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Environmental Noise Control Study

Proposed Multi-Storey Building
89 Richmond Road, Ottawa

Prepared For

Ms. Tanuja Vaidya

August 8, 2019

Report: PG4720-1 Revision 1

Table of Contents Page

Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Ms. Tanuja Vaidya to conduct an environmental noise control study for the proposed multi-storey building to be located at 89 Richmond Road, 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 six (6) storey building with associated landscaped areas. There were no outdoor living areas identified on the plans. Additionally, all balconies and elevated terraces are less than 4 m deep and therefore are not classified as outdoor living areas.

It is understood that the rear yard on the main level will be utilized commercially by the spa with the intention for the quiet enjoyment of the outdoor environment. Therefore, this rear yard will be included in the analysis.

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

- 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
❑ 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."
❑ 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.

No outdoor living areas were noted on the concept plans. A landscaped area was identified on the ground floor at the rear of the property. The mechanical units of the 101 Richmond Road and of 89 Richmond Road will be located on the roof, six stories above this receptor point. Due to the separation between the stationary noise source and the receptor location, a stationary noise analysis will not be required.

Aircraft/Airport Noise

Due to the location of the subject site, an analysis of aircraft/airport noise is not required.

4.0 Analysis

The proposed development is bordered to the south by Richmond Road, to the west by a six-storey residential building, and to the east and north by two-storey residential buildings. Richmond Road, Patricia Avenue, Mailes Avenue, Island Park Drive and Leighton Terrace are identified within the 100 m radius of the proposed development. The proposed Confederation Line is outside of the 250 m radius and is therefore not included in this analysis.

Based on the City of Ottawa Official Plan, Schedule E, neither Patricia Avenue, Mailes Avenue and Leighton Terrace are classified as either an arterial, collector or major collector road and therefore they are not included in this study. Richmond Road is identified as a 2-lane urban arterial and is included in this study. Island Park Drive is identified as a federally owned road and therefore is not included in this study.

All noise sources are presented in Drawing PG4720-1 - Site Plan in Appendix 1.

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 %
Richmond Road	2-UAU	15,000	40	92/8	7	5

❑ Data obtained from the City of Ottawa document ENCG or calculated from OC Transpo online schedules

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	Commercial	daytime
Sixth Floor	17.35	Living area/bedrooms	daytime/nighttime

For this analysis, a reception point was taken at the centre of each floor, at the ground floor and sixth floor. Reception points are detailed on Drawing PG4720-2 - Receptor Locations presented in Appendix 1.

All horizontal distances have been measured from the reception point to the edge of the right-of-way. Richmond Road was analyzed where they intersected the 100 m buffer zone, which is reflected in the local angles, described in Paterson Drawings PG4720-1A to 1D - Site Geometry in Appendix 1.

Table 7 - Summary of Reception Points and Geometry, located 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 ENGC.

The subject site is relatively flat and at grade with the neighbouring roads with 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.

The buildings located directly to the west of the proposed development was analyzed as a solid barrier in the STAMSON software. Due to the proximity of the building and the building components, this is an accurate modeling representation for this development.

One limitation of the STAMSON software is that the minimum distance between the reception point and the noise source is 15 m. The actual distance from the reception point and the noise source of REC 2-1 and REC 2-6 is actually 9 m, measured from the window pane to the centre of the right-of-way. Therefore, the data will need to be further analyzed in order to determine an accurate noise level resulting from the roadway noise.

5.0 Results

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 can be located in Appendix 2, and the summary of the results can be noted in Table 6.

As it was noted in Subsection 4.0, a limitation of the STAMSON software does not allow for the noise source to be closer than 15 m to the reception point. In this situation, Reception Point 2-1 and Reception Point 2-6 are located 6 m from the source. Therefore, the difference in the sound level between a noise source at 15 m and a noise source at 6 m can be calculated using the following formula:

$$L_2 = L_1 - \left[20 \log\left(\frac{r_2}{r_1} \right) \right]$$

Where: L_2 = Sound Level at reception point 2
L_1 = Sound Level at reception point 1
r_2 = distance from source to reception point 2
r_1 = distance from source to reception point 1

The final results from the analysis are presented in Table 6, below.

Table 6 - Proposed Noise Levels

Reception Point	Description	Outdoor Living Area (dBA)	Daytime at Facade $L_{EQ(16)}$ (dBA)	Nighttime at Facade $L_{eq(8)}$ (dBA)
REC 1-1	Eastern elevation, ground floor	--	53.01	45.41
REC 1-6	Eastern elevation, sixth floor	--	53.01	45.41
REC 2-1	Southern elevation, ground floor	--	69.63	62.03
REC 2-6	Southern elevation, sixth floor	--	70.47	62.88
REC 3-1	Western elevation, ground floor	--	50.15	32.46
REC 3-6	Western elevation, sixth floor	--	50.15	32.46
REC 4-1	Rear Yard - northern elevation	30.45	--	--

6.0 Discussion and Recommendations

6.1 Outdoor Living Areas

There were no outdoor living areas identified for this development. A outdoor receptor point was analyzed at the rear landscaped area on the main floor. The result of this STAMSON modelling indicates that the $L_{eq(16)}$ for this receptor point is 30.45 dBA. This is below the 55 dBA limit and is considered acceptable.

6.2 Indoor Living Areas and Ventilation

The results of the STAMSON modelling indicates that the $L_{eq(16)}$ ranges between 50.13 dBA and 53.01 dBA on the east and west side of the proposed building. However, the southern elevation that is directly exposed to Richmond Road ranges from 69.63 dBA to 70.47 dBA. The ENGC states that the limits for the exterior of the pane of glass is 55 dBA. This value was exceeded at the southern receptor points. Therefore, all units that face Richmond Road must have a central air conditioning unit installed. Additionally, warning clause Type D, as outlined in Table 3, is also required.

An analysis of building materials will be required if the analysis indicates that the levels exceed the 65 dBA threshold for daytime noise or exceeds the 60 dBA threshhold for nighttime noise. Therefore, additional analysis will be required.

Proposed Construction Specifications

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

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

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 31 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 34 or higher, this would be a sufficient noise attenuation device.

