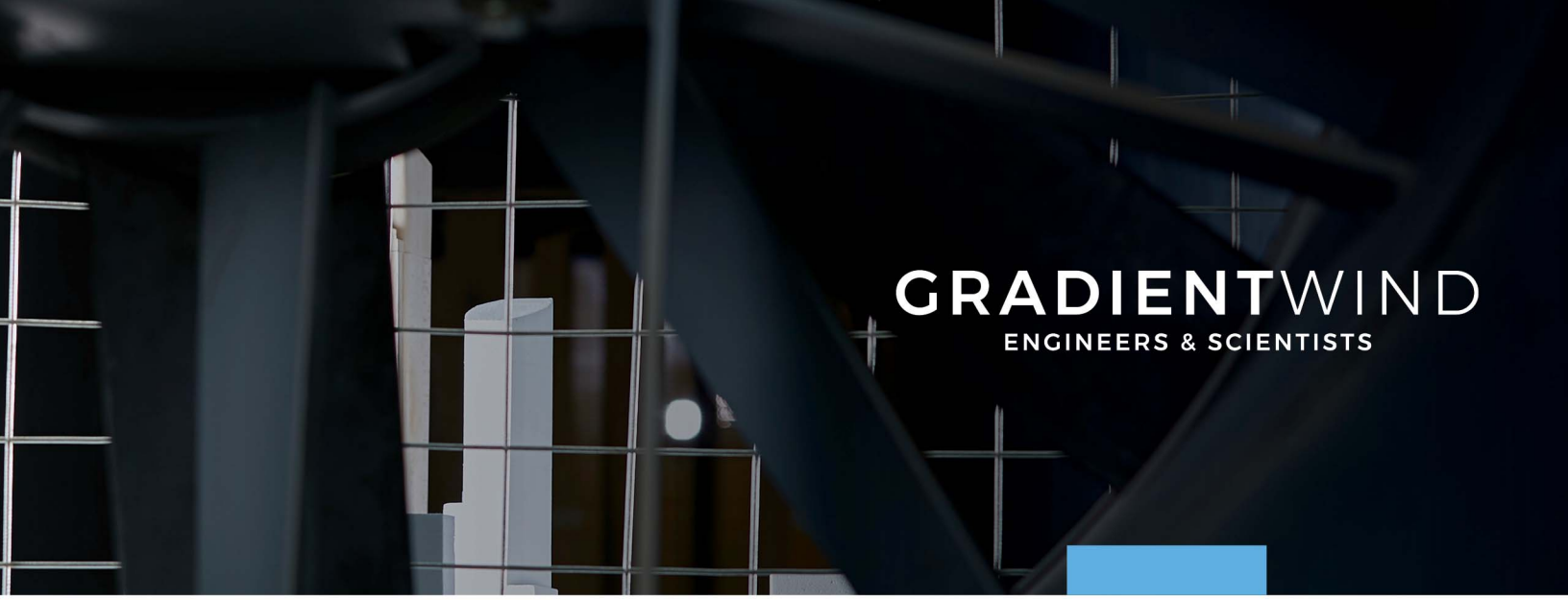

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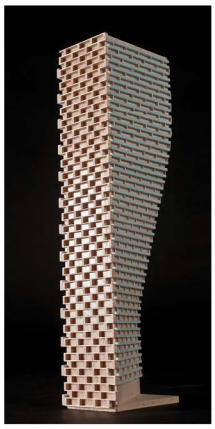
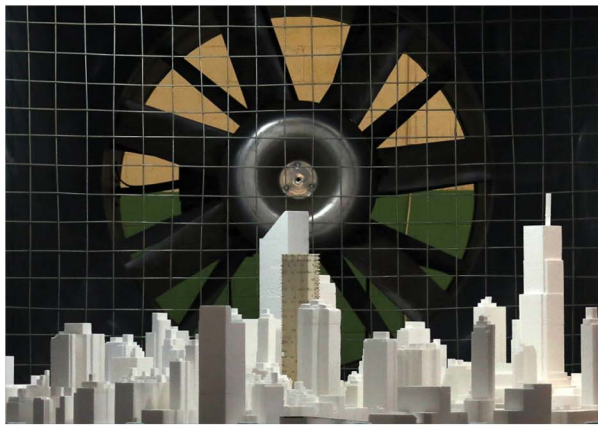
ENGINEERS & SCIENTISTS

TRAFFIC NOISE FEASIBILITY ASSESSMENT

Brazeau Subdivision
Ottawa, Ontario

REPORT: GWE18-198 – Traffic Noise





December 18, 2018

PREPARED FOR

Andrew Finnson
Director, Land Development
Caivan Brazeau Development Corporation
2934 Baseline Road, Suite 302
Ottawa, Ontario
K2H 1B2

PREPARED BY

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

EXECUTIVE SUMMARY

This report describes a traffic noise feasibility assessment undertaken in support of a rezoning and draft plan of subdivision application for a proposed residential subdivision known as Brazeau situated in Ottawa, Ontario. The proposed development is on a nearly rectangular lot and comprises a mixture of detached homes and townhomes connected by a series of streets and walkways. The development site is bound by aggregate pits to the north and west, realigned Greenbank Road to the east, and vacant land to the south. A park is located on the southwest corner of the site. On the west side, a new road may be constructed connecting the subdivision to Borrisokane Road. Major sources of noise impacting the site are roadway traffic along the realigned Greenbank Road, Borrisokane Road, Highway 416, and the Bus Rapid Transit (BRT) lane in the center of the realigned Greenbank Road. Other sources of noise in the area include the mentioned aggregate pits, but operations are likely to cease prior to construction. A mineral and noise impact assessment has been prepared by Patterson. The focus of this study is impacts from roadway sources. Figure 1 illustrates a complete 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) future vehicular traffic volumes based on the City of Ottawa's Official Plan roadway classifications; and (iv) site plan drawings prepared by Gerrard Design Associates Inc. dated October 30, 2018.

