

Geotechnical
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Environmental Noise Control Study

Proposed Multi-Storey Building
10 McArthur Avenue
Ottawa, Ontario

Prepared For

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May 2, 2019

Report: PG4853-1

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1.0 Introduction

Paterson Group (Paterson) was commissioned by 2672915 Ontario Inc. to conduct an environmental noise control study for the proposed residential building to be located at 10 McArthur Avenue, in the City of Ottawa.

The objective of the current study is to:

- ❑ Determine the primary noise sources impacting the site and compare the projected sound levels to guidelines set out by the Ministry of Environment and Climate Change (MOECC) and the City of Ottawa.
- ❑ Review the projected noise levels and offer recommendations regarding warning classes, construction materials or alternative sound barriers.

The following report has been prepared specifically and solely for the aforementioned project which is described herein. It contains our findings and includes acoustical recommendations pertaining to the design and construction of the subject development as they are understood at the time of writing this report.

This study has been conducted according to City of Ottawa document - Engineering Noise Control Guidelines (ENCG), dated January 2016, and the Ontario Ministry of the Environment Guideline NPC-300.

2.0 Background

It is understood that the proposed development will consist of a four-storey building. Balconies, less than 4 m deep, were identified for the individual units but are not classified as outdoor living areas and therefore are not included in the study. Therefore, no outdoor living areas were analyzed.

3.0 Methodology and Noise Assessment Criteria

The City of Ottawa outlines three (3) sources of environmental noise that must be analyzed separately:

- ☐ Surface Transportation Noise
- ☐ Stationary Noise
 - ☐ new noise-sensitive development applications (noise receptors) in proximity to existing or approved stationary sources of noise, and
 - ☐ new stationary sources of noise (noise generating) in proximity to existing or approved noise-sensitive developments
- ☐ Aircraft noise

Surface Transportation Noise

The City of Ottawa's Official Plan, in addition to the ENCG dictate that the influence area must contain any of following conditions to classify as a surface transportation noise source for a subject site:

- ☐ Within 100 m of the right-of-way of an existing or proposed arterial, collector or major collector road; a light rail transit corridor; bus rapid transit, or transit priority corridor
- ☐ Within 250 m of the right-of-way for an existing or proposed highway or secondary rail line
- ☐ Within 300 m from the right of way of a proposed or existing rail corridor or a secondary main railway line
- ☐ Within 500 m of an existing 400 series provincial highway, freeway or principle main railway line.

The NPC-300 outlines the limitations of the stationary and environmental noise levels in relation to the location of the receptors. These can be found in the following tables:

Table 1 - Sound Level Limits for Outdoor Living Areas	
Time Period	Required $L_{eq(16)}$ (dBA)
16-hour, 7:00-23:00	55
<input type="checkbox"/> Standards taken from Table 2.2a; Sound Level Limit for Outdoor Living Areas - Road and Rail	

Table 2 - Sound Level Limits for Indoor Living Area			
Type of Space	Time Period	Required L_{eq} (dBA)	
		Road	Rail
Living/Dining, den areas of residences, hospitals, nursing homes, schools, daycare centres, etc	7:00-23:00	45	40
Theaters, place of worship, libraries, individual or semi-private offices, conference rooms, reading rooms	23:00-7:00	45	40
Sleeping quarters	7:00-23:00	45	40
	23:00-7:00	40	35
<input type="checkbox"/> Standards taken from Table 2.2b; Sound Level Limit for Indoor Living Areas - Road and Rail			

It is noted in ENCG, that the limits outlined in Table 2 are for the sound levels on the interior of the glass pane. The ENCG further goes on to state that the limit for the exterior of the pane of glass will be 55 dBA.

If the sound level limits are exceeded at the window panes for the indoor living areas, the following Warning Clauses may be referenced:

Table 3 - Warning Clauses for Sound Level Exceedances	
Warning Clause	Description
Warning Clause Type A	"Purchasers/tenants are advised that sound levels due to increasing road traffic (rail traffic) (air traffic) may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the Municipality and the Ministry of the Environment."
Warning Clause Type B	"Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing road traffic (rail traffic) (air traffic) may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the Municipality and the Ministry of the Environment."
Warning Clause Type C	"This dwelling unit has been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air conditioning by the occupant in low and medium density developments will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."
Warning Clause Type D	"This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."
<input type="checkbox"/> Clauses taken from section C8 Warning Clauses; Environmental Noise Guidelines - NPC-300	

Stationary Noise

Stationary noise sources include sources or facilities that are fixed or mobile and can cause a combination of sound and vibration levels emitted beyond the property line. These sources may include commercial air conditioner units, generators and fans. Facilities that may contribute to stationary noise may include car washes, snow disposal sites, transit stations and manufacturing facilities.

A stationary noise analysis will not be required for this analysis.

Aircraft/Airport Noise

Due to the location of the proposed development, an aircraft/airport noise analysis will not be required.

4.0 Analysis

4.1 Surface Transportation Noise

The proposed development is bordered to the east by residential units followed by Marguenite Avenue, to the south by residential dwellings followed by Carlotta Avenue, to the west by a multi-storey building followed by North River Road, and to the north by McArthur Avenue. North River Road, McArthur Avenue and Carlotta Avenue are located within the 100 m buffer zone.

Based on the City of Ottawa Official Plan, Schedule E, McArthur Avenue is considered a 2 lane urban arterial road (2-UAU). North River Road, north of McArthur Avenue, is also considered a 2 lane urban arterial road (2-UAU). However, North River Road, south of McArthur Avenue is considered a 2 lane urban collector (2-UCU). All other roads within the 100 m radius are not classified as either arterial, collector or major collector roads and therefore are not included in this study. Additionally, the provincial highway 417 is outside of the 500 m radius from the proposed building. All noise sources are presented in Drawing PG4853-1B to 1E - Site Geometry, located in Appendix 1.

It is understood that the proposed development will consist of a four-storey residential building. Reception points were selected on every elevation at the first floor and fourth floor.

The noise levels from road traffic are provided by the City of Ottawa, taking into consideration the right-of-way width and the implied roadway class. It is understood that these values represent the maximum allowable capacity of the proposed roadways. The parameters to be used for sound level predictions can be found below.

Table 4 - Traffic and Road Parameters						
Road	Implied Roadway	AADT (Veh/day)	Posted Speed (km/h)	Day/Night Split %	Medium Truck %	Heavy Truck %
North River Road	2-UAU	15,000	50	92/8	7	5
North River Road	2-UCU	8,000	50	92/8	7	5
McArthur Avenue	2-UAU	15,000	50	92/8	7	5
<input type="checkbox"/> Data obtained from the City of Ottawa document ENCG						

Two (2) levels of reception points were selected for this analysis. The following elevations were selected from the heights provided on the building elevation plans for this development.

Table 5 - Elevation of Reception Points			
Floor Number	Elevation at Centre of Window (m)	Floor Use	Daytime/Nighttime Analysis
Ground Floor	1.5	Living and sleeping quarters	daytime/nighttime
fourth floor	10.5	Living and sleeping quarters	daytime/nighttime

For this analysis, a reception point was taken at the centre of the predetermined floors. Reception points are noted on Drawing PG4853-2 - Receptor Locations in Appendix 1.

All horizontal distances have been measured from the reception point to the edge of the right-of-way. The roadways were analyzed where they intersected the 100 m buffer zone, which is reflected in the local angles, presented in Drawings PG4853-1B to 1E - Site Geometry in Appendix 1.

Table 8 - Summary of Reception Points and Geometry in Appendix 1, provides a summary of the points of reception and their geometry with respect to the noise sources. The analysis is completed so that no effects of sound reflection off of the building facade are considered, as stipulated by the ENG C.

The subject site is relatively flat and at grade with the neighbouring roads within the 100 m radius.

The analysis was completed using STAMSON version 5.04, a computer program which uses the road and rail traffic noise prediction methods using ORNAMENT (Ontario Road Noise Analysis Method for Environment and Transportation) and STEAM (Sound from Trains Environment Analysis Method), publications from the Ontario Ministry of Environment and Energy.

5.0 Results

5.1 Surface Transportation Noise

The primary descriptors are the 16-hour daytime and the 8-hour night time equivalent sound levels, $L_{eq(16)}$ and the $L_{eq(8)}$ for City roads.

The proposed traffic noise levels were analyzed at all reception points. The results of the STAMSON software are presented in Appendix 2, and the summary of the results are detailed in Table 6 below.

Table 6 - Proposed Noise Levels				
Reception Point	Description	Daytime at Facade $L_{EQ(16)}$ (dBA)	Nighttime at Facade $L_{EQ(16)}$ (dBA)	Outdoor Living Area $L_{EQ(16)}$ (dBA)
REC 1-1	Western elevation, first floor	62.23	54.63	--
REC 1-4	Western elevation, fourth floor	62.74	55.14	--
REC 2-1	Northern elevation, first floor	67.11	59.51	--
REC 2-4	Northern elevation, fourth floor	67.58	59.98	--
REC 3-1	Eastern elevation, first floor	60.43	52.83	--
REC 3-4	Eastern elevation, fourth floor	61.03	53.43	--
REC 4-1	Southern elevation, first floor	38.60	31.02	--
REC 4-4	Southern elevation, fourth floor	39.73	32.15	--

6.0 Discussion and Recommendations

6.1 Outdoor Living Areas

No outdoor living areas were identified.

