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Environmental Noise Control Study

Proposed Multi-Storey Buildings
3484, 3490 and 3592 Innes Road, Ottawa

Prepared For

Canadian Rental Development Services Inc.

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June 17, 2019

Report: PG4488-2 Revision 1

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Appendices

1.0 Introduction

Paterson Group (Paterson) was commissioned by Canadian Rental Development Services Inc. to conduct an environmental noise control study for the proposed multi-storey buildings to be located at 3484, 3490 and 3590 Innes 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 be constructed in phases. It is understood that the current phase will consist of eight (8) multi-storey buildings ranging in height from 9 to 16 storeys. Two (2) outdoor living areas were identified within the perimeters of the buildings. These have been identified on Paterson Drawing PG4488-3.

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.

A stationary noise analysis is not applicable for this preliminary review. If roof top patios are proposed for this development, a stationary noise source analysis will be completed at that time once all mechanical equipment is known.

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 north by Innes Road and to the west by a row of buildings followed by Page Road. Developed and undeveloped land surround the proposed development to the east and south.

Based on the City of Ottawa Official Plan, Schedule E, Innes Road is considered a 4 lane urban arterial undivided road (4-UAU) and Page Road is considered a 2 lane urban collector (2-UCU). There are no other roads within the 100 m radius. All noise sources are presented in Drawing PG4488-1 - Site Plan, located 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 %
Page Road	2-UMCU	8,000	40	92/8	7	5
Innes Road	4-UAU	30,000	60	92/8	7	5

❑ Data obtained from the City of Ottawa document ENCG

It is understood that the final design for the proposed development is being completed. However, it is understood to contain several high-rise buildings with associated outdoor living areas. For the variation in the design, the analysis will be completed in zones that will determine how each particular building or outdoor living area within that zone is to be designed.

Three (3) levels of reception points were selected for this analysis. It is understood that either residential units or commercial units may be located on the main floor. The commercial units may contain offices, daycares or other noise sensitive businesses that operate during the daytime hours. Therefore, both daytime and nighttime analysis is required for all levels of the proposed development. 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	Residential/commercial	daytime/nighttime
Fifth Floor	16.5	Residential	daytime/nighttime
Sixteenth Floor	49.5	Residential	daytime/nighttime

For this analysis, reception points were taken at the predetermined floor throughout the subject area. These results are presented on a site plan using noise contours at 45 dBA, 50 dBA, 55 dBA, 60 dBA and 65 dBA.

All horizontal distances have been measured from the reception point to the edge of the right-of-way. To utilize a conservative approach to the analysis, all roadways were analyzed at angles of -90° to 90°. The analysis is completed so that no effects of sound reflection off of the building facade are considered, as stipulated by the ENGC.

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

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 utilizing a grid pattern across the proposed development. The results of the STAMSON software are presented in Table 6 in Appendix 1, and graphically in Paterson Drawings PG4488-3A through 3F located in Appendix 1.

6.0 Discussion and Recommendations

6.1 Outdoor Living Areas

It is understood that outdoor amenity areas are to be located within the centre of 4 building squares, as identified on Paterson Drawing PG4488-3 Site Plan. For the analysis, no building effects were taken into consideration, as per the ENGC standards.

For the northern outdoor amenity area, the noise level will be between 56-65 dBA in the northern portion of the amenity area, to 51-55 dBA in the southern portion. The values of the northern amenity area exceed the 55 dBA threshhold and mitigation measures must be considered. The values of the southern amenity area are below the thresshold released in the ENCG and no mitigation measures will be required. According to the City of Ottawa document, there are 5 recommended mitigation measures where there are exceedances in the outdoor living areas.

1) Distance setback with soft ground

   Response: The building layout has been optimized to provide the maximum setback with the required layout. The outdoor living area can not be set back further. This mitigation measure has already been utilized.

2) Insertion of noise insensitive land uses between the source and sensitive receptor.

   Response: There are currently buildings and landscaped areas between the source and the sensitive receptor. This mitigation measure has already been utilized.

3) Orientation of buildings to provide sheltered zones in the rear yards.

   Response: There are two (2) buildings that will shelter the majority of the outdoor amenity area. As per the regulations, these buildings are not to be taken into consideration while performing the analysis. However, once these buildings have been constructed, the outdoor amenity area will reduce in sound to 55-58.32 dBA. However, it is unknown what order the buildings may be constructed in, and it may be possible that the outdoor amenity area will be operational prior to the completion of the buildings on the northern portion of the site.

4) Earth Berms
Response: Not feasible.

5) Acoustic Barriers
Response: Not feasible.

Therefore, the northern amenity area will require a Warning Clause type B. The southern amenity area will not require any warning clauses. If the northern amenity area is operational prior to the northernmost buildings being constructed, then the residents should be instructed to use the southern amenity area for lower ambient noise from the surface transportation.

6.2 Indoor Living Areas and Ventilation

The results of the STAMSON modeling indicates that the daytime $L_{eq(16)}$ exceeds 65 dBA on the northern portion of the site, with the southern portion of the site exceeding 60 dBA, elevation dependant.

Therefore, all buildings will required to be provided with a central air conditioning unit, and Warning Clause D will be required on all deeds of sale.

