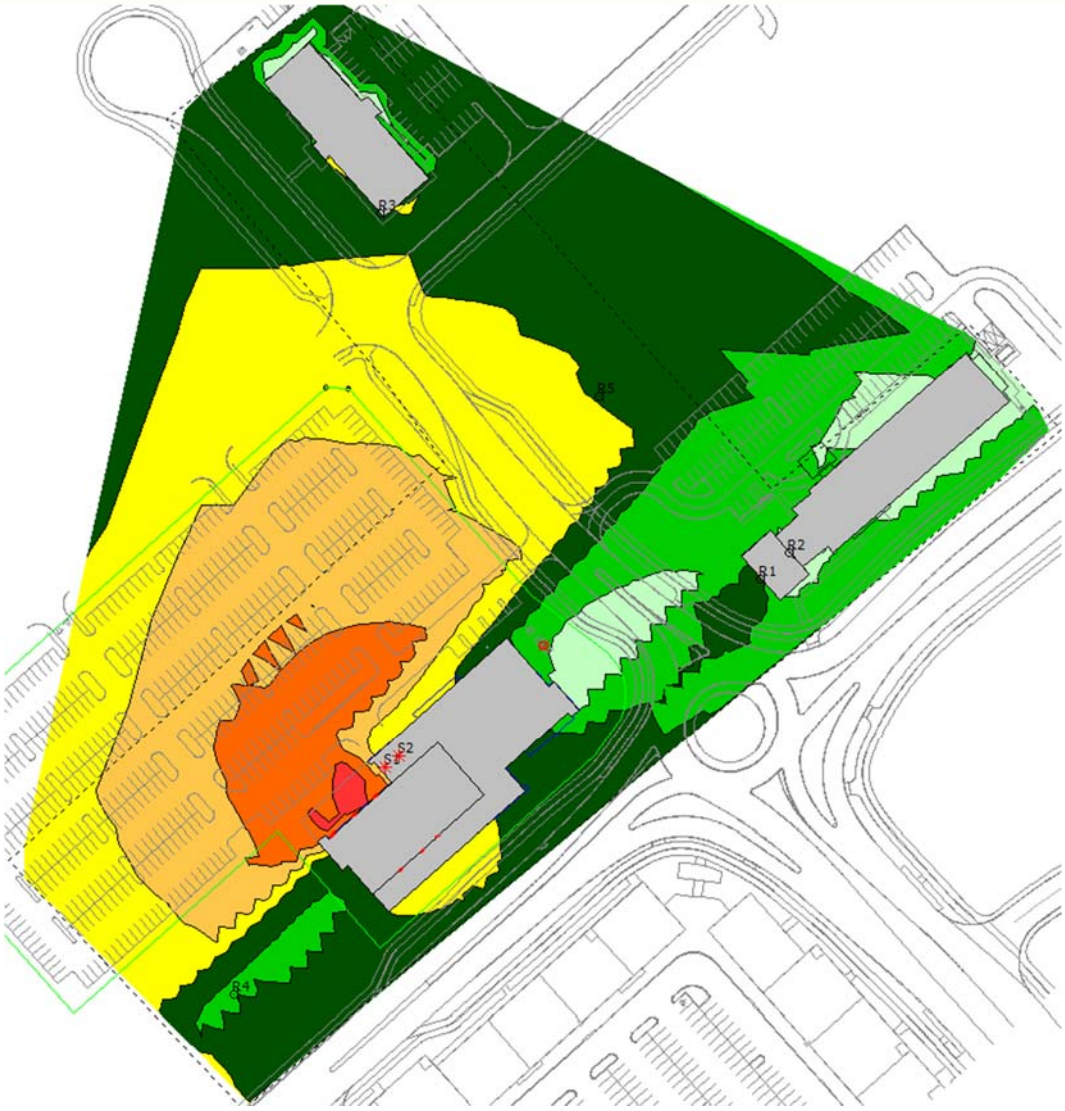
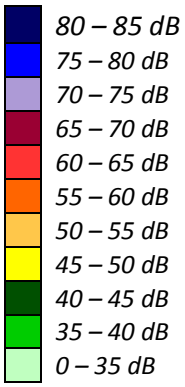