Paterson was informed by Ms. Tanuja Vaidya that the exterior cladding will consist of either a brick veneer on the lower levels and cement and metal paneling on the upper levels. The remainder of the wall assembly was forwarded to Paterson for review by Mr. Kevin Reid of roderick lahey architect inc. This correspondence has been included in Appendix 3.

Brick veneer has an STC rating of 53 dBA or greater depending on how the wall is designed. Additionally, cement panels and metal cladding is similar to stucco, which has an STC rating of 46 dBA or greater, depending on how the wall is designed. General wall assemblies have been compared to standard wall assemblies tested for STC ratings and those general assemblies have been included in Appendix 3. Based on the wall assembly data provided, the design of the exterior walls is considered acceptable.

7.0 Summary of Findings

The subject site is located at 89 Richmond Road. It is understood that the development will consist of a six storey building. The associated analysis identified one noise sources: Richmond Road.

Several reception points were selected for the analysis, consisting of pane of glass reception points on both the first and sixth level in addition to a rear yard point. The southern elevation of the proposed building exceeded the 55 dBA guideline specified by the ENCG. Therefore, a warning clause Type D will be required for these units in addition to the installation of an air conditioning unit.

A review of the building materials was completed to ensure that the sound dampening will be sufficient to minimize the noise within the individual units. Based on the wall assembly data provided, the design of the exterior walls is considered acceptable.

The rear yard was analyzed as an outdoor living area for this development. It was noted that the reception points in the rear yard did not exceeded the 55 dBA guideline.

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 Ms.Tanuja Vaidya 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.

David J. Gilbert, P.Eng.

Report Distribution:

- ❑ Ms. Tanuja Vaidya (3 copies)
- ❑ Paterson Group (1 copy)

APPENDIX 1

TABLE 7 - SUMMARY OF RECEPTION POINTS AND GEOMETRY

DRAWING PG4720-1 - SITE PLAN

DRAWING PG4720-1B - SITE GEOMETRY (REC 1-1, REC 1-2)

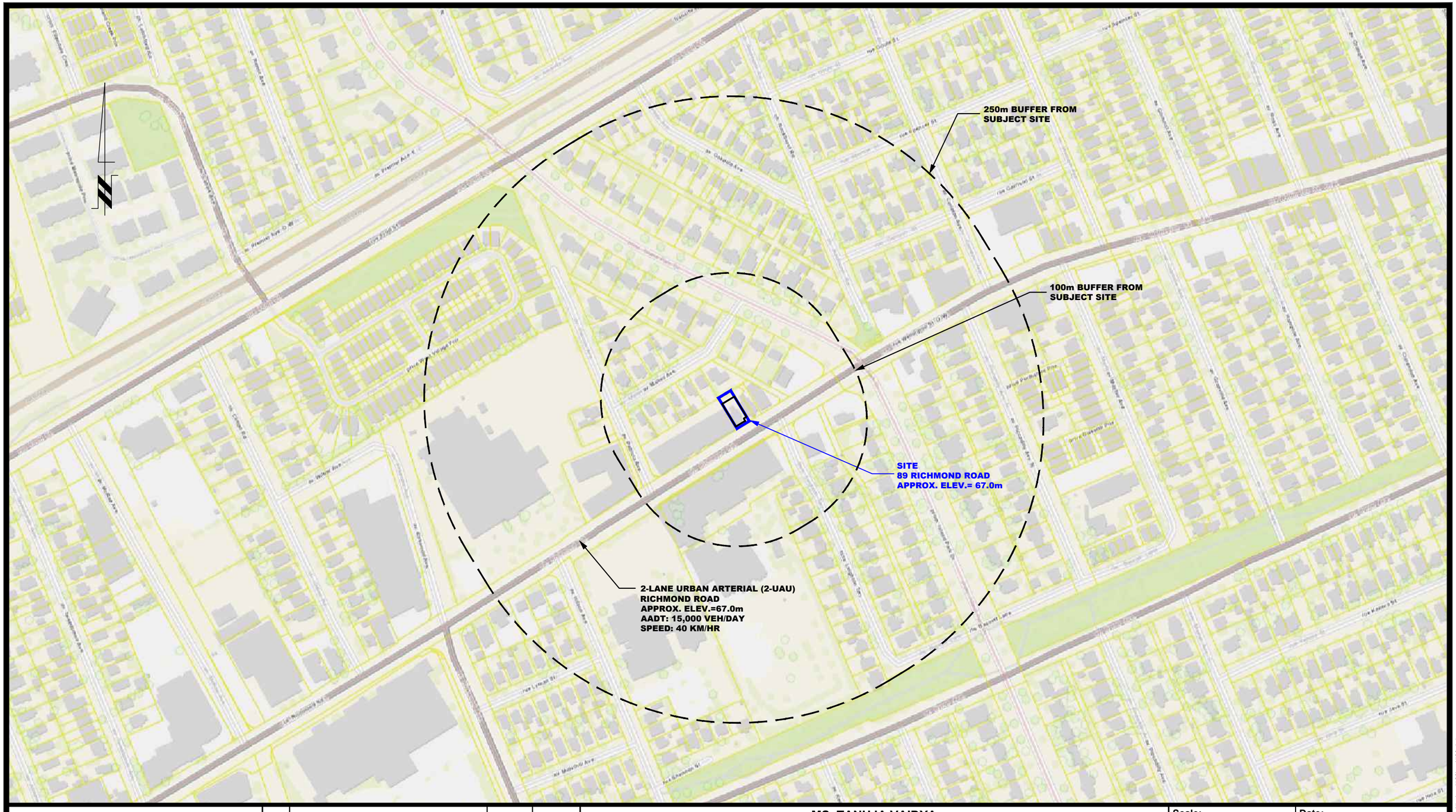
DRAWING PG4720-1C - SITE GEOMETRY (REC 2-1, REC 2-2)

DRAWING PG4720-1D - SITE GEOMETRY (REC 3-1, REC 3-2)

DRAWING PG4720-1E - SITE GEOMETRY (REC 4-1)