6.2 Indoor Living Areas and Ventilation

The results of the STAMSON modeling indicates that the daytime $L_{eq(16)}$ ranges between 38.60 dBA and 67.11 dBA. The ENG C states that the limits for the exterior of the pane of glass is 55 dBA. This value was exceeded on the north, west and east elevations of the buildings. Therefore, all units on the northern, western and eastern elevations are to be designed with the installation of a central air conditioning unit. Additionally, warning clause Type D, as outlined in Table 3, is also recommended for units on the northern, eastern and western elevation.

Where the daytime sound level at the plane of the window exceeds 65 dBA on the northern, eastern and western elevations, noise control measures should be implemented. The following table outlines the MOECC recommended options for sound mitigation and the respected responses.

Table 7 - Indoor Living Area Noise Mitigation Solutions	
MOECC Recommended Option	Site Specific Response
Distance setback with soft ground.	The proposed development configuration limits the actual maximum setback distance. An additional setback is not feasible.
Insertion of noise insensitive land uses between the source and sensitive receptor.	Not applicable to this development.
Orientation of buildings to provide sheltered zones or modified interior spaces (room and corridor arrangement) and amenity areas	The proposed buildings are situated in order to shield the rear yards from the noise sources. There is a possibility that living areas and bedrooms will face the noise source.
Enhanced construction techniques and construction quality (e.g. brick veneers, multi-pane windows).	Construction techniques and building materials are to be analyzed to confirm sufficient soundproofing.
Earth berms (sound barriers).	Not required
Indoor isolation - air conditioning and ventilation, enhanced dampening materials (indoor isolation)	Not required

Proposed Construction Specifications

It is understood that typical window and wall details are proposed for the residential buildings. The effectiveness of the noise insulation can be expressed as the Acoustical Insulation Factor (AIF), calculated as follows:

$$AIF = L_{eq(16)(Exterior)} - L_{eq(16)(Interior)} + 10 \log_{10}(N) + 2 \text{dBA}$$

Where:

$L_{eq(16)(Exterior)}$ = Calculated value at the window pane
 $L_{eq(16)(Interior)}$ = 45 dBA
 N = number of components in the room

No floor plans or detailed design drawings were provided for this portion of the review. A conservative approach is to assume that there are 2 components per room. Therefore, the AIF would need to be at least 28 dBA.

A conversion from AIF to a Standard Transmission Class (STC) rating will require the knowledge of room dimensions in addition to the wall and window dimensions. However, a conservative approach would be to increase the AIF factor by 3. **Therefore, provided the building materials of either the windows and/or exterior walls have an STC rating of 31 or higher, this would be a sufficient noise attenuation device.**

A review of industry standards for construction material indicates that, as long as the exterior cladding of the northern, eastern and western elevations consist of brick or concrete panels and that all windows consist of double pane glass, these materials have an STC rating of greater than 31 and are considered acceptable. If alternative materials are to be utilized on the northern, eastern or western elevations, then an review will need to be completed once design details are finalized.

7.0 Conclusion

The subject site is located at 10 McArthur Avenue. It is understood that the development will consist of a four storey building with no associated outdoor living areas. The noise analysis identified two noise sources: North River Road and McArthur Avenue (surface transportation noise).

Pane of glass reception points were selected on the northern, eastern, western, and southern elevations, at both 1.5 m (ground floor) and 10.5 m (fourth floor). These results indicate that the noise levels will be above 65 dBA on the northern, western and eastern elevations. Therefore, a review of the construction materials will be required. Based on industry standards, the construction materials suitable for the proposed noise attenuation would be concrete panels or brick veneer, with windows being double pane. If alternative construction materials are proposed, a review will be required.

The following warning clause is to be included on all Offers of Purchase and Sale and/or lease agreements:

"This dwelling unit has been supplied with a central air conditioning system which will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment."


8.0 Statement of Limitations

The recommendations made in this report are in accordance with our present understanding of the project. Our recommendations should be reviewed when the project drawings and specifications are complete.

The present report applies only to the project described in this document. Use of this report for purposes other than those described herein or by person(s) other than 2672915 Ontario Inc or their agent(s) is not authorized without review by this firm for the applicability of our recommendations to the altered use of the report.

Paterson Group Inc.


Stephanie A. Boisvenue, P.Eng.


Scott Dennis, P.Eng.



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APPENDIX 1

TABLE 8 - SUMMARY OF RECEPTION POINTS AND GEOMETRY

DRAWING PG4853-1B - SITE GEOMETRY (REC 1-1 and REC 1-4)

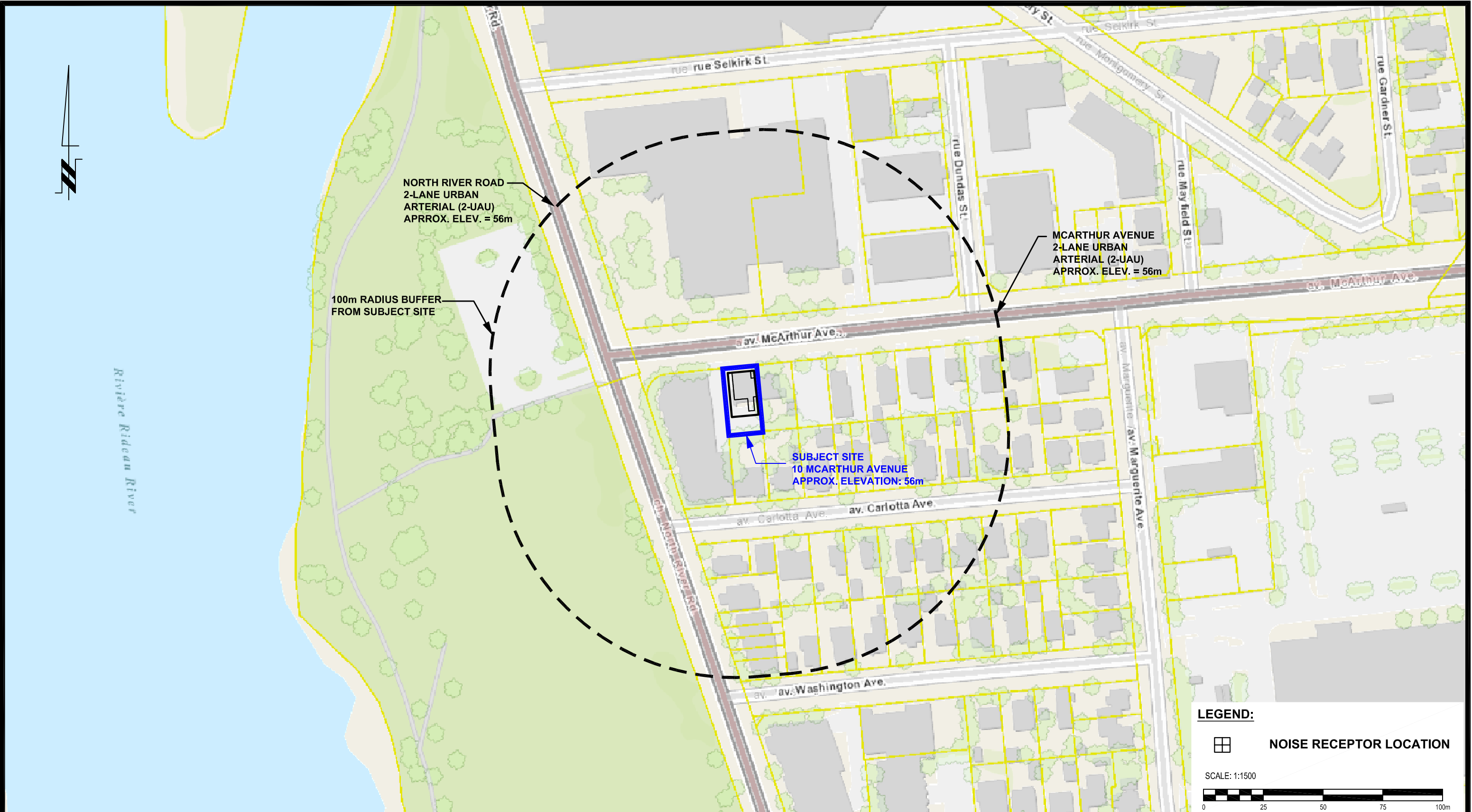
DRAWING PG4853-1C - SITE GEOMETRY (REC 2-1 and REC 2-4)

DRAWING PG4853-1D - SITE GEOMETRY (REC 3-1 and REC 3-4)