An analysis of building materials will be required if the daytime limits exceed the 65 dBA threshold for daytime noise or exceeds the 60 dBA threshhold for nighttime noise. The noise levels exceed these limits at all buildings and therefore additional analysis will be required.

Proposed Construction Specifications

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

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

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. Based on our noise analysis, the maximum $L_{eq(16)(Exterior)}$ for the northernmost building will be 73.14 dBA. A conservative approach is to assume that there are 2 components per room. Therefore, the AIF would need to be at least 34 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 37 or higher, this would be a sufficient noise attenuation device.**

Detailed shop drawing are not available at the time of issuance of this memo. It is understood through e-mail correspondence that the building materials will consist of the following:

- ❏ double paned windows
- ❏ Exterior will be 5 ½" cement board cladding
- ❏ construction will be steel stud walls with concrete structure

From a review of these construction materials, it was determined that they are sufficient for the noise attenuation properties to ensure that the indoor living areas will be below 45 dBA.

7.0 Conclusion

The subject site is located at 3484, 3490 and 3592 Innes Road. It is understood that the current phase of the development will consist of eight (8) multi-storey buildings, ranging in height from 9 to 16 stories. The associated analysis identified two noise sources: Innes Road and Page Road.

Outdoor living areas were identified in the centre courtyards surrounded by 4 proposed buildings. There were 2 outdoor living areas identified: the northern area and the southern area. Due to the proximity to Innes Road, the northern outdoor living area exceeds the 55 dBA thresshold. However, due to the site layout, it is not feasible to relocate the outdoor living area further from Innis Road or to construct acoustical barriers or berms. Upon review, the proposed building layout will reduce the anticipated noise level to below 60 dBA. Therefore, the northern outdoor living area will have a Warning Clause Type B. The southern outdoor amenity area is below the 55 dBA threshhold and is considered acceptable with no additional warning clauses. If the northern amenity area is operational prior to the northernmost buildings being constructed, then the residents should be instructed to use the southern amenity area for lower ambient noise from the surface transportation.

The results of the STAMSON modeling indicates that the daytime $L_{eq(16)(exterior)}$ exceeds 65 dBA on the northern portion of the site with the southern portion of the site exceeding 60 dBA (elevation dependant).

Therefore, all buildings will be required to be provided with a central air conditioning unit, and that Warning Clause D will be required to be on all deeds of sale. A review of the proposed building materials were completed as part of this analysis and the building materials are considered acceptable for the development.

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 Canadian Rental Development Services 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.

Report Distribution:

- ❑ Canadian Rental Development Services (3 copies)
- ❑ Paterson Group (1 copy)

APPENDIX 1

TABLE 6 - SUMMARY OF RESULTS

DRAWING PG4488-3A - NOISE EXPOSURE MAP (1.5 m DAYTIME)

DRAWING PG4488-3B - NOISE EXPOSURE MAP (1.5 m NIGHTTIME)

DRAWING PG4488-3C - NOISE EXPOSURE MAP (16.5 m DAYTIME)

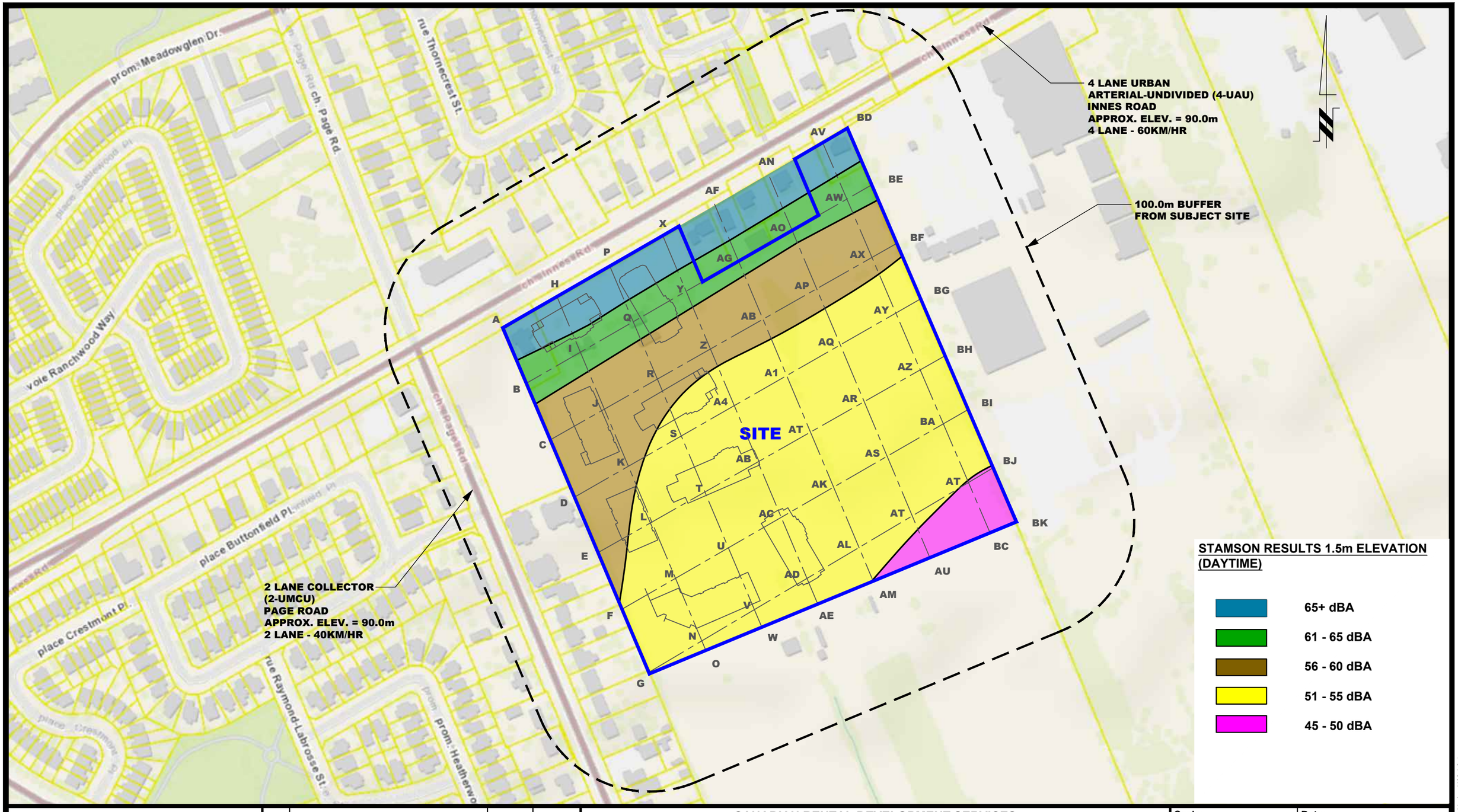
DRAWING PG4488-3D - NOISE EXPOSURE MAP (16.5 m NIGHTTIME)