DRAWING PG4720-2 - RECEPTOR LOCATIONS

Table 7 - Summary of Reception Points and Geometry 89 Richmond Road								
Point of Reception	Location	Leq Day (dBA)	Richmond Road					
			Horizontal (m)	Vertical (m)	Total (m)	Local Angle (degree)	Barrier Height (m)	Distance (m)
REC 1-1	Eastern Elevation, 1st floor	53.01	15	1.5	15.07481	-79, 0	7.5	2
REC 1-6	Eastern Elevation, 6th floor	53.01	15	17.35	22.93518	-79, 0	7.5	2
REC 2-1	Southern Elevation, 1st Floor	69.63	9	1.5	9.124144	-86, 84	n/a	n/a
REC 2-6	Northern Elevation, 1st floor	70.47	9	17.35	19.5454	-86, 84	n/a	n/a
REC 3-1	Northern Elevation, 5th floor	50.15	15	1.5	15.07481	0, 4	n/a	n/a
REC 3-6	Northern Elevation, 11th floor	50.15	15	17.35	22.93518	0, 4	n/a	n/a
REC 4-1	Outdoor Living Area - Spa Area	30.43	95	1.5	95.01184	14, 17	7.5	10



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MS. TANUJA VAIDYA

NOISE ATTENUATION STUDY - PROPOSED DEVELOPMENT
89 RICHMOND ROAD

OTTAWA, ONTARIO

Title:

SITE PLAN

Scale: 1:3000	Date: 10/2018
Drawn by: RCG	Report No.: PG4720-1
Checked by: SB	Dwg. No.: PG4720-1
Approved by: DJG	Revision No.: 0

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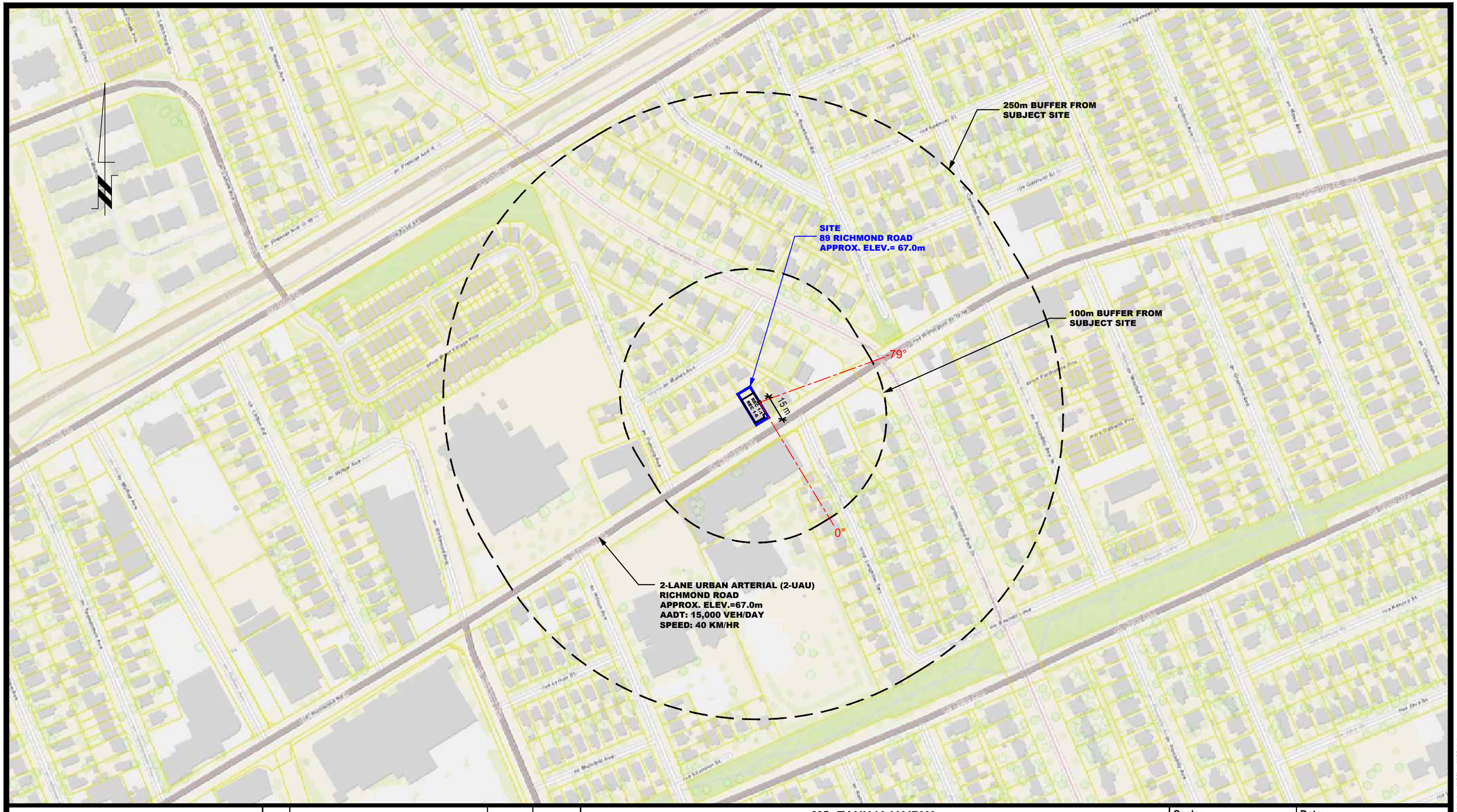

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MS. TANUJA VAIDYA

NOISE ATTENUATION STUDY - PROPOSED DEVELOPMENT
89 RICHMOND ROAD

OTTAWA, ONTARIO

Title:

SITE GEOMETRY - REC 1-1,1-6

Scale: 1:3000	Date: 10/2018
Drawn by: RCG	Report No.: PG4720-1
Checked by: SB	Dwg. No.: **PG4720-1B**
Approved by: DJG	Revision No.: 0