FIGURE 12: STATIONARY NOISE CONTOURS 4.5 METERS ABOVE GRADE (NIGHTTIME PERIOD)



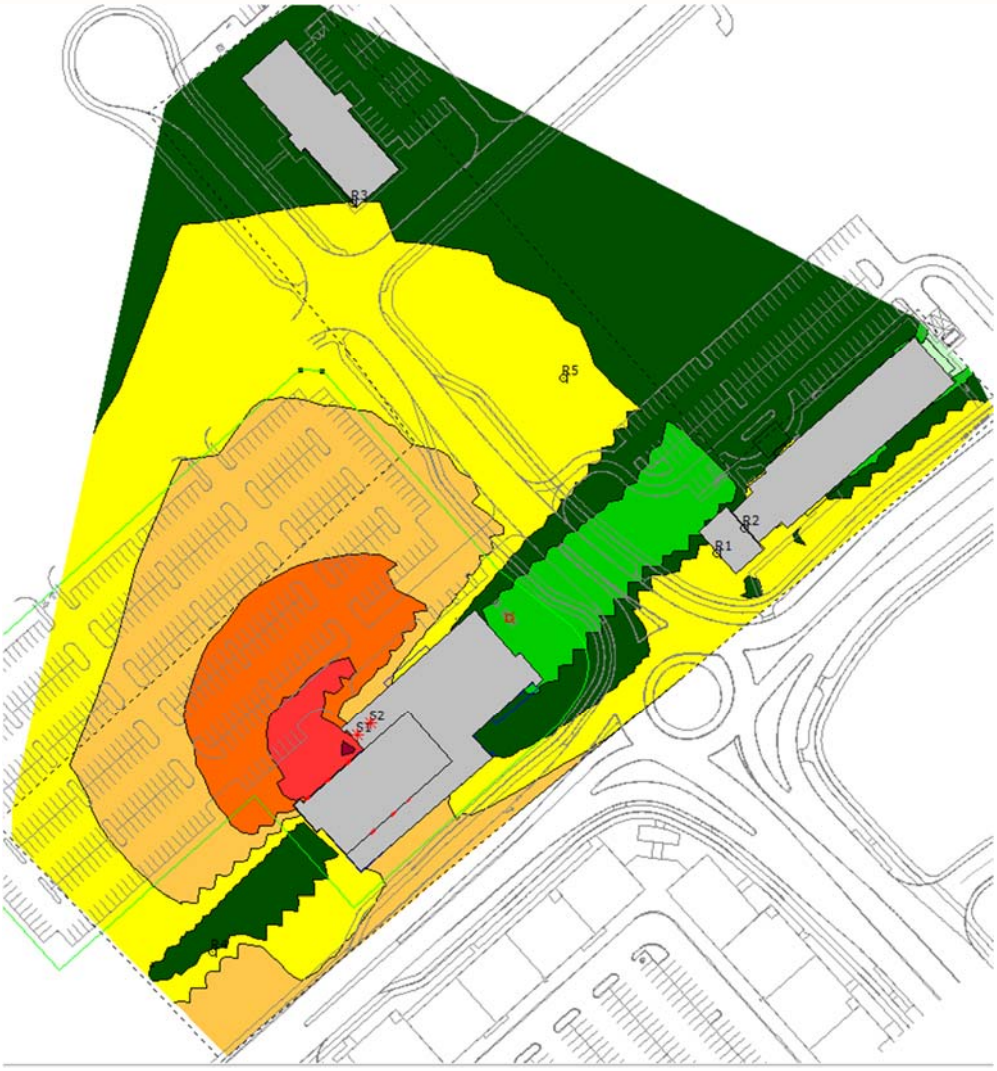


FIGURE 13: STATIONARY NOISE CONTOURS 10.5 METERS ABOVE GRADE (DAYTIME PERIOD)