DRAWING PG4488-3E - NOISE EXPOSURE MAP (49.5 m DAYTIME)

DRAWING PG4488-3F - NOISE EXPOSURE MAP (49.5 m NIGHTTIME)

Table 6 - Summary of Geometry and Results								
	Distance from		STAMSON Results (day)			STAMSON Results (night)		
Reception Point	Page Road	Innes Road	at 1.5 m height	at 16.5 m height	at 49.5 m height	at 1.5 m height	at 16.5 m height	at 49.5 m height
A	60	15	71.6	73.14	73.14	60	65.54	65.54
B	60	65	61.56	67.19	67.19	53.96	59.59	59.59
C	60	115	58.22	65.09	65.09	50.63	57.49	57.49
D	60	165	56.48	63.87	63.87	48.89	56.28	56.28
E	60	215	55.44	63.04	63.04	47.85	55.45	55.45
F	60	265	54.76	62.43	62.43	47.17	54.84	54.84
G	60	315	54.3	61.96	61.96	46.7	54.37	54.37
H	110	15	71.57	73.08	73.08	63.97	65.48	65.48
I	110	65	61.2	66.95	66.95	53.6	59.35	59.35
J	110	115	57.41	64.69	64.69	49.82	57.09	57.09
K	110	165	55.21	63.33	63.33	47.62	55.74	55.74
L	110	215	53.74	62.39	62.39	46.15	54.8	54.8
M	110	265	52.71	61.67	61.67	45.11	54.08	54.08
N	110	315	51.94	61.1	61.1	44.34	53.15	53.15
O	110	325	51.81	61.01	61.01	44.21	53.41	53.41
P	160	15	71.56	73.06	73.06	63.96	65.46	65.46
Q	160	65	61.1	66.85	66.85	53.5	59.25	59.25
R	160	115	57.17	64.53	64.53	49.57	56.93	56.93
S	160	165	54.79	63.12	63.12	47.2	55.52	55.52
T	160	215	53.15	62.11	62.11	45.56	54.52	54.52
U	160	265	51.95	61.35	61.35	44.35	53.75	53.75
V	160	315	51.01	60.73	60.73	43.41	53.14	53.14
W	160	330	50.77	60.57	60.57	43.17	52.98	52.98
X	210	15	71.56	73.05	73.05	63.96	65.45	65.45
Y	210	65	61.06	66.82	66.82	53.46	59.2	59.2
Z	210	115	57.06	64.45	64.45	49.46	56.85	56.85
AA	210	165	54.61	62.99	62.99	47.02	55.4	55.4
AB	210	215	52.88	61.96	61.96	45.29	54.37	54.37
AC	210	265	51.58	61.16	61.16	43.96	53.57	53.57
AD	210	315	50.55	60.52	60.52	42.95	52.93	52.93
AE	210	340	50.11	60.25	60.25	42.51	52.66	52.66
AF	260	15	71.55	73.04	73.04	63.95	65.44	65.44
AG	260	65	61.03	66.77	66.77	53.43	59.17	59.17
AH	260	115	57.01	64.39	64.39	49.41	56.79	56.79
AI	260	165	54.51	62.92	62.92	46.92	55.33	55.33
AJ	260	215	52.73	61.87	61.87	45.14	54.27	54.27
AK	260	265	51.37	61.05	61.05	43.78	53.46	53.46
AL	260	315	50.29	60.39	60.39	42.69	52.8	52.8