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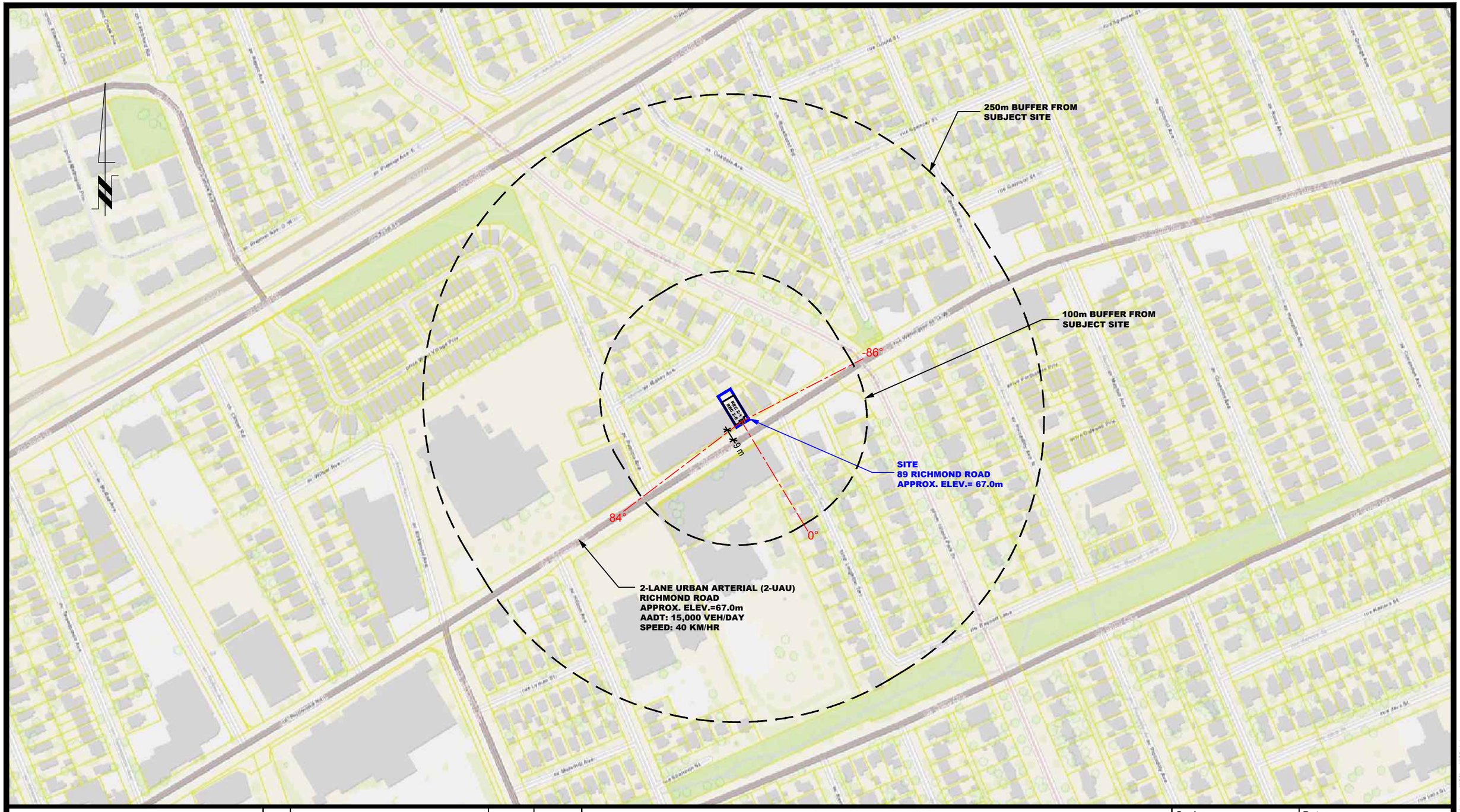

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MS. TANUJA VAIDYA

NOISE ATTENUATION STUDY - PROPOSED DEVELOPMENT
89 RICHMOND ROAD

OTTAWA, ONTARIO

Title:

SITE GEOMETRY - REC 2-1,2-6

Scale: 1:3000	Date: 10/2018
Drawn by: RCG	Report No.: PG4720-1
Checked by: SB	Dwg. No.: PG4720-1C
Approved by: DJG	Revision No.: 0

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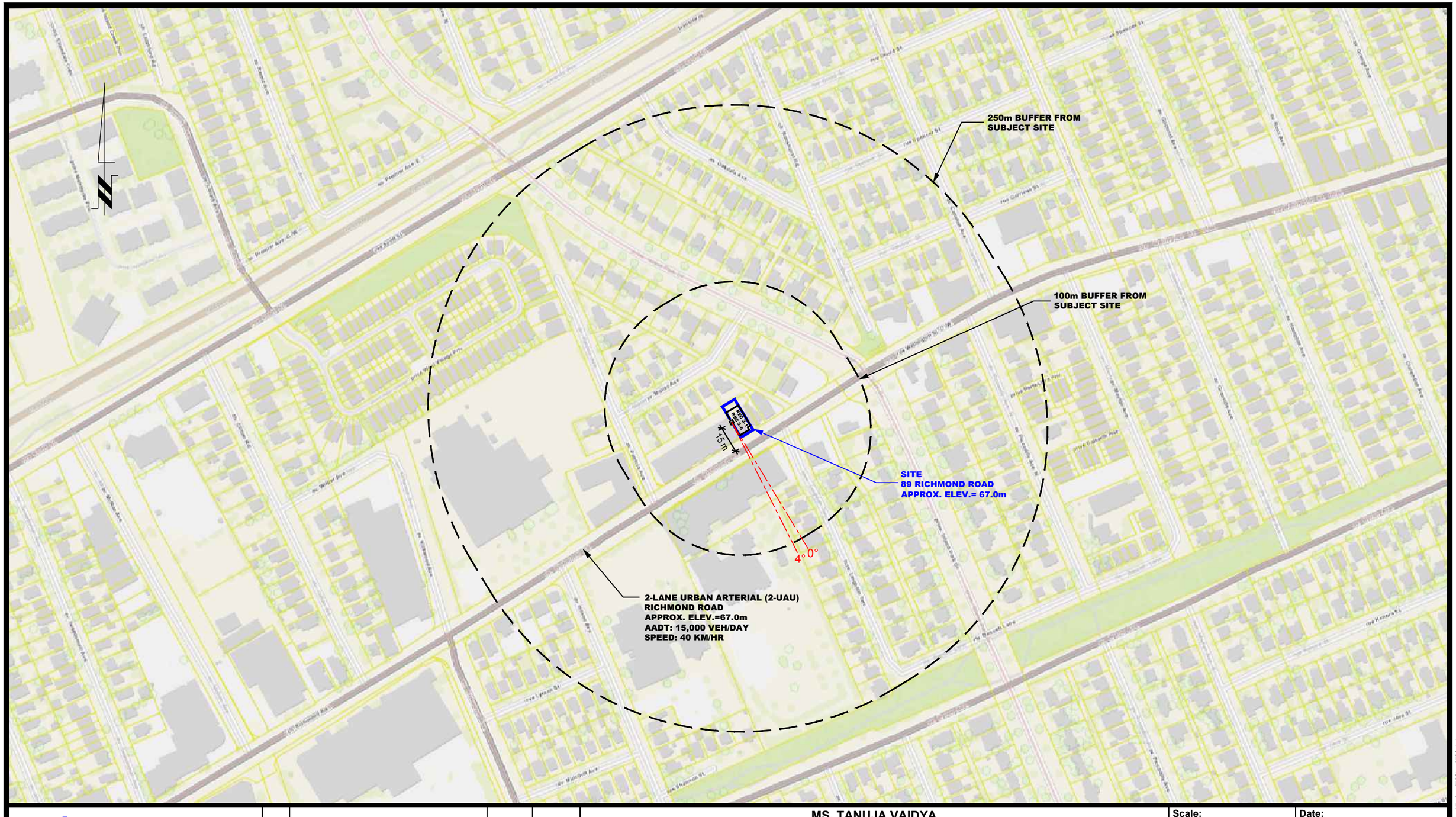