DRAWING PG4853-1E - SITE GEOMETRY (REC 4-1 and REC 4-4)

DRAWING PG4853-2 - RECEPTOR LOCATIONS

Table 8 - Summary of Reception Points and Geometry 10 McArthur Avenue																
Point of Reception	Location	Leq	North River Road (2-UAU - Northern Portion)							North River Road (2-UCU - Southern Portion)						
		Day	Horizontal	Vertical	Total	Local Angle	Building Barrier	Distance	Local Angle	Horizontal	Vertical	Total	Local Angle	Building Barrier	Distance	Local Angle
		(dBA)	(m)	(m)	(m)	(degree)	(m)	(m)	(degree)	(m)	(m)	(m)	(degree)	(m)	(m)	(degree)
REC 1-1	Western elevation, 1st floor	62.23	40	1.5	40.03	22, 54	15	8	22, 54	40	1.5	40.03	-85, 22	15	8	-85, 22
REC 1-4	Western elevation, 4th floor	62.74	40	10.5	41.36	22, 54	15	8	22, 54	40	10.5	41.36	-85, 22	15	8	-85, 22
REC 2-1	Northern elevation, 1st floor	67.11	48	1.5	48.02	11, 45.5	n/a	n/a	n/a	48	1.5	48.02	0, 11	n/a	n/a	n/a
REC 2-4	Northern elevation, 4th floor	67.58	48	10.5	49.14	11, 45.5	n/a	n/a	n/a	48	10.5	49.14	0, 11	n/a	n/a	n/a
REC 3-1	Eastern elevation, 1st floor	60.43	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
REC 3-4	Eastern elevation, 4th elevation	61.03	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
REC 4-1	Southern elevation, 1st elevation	38.6	n/a	n/a	n/a	n/a	n/a	n/a	n/a	44	1.5	44.03	-80, 0	18	12	-80, 0
REC 4-4	Southern elevation, 4th elevation	39.73	n/a	n/a	n/a	n/a	n/a	n/a	n/a	44	10.5	45.24	-80, 0	18	12	-80, 0
Point of Reception	Location	Leq	McArthur Avenue													
		Day	Horizontal	Vertical	Total	Local Angle	Building Barrier	Distance	Local Angle							
		(dBA)	(m)	(m)	(m)	(degree)	(m)	(m)	(degree)							
REC 1-1	Western elevation, 1st floor	62.23	18	1.5	18.06	-68, 0	n/a	n/a	n/a							
REC 1-4	Western elevation, 4th floor	62.74	18	10.5	20.84	-68, 0	n/a	n/a	n/a							
REC 2-1	Northern elevation, 1st floor	67.11	15	1.5	15.07	-79.5, 84	n/a	n/a	n/a							
REC 2-4	Northern elevation, 4th floor	67.58	15	10.5	18.31	-79.5, 84	n/a	n/a	n/a							
REC 3-1	Eastern elevation, 1st floor	60.43	18	1.5	18.06	0, 78.4	1 house	4	32, 78.4							
REC 3-4	Eastern elevation, 4th elevation	61.03	18	10.5	20.84	0, 78.4	1 house	4	32, 78.4							
REC 4-1	Southern elevation, 1st elevation	38.6	n/a	n/a	n/a	n/a	n/a	n/a	n/a							
REC 4-4	Southern elevation, 4th elevation	39.73	n/a	n/a	n/a	n/a	n/a	n/a	n/a							



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NO.	REVISIONS	DATE	INITIAL

COLDWELL BANKER
NOISE ATTENUATION STUDY
10 MCARTHUR AVENUE

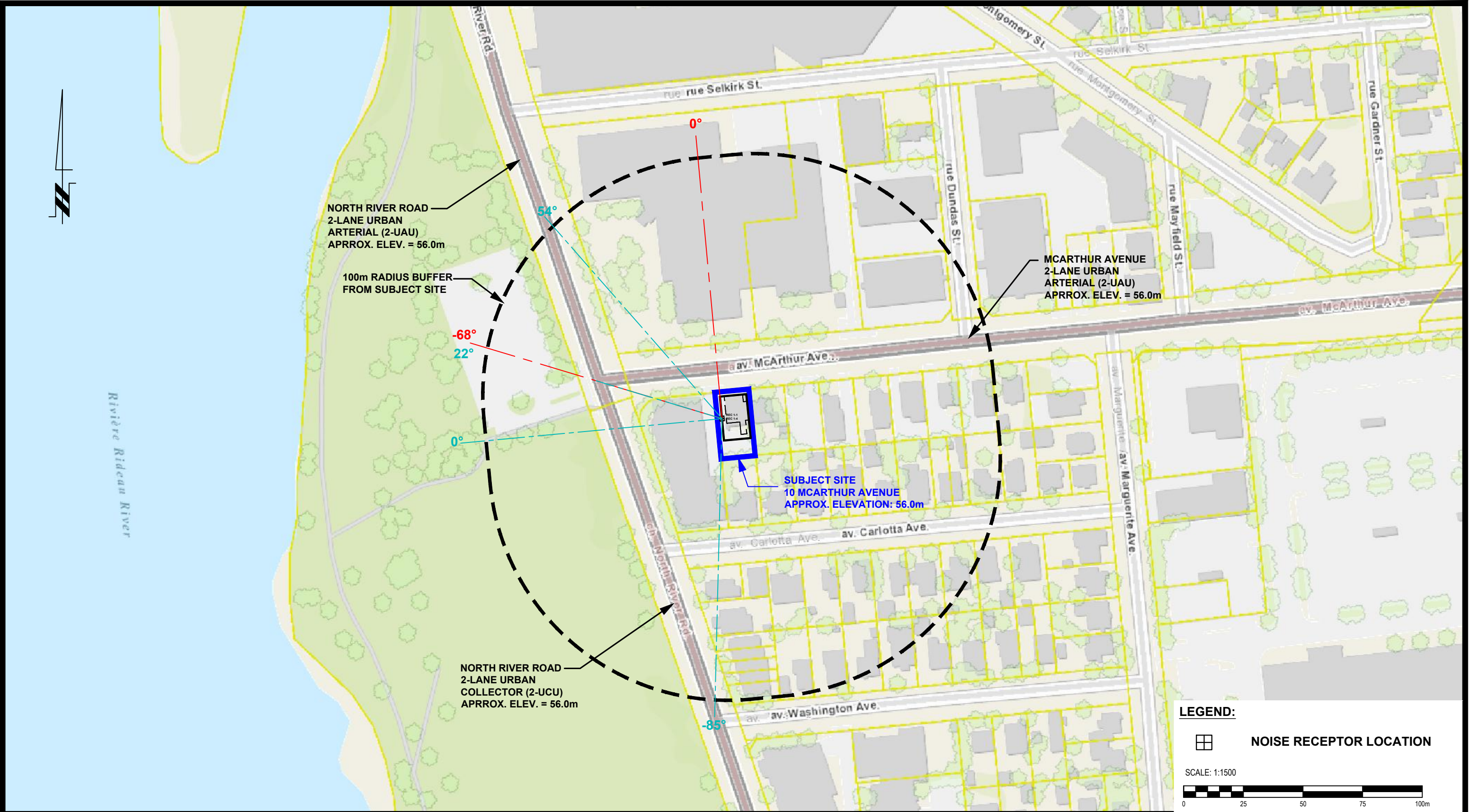
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ONTARIO


SITE PLAN

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Drawn by:	RCG	Report No.:	PG4853-1
Checked by:	SB	PG4853-1A	Revision No.:
Approved by:	DJG		

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LEGEND:

 **NOISE RECEPTOR LOCATION**

SCALE: 1:1500



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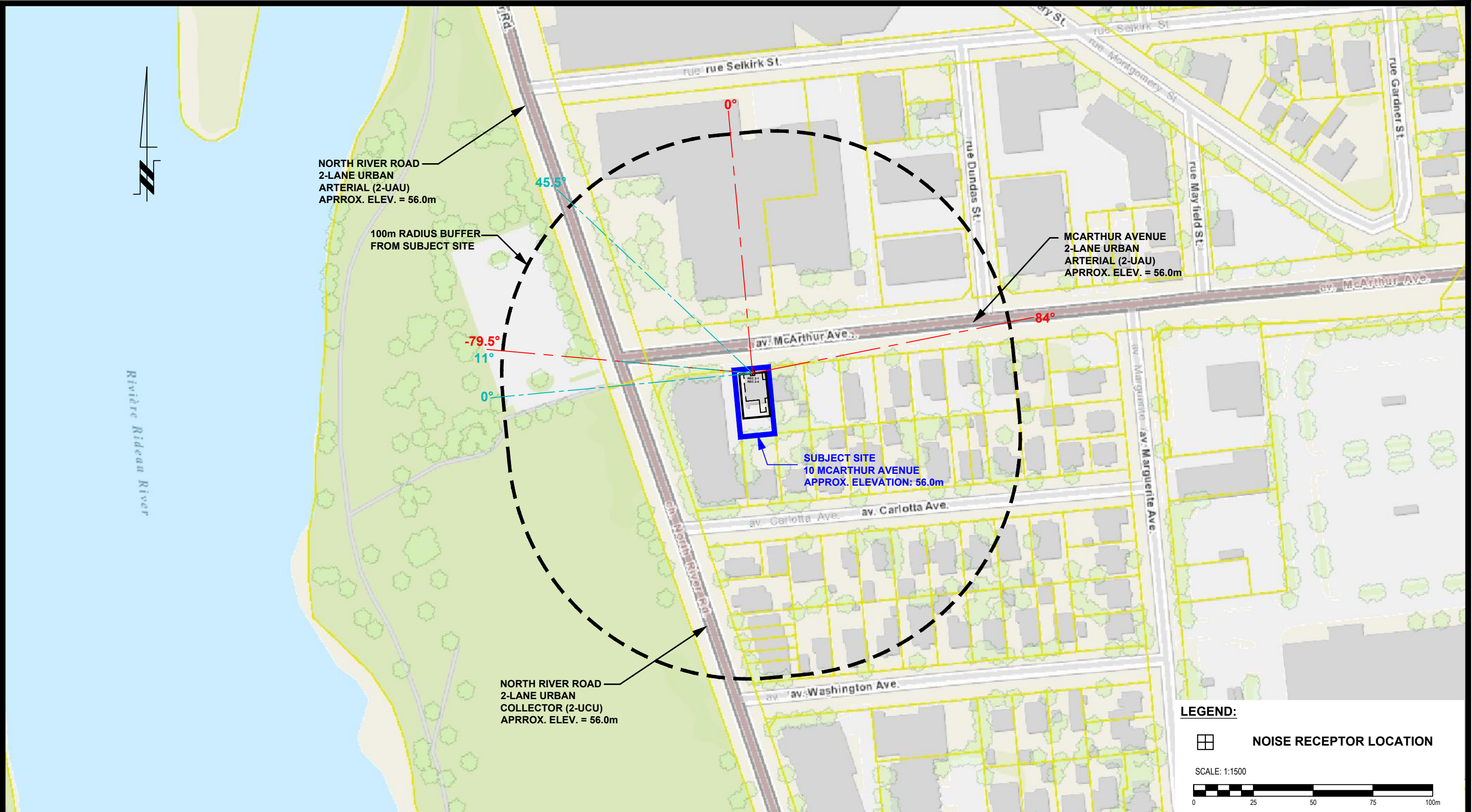
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NOISE ATTENUATION STUDY
10 MCARTHUR AVENUE

OTTAWA, ONTARIO

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Scale:	1:1500	Date:	04/2019
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NOISE ATTENUATION STUDY
10 MCARTHUR AVENUE

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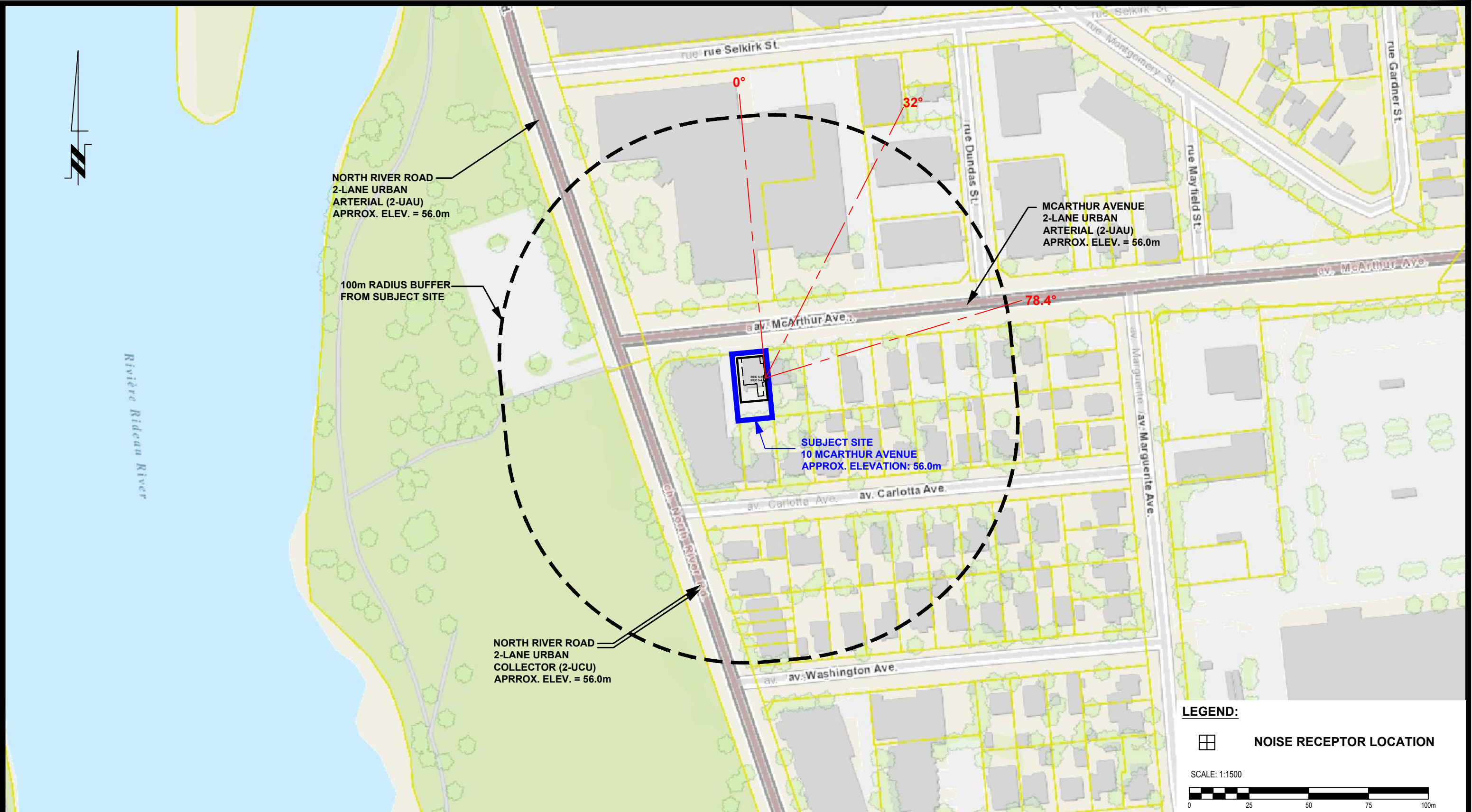
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Report No.: PG4853-1

PG4853-1C

Revision No.:



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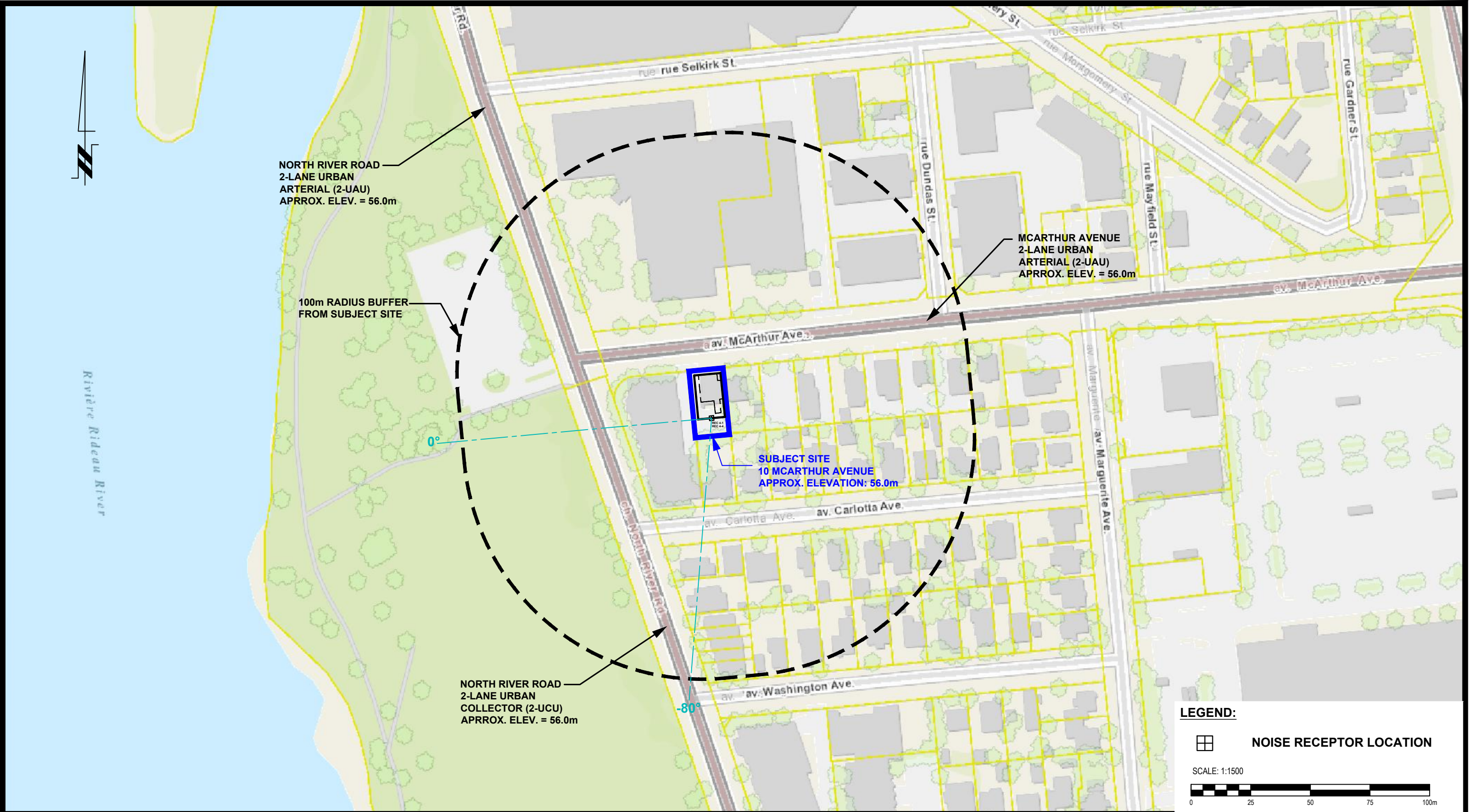
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10 MCARTHUR AVENUE	
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Title:	
SITE GEOMETRY - REC 3-1, REC 3-4	