The results of the current study indicate that noise levels due to roadway traffic over the site will range between approximately 46 and 62 dBA during the daytime period (07:00-23:00). The highest roadway traffic noise levels will occur nearest to Greenbank Road. Results of the roadway traffic noise calculations also indicate that outdoor living areas having direct exposure to Greenbank Road will likely require noise control measures. Mitigation measures are described in Section 4.4, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible.

A detailed roadway traffic noise study will be required at the time of site plan approval to determine specific noise control measures for the development.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Caivan Brazeau Development Corporation to undertake a traffic noise assessment in support of site plan application for a proposed residential subdivision known as Brazeau situated in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to a roadway traffic noise feasibility assessment and was prepared in consideration of the client's draft plan of subdivision applications. GWE's scope of work involved assessing exterior noise levels throughout the site, generated by local roadway traffic.

The assessment was performed on the basis of theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MECP)[2] guidelines. Noise calculations were based on architectural drawings prepared by Gerrard Design Associates Inc. dated October 30, 2018, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The focus of this traffic noise assessment in support of a proposed subdivision known as Brazeau situated in Ottawa, Ontario. The proposed development is on a nearly rectangular lot and comprises a mixture of detached homes and townhomes. A park is located on the southwest corner of the site. The development will include creation of new walkways and residential streets feeding into the subdivision from the realigned Greenbank Road. The site will also include a storm water retention pond to the north west.

The development site is bound by aggregate pits to the west and north identified as Brazeau Pit and Costello Pit respectively, realigned Greenbank Road to the east, and vacant land to the south. To the west of the Brazeau Pit is Borrisokane Road as well as Highway 416. On the west side, a new road will be constructed connecting the subdivision to Borrisokane Road. Major sources of noise impacting the site are roadway traffic along the realigned Greenbank Road, Borrisokane Road, Highway 416 and the Bus Rapid Transit (BRT) lane in the center of the realigned Greenbank Road. Other sources of noise in the area include the

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

mentioned aggregate pits, but operations are likely to cease prior to construction. A mineral and noise impact assessment has been prepared by Patterson. The focus of this study is impacts from roadway sources. The investigation is based on a concept plan drawing prepared by Gerrard Design Associates Inc. Figure 1 illustrates the site plan with surrounding context.

The study site is divided by an urban boundary line which travels north and south, signifying urban development west of the boundary is restricted. A proposed transit station / park-and-ride is located south of the site. Since the station is more than 100 m away from the site, it is considered an insignificant source noise.

3. OBJECTIVES

The principal objective of this work is to calculate the future noise levels on the study site produced by local roadway traffic and explore potential for noise mitigation where required, noise calculations are based on initial concept plan prepared by Gerrard Design Associates Inc, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

4. METHODOLOGY

4.1 Background

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

4.2 Roadway Traffic Noise

4.2.1 Criteria for Roadway Traffic Noise

For surface roadway traffic noise, the equivalent sound energy level, L_{eq}, provides a measure of the time varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level, which has the same energy as a time varying noise level over a period of time. For roadways, the L_{eq} is commonly calculated on the basis of a 16-hour (L_{eq16}) daytime (07:00-23:00) / 8-hour (L_{eq8}) nighttime (23:00-07:00) split to assess its impact on residential buildings. The City of Ottawa's Environmental Noise Control Guidelines (ENCG) specifies that the recommended Outdoor Living Area (OLA) noise limit is 55 dBA during the daytime period. OLA do not need to be considered during the nighttime period.

Predicted noise levels at the OLA dictate the action required to achieve the recommended sound levels. According to the ENCG, if an area is to be used as an OLA, noise control measures are required to reduce the L_{eq} to 55 dBA. This is typically done with noise control measures outlined in Section 4.4. When noise levels at these areas exceed the criteria, specific Warning Clause requirements may apply. As this is a preliminary assessment, noise control recommendations are of a general nature. Specific mitigation requirements would be the work of a future study.

4.2.2 Theoretical Roadway Noise Predictions

Noise predictions were determined by computer modelling using two programs. To provide a general sense of noise across the site, the employed software program was Predictor-Lima (TNM calculation), which incorporates the United States Federal Highway Administration's (FHWA) Transportation Noise Model (TNM) 2.5. This computer program is capable of representing three-dimensional surface and first reflections of sound waves over a suitable spectrum for human hearing. A receptor grid with 5 × 5 m spacing was placed across the study site, along with a number of discrete receptors at key sensitive areas.