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MS. TANUJA VAIDYA

NOISE ATTENUATION STUDY - PROPOSED DEVELOPMENT
89 RICHMOND ROAD

OTTAWA, ONTARIO

Title:

SITE GEOMETRY - REC 3-1,3-6

Scale: 1:3000	Date: 10/2018
Drawn by: RCG	Report No.: PG4720-1
Checked by: SB	Dwg. No.: **PG4720-1D**
Approved by: DJG	Revision No.: 0

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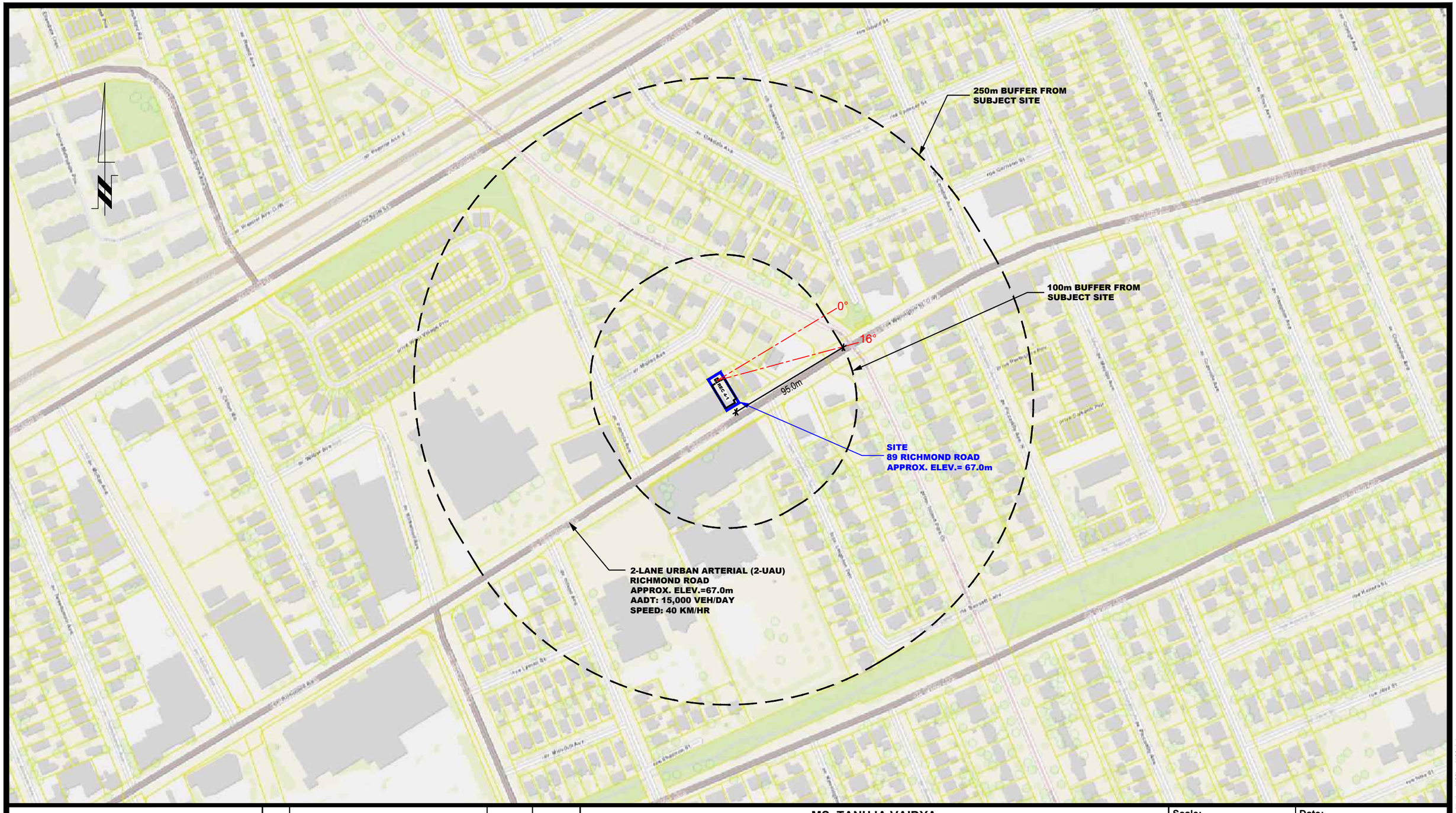

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MS. TANUJA VAIDYA

NOISE ATTENUATION STUDY - PROPOSED DEVELOPMENT
89 RICHMOND ROAD

OTTAWA, ONTARIO

Title:

SITE GEOMETRY - REC 4-1

Scale: 1:3000	Date: 10/2018
Drawn by: RCG	Report No.: PG4720-1
Checked by: SB	Dwg. No.: PG4720-1E
Approved by: DJG	Revision No.: 0