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Checked by:	SB	PG4853-1D	
Approved by:	DJG		
		Revision No.:	

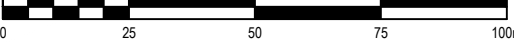
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LEGEND:

 **NOISE RECEPTOR LOCATION**

SCALE: 1:1500



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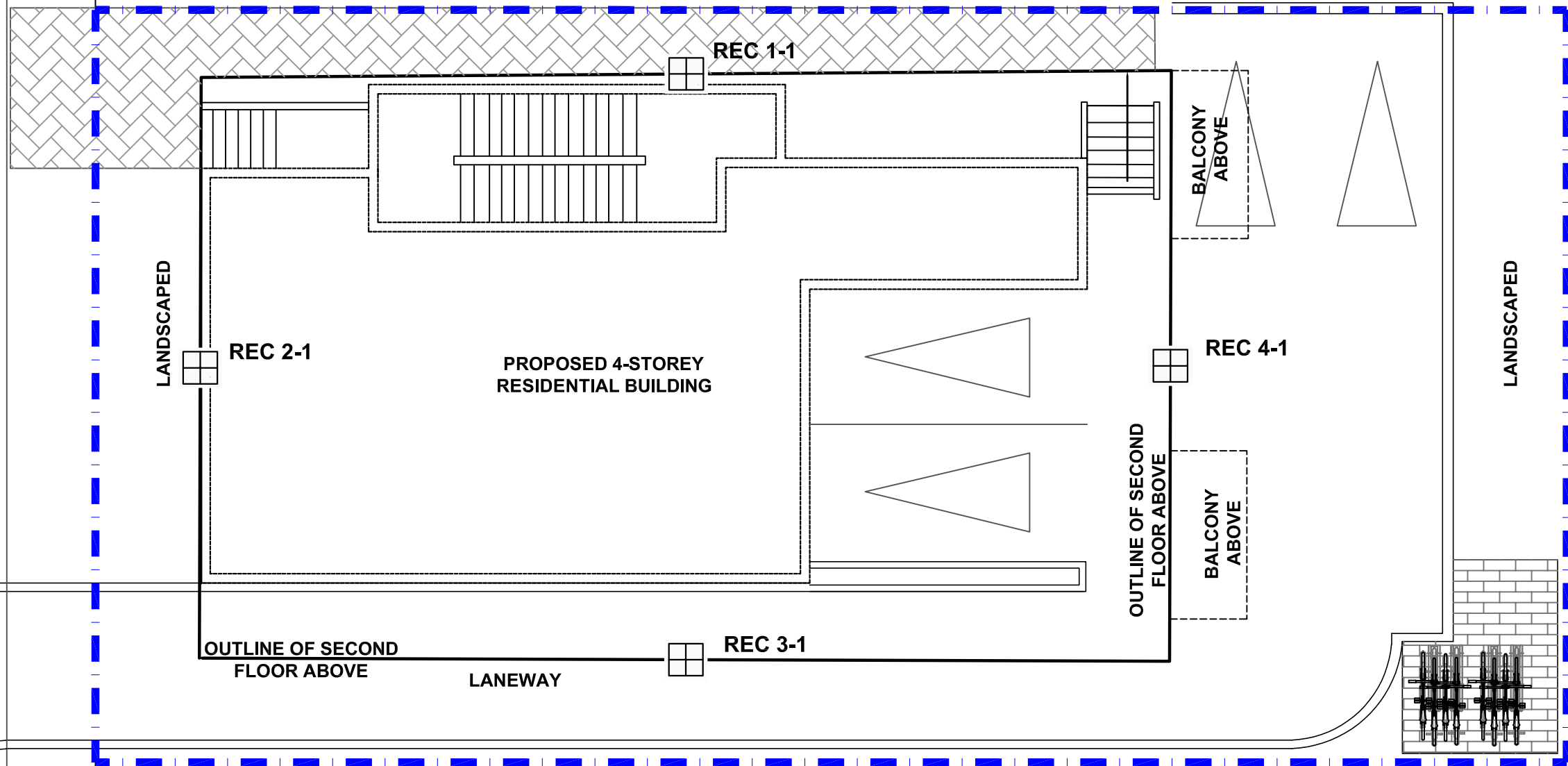
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Title: **SITE GEOMETRY - REC 4-1, REC 4-4**

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Checked by:	SB	PG4853-1E	Revision No.:
Approved by:	DJG		

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MCCARTHUR AVENUE



LEGEND:

 NOISE RECEPTOR LOCATION

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OTTAWA,
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NOISE ATTENUATION STUDY
10 MCARTHUR AVENUE

ONTARIO

NOISE RECEPTOR LOCATION PLAN

Scale: 1:100
Drawn by: RCG
Checked by: SB
Approved by: DJG

Date: 02/2019
Report No.: PG4853-1
PG4853-2
Revision No.:

APPENDIX 2

STAMSON RESULTS

STAMSON 5.0 NORMAL REPORT Date: 15-04-2019 13:31:35
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec11.te Time Period: Day/Night 16/8 hours
Description: Reception Point 1-1

Road data, segment # 1: North River1 (day/night)

Car traffic volume : 12144/1056 veh/TimePeriod *
Medium truck volume : 966/84 veh/TimePeriod *
Heavy truck volume : 690/60 veh/TimePeriod *
Posted speed limit : 50 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): 15000
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: North River1 (day/night)

Angle1 Angle2 : 22.00 deg 54.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 40.00 / 40.00 m
Receiver height : 1.50 / 1.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : 22.00 deg Angle2 : 54.00 deg
Barrier height : 15.00 m
Barrier receiver distance : 8.00 / 8.00 m
Source elevation : 56.00 m
Receiver elevation : 56.00 m
Barrier elevation : 56.00 m
Reference angle : 0.00

↑

Road data, segment # 2: North River2 (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 : 50 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 # 2: North River2 (day/night)

Angle1 Angle2 : -85.00 deg 22.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 40.00 / 40.00 m
Receiver height : 1.50 / 1.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -85.00 deg Angle2 : 22.00 deg
Barrier height : 15.00 m
Barrier receiver distance : 8.00 / 8.00 m
Source elevation : 56.00 m
Receiver elevation : 56.00 m
Barrier elevation : 56.00 m
Reference angle : 0.00

↑

Road data, segment # 3: McArthur (day/night)

Car traffic volume : 12144/1056 veh/TimePeriod *
Medium truck volume : 966/84 veh/TimePeriod *
Heavy truck volume : 690/60 veh/TimePeriod *
Posted speed limit : 50 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): 15000
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: McArthur (day/night)

Angle1 Angle2 : -68.00 deg 0.00 deg

Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 18.00 / 18.00 m
 Receiver height : 1.50 / 1.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00

↑

Results segment # 1: North River1 (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	! Receiver ! Height (m)	! Barrier ! Height (m)	! Elevation of ! Barrier Top (m)
1.50 !	1.50 !	1.50 !	57.50

ROAD (0.00 + 36.72 + 0.00) = 36.72 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
22	54	0.00	68.48	0.00	-4.26	-7.50	0.00	0.00	-20.00	36.72

Segment Leq : 36.72 dBA

↑

Results segment # 2: North River2 (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	! Receiver ! Height (m)	! Barrier ! Height (m)	! Elevation of ! Barrier Top (m)
1.50 !	1.50 !	1.50 !	57.50