Although this program outputs noise contours, it is not the approved model for roadway predictions by the City of Ottawa. Therefore, the results were confirmed by performing discrete noise calculations with the Ministry of the Environment, Conservations and Parks (MECP) computerized noise assessment program, STAMSON 5.04, at key receptor locations coinciding with receptor locations in Predictor as

shown in Figure 2 and 3, as well as receptor distances. Appendix A includes the STAMSON 5.04 input and output data.

Roadway noise calculations were performed by treating each road segment as separate line sources of noise. In addition to the traffic volumes summarized in Table 1 below, theoretical noise predictions were based on the following parameters:

- Truck traffic on all roadways was taken to comprise 5% heavy trucks and 7% medium trucks, as per ENCG requirements for noise level predictions
- The day/night split was taken to be 92% / 8% respectively for all streets
- Receptor heights taken to be 1.5 m above grade
- Absorptive ground surface between source and receivers
- The study site was treated as having flat or gently sloping topography
- No massing considered as potential noise screening elements
- Roadways exceeding a distance of 500 m from a discrete receptor were omitted

4.2.3 Roadway Traffic Volumes

The ENCG dictates that noise calculations should consider future sound levels based on a roadway's classification at the mature state of development. Therefore, traffic volumes are based on the roadway classifications outlined in the City of Ottawa's Official Plan (OP) and Transportation Master Plan[3] 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. As for the BRT, volumes were used based on Gradient Wind's experience with similar developments. Table 1 (below) summarizes the AADT values used for each roadway included in this assessment.

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

TABLE 1: ROADWAY TRAFFIC DATA

Roadway	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes	GWE Assumed Volumes
Greenbank Road (Realigned)	4-Lane Urban Arterial Divided (4-UAD)	70	**35,000**	-
Borrisokane Road	2-Lane Urban Collector (2-UCU)	80	**8,000**	-
Northbound Veterans Memorial Highway (Highway 416)	2 Lane Freeway	100	**18,333/Lane**	-
Southbound Veterans Memorial Highway (Highway 416)	2 Lane Freeway	100	**18,333/Lane**	-
Bus Rapid Transit	BRT	80	-	***191/67**

* Daytime and nighttime volumes based on correspondence with the City of Ottawa

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

The results of the roadway traffic noise calculations for the daytime period, covering the entire study site, are shown in Figure 4. Discrete receptors were also placed at ground level at key locations throughout the site. The noise contours were generated using TNM and verified with discrete receptors using STAMSON 5.04, as shown in Figure 2 and 3, and summarized in Table 2 below. Appendix A contains the complete set of input and output data from all STAMSON 5.04 calculations.

TABLE 2: EXTERIOR NOISE LEVELS DUE TO ROAD TRAFFIC

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	STAMSON 5.04 Noise Level (dBA)	Predictor-Lima Noise Level (dBA)
			Day	Day
1	1.5	OLA – Grade Level – Western Block	50	46
2	1.5	OLA – Grade Level – Central Block	50	45
3	1.5	OLA – Grade Level – Southern Block	52	47
4	1.5	OLA – Grade Level – Eastern Block	58	55
5	1.5	OLA – Grade Level – Eastern Boundary	62	60

As shown above, the results calculated from TNM have good correlation with calculations performed in STAMSON 5.04. A tolerance of 3 dBA between models is generally considered acceptable given human hearing cannot detect a change in sound level of less than 3 dBA. As stated in Section 4.2.2, massing elements, such as buildings, were conservatively ignored as potential screening elements. Results of the roadway traffic noise calculations also indicate that outdoor living areas (R4 and R5) on blocks adjacent to and having direct exposure to Greenbank Road will likely require noise control measures. These measures are briefly described in Section 4.4, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible.

According to Table 2, the blocks orientated east/west situated in the northeast corner of the site will likely require sound barriers along the edge of the rear yards closest to Greenbank Road. However, massing elements along the edge of the development are expected block direct line of sight of the roadways and act as sound barriers, reducing the sound experienced at the inner bocks within the subdivision. It is possible homes along the edge of the development will require noise control measures as outlined in Section 4.4. A detailed roadway traffic noise study will be required at the time of subdivision registration to determine specific noise control measures for the development.

5.2 Noise Control Measures

The noise levels predicted due to roadway traffic, at a number of receptors, exceed the criteria listed in the ENCG for outdoor living areas, as discussed in Section 4.3. Therefore, noise control measures as

described below, subscribing to Table 2.3a in the ENCG and listed in order of preference, will be required to reduce the L_{eq} to 55 dBA:

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

Based on expected noise levels, blocks in the dark orange and red regions in Figure 4 will require forced air heating with provisions for central air conditioning. Warning clauses will also be required to be placed on agreements of purchase, sale, and lease. Specific mitigation will be determined during detailed design.

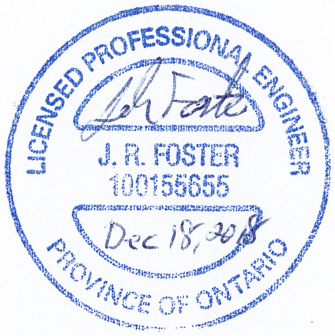
6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current study indicate that noise levels due to roadway traffic over the site will range between approximately 46 and 62 dBA during the daytime period (07:00-23:00). The highest roadway traffic noise levels will occur nearest to Greenbank Road. Results of the roadway traffic noise calculations also indicate that outdoor living areas having direct exposure to Greenbank Road will likely require noise control measures. Mitigation measures are described in Section 4.4, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible. A detailed roadway traffic noise study will be required at the time of site plan approval to determine specific noise control measures for the development.