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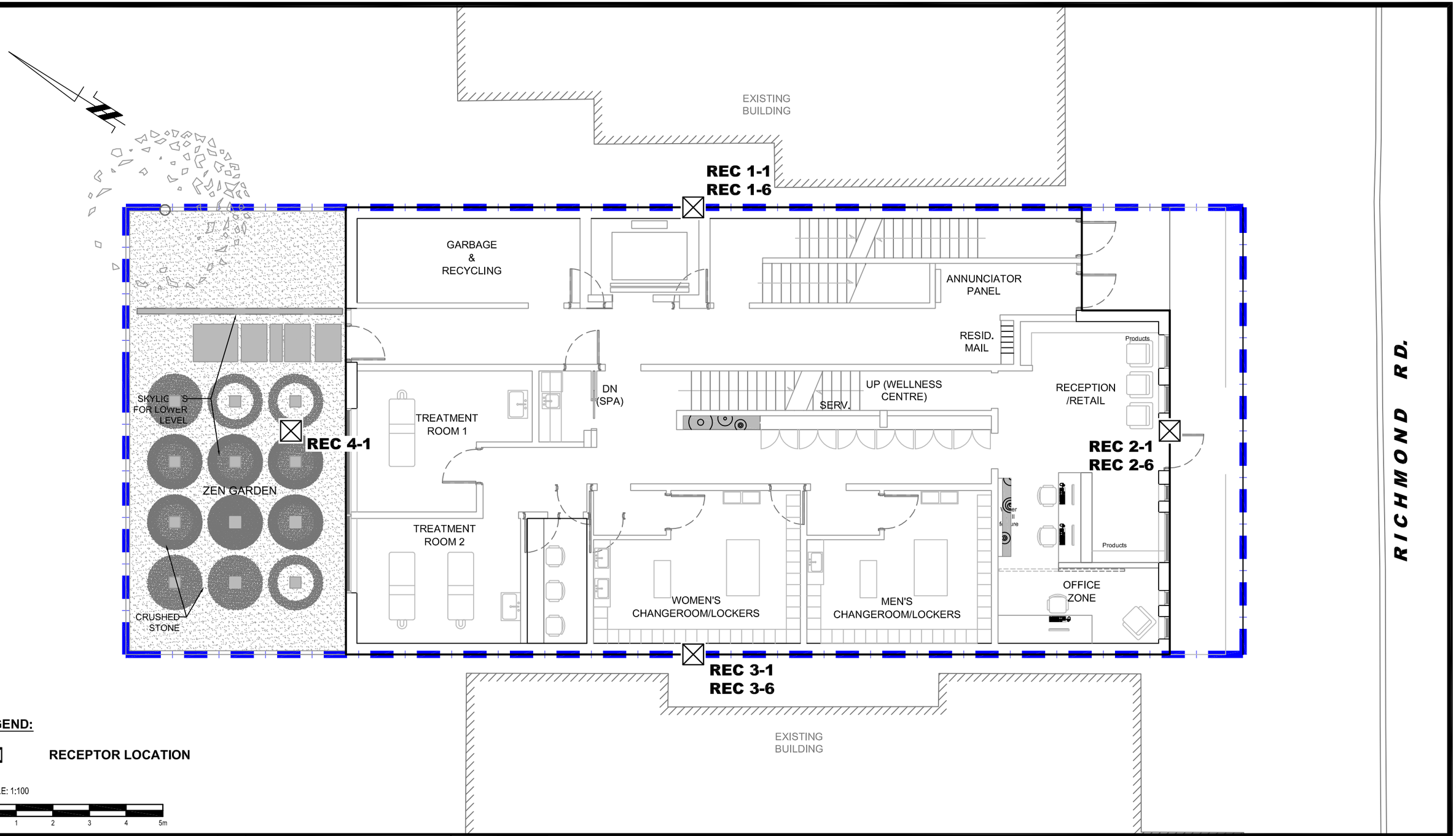

LEGEND:

⊠ RECEPTOR LOCATION

SCALE: 1:100

0 1 2 3 4 5m

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MS. TANUJA VAIDYA

NOISE ATTENUATION STUDY - PROPOSED DEVELOPMENT
89 RICHMOND ROAD

OTTAWA, ONTARIO

Title:

RECEPTOR LOCATION PLAN

Scale: 1:100	Date: 10/2018
Drawn by: RCG	Report No.: PG4720-1
Checked by: SB	Dwg. No.: PG4720-2
Approved by: DJG	Revision No.: 0

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APPENDIX 2

STAMSON RESULTS

STAMSON 5.0 NORMAL REPORT Date: 22-11-2018 12:00:59
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: Richmond (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  :    40 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: Richmond (day/night)

```
Angle1   Angle2           : -79.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      1 / 1
House density             :     95 %
Surface                   :      2       (Reflective 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: Richmond (day)

Source height = 1.50 m

ROAD (0.00 + 53.01 + 0.00) = 53.01 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-79	0	0.00	66.69	0.00	0.00	-3.58	0.00	-10.10	0.00	53.01

Segment Leq : 53.01 dBA

Total Leq All Segments: 53.01 dBA

↟
Results segment # 1: Richmond (night)

Source height = 1.50 m

ROAD (0.00 + 45.41 + 0.00) = 45.41 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-79	0	0.00	59.09	0.00	0.00	-3.58	0.00	-10.10	0.00	45.41

Segment Leq : 45.41 dBA

Total Leq All Segments: 45.41 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 53.01
(NIGHT): 45.41

↟
↟

STAMSON 5.0 NORMAL REPORT Date: 22-11-2018 12:02:07
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec16.te Time Period: Day/Night 16/8 hours
Description: Reception Point 1-6

Road data, segment # 1: Richmond (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  :    40 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: Richmond (day/night)

```
Angle1   Angle2           : -79.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      1 / 1
House density             :     95 %
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  15.00 / 15.00  m
Receiver height           :  17.35 / 17.35  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

Results segment # 1: Richmond (day)

Source height = 1.50 m

ROAD (0.00 + 53.01 + 0.00) = 53.01 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-79	0	0.00	66.69	0.00	0.00	-3.58	0.00	-10.10	0.00	53.01

Segment Leq : 53.01 dBA

Total Leq All Segments: 53.01 dBA

↟
Results segment # 1: Richmond (night)

Source height = 1.50 m

ROAD (0.00 + 45.41 + 0.00) = 45.41 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-79	0	0.00	59.09	0.00	0.00	-3.58	0.00	-10.10	0.00	45.41

Segment Leq : 45.41 dBA

Total Leq All Segments: 45.41 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 53.01
(NIGHT): 45.41