ROAD (0.00 + 39.30 + 0.00) = 39.30 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-85	22	0.00	65.75	0.00	-4.26	-2.26	0.00	0.00	-19.94	39.30

Segment Leq : 39.30 dBA



Results segment # 3: McArthur (day)

Source height = 1.50 m

ROAD (0.00 + 62.20 + 0.00) = 62.20 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-68	0	0.66	68.48	0.00	-1.31	-4.97	0.00	0.00	0.00	62.20

Segment Leq : 62.20 dBA

Total Leq All Segments: 62.23 dBA



Results segment # 1: North River1 (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	! Receiver ! Height (m)	! Barrier ! Height (m)	! Elevation of ! Barrier Top (m)
1.50 !	1.50 !	1.50 !	57.50

ROAD (0.00 + 29.12 + 0.00) = 29.12 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
22	54	0.00	60.88	0.00	-4.26	-7.50	0.00	0.00	-20.00	29.12

Segment Leq : 29.12 dBA



Results segment # 2: North River2 (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	! Receiver ! Height (m)	! Barrier ! Height (m)	! Elevation of ! Barrier Top (m)
1.50 !	1.50 !	1.50 !	57.50

ROAD (0.00 + 31.70 + 0.00) = 31.70 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-85	22	0.00	58.16	0.00	-4.26	-2.26	0.00	0.00	-19.94	31.70

Segment Leq : 31.70 dBA

↑

Results segment # 3: McArthur (night)

Source height = 1.50 m

ROAD (0.00 + 54.60 + 0.00) = 54.60 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-68	0	0.66	60.88	0.00	-1.31	-4.97	0.00	0.00	0.00	54.60

Segment Leq : 54.60 dBA

Total Leq All Segments: 54.63 dBA

↑

TOTAL Leq FROM ALL SOURCES (DAY): 62.23
(NIGHT): 54.63

↑

↑

STAMSON 5.0 NORMAL REPORT Date: 15-04-2019 13:32:14
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec14.te Time Period: Day/Night 16/8 hours
Description: Reception Point 1-4

Road data, segment # 1: North River1 (day/night)

Car traffic volume : 12144/1056 veh/TimePeriod *
Medium truck volume : 966/84 veh/TimePeriod *
Heavy truck volume : 690/60 veh/TimePeriod *
Posted speed limit : 50 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): 15000
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: North River1 (day/night)

Angle1 Angle2 : 22.00 deg 54.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 40.00 / 40.00 m
Receiver height : 10.50 / 10.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : 22.00 deg Angle2 : 54.00 deg
Barrier height : 15.00 m
Barrier receiver distance : 8.00 / 8.00 m
Source elevation : 56.00 m
Receiver elevation : 56.00 m
Barrier elevation : 56.00 m
Reference angle : 0.00

↑

Road data, segment # 2: North River2 (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 : 50 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 # 2: North River2 (day/night)

Angle1 Angle2 : -85.00 deg 22.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 40.00 / 40.00 m
Receiver height : 10.50 / 10.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -85.00 deg Angle2 : 22.00 deg
Barrier height : 15.00 m
Barrier receiver distance : 8.00 / 8.00 m
Source elevation : 56.00 m
Receiver elevation : 56.00 m
Barrier elevation : 56.00 m
Reference angle : 0.00

↑

Road data, segment # 3: McArthur (day/night)

Car traffic volume : 12144/1056 veh/TimePeriod *
Medium truck volume : 966/84 veh/TimePeriod *
Heavy truck volume : 690/60 veh/TimePeriod *
Posted speed limit : 50 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): 15000
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: McArthur (day/night)

Angle1 Angle2 : -68.00 deg 0.00 deg

Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 18.00 / 18.00 m
 Receiver height : 10.50 / 10.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00

↑

Results segment # 1: North River1 (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	! Receiver ! Height (m)	! Barrier ! Height (m)	! Elevation of ! Barrier Top (m)
1.50 !	10.50 !	8.70 !	64.70

ROAD (0.00 + 36.72 + 0.00) = 36.72 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
22	54	0.00	68.48	0.00	-4.26	-7.50	0.00	0.00	-20.00	36.72

Segment Leq : 36.72 dBA

↑

Results segment # 2: North River2 (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	! Receiver ! Height (m)	! Barrier ! Height (m)	! Elevation of ! Barrier Top (m)
1.50 !	10.50 !	8.70 !	64.70

ROAD (0.00 + 40.51 + 0.00) = 40.51 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-85	22	0.00	65.75	0.00	-4.26	-2.26	0.00	0.00	-18.72	40.51

Segment Leq : 40.51 dBA



Results segment # 3: McArthur (day)

Source height = 1.50 m

ROAD (0.00 + 62.70 + 0.00) = 62.70 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-68	0	0.39	68.48	0.00	-1.10	-4.68	0.00	0.00	0.00	62.70

Segment Leq : 62.70 dBA

Total Leq All Segments: 62.74 dBA



Results segment # 1: North River1 (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	! Receiver ! Height (m)	! Barrier ! Height (m)	! Elevation of ! Barrier Top (m)
1.50 !	10.50 !	8.70 !	64.70

ROAD (0.00 + 29.12 + 0.00) = 29.12 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
22	54	0.00	60.88	0.00	-4.26	-7.50	0.00	0.00	-20.00	29.12

Segment Leq : 29.12 dBA



Results segment # 2: North River2 (night)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	! Receiver ! Height (m)	! Barrier ! Height (m)	! Elevation of ! Barrier Top (m)
1.50 !	10.50 !	8.70 !	64.70

ROAD (0.00 + 32.91 + 0.00) = 32.91 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-85	22	0.00	58.16	0.00	-4.26	-2.26	0.00	0.00	-18.72	32.91

Segment Leq : 32.91 dBA

↑

Results segment # 3: McArthur (night)

Source height = 1.50 m

ROAD (0.00 + 55.10 + 0.00) = 55.10 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-68	0	0.39	60.88	0.00	-1.10	-4.68	0.00	0.00	0.00	55.10

Segment Leq : 55.10 dBA

Total Leq All Segments: 55.14 dBA

↑

TOTAL Leq FROM ALL SOURCES (DAY): 62.74
(NIGHT): 55.14

↑

↑

STAMSON 5.0 NORMAL REPORT Date: 15-04-2019 13:35:40
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: REC21.te Time Period: Day/Night 16/8 hours
Description: Reception Point 2-1

Road data, segment # 1: River Road1 (day/night)

Car traffic volume : 12144/1056 veh/TimePeriod *
Medium truck volume : 966/84 veh/TimePeriod *
Heavy truck volume : 690/60 veh/TimePeriod *
Posted speed limit : 50 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): 15000
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: River Road1 (day/night)

Angle1 Angle2 : 11.00 deg 45.50 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 48.00 / 48.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↑

Road data, segment # 2: River Road2 (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 : 50 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 # 2: River Road2 (day/night)

 Angle1 Angle2 : 0.00 deg 11.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 48.00 / 48.00 m
 Receiver height : 1.50 / 1.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00



Road data, segment # 3: McArthur (day/night)

 Car traffic volume : 12144/1056 veh/TimePeriod *
 Medium truck volume : 966/84 veh/TimePeriod *
 Heavy truck volume : 690/60 veh/TimePeriod *
 Posted speed limit : 50 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): 15000
 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: McArthur (day/night)

 Angle1 Angle2 : -80.00 deg 84.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 15.00 / 15.00 m
 Receiver height : 1.50 / 1.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00



Results segment # 1: River Road1 (day)

Source height = 1.50 m

ROAD (0.00 + 52.51 + 0.00) = 52.51 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
11	46	0.66	68.48	0.00	-8.39	-7.59	0.00	0.00	0.00	52.51

Segment Leq : 52.51 dBA

↑

Results segment # 2: River Road2 (day)

Source height = 1.50 m

ROAD (0.00 + 45.21 + 0.00) = 45.21 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	11	0.66	65.75	0.00	-8.39	-12.16	0.00	0.00	0.00	45.21

Segment Leq : 45.21 dBA

↑

Results segment # 3: McArthur (day)

Source height = 1.50 m

ROAD (0.00 + 66.93 + 0.00) = 66.93 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-80	84	0.66	68.48	0.00	0.00	-1.55	0.00	0.00	0.00	66.93

Segment Leq : 66.93 dBA

Total Leq All Segments: 67.11 dBA

↑

Results segment # 1: River Road1 (night)

Source height = 1.50 m

ROAD (0.00 + 44.91 + 0.00) = 44.91 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
11	46	0.66	60.88	0.00	-8.39	-7.59	0.00	0.00	0.00	44.91

Filename: REC24.te Time Period: Day/Night 16/8 hours
Description: Reception Point 2-4

Road data, segment # 1: River Road1 (day/night)

Car traffic volume : 12144/1056 veh/TimePeriod *
Medium truck volume : 966/84 veh/TimePeriod *
Heavy truck volume : 690/60 veh/TimePeriod *
Posted speed limit : 50 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): 15000
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: River Road1 (day/night)