This concludes our traffic noise 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
GWE18-198

Joshua Foster, P.Eng.
Principal

GRADIENTWIND
ENGINEERS & SCIENTISTS

127 WALGREEN ROAD , OTTAWA, ON
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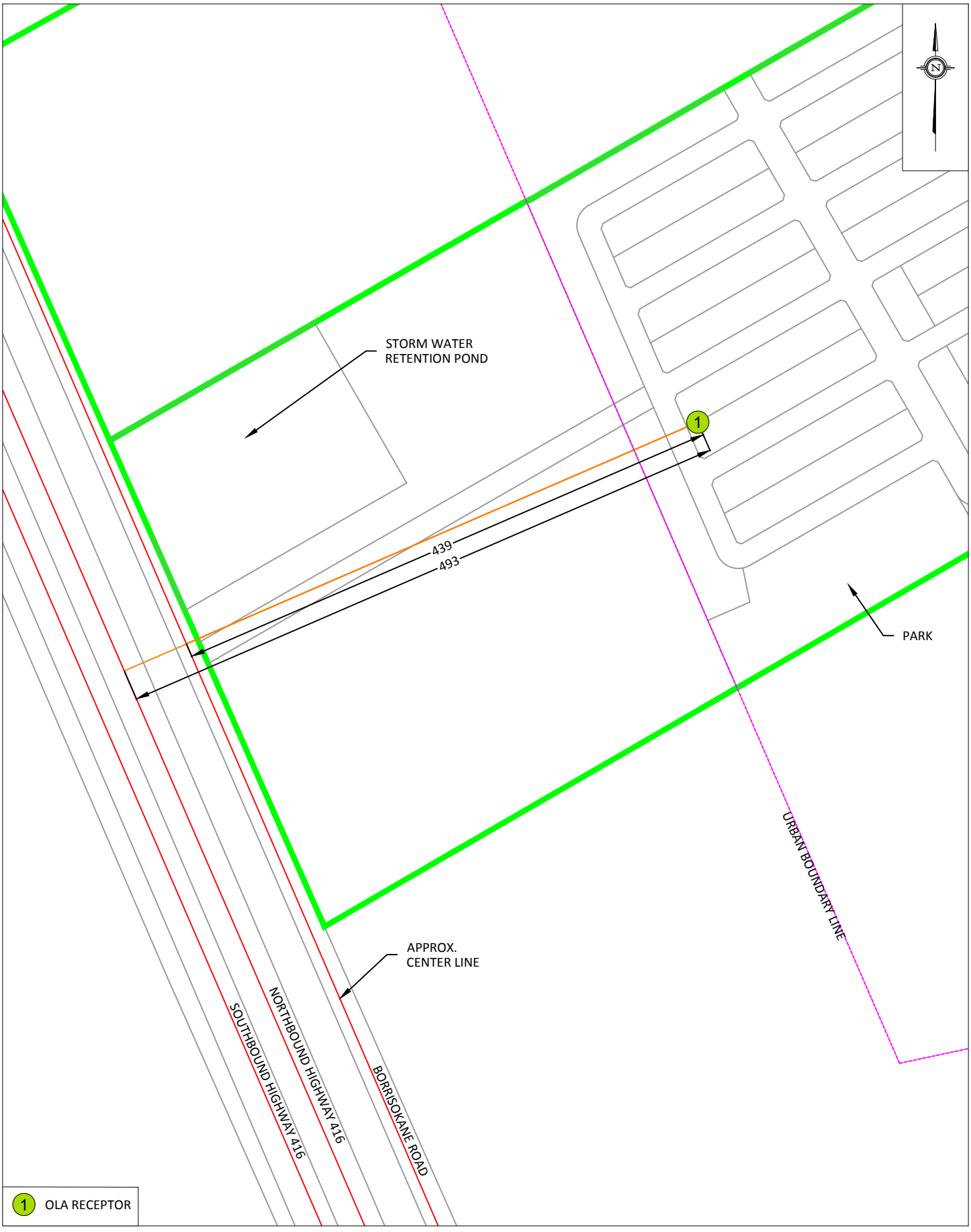
PROJECT	BRAZEAU SUBDIVISION - TRAFFIC NOISE STUDY
SCALE	1:8000 (APPROX.)
DRAWING NO.	GWE18-198
DATE	NOVEMBER 23, 2018
DRAWN BY	G.G.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