AM	260	345	49.74	60.05	60.05	42.14	52.45	52.45
AN	310	15	71.55	73.04	73.04	63.95	65.44	65.44
AO	310	65	61.02	66.75	66.75	53.42	59.15	59.15
AP	310	115	56.97	64.36	64.36	49.37	56.76	56.76
AQ	310	165	51.45	62.87	62.87	46.86	55.28	55.28
AR	310	215	52.64	61.82	61.82	45.04	54.12	54.12
AS	310	265	51.25	60.97	60.97	43.65	53.38	53.38
AT	310	315	50.12	60.3	60.3	42.52	52.71	52.71
AU	310	350	49.46	59.9	59.9	41.86	52.3	52.3
AV	360	15	71.55	73.03	73.03	63.95	65.44	65.44
AW	360	65	61.01	66.74	66.74	53.41	59.17	59.17
AX	360	115	56.95	64.33	64.33	49.35	56.79	56.79
AY	360	165	54.41	62.83	62.83	46.82	55.33	55.33
AZ	360	215	52.57	61.75	61.75	44.98	54.27	54.27
BA	360	265	51.16	60.91	60.91	43.56	53.46	53.46
BB	360	315	50.01	60.23	60.23	42.41	52.8	52.8
BC	360	355	49.24	59.77	59.77	41.64	52.35	52.35
BD	380	15	71.55	73.03	73.03	63.95	65.43	65.43
BE	380	65	61.01	66.73	66.73	53.41	59.13	59.13
BF	380	115	56.94	64.32	64.32	49.34	56.73	56.73
BG	380	165	54.39	62.82	62.82	46.8	55.23	55.23
BH	380	215	52.56	61.74	61.74	44.96	54.15	54.15
BI	380	265	51.14	60.89	60.89	43.54	53.3	53.3
BJ	380	315	49.98	60.21	60.21	42.38	52.62	52.62
BK	380	360	49.11	59.68	59.68	41.51	52.09	52.09



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CANADIAN RENTAL DEVELOPMENT SERVICES

NOISE ATTENUATION STUDY
PROP. MULTI-STOREY RESIDENTIAL BLDGS. - 3484, 3490 & 3592 INNES ROAD
OTTAWA, ONTARIO

Title:

NOISE EXPOSURE MAP

Scale: 1:3000	Date: 09/2018
Drawn by: RCG	Report No.: PG4488-2
Checked by: SB	Dwg. No.: PG4488-3A
Approved by: DJG	Revision No.: 0

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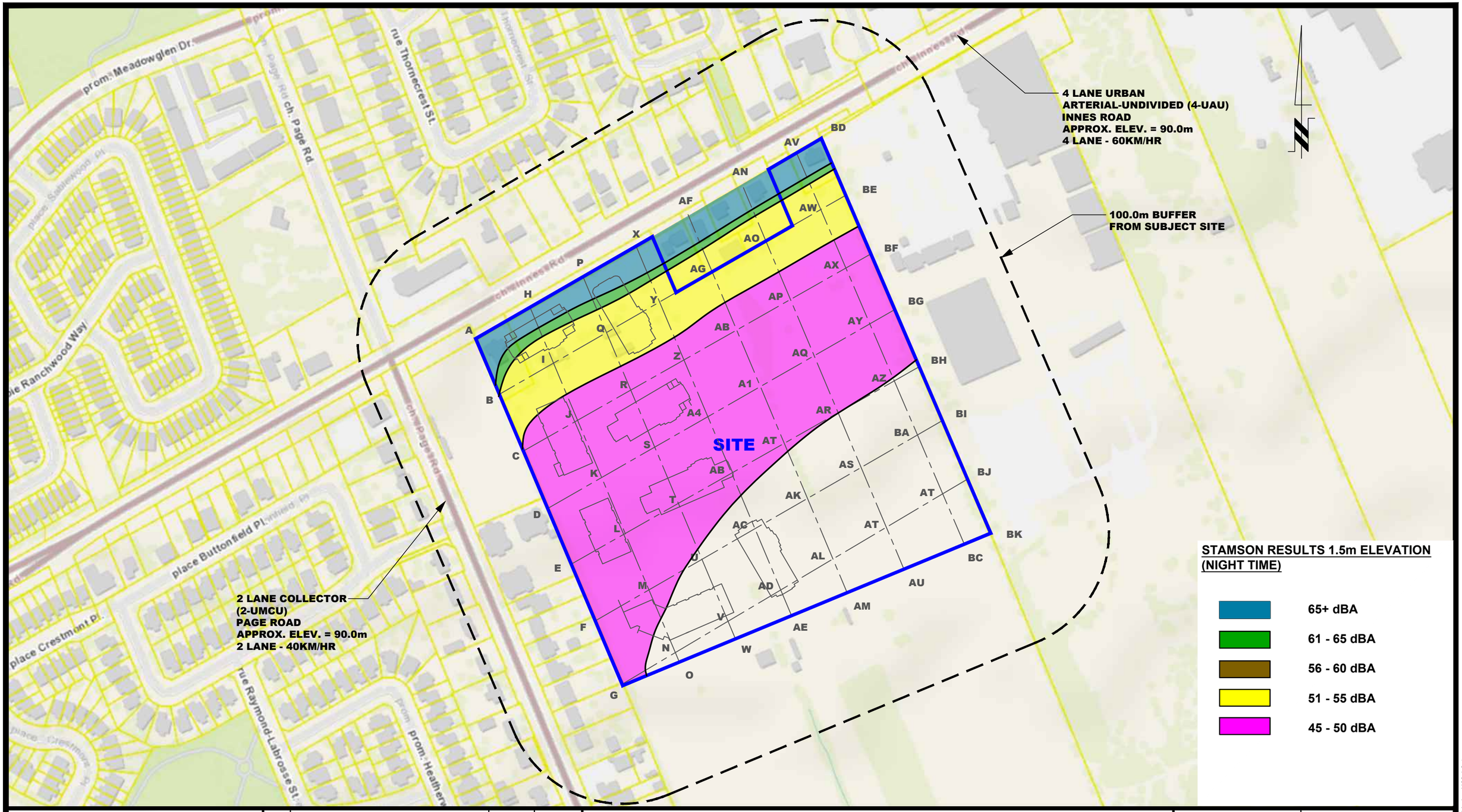