Angle1 Angle2 : 11.00 deg 45.50 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 48.00 / 48.00 m
Receiver height : 10.50 / 10.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↑

Road data, segment # 2: River Road2 (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 : 50 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 # 2: River Road2 (day/night)

Angle1	Angle2	:	0.00 deg	11.00 deg
Wood depth	:	0	(No woods.)	
No of house rows	:	0 / 0		
Surface	:	1	(Absorptive ground surface)	
Receiver source distance	:	48.00 / 48.00	m	
Receiver height	:	10.50 / 10.50	m	
Topography	:	1	(Flat/gentle slope; no barrier)	
Reference angle	:	0.00		



Road data, segment # 3: McArthur (day/night)

Car traffic volume	:	12144/1056	veh/TimePeriod	*
Medium truck volume	:	966/84	veh/TimePeriod	*
Heavy truck volume	:	690/60	veh/TimePeriod	*
Posted speed limit	:	50 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):	15000
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: McArthur (day/night)

Angle1	Angle2	:	-80.00 deg	84.00 deg
Wood depth	:	0	(No woods.)	
No of house rows	:	0 / 0		
Surface	:	1	(Absorptive ground surface)	
Receiver source distance	:	15.00 / 15.00	m	
Receiver height	:	10.50 / 10.50	m	
Topography	:	1	(Flat/gentle slope; no barrier)	
Reference angle	:	0.00		



Results segment # 1: River Road1 (day)

Source height = 1.50 m

ROAD (0.00 + 54.04 + 0.00) = 54.04 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
11	46	0.39	68.48	0.00	-7.02	-7.42	0.00	0.00	0.00	54.04

Segment Leq : 54.04 dBA

↑

Results segment # 2: River Road2 (day)

Source height = 1.50 m

ROAD (0.00 + 46.58 + 0.00) = 46.58 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	11	0.39	65.75	0.00	-7.02	-12.15	0.00	0.00	0.00	46.58

Segment Leq : 46.58 dBA

↑

Results segment # 3: McArthur (day)

Source height = 1.50 m

ROAD (0.00 + 67.35 + 0.00) = 67.35 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-80	84	0.39	68.48	0.00	0.00	-1.13	0.00	0.00	0.00	67.35

Segment Leq : 67.35 dBA

Total Leq All Segments: 67.58 dBA

↑

Results segment # 1: River Road1 (night)

Source height = 1.50 m

ROAD (0.00 + 46.44 + 0.00) = 46.44 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
11	46	0.39	60.88	0.00	-7.02	-7.42	0.00	0.00	0.00	46.44

Segment Leq : 46.44 dBA

↑
Results segment # 2: River Road2 (night)

Source height = 1.50 m

ROAD (0.00 + 38.99 + 0.00) = 38.99 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	11	0.39	58.16	0.00	-7.02	-12.15	0.00	0.00	0.00	38.99

Segment Leq : 38.99 dBA

↑
Results segment # 3: McArthur (night)

Source height = 1.50 m

ROAD (0.00 + 59.75 + 0.00) = 59.75 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-80	84	0.39	60.88	0.00	0.00	-1.13	0.00	0.00	0.00	59.75

Segment Leq : 59.75 dBA

Total Leq All Segments: 59.98 dBA

↑

TOTAL Leq FROM ALL SOURCES (DAY): 67.58
 (NIGHT): 59.98

↑
↑

STAMSON 5.0 NORMAL REPORT Date: 15-04-2019 13:37:54
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: REC31.te Time Period: Day/Night 16/8 hours
Description: Reception Point 3-1

Road data, segment # 1: McArthur (day/night)

Car traffic volume : 12144/1056 veh/TimePeriod *
Medium truck volume : 966/84 veh/TimePeriod *
Heavy truck volume : 690/60 veh/TimePeriod *
Posted speed limit : 50 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): 15000
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: McArthur (day/night)

Angle1 Angle2 : 0.00 deg 78.40 deg
Wood depth : 0 (No woods.)
No of house rows : 1 / 1
House density : 40 %
Surface : 1 (Absorptive ground surface)
Receiver source distance : 18.00 / 18.00 m
Receiver height : 1.50 / 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↑

Results segment # 1: McArthur (day)

Source height = 1.50 m

ROAD (0.00 + 60.43 + 0.00) = 60.43 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	78	0.66	68.48	0.00	-1.31	-4.63	0.00	-2.10	0.00	60.43

Segment Leq : 60.43 dBA

Total Leq All Segments: 60.43 dBA

↑

Results segment # 1: McArthur (night)

Source height = 1.50 m

ROAD (0.00 + 52.83 + 0.00) = 52.83 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
--------	--------	-------	--------	-------	-------	-------	-------	-------	-------	--------

0	78	0.66	60.88	0.00	-1.31	-4.63	0.00	-2.10	0.00	52.83
---	----	------	-------	------	-------	-------	------	-------	------	-------

Segment Leq : 52.83 dBA

Total Leq All Segments: 52.83 dBA

↑

TOTAL Leq FROM ALL SOURCES (DAY): 60.43
(NIGHT): 52.83

↑

↑

STAMSON 5.0 NORMAL REPORT Date: 15-04-2019 13:38:34
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: REC34.te Time Period: Day/Night 16/8 hours
Description: Reception Point 3-4

Road data, segment # 1: McArthur (day/night)

Car traffic volume : 12144/1056 veh/TimePeriod *
Medium truck volume : 966/84 veh/TimePeriod *
Heavy truck volume : 690/60 veh/TimePeriod *
Posted speed limit : 50 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): 15000
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: McArthur (day/night)

Angle1 Angle2 : 0.00 deg 78.40 deg
Wood depth : 0 (No woods.)
No of house rows : 1 / 1
House density : 40 %
Surface : 1 (Absorptive ground surface)
Receiver source distance : 18.00 / 18.00 m
Receiver height : 10.50 / 10.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↑

Results segment # 1: McArthur (day)

Source height = 1.50 m

ROAD (0.00 + 61.03 + 0.00) = 61.03 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	78	0.39	68.48	0.00	-1.10	-4.25	0.00	-2.10	0.00	61.03

Segment Leq : 61.03 dBA

Total Leq All Segments: 61.03 dBA

↑

Results segment # 1: McArthur (night)

Source height = 1.50 m

ROAD (0.00 + 53.43 + 0.00) = 53.43 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
--------	--------	-------	--------	-------	-------	-------	-------	-------	-------	--------

0	78	0.39	60.88	0.00	-1.10	-4.25	0.00	-2.10	0.00	53.43
---	----	------	-------	------	-------	-------	------	-------	------	-------

Segment Leq : 53.43 dBA

Total Leq All Segments: 53.43 dBA

↑

TOTAL Leq FROM ALL SOURCES (DAY): 61.03

(NIGHT): 53.43

↑

↑

STAMSON 5.0 NORMAL REPORT Date: 15-04-2019 13:40:18
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: REC41.te Time Period: Day/Night 16/8 hours
Description: Reception Point 4-1

Road data, segment # 1: River Road2 (day/night)

Car traffic volume : 6256/544 veh/TimePeriod *
Medium truck volume : 589/51 veh/TimePeriod *
Heavy truck volume : 515/45 veh/TimePeriod *
Posted speed limit : 50 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 : 8.00
Heavy Truck % of Total Volume : 7.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: River Road2 (day/night)

Angle1 Angle2 : -80.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 44.00 / 44.00 m
Receiver height : 1.50 / 1.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -80.00 deg Angle2 : 0.00 deg
Barrier height : 15.00 m
Barrier receiver distance : 12.00 / 12.00 m
Source elevation : 56.00 m
Receiver elevation : 56.00 m
Barrier elevation : 56.00 m
Reference angle : 0.00

↑

Results segment # 1: River Road2 (day)

Source height = 1.63 m

Barrier height for grazing incidence

Source	!	Receiver	!	Barrier	!	Elevation of
Height (m)	!	Height (m)	!	Height (m)	!	Barrier Top (m)
-----+-----+-----+-----						
1.63	!	1.50	!	1.53	!	57.53

ROAD (0.00 + 38.60 + 0.00) = 38.60 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
-80	0	0.00	66.79	0.00	-4.67	-3.52	0.00	0.00	-20.00	38.60
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Segment Leq : 38.60 dBA

Total Leq All Segments: 38.60 dBA

↑

Results segment # 1: River Road2 (night)

Source height = 1.63 m

Barrier height for grazing incidence

Source	!	Receiver	!	Barrier	!	Elevation of
Height (m)	!	Height (m)	!	Height (m)	!	Barrier Top (m)
-----+-----+-----+-----						
1.63	!	1.50	!	1.54	!	57.54

ROAD (0.00 + 31.02 + 0.00) = 31.02 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
-80	0	0.00	59.21	0.00	-4.67	-3.52	0.00	0.00	-20.00	31.02
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Segment Leq : 31.02 dBA