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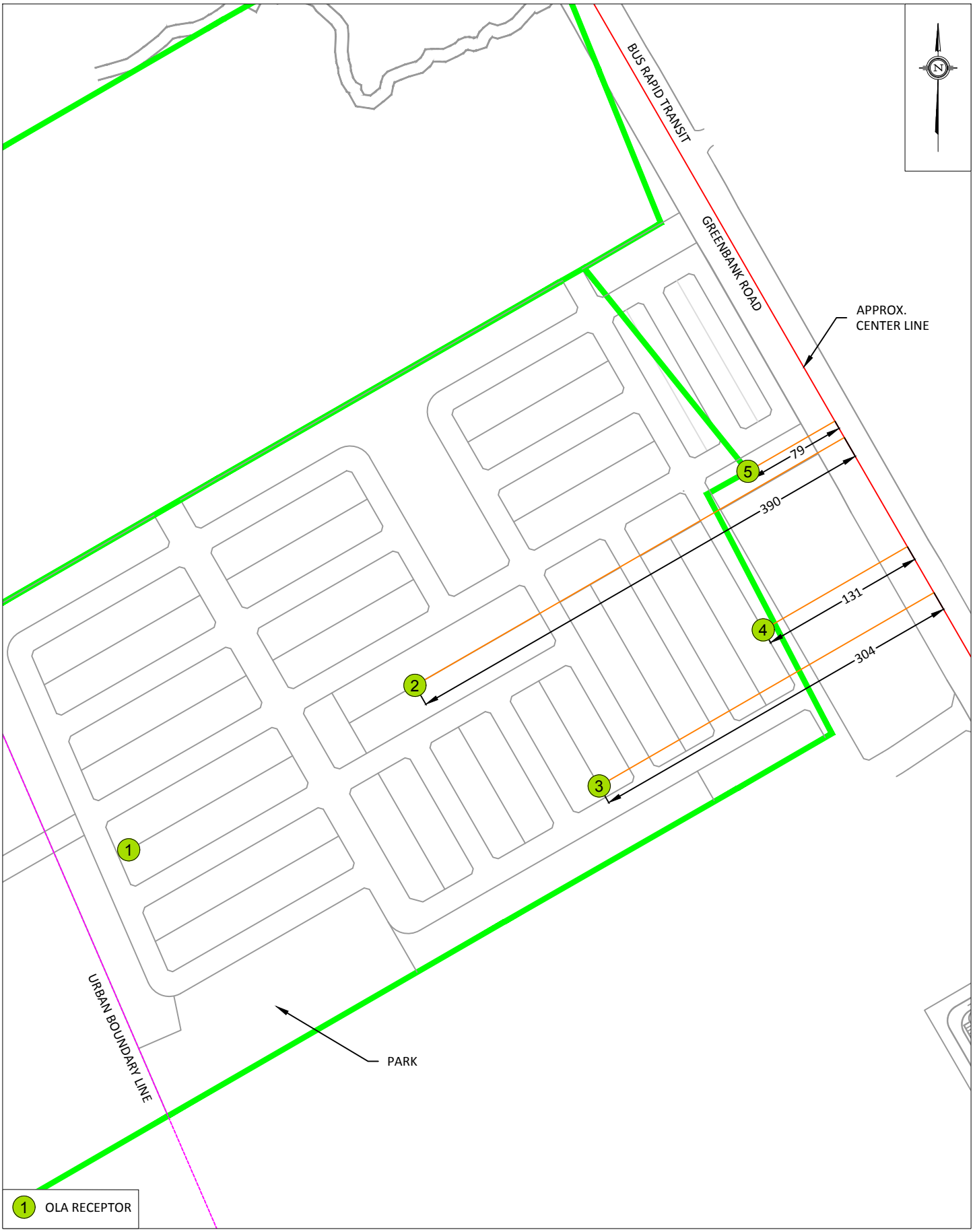
SCALE	1:4000 (APPROX.)
DRAWING NO.	GWE18-198
DATE	NOVEMBER 23, 2018
DRAWN BY	G.G.

DESCRIPTION

FIGURE 2:
RECEPTOR 1 LOCATION AND STAMSON INPUT



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PROJECT	BRAZEAU SUBDIVISION - TRAFFIC NOISE STUDY		
SCALE	1:4000 (APPROX.)	DRAWING NO.	GWE18-198
DATE	NOVEMBER 23, 2018	DRAWN BY	G.G.