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Drawn by: RCG	Report No.: PG4488-2
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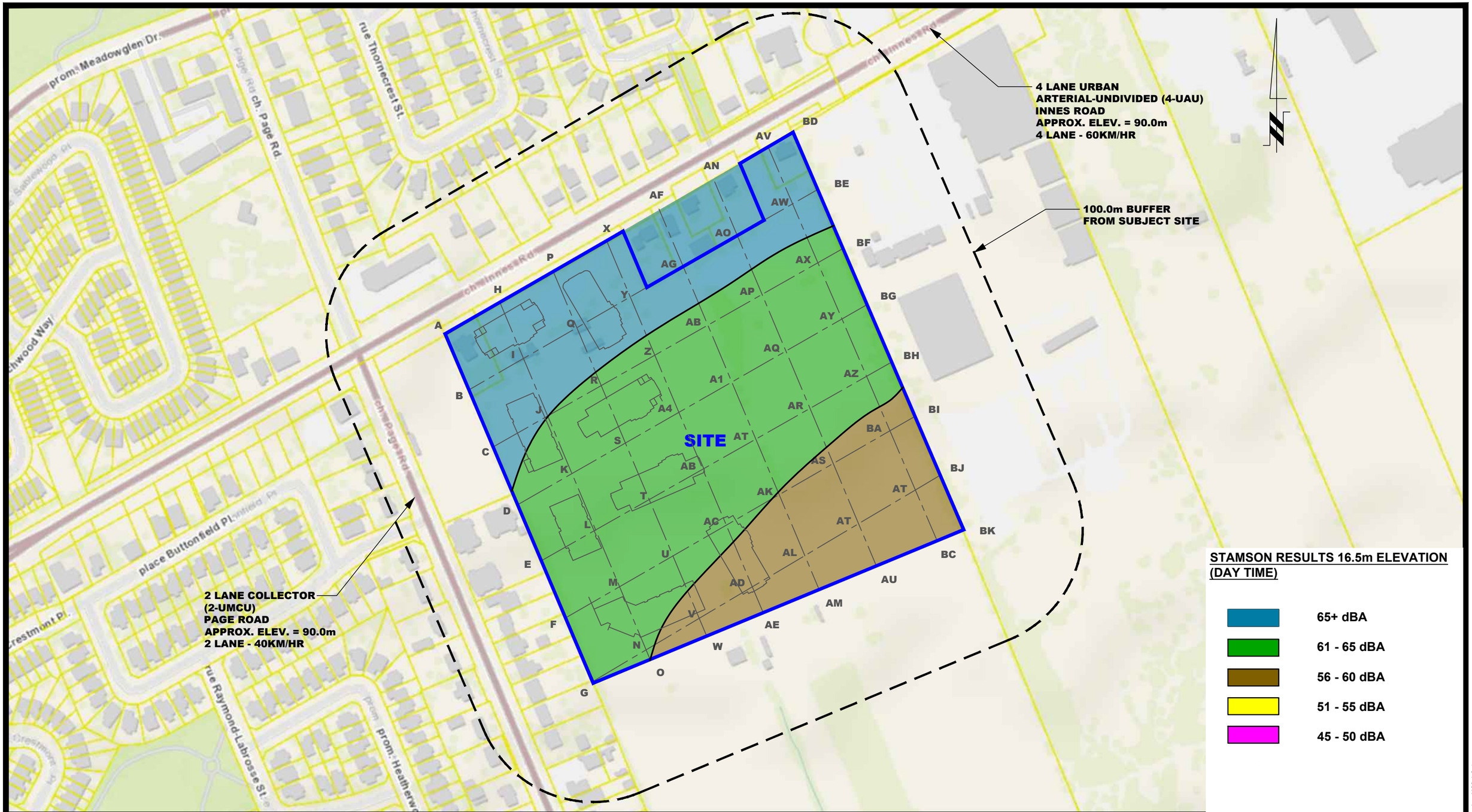

STAMSON RESULTS 16.5m ELEVATION (DAY TIME)