↟
↟

STAMSON 5.0 NORMAL REPORT Date: 22-11-2018 12:02:56
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: Richmond (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	: 40	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: Richmond (day/night)

Angle1 Angle2	: -86.00 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: Richmond (day)

Source height = 1.50 m

ROAD (0.00 + 65.19 + 0.00) = 65.19 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-86	84	0.66	66.69	0.00	0.00	-1.50	0.00	0.00	0.00	65.19

Segment Leq : 65.19 dBA

Total Leq All Segments: 65.19 dBA

↟

Results segment # 1: Richmond (night)

Source height = 1.50 m

ROAD (0.00 + 57.59 + 0.00) = 57.59 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-86	84	0.66	59.09	0.00	0.00	-1.50	0.00	0.00	0.00	57.59

Segment Leq : 57.59 dBA

Total Leq All Segments: 57.59 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 65.19
(NIGHT): 57.59

↟
↟

STAMSON 5.0 NORMAL REPORT Date: 22-11-2018 12:03:36
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec26.te Time Period: Day/Night 16/8 hours
Description: Reception Point 2-6

Road data, segment # 1: Richmond (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	: 40	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: Richmond (day/night)

Angle1 Angle2	: -86.00 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	: 17.35 / 17.35	m
Topography	: 1	(Flat/gentle slope; no barrier)
Reference angle	: 0.00	

Results segment # 1: Richmond (day)

Source height = 1.50 m

ROAD (0.00 + 66.03 + 0.00) = 66.03 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-86	84	0.18	66.69	0.00	0.00	-0.65	0.00	0.00	0.00	66.03

Segment Leq : 66.03 dBA

Total Leq All Segments: 66.03 dBA

↟

Results segment # 1: Richmond (night)

Source height = 1.50 m

ROAD (0.00 + 58.44 + 0.00) = 58.44 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-86	84	0.18	59.09	0.00	0.00	-0.65	0.00	0.00	0.00	58.44

Segment Leq : 58.44 dBA

Total Leq All Segments: 58.44 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 66.03
(NIGHT): 58.44

↟
↟

STAMSON 5.0 NORMAL REPORT Date: 22-11-2018 12:45:53
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: Richmond (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	: 40	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: Richmond (day/night)

Angle1 Angle2	: 0.00 deg	4.00 deg
Wood depth	: 0	(No woods.)
No of house rows	: 0 / 1	
House density	: 95 %	
Surface	: 2	(Reflective 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: Richmond (day)

Source height = 1.50 m

ROAD (0.00 + 50.15 + 0.00) = 50.15 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	4	0.00	66.69	0.00	0.00	-16.53	0.00	0.00	0.00	50.15

Segment Leq : 50.15 dBA

Total Leq All Segments: 50.15 dBA

↟
Results segment # 1: Richmond (night)

Source height = 1.50 m

ROAD (0.00 + 32.46 + 0.00) = 32.46 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	4	0.00	59.09	0.00	0.00	-16.53	0.00	-10.10	0.00	32.46

Segment Leq : 32.46 dBA

Total Leq All Segments: 32.46 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 50.15
(NIGHT): 32.46

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↟

STAMSON 5.0 NORMAL REPORT Date: 22-11-2018 12:47:01
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: rec36.te Time Period: Day/Night 16/8 hours
Description: Reception Point 3-6

Road data, segment # 1: Richmond (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	: 40	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: Richmond (day/night)

Angle1 Angle2	: 0.00 deg	4.00 deg
Wood depth	: 0	(No woods.)
No of house rows	: 0 / 0	
Surface	: 2	(Reflective ground surface)
Receiver source distance	: 15.00 / 15.00	m
Receiver height	: 17.35 / 17.35	m
Topography	: 1	(Flat/gentle slope; no barrier)
Reference angle	: 0.00	

Results segment # 1: Richmond (day)

Source height = 1.50 m

ROAD (0.00 + 50.15 + 0.00) = 50.15 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	4	0.00	66.69	0.00	0.00	-16.53	0.00	0.00	0.00	50.15

Segment Leq : 50.15 dBA

Total Leq All Segments: 50.15 dBA

↟

Results segment # 1: Richmond (night)

Source height = 1.50 m

ROAD (0.00 + 42.56 + 0.00) = 42.56 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	4	0.00	59.09	0.00	0.00	-16.53	0.00	0.00	0.00	42.56

Segment Leq : 42.56 dBA

Total Leq All Segments: 42.56 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 50.15
(NIGHT): 42.56

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↟

STAMSON 5.0 NORMAL REPORT Date: 22-11-2018 12:52:48
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: Richmond (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	: 40	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: Richmond (day/night)

Angle1 Angle2	: 14.00 deg	17.00 deg
Wood depth	: 0	(No woods.)
No of house rows	: 2 / 1	
House density	: 95 %	
Surface	: 2	(Reflective ground surface)
Receiver source distance	: 95.00 / 95.00	m
Receiver height	: 1.50 / 1.50	m
Topography	: 1	(Flat/gentle slope; no barrier)
Reference angle	: 0.00	

Results segment # 1: Richmond (day)

Source height = 1.50 m

ROAD (0.00 + 30.45 + 0.00) = 30.45 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
14	17	0.00	66.69	0.00	-8.02	-17.78	0.00	-10.43	0.00	30.45

Segment Leq : 30.45 dBA

Total Leq All Segments: 30.45 dBA

↟
Results segment # 1: Richmond (night)

Source height = 1.50 m

ROAD (0.00 + 24.36 + 0.00) = 24.36 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
14	17	0.00	59.09	0.00	-8.02	-17.78	0.00	-8.93	0.00	24.36

Segment Leq : 24.36 dBA

Total Leq All Segments: 24.36 dBA

↟

TOTAL Leq FROM ALL SOURCES (DAY): 30.45
(NIGHT): 24.36

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APPENDIX 3

INDUSTRY STANDARDS

WALL ASSEMBLY E-MAIL

Insulating Glass (Table 2)

Glass Makeup			Frequency in Hertz (Hz)																	
			100	125	160	200	250	315	400	500	650	800	1000	1250	1600	2000	2500	3150	4000	5000	STC
			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)																	
					100	125	160	200	250	315	400	500	650	800	1000	1250	1600	2000	2500	3150	4000	5000	STC
					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 to ASTM E413-87 in an acoustical wall. Glass size and glazing system will affect STC rating.
*PVB (polyvinyl butyral) interlayer