DESCRIPTION

FIGURE 3:
RECEPTOR 2-5 LOCATIONS AND STAMSON INPUT

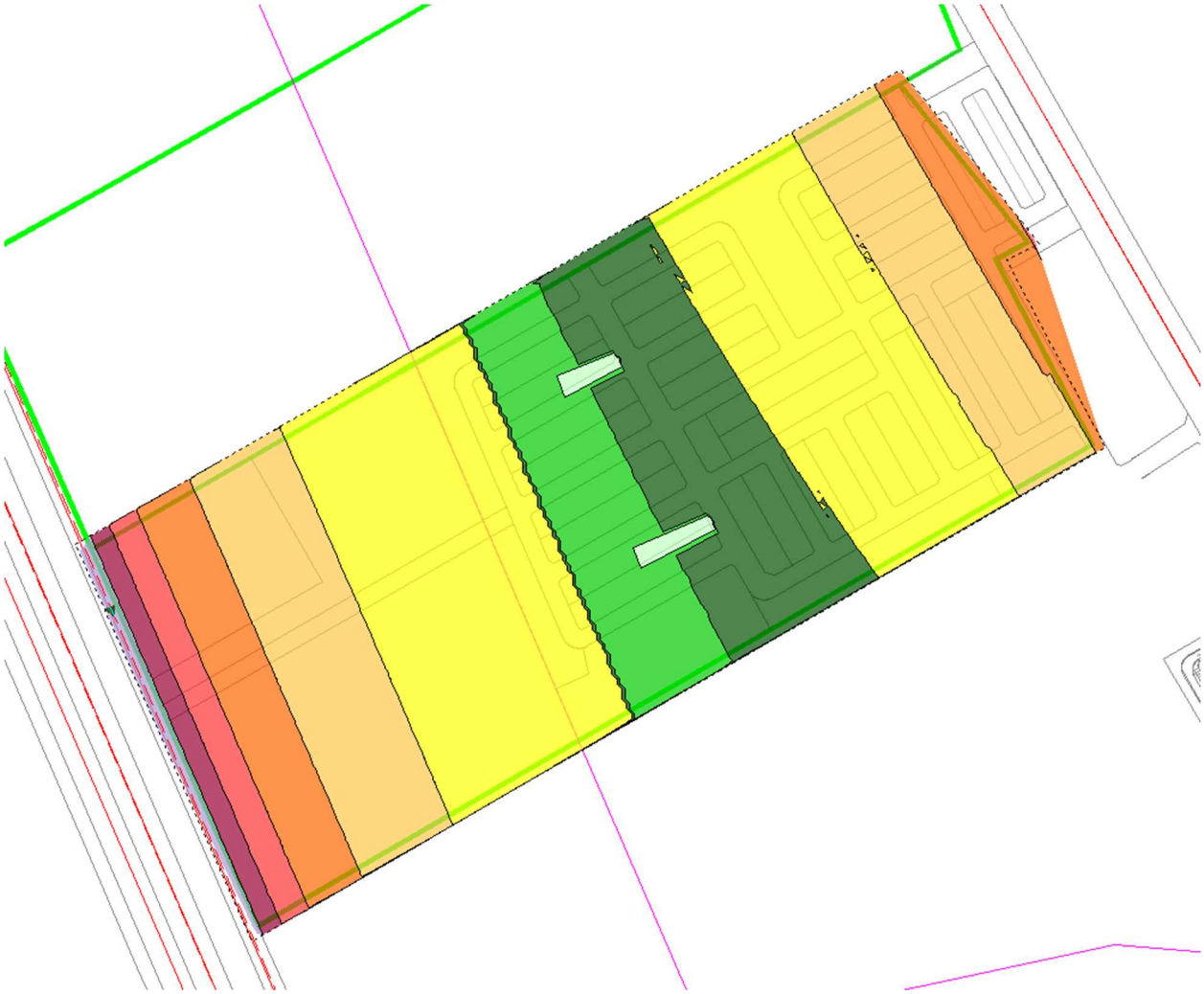
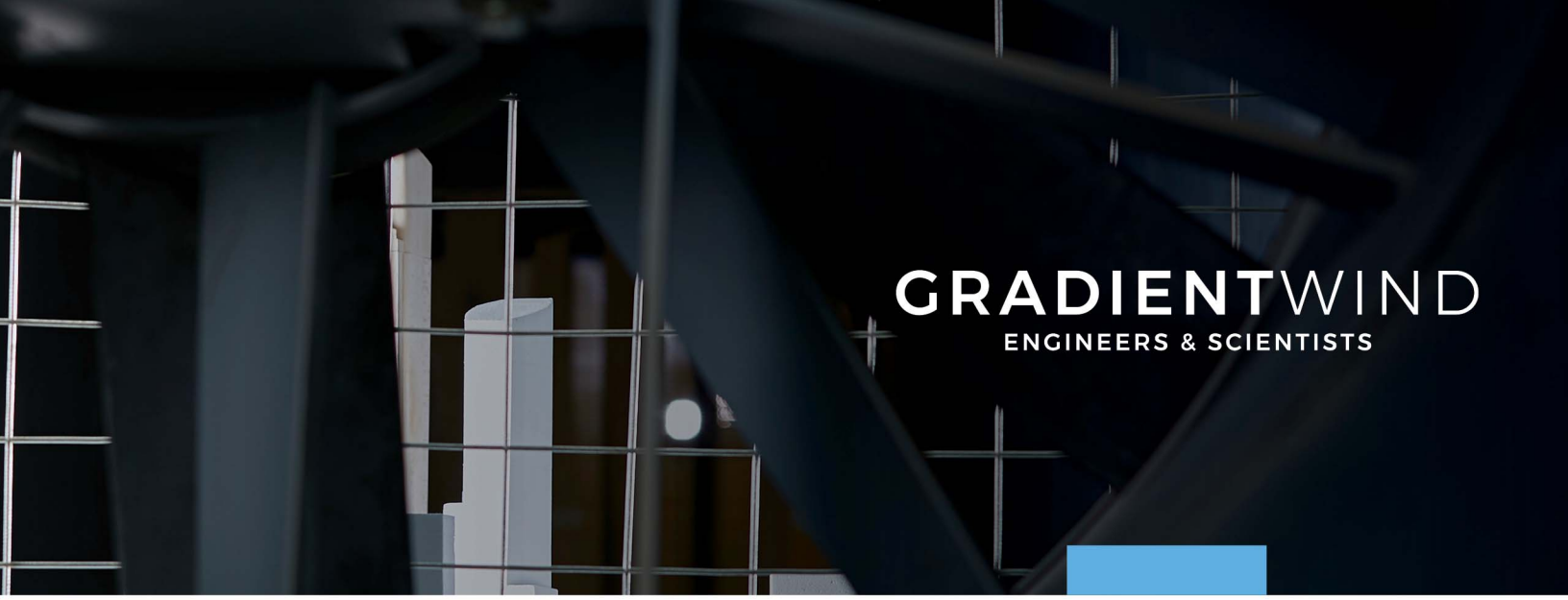
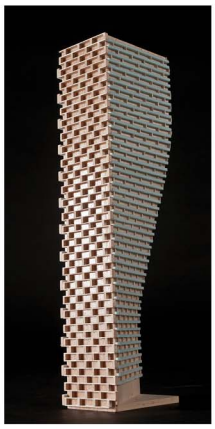
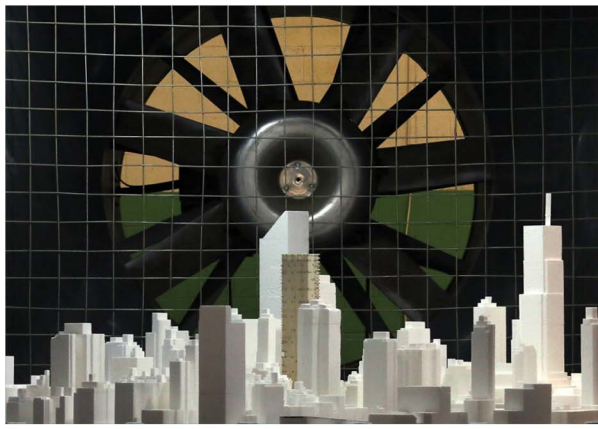