	65+ dBA
	61 - 65 dBA
	56 - 60 dBA
	51 - 55 dBA
	45 - 50 dBA

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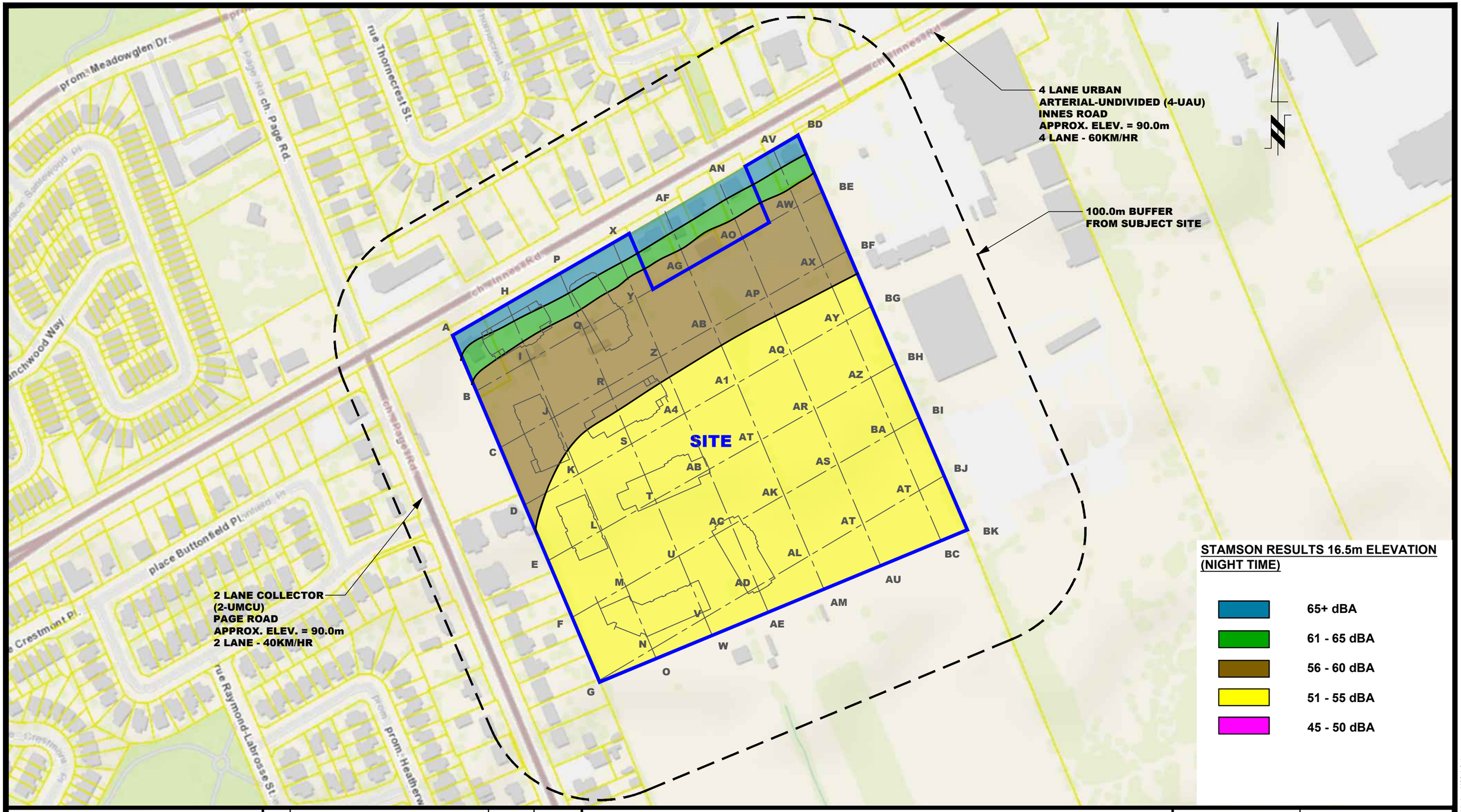