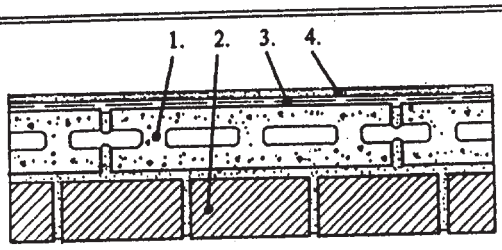
Sound Transmission Loss of Exterior Walls

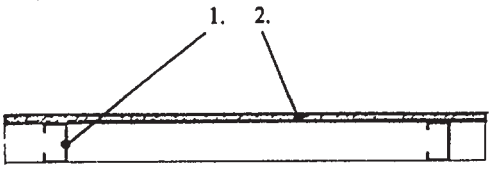
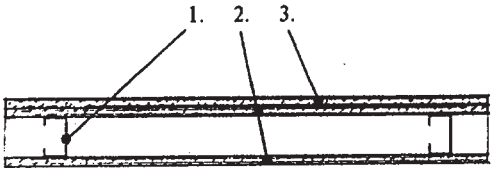
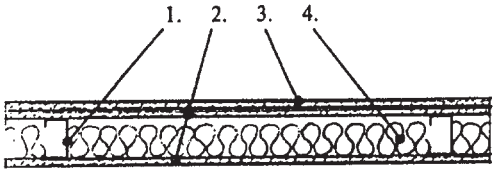
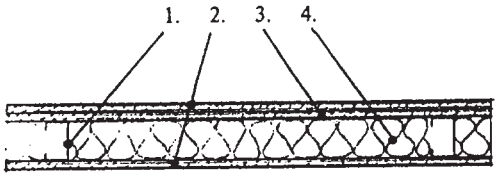
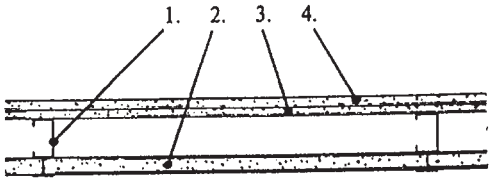
Exterior finish	*Cavity Insulation*	*Resilient channel*	*STC*
Wood siding (1)	None	No	**37**
	3-1/2" PINK™ FIBERGLAS® Batt Insulation	No	**39**
	None	Yes	**43**
	3-1/2" PINK™ FIBERGLAS® Batt Insulation	Yes	**47**
Stucco (2)	3-1/2" PINK™ FIBERGLAS® Batt Insulation	No	**46**
	None	Yes	**49**
	3-1/2" PINK™ 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

Sketch	Brief Description	...	Laboratory Test Number Year Frequencies Tested Source of Data	STC	Section Number
	1. 4x8x18" 3-cell lightweight concrete masonry units (19 lbs./block). 2. common brick, mortared together. 3. resilient channels. 4. 1/2" gypsum board screwed to channels.	...	Kodaras Acoustical Labs. 1023-5-71 1971 16f National Concrete Masonry Assn.	56	1.4.4.3.4.1

Sketch	Brief Description	...	Laboratory Test Number . Year Frequencies Tested Source of Data	STC	Section Number
	1. 2 1/2" metal studs, 24"o.c. 2. 1/2" vinyl-faced gypsum board screwed to studs.	...	National Research Council of Canada NRC #66 1968 16f National Research Council of Canada	27	1.3.2.5.4.1
	1. 2 1/2" metal studs, 24"o.c. 2. 1/2" type X gypsum board screwed 12"o.c. 3. 1/2" type X gypsum board screwed 24"o.c.	...	Owens/Corning Fiberglas OCF 555 1967 16f Owens/Corning Fiberglas	44	1.3.2.5.4.2
	1. 2 1/2" metal studs, 24"o.c. 2. 1/2" type X gypsum board screwed 12"o.c. 3. 1/2" type X gypsum board screwed 24"o.c. 4. 2" thick sound attenuation blanket.	...	Owens/Corning Fiberglas OCF 551 1967 16f Owens/Corning Fiberglas	51	1.3.2.5.4.3
	1. 2 1/2" metal studs, 24"o.c. 2. 1/2" type X gypsum board screwed 12"o.c. at edges and intermediate studs. 3. 1/2" type X gypsum board screwed 36"o.c. 4. 3" thick sound attenuation blanket.	...	National Gypsum Co. NGC 2253 1967 16f Gypsum Association	50	1.3.2.5.4.4
	1. 2 1/2" C-T metal studs, 24"o.c. 2. 1" gypsum board inserted between T section of studs. 3. 1/2" type X gypsum board screwed 24"o.c. 4. 1/2" type X gypsum board screwed 8"o.c.	...	Warnock Hersey Int'l., Inc. 0034-2 1977 16f Gypsum Association	40	1.3.2.5.4.5

Stephanie Boisvenue

From: Kevin Reid <kreid@rlaarchitecture.ca>
Sent: July 19, 2019 11:12 AM
To: Stephanie Boisvenue
Subject: FW: City's comments - 89 Richmond Rd

Hi Stephanie,

I'd received this forwarded message wrt the 89 Richmond Rd project and specifically your question about the exterior wall assembly.
As of now the opaque exterior walls will either be one of two assemblies:

W1
90mm Clay Brick
25mm air space 75mm Semi-rigid mineral wool insulation
Vapour Permeable Water Resistive Membrane
16mm exterior Gypsum Sheathing
Steel Studs (varying depths) with minimum 75mm Semi-rigid mineral wool insulation
Vapour Barrier
16mm exterior Gypsum Sheathing

W2
90mm Clay Brick
25mm air space 75mm Semi-rigid mineral wool insulation
Vapour Barrier Membrane
16mm exterior Gypsum Sheathing
200mm Concrete Masonry Units
16mm exterior Gypsum Sheathing

Kevin Reid MArch OAA NSAA MRAIC

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Tel: 613.724.9932 x 249
Fax: 613.724.1209
kreid@rodericklahey.ca

From: tanuja vaidya <tanujavaidya@hotmail.com>
Sent: Monday, July 15, 2019 12:08 PM
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