FIGURE 4: GROUND LEVEL NOISE CONTOURS FOR THE SITE (DAYTIME PERIOD)







APPENDIX A

SAMPLE CALCULATION INPUT/OUTPUT

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

STAMSON 5.0 NORMAL REPORT Date: 26-11-2018 13:15:45
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

Road data, segment # 1: Borris. Rd (day/night)

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 80 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): 8000
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: Borris. Rd (day/night)

Angle1 Angle2 : -45.00 deg 45.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 439.00 / 439.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: NB HWY 416 (day/night)

Car traffic volume : 29685/2581 veh/TimePeriod *
Medium truck volume : 2361/205 veh/TimePeriod *
Heavy truck volume : 1687/147 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): 36666
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: NB HWY 416 (day/night)

```
Angle1   Angle2           : -45.00 deg   45.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 493.00 / 493.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

Results segment # 1: Borris. Rd (day)

Source height = 1.50 m

ROAD (0.00 + 42.10 + 0.00) = 42.10 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	45	0.66	69.76	0.00	-24.34	-3.32	0.00	0.00	0.00	42.10

Segment Leq : 42.10 dBA

Results segment # 2: NB HWY 416 (day)

Source height = 1.50 m

ROAD (0.00 + 49.89 + 0.00) = 49.89 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	45	0.66	78.39	0.00	-25.18	-3.32	0.00	0.00	0.00	49.89

Segment Leq : 49.89 dBA

Total Leq All Segments: 50.56 dBA

Results segment # 1: Borris. Rd (night)

Source height = 1.50 m

ROAD (0.00 + 34.51 + 0.00) = 34.51 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	45	0.66	62.16	0.00	-24.34	-3.32	0.00	0.00	0.00	34.51

Segment Leq : 34.51 dBA

Results segment # 2: NB HWY 416 (night)

Source height = 1.50 m

ROAD (0.00 + 42.30 + 0.00) = 42.30 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-45	45	0.66	70.79	0.00	-25.18	-3.32	0.00	0.00	0.00	42.30

Segment Leq : 42.30 dBA

Total Leq All Segments: 42.97 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 50.56
(NIGHT): 42.97

STAMSON 5.0 NORMAL REPORT Date: 30-11-2018 14:41:56
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

Road data, segment # 1: Greenbank Rd (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 : 70 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: Greenbank Rd (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 390.00 / 390.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Greenbank Rd (day)

Source height = 1.50 m

ROAD (0.00 + 50.05 + 0.00) = 50.05 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	75.00	0.00	-23.49	-1.46	0.00	0.00	0.00	50.05

Segment Leq : 50.05 dBA

Total Leq All Segments: 50.05 dBA

Results segment # 1: Greenbank Rd (night)

Source height = 1.50 m

ROAD (0.00 + 42.45 + 0.00) = 42.45 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	67.40	0.00	-23.49	-1.46	0.00	0.00	0.00	42.45

Segment Leq : 42.45 dBA

Total Leq All Segments: 42.45 dBA

RT/Custom data, segment # 1: BRT (day/night)
---
1 - Bus:
Traffic volume : 191/67 veh/TimePeriod
Speed : 80 km/h

Data for Segment # 1: BRT (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 390.00 / 390.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: BRT (day)

Source height = 0.50 m

RT/Custom (0.00 + 34.47 + 0.00) = 34.47 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	59.41	-23.49	-1.46	0.00	0.00	0.00	34.47

Segment Leq : 34.47 dBA

Total Leq All Segments: 34.47 dBA

Results segment # 1: BRT (night)

Source height = 0.50 m

RT/Custom (0.00 + 32.93 + 0.00) = 32.93 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	57.87	-23.49	-1.46	0.00	0.00	0.00	32.93

Segment Leq : 32.93 dBA

Total Leq All Segments: 32.93 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 50.17
(NIGHT): 42.91

STAMSON 5.0 NORMAL REPORT Date: 30-11-2018 14:47:49
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

Road data, segment # 1: Greenbank Rd (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 : 70 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: Greenbank Rd (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 304.00 / 304.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Greenbank Rd (day)

Source height = 1.50 m

ROAD (0.00 + 51.85 + 0.00) = 51.85 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	75.00	0.00	-21.69	-1.46	0.00	0.00	0.00	51.85

Segment Leq : 51.85 dBA

Total Leq All Segments: 51.85 dBA

Results segment # 1: Greenbank Rd (night)