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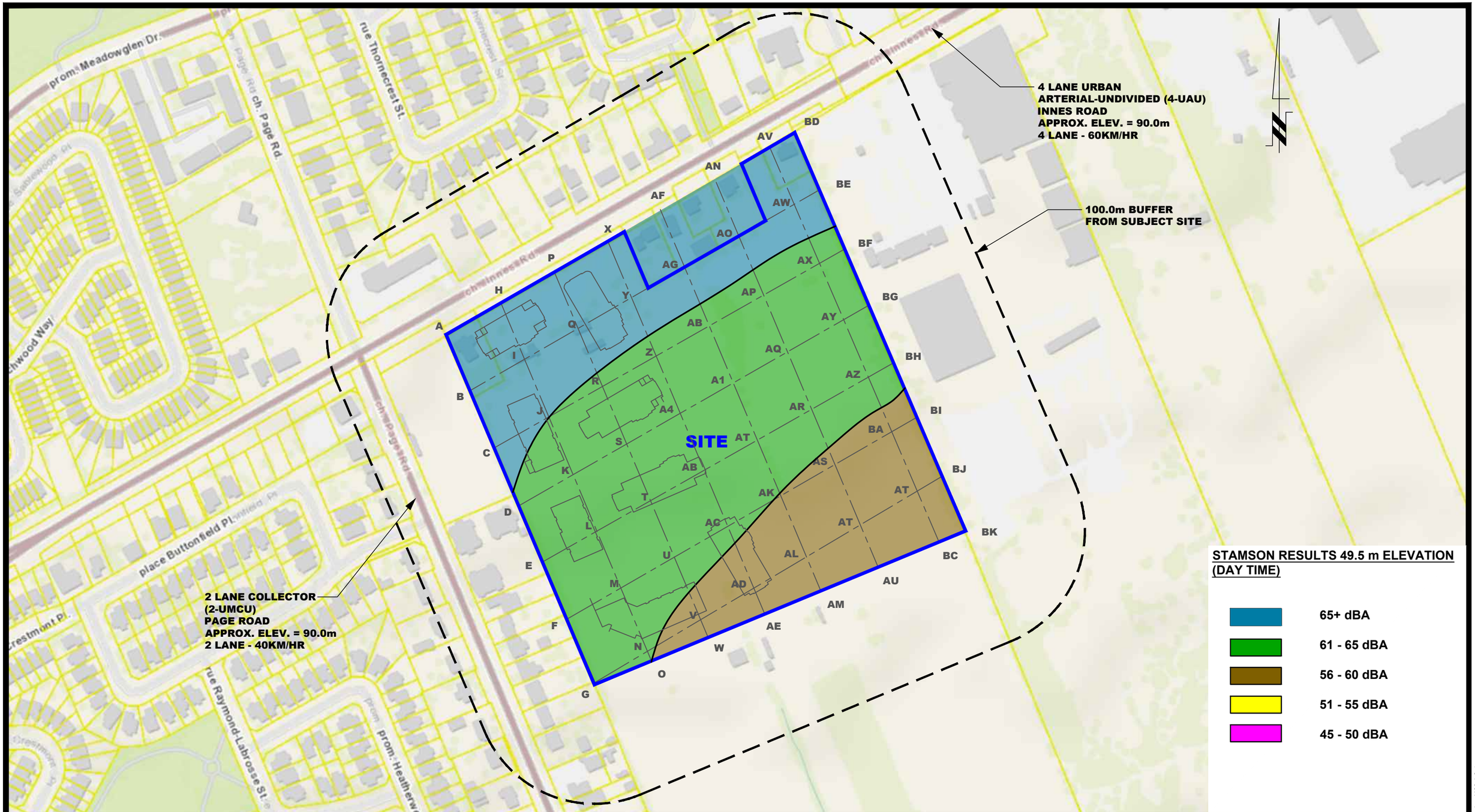

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Checked by: SB	Dwg. No.: PG4488-3E
Approved by: DJG	Revision No.: 0

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4 LANE URBAN
ARTERIAL-UNDIVIDED (4-UAU)
INNES ROAD
APPROX. ELEV. = 90.0m
4 LANE - 60KM/HR

100.0m BUFFER
FROM SUBJECT SITE

2 LANE COLLECTOR
(2-UMCU)
PAGE ROAD
APPROX. ELEV. = 90.0m
2 LANE - 40KM/HR

SITE

A B C D E F G H I J K L M N O P Q R S T U V W X Y Z
A1 A4 AB AC AD AE AF AG AH AI AJ AK AL AM AN AO AP AQ AR AS AT AU AV AW AX AY AZ
BA BB BC BD BE BF BG BH BI BJ BK

STAMSON RESULTS 49.5 m ELEVATION
(NIGHT TIME)

	65+ dBA
	61 - 65 dBA
	56 - 60 dBA
	51 - 55 dBA
	45 - 50 dBA

patersongroup
consulting engineers

154 Colonnade Road South
Ottawa, Ontario K2E 7J5
Tel: (613) 226-7381 Fax: (613) 226-6344

NO.	REVISIONS	DATE	INITIAL
0			

CANADIAN RENTAL DEVELOPMENT SERVICES

NOISE ATTENUATION STUDY
PROP. MULTI-STOREY RESIDENTIAL BLDGS. - 3484, 3490 & 3592 INNES ROAD
OTTAWA, ONTARIO

Title:

NOISE EXPOSURE MAP

Scale: 1:3000	Date: 09/2018
Drawn by: RCG	Report No.: PG4488-2
Checked by: SB	Dwg. No.: PG4488-3F
Approved by: DJG	Revision No.: 0

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APPENDIX 2

GENERAL STAMSON RESULTS

STAMSON 5.0 NORMAL REPORT Date: 21-05-2019 15:07:23
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: generic.te Time Period: Day/Night 16/8 hours
Description: Typical analysis

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

Car traffic volume : 24288/2112 veh/TimePeriod *
Medium truck volume : 1932/168 veh/TimePeriod *
Heavy truck volume : 1380/120 veh/TimePeriod *
Posted speed limit : 60 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 30000
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: Innes Road (day/night)

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 2 (Reflective ground surface)
Receiver source distance : 115.00 / 15.00 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

↑
Road data, segment # 2: Page Road (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 : 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): 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: Page Road (day/night)
------------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  60.00 / 15.00  m
Receiver height           :   1.50 / 4.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

↟

```
Results segment # 1: Innes Road (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 64.16 + 0.00) = 64.16 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  73.01   0.00  -8.85   0.00   0.00   0.00   0.00  64.16
-------------------------------------------------------------------------------

Segment Leq : 64.16 dBA
```