Total Leq All Segments: 31.02 dBA

↑

TOTAL Leq FROM ALL SOURCES (DAY): 38.60
(NIGHT): 31.02

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↑

STAMSON 5.0 NORMAL REPORT Date: 15-04-2019 13:40:51
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: REC44.te Time Period: Day/Night 16/8 hours
Description: Reception Point 4-4

Road data, segment # 1: River Road2 (day/night)

Car traffic volume : 6256/544 veh/TimePeriod *
Medium truck volume : 589/51 veh/TimePeriod *
Heavy truck volume : 515/45 veh/TimePeriod *
Posted speed limit : 50 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 : 8.00
Heavy Truck % of Total Volume : 7.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 1: River Road2 (day/night)

Angle1 Angle2 : -80.00 deg 0.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 44.00 / 44.00 m
Receiver height : 10.50 / 10.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -80.00 deg Angle2 : 0.00 deg
Barrier height : 15.00 m
Barrier receiver distance : 12.00 / 12.00 m
Source elevation : 56.00 m
Receiver elevation : 56.00 m
Barrier elevation : 56.00 m
Reference angle : 0.00

↑

Results segment # 1: River Road2 (day)

Source height = 1.63 m

Barrier height for grazing incidence

Source	!	Receiver	!	Barrier	!	Elevation of
Height (m)	!	Height (m)	!	Height (m)	!	Barrier Top (m)
-----+-----+-----+-----						
1.63	!	10.50	!	8.08	!	64.08

ROAD (0.00 + 39.73 + 0.00) = 39.73 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
-80	0	0.00	66.79	0.00	-4.67	-3.52	0.00	0.00	-18.87	39.73
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Segment Leq : 39.73 dBA

Total Leq All Segments: 39.73 dBA

↑

Results segment # 1: River Road2 (night)

Source height = 1.63 m

Barrier height for grazing incidence

Source	!	Receiver	!	Barrier	!	Elevation of
Height (m)	!	Height (m)	!	Height (m)	!	Barrier Top (m)
-----+-----+-----+-----						
1.63	!	10.50	!	8.08	!	64.08

ROAD (0.00 + 32.15 + 0.00) = 32.15 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
-80	0	0.00	59.21	0.00	-4.67	-3.52	0.00	0.00	-18.87	32.15
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Segment Leq : 32.15 dBA

Total Leq All Segments: 32.15 dBA

↑

TOTAL Leq FROM ALL SOURCES (DAY): 39.73
(NIGHT): 32.15

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APPENDIX 3

INDUSTRY STANDARDS

Insulating Glass (Table 2)

Glass Makeup			Frequency in Hertz (Hz)																			STC
			100	125	160	200	250	315	400	500	650	800	1000	1250	1600	2000	2500	3150	4000	5000		
Sound Transmission Loss (dB)																						
Glass Ply	Air Space	Glass Ply																				
1/8" 3 mm	1/4" 6 mm	1/8" 3 mm	26	21	23	23	26	21	19	24	27	30	33	36	40	44	46	39	34	45	28	
1/8" 3 mm	3/8" 9 mm	1/8" 3 mm	26	23	23	20	23	19	23	27	29	32	35	39	44	47	48	41	36	43	31	
1/4" 6 mm	1/2" 13 mm	1/4" 6 mm	27	24	29	22	22	25	30	33	35	38	40	42	42	37	37	43	46	49	35	
1/4" 6 mm	1/2" 13 mm	5/16" 8 mm	28	29	33	29	29	32	36	37	40	43	42	43	42	37	40	44	48	53	40	
1/4" 6 mm	1/2" 13 mm	3/8" 10 mm	28	26	32	29	29	31	35	37	38	39	41	43	41	40	41	44	47	49	39	
5/16" 8 mm	1/2" 13 mm	5/16" 8 mm	26	24	25	31	24	32	32	35	37	39	39	38	36	38	42	44	46	49	37	
1/4" 6 mm	3/4" 19 mm	1/4" 6 mm	27	23	28	21	27	29	34	35	37	41	43	45	44	39	39	46	49	52	38	
1/4" 6 mm	1" 25 mm	1/4" 6 mm	22	19	27	23	31	30	35	35	36	39	41	42	41	36	37	46	51	56	37	

Laminated Insulating Glass (Table 3)

Glass Makeup					Frequency in Hertz (Hz)																		STC
					100	125	160	200	250	315	400	500	650	800	1000	1250	1600	2000	2500	3150	4000	5000	
Sound Transmission Loss (dB)																							
Glass Ply	Air Space	Glass Ply	PVB*	Glass Ply																			
3/16" 5 mm	3/8" 9 mm	1/8" 3 mm	.030" .76 mm	1/8" 3 mm	27	27	26	24	22	28	32	35	38	38	39	40	42	43	41	45	52	57	37
3/16" 5 mm	1/2" 13 mm	1/8" 3 mm	.030" .76 mm	1/8" 3 mm	26	23	25	23	27	31	34	36	38	39	41	43	45	46	43	49	55	55	39
1/4" 6 mm	1/2" 13 mm	1/8" 3 mm	.030" .76 mm	1/8" 3 mm	28	20	29	24	26	30	34	36	39	42	43	44	44	41	40	47	52	56	39
1/4" 6 mm	1/2" 13 mm	1/4" 6 mm	.030" .76 mm	1/8" 3 mm	28	17	28	29	33	34	38	40	40	41	41	41	41	40	43	49	54	58	40
1/4" 6 mm	1/2" 13 mm	3/16" 5 mm	.060" 1.52 mm	3/16" 5 mm	30	29	31	28	31	34	37	39	41	42	44	46	45	44	47	52	55	60	42
1/4" 6 mm	1/2" 13 mm	1/4" 6 mm	.030" .76 mm	1/4" 6 mm	31	29	32	30	32	35	38	40	40	42	44	46	47	46	47	52	56	61	43
5/16" 8 mm	5/8" 16 mm	3/16" 5 mm	.060" 1.52 mm	3/16" 5 mm	28	28	34	36	33	40	41	42	43	43	42	40	40	43	49	53	57	61	43
1/4" 6 mm	3/4" 19 mm	3/16" 5 mm	.060" 1.52 mm	3/16" 5 mm	28	26	32	30	35	37	40	41	43	44	45	47	47	44	47	53	57	60	44
1/4" 6 mm	3/4" 19 mm	1/4" 6 mm	.060" 1.52 mm	1/4" 6 mm	28	29	36	32	34	39	41	41	41	43	44	45	45	46	47	52	56	61	44
3/8" 10 mm	3/4" 19 mm	1/4" 6 mm	.060" 1.52 mm	1/4" 6 mm	25	31	38	33	37	39	42	43	43	42	40	40	41	56	50	55	58	61	43

Data based on testing 36" x 84" glass in an acoustical wall. Glass size and glazing system will affect STC rating.
 *PVB (polyvinyl butyral) interlayer

Wall & Floor Assembly Guide

Insulation for Sound & Fire Rated Assemblies

Sound Transmission Loss of Exterior Walls

<i>Exterior finish</i>	<i>Cavity Insulation</i>	<i>Resilient channel</i>	<i>STC</i>
Wood siding (1)	None	No	37
	3-1/2" PINK™ FIBERGLAS® Batt Insulation	No	39
	None	Yes	43
	3-1/2" PINK™ FIBERGLAS® Batt Insulation	Yes	47
Stucco (2)	3-1/2" PINK™ FIBERGLAS® Batt Insulation	No	46
	None	Yes	49
	3-1/2" PINK™ FIBERGLAS® Batt Insulation	Yes	57
Brick veneer (3)	3-1/2" PINK™ FIBERGLAS® Batt Insulation	No	56
	None	Yes	54
	3-1/2" PINK™ FIBERGLAS® Batt Insulation	Yes	58
Concrete block	None	No	45

Wall construction details

Wood siding (1)	Framing	2"x4" wood studs, (16" o.c.)
	Sheathing	1/2" wood fiberboard insulation nailed to studs
	Siding	5/8"x10" redwood nailed through sheathing into studs
	Interior	1/2" gypsum board screwed to studs or to metal resilient channels which were attached to the studs
Stucco (2)	Framing	2"x4" woods studs, (16" o.c.)
	Sheathing	None
	Stucco	No. 15 felt building and 1" wire mesh nailed to studs. Stucco Applied in 3 coats to 7/8" total thickness. Dry weight of Stucco 7.9 lb/sq ft
	Interior	1/2" gypsum board screwed to studs or resilient channel
Brick veneer (3)	Framing	2"x4" wood studs, (16" o.c.)
	Sheathing	3/4" wood fiberboard insulation
	Brick	standard face brick 3-1/2" wide, spaced 1/2" out from sheathing with metal ties nailed through sheathing into studs. Dry weight of brick and mortar 41 lb/sq ft .
	Interior	1/2" gypsum board screwed to studs or resilient channel

Taken from the U.S. Department of Commerce National Bureau of Standards Building Science Series 77.

* Information received in imperial units only