Source height = 1.50 m

ROAD (0.00 + 44.25 + 0.00) = 44.25 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	67.40	0.00	-21.69	-1.46	0.00	0.00	0.00	44.25

Segment Leq : 44.25 dBA

Total Leq All Segments: 44.25 dBA

RT/Custom data, segment # 1: BRT (day/night)
---
1 - Bus:
Traffic volume : 191/67 veh/TimePeriod
Speed : 80 km/h

Data for Segment # 1: BRT (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 304.00 / 304.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: BRT (day)

Source height = 0.50 m

RT/Custom (0.00 + 36.26 + 0.00) = 36.26 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	59.41	-21.69	-1.46	0.00	0.00	0.00	36.26

Segment Leq : 36.26 dBA

Total Leq All Segments: 36.26 dBA

Results segment # 1: BRT (night)

Source height = 0.50 m

RT/Custom (0.00 + 34.73 + 0.00) = 34.73 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	57.87	-21.69	-1.46	0.00	0.00	0.00	34.73

Segment Leq : 34.73 dBA

Total Leq All Segments: 34.73 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 51.97
(NIGHT): 44.71

STAMSON 5.0 NORMAL REPORT Date: 30-11-2018 14:51:03
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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

Road data, segment # 1: Greenbank Rd (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 : 70 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: Greenbank Rd (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 131.00 / 131.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Greenbank Rd (day)

Source height = 1.50 m

ROAD (0.00 + 57.92 + 0.00) = 57.92 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	75.00	0.00	-15.62	-1.46	0.00	0.00	0.00	57.92

Segment Leq : 57.92 dBA

Total Leq All Segments: 57.92 dBA

Results segment # 1: Greenbank Rd (night)

Source height = 1.50 m

ROAD (0.00 + 50.32 + 0.00) = 50.32 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	67.40	0.00	-15.62	-1.46	0.00	0.00	0.00	50.32

Segment Leq : 50.32 dBA

Total Leq All Segments: 50.32 dBA

RT/Custom data, segment # 1: BRT (day/night)
---
1 - Bus:
Traffic volume : 191/67 veh/TimePeriod
Speed : 80 km/h

Data for Segment # 1: BRT (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 131.00 / 131.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: BRT (day)

Source height = 0.50 m

RT/Custom (0.00 + 42.33 + 0.00) = 42.33 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	59.41	-15.62	-1.46	0.00	0.00	0.00	42.33

Segment Leq : 42.33 dBA

Total Leq All Segments: 42.33 dBA

Results segment # 1: BRT (night)

Source height = 0.50 m

RT/Custom (0.00 + 40.79 + 0.00) = 40.79 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	57.87	-15.62	-1.46	0.00	0.00	0.00	40.79

Segment Leq : 40.79 dBA

Total Leq All Segments: 40.79 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 58.04
(NIGHT): 50.78

STAMSON 5.0 NORMAL REPORT Date: 30-11-2018 14:54:32
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: r5.te Time Period: Day/Night 16/8 hours
Description:

Road data, segment # 1: Greenbank Rd (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 : 70 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: Greenbank Rd (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 79.00 / 79.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Greenbank Rd (day)

Source height = 1.50 m

ROAD (0.00 + 61.56 + 0.00) = 61.56 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	75.00	0.00	-11.98	-1.46	0.00	0.00	0.00	61.56

Segment Leq : 61.56 dBA

Total Leq All Segments: 61.56 dBA

Results segment # 1: Greenbank Rd (night)

Source height = 1.50 m

ROAD (0.00 + 53.96 + 0.00) = 53.96 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	67.40	0.00	-11.98	-1.46	0.00	0.00	0.00	53.96

Segment Leq : 53.96 dBA

Total Leq All Segments: 53.96 dBA

RT/Custom data, segment # 1: BRT (day/night)
---
1 - Bus:
Traffic volume : 191/67 veh/TimePeriod
Speed : 80 km/h

Data for Segment # 1: BRT (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 79.00 / 79.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: BRT (day)

Source height = 0.50 m

RT/Custom (0.00 + 45.98 + 0.00) = 45.98 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	59.41	-11.98	-1.46	0.00	0.00	0.00	45.98

Segment Leq : 45.98 dBA

Total Leq All Segments: 45.98 dBA

Results segment # 1: BRT (night)

Source height = 0.50 m

RT/Custom (0.00 + 44.44 + 0.00) = 44.44 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	57.87	-11.98	-1.46	0.00	0.00	0.00	44.44

Segment Leq : 44.44 dBA

Total Leq All Segments: 44.44 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 61.68
(NIGHT): 54.42