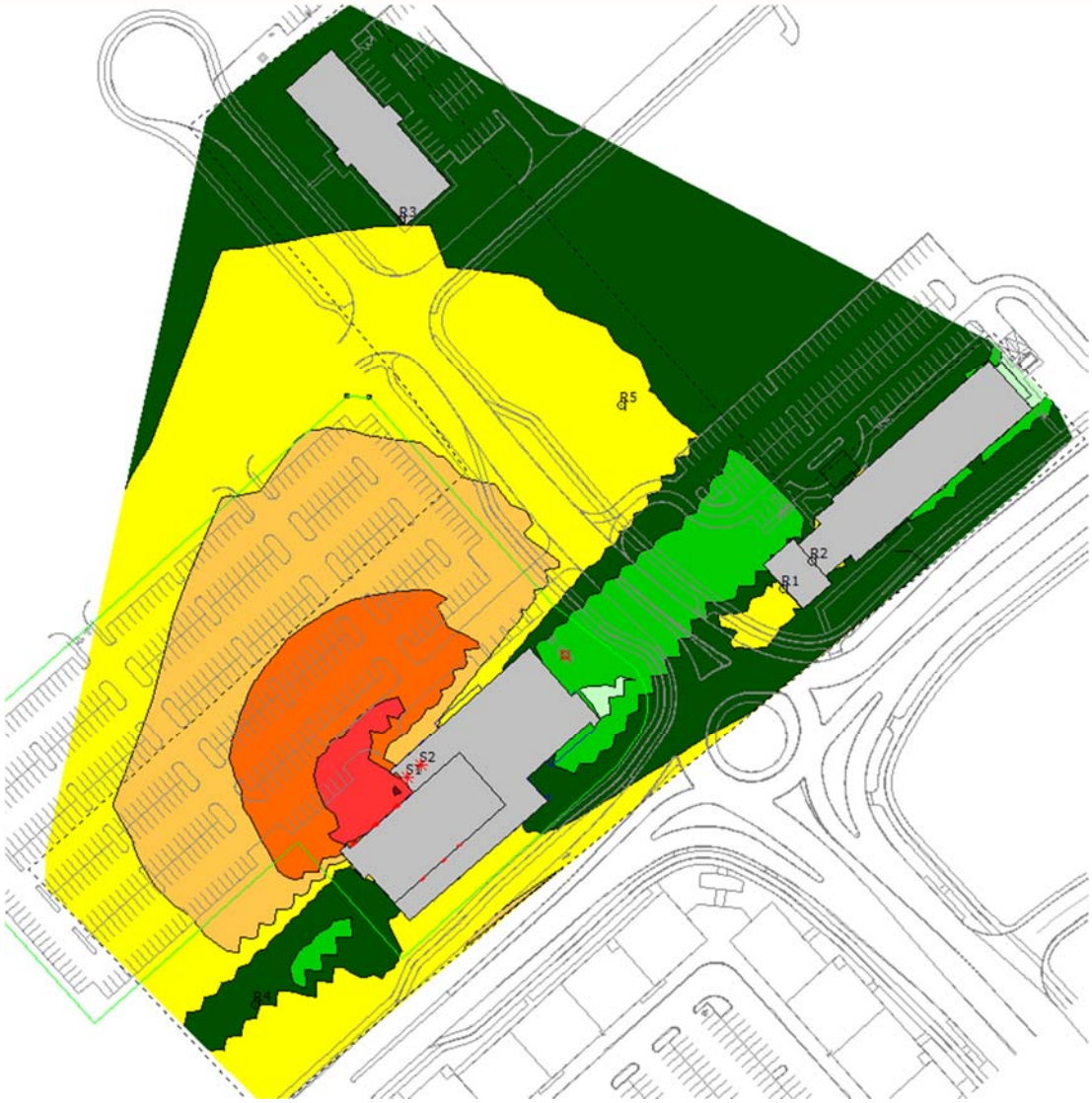


FIGURE 14: STATIONARY NOISE CONTOURS 10.5 METERS ABOVE GRADE (NIGHTTIME PERIOD)

APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

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```
STAMSON 5.0        NORMAL REPORT        Date: 02-07-2019 14:48:15
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Camp Dr (day/night)
-------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Camp Dr (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   -41.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  37.00 / 37.00  m
Receiver height           :  16.95 / 16.95  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Pall Dr (day/night)
----------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Pall Dr (day/night)
----------------------------------------
Angle1   Angle2           :  52.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  30.00 / 30.00  m
Receiver height           :  16.95 / 16.95  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Results segment # 1: Camp Dr (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 64.10 + 0.00) = 64.10 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90    -41   0.00  73.68   0.00  -3.92  -5.65   0.00   0.00   0.00
64.10
-------------------------------------------------------------------------------
--

Segment Leq : 64.10 dBA
```

```
Results segment # 2: Pall Dr (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 63.91 + 0.00) = 63.91 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    52     90   0.00  73.68   0.00  -3.01  -6.75   0.00   0.00   0.00
63.91
-------------------------------------------------------------------------
--

Segment Leq : 63.91 dBA

Total Leq All Segments: 67.02 dBA


Results segment # 1: Camp Dr (night)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.51 + 0.00) = 56.51 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -41   0.00  66.08   0.00  -3.92  -5.65   0.00   0.00   0.00
56.51
-------------------------------------------------------------------------
--

Segment Leq : 56.51 dBA
```

```
Results segment # 2: Pall Dr (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.31 + 0.00) = 56.31 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    52     90   0.00  66.08   0.00  -3.01  -6.75   0.00   0.00   0.00
56.31
-------------------------------------------------------------------------
--

Segment Leq : 56.31 dBA

Total Leq All Segments: 59.42 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 67.02
                           (NIGHT): 59.42
```

```
STAMSON 5.0        NORMAL REPORT        Date: 02-07-2019 14:48:24
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r2.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: Camp Dr (day/night)
-------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Camp Dr (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   -47.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  33.00 / 33.00  m
Receiver height           :  16.95 / 16.95  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Pall Dr (day/night)
-------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Pall Dr (day/night)
-----------------------------------------
Angle1   Angle2           :  45.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  34.00 / 34.00  m
Receiver height           :  16.95 / 16.95  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Results segment # 1: Camp Dr (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 64.03 + 0.00) = 64.03 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90    -47   0.00  73.68   0.00  -3.42  -6.22   0.00   0.00   0.00
64.03
-------------------------------------------------------------------------------
--

Segment Leq : 64.03 dBA
```

```
Results segment # 2: Pall Dr (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 64.10 + 0.00) = 64.10 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    45     90   0.00  73.68   0.00  -3.55  -6.02   0.00   0.00   0.00
64.10
-------------------------------------------------------------------------
--

Segment Leq : 64.10 dBA

Total Leq All Segments: 67.08 dBA


Results segment # 1: Camp Dr (night)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.44 + 0.00) = 56.44 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -47   0.00  66.08   0.00  -3.42  -6.22   0.00   0.00   0.00
56.44
-------------------------------------------------------------------------
--

Segment Leq : 56.44 dBA
```

```
Results segment # 2: Pall Dr (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.50 + 0.00) = 56.50 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    45     90   0.00  66.08   0.00  -3.55  -6.02   0.00   0.00   0.00
56.50
-------------------------------------------------------------------------
--

Segment Leq : 56.50 dBA

Total Leq All Segments: 59.48 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 67.08
                           (NIGHT): 59.48
```

```
STAMSON 5.0        NORMAL REPORT        Date: 02-07-2019 14:48:33
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Camp Dr (day/night)
-------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Camp Dr (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   -70.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  23.00 / 23.00  m
Receiver height           :  16.95 / 16.95  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Pall Dr (day/night)
------------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT):  35000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Pall Dr (day/night)
-----------------------------------------
Angle1   Angle2           :  23.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  62.00 / 62.00  m
Receiver height           :  16.95 / 16.95  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 3: HWY 417 (day/night)
-------------------------------------------
Car traffic volume  : 89054/7744  veh/TimePeriod  *
Medium truck volume :  7084/616   veh/TimePeriod  *
Heavy truck volume  :  5060/440   veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT): 109998
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 3: HWY 417 (day/night)
-----------------------------------------
Angle1   Angle2           :  -5.00 deg   21.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 500.00 / 500.00 m
Receiver height           :  16.95 / 16.95  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

Results segment # 1: Camp Dr (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 62.28 + 0.00) = 62.28 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90    -70   0.00  73.68   0.00  -1.86  -9.54   0.00   0.00   0.00
62.28
-------------------------------------------------------------------------------
--

Segment Leq : 62.28 dBA
```

```
Results segment # 2: Pall Dr (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 63.22 + 0.00) = 63.22 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    23     90   0.00  73.68   0.00  -6.16  -4.29   0.00   0.00   0.00
63.22
-------------------------------------------------------------------------
--

Segment Leq : 63.22 dBA

Results segment # 3: HWY 417 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 56.52 + 0.00) = 56.52 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    -5     21   0.20  83.16   0.00 -18.22  -8.42   0.00   0.00   0.00
56.52
-------------------------------------------------------------------------
--

Segment Leq : 56.52 dBA

Total Leq All Segments: 66.27 dBA
```

```
Results segment # 1: Camp Dr (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 54.68 + 0.00) = 54.68 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -70   0.00  66.08   0.00  -1.86  -9.54   0.00   0.00   0.00
54.68
-------------------------------------------------------------------------
--

Segment Leq : 54.68 dBA


Results segment # 2: Pall Dr (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 55.62 + 0.00) = 55.62 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    23     90   0.00  66.08   0.00  -6.16  -4.29   0.00   0.00   0.00
55.62
-------------------------------------------------------------------------
--

Segment Leq : 55.62 dBA
```

```
Results segment # 3: HWY 417 (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 48.92 + 0.00) = 48.92 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    -5     21   0.20  75.56   0.00 -18.22  -8.42   0.00   0.00   0.00
48.92
-------------------------------------------------------------------------
--

Segment Leq : 48.92 dBA

Total Leq All Segments: 58.67 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 66.27
                           (NIGHT): 58.67
```

```
STAMSON 5.0        NORMAL REPORT        Date: 02-07-2019 14:48:43
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r4.te                Time Period: Day/Night 16/8 hours
Description:


Road data, segment # 1: HWY 417 (day/night)
-------------------------------------------
Car traffic volume  : 89054/7744  veh/TimePeriod  *
Medium truck volume :  7084/616   veh/TimePeriod  *
Heavy truck volume  :  5060/440   veh/TimePeriod  *
Posted speed limit  :   100 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

* Refers to calculated road volumes based on the following input:

    24 hr Traffic Volume (AADT or SADT): 109998
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: HWY 417 (day/night)
-----------------------------------------
Angle1   Angle2           :   0.00 deg   16.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 500.00 / 500.00 m
Receiver height           :  16.95 / 16.95  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: HWY 417 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 54.41 + 0.00) = 54.41 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     16   0.20  83.16   0.00 -18.22 -10.52   0.00   0.00   0.00
54.41
-------------------------------------------------------------------------
--

Segment Leq : 54.41 dBA

Total Leq All Segments: 54.41 dBA


Results segment # 1: HWY 417 (night)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 46.81 + 0.00) = 46.81 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
     0     16   0.20  75.56   0.00 -18.22 -10.52   0.00   0.00   0.00
46.81
-------------------------------------------------------------------------
--

Segment Leq : 46.81 dBA

Total Leq All Segments: 46.81 dBA


TOTAL Leq FROM ALL SOURCES (DAY): 54.41
                           (NIGHT): 46.81
```