↟

```
Results segment # 2: Page Road (day)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 57.93 + 0.00) = 57.93 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  63.96   0.00  -6.02   0.00   0.00   0.00   0.00  57.93
-------------------------------------------------------------------------------

Segment Leq : 57.93 dBA

Total Leq All Segments: 65.09 dBA
```

↟

```
Results segment # 1: Innes Road (night)
---------------------------------------
```

Source height = 1.50 m

ROAD (0.00 + 65.41 + 0.00) = 65.41 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	65.41	0.00	0.00	0.00	0.00	0.00	0.00	65.41

Segment Leq : 65.41 dBA

Results segment # 2: Page Road (night)

Source height = 1.50 m

ROAD (0.00 + 56.36 + 0.00) = 56.36 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	56.36	0.00	0.00	0.00	0.00	0.00	0.00	56.36

Segment Leq : 56.36 dBA

Total Leq All Segments: 65.92 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 65.09
(NIGHT): 65.92

APPENDIX 3

E-MAIL CORRESPONDENCE

CONSTRUCTION STANDARDS

Stephanie Boisvenue

From: Don Schultz <dschultz@lepinecorp.com>
Sent: May 21, 2019 11:04 AM
To: Stephanie Boisvenue
Subject: RE: 3484, 3490 and 3592 Innes Road

Good Morning Stephanie,

In response to your questions about the captioned project at 3484, 3490, and 3592 Innes Road:

1. All exterior cladding will be pre-cast concrete panels.
2. All windows will be double-paned.
3. All apartment units will be provided with central air conditioning.

Thank you,

Don Schultz MCIP RPP AICP
Planning Manager
LÉPINE
dschultz@lepinecorp.com
Phone: (613) 591-9090 x227
206-555 Legget Drive (Tower A), Ottawa, Ontario, K2K-2X3
Build Quality - Build A Solid Investment

From: Stephanie Boisvenue <SBoisvenue@Patersongroup.ca>
Sent: May-21-19 10:54 AM
To: Don Schultz <dschultz@lepinecorp.com>
Subject: Innes Road

Good morning Don,

I am finalizing the noise attenuation report for 3484, 3490 and 3592 Innes Road.

I was wondering if you could confirm that the exterior cladding will be cement board and/or brick veneer. In addition, can you confirm if the windows will be double-paned?

Finally – can you confirm if all units are to be provided with central air conditioning?

Best Regards

Stephanie Boisvenue, P.Eng.
patersongroup
solution oriented engineering
over 60 years servicing our clients

154 Colonnade Road South
Ottawa, Ontario, K2E 7J5
Tel: (613) 226-7381 Ext. 219

Wall & Floor Assembly Guide

Insulation for Sound & Fire Rated Asemblies

Sound Transmission Loss of Exterior Doors and Windows

Door	*Weather Strip*	*Normally closed STC*
Wood, flush solid core(1)	Brass	**27**
Wood, flush solid core(1)	Plastic	**27**
Steel, flush(2)	Magnetic	**28**

Door Construction Detail

(1)Flush solid core wood door	Width	1-3/4"
	Weight	78lb, 3.9 lb/sq ft
(2)Flush steel door	Width	1-3/4"
	Faces	0.028" steel, separated by plastic perimeter strip
	Core	Rigid polyurethane, 2 2-1/2" lb/cu.ft, foamed in place
	Weight	64lb, 3.2 lb/sq ft

Sound Transmission Loss of Windows

Material	*Type*	*Size*	*Glazing*[1]	*Sealed STC*	*Locked STC*	*Unlocked STC*
Wood	Double hung	3'x5'	ss	**29**		**23**
			ss-d	**29**		
			ds	**29**		
			ds-d	**30**		
			In-7/16"	**28**	**26**	**22**
	Fixed picture	6'x5'	ss-d	**28**		
			ds	**29**		
			in-1"	**34**	**STC**	**STC**
Wood-plastic	Double hung		ss	**29**	**26**	**26**
			in-3/8"	**26**	**26**	**25**
	Storm sash		ds	**30**	**27**	
			in-3/8"	**28**	**24**	
	Fixed casement		ds	**31**		
	Operable casement		ds		**30**	**22**
	Sliding glass door		lam-3/16"	**31**	**26**	**26**
Aluminum	Sliding		ss	**28**	**24**	
	Operable casement		ds	**31**	**21**	**17**
	Single hung		in-7/16"	**30**	**27**	**25**
Single pane 1/4" laminated glass						**34**

[1]ss	=	single strength
ds	=	double strength
d	=	divided lights
in	=	insulating glass of indicated overall thickness
lam	=	laminated safety glass of indicated overall thickness

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

* Information received in imperial units only

curved interior wall panels to distribute sound throughout the hall in a geometrically controlled fashion. They also serve as structural members. Some 200 curved, sandblasted panels, employing eight different radii, were created to meet all of the acoustical requirements. They were given a staining sealer for aesthetic effects.

Absorption of Sound

A sound wave always loses part of its energy as it is reflected by a surface. This loss of energy is called sound absorption. It appears as a decrease in sound pressure of the reflected wave. The sound absorption coefficient is the fraction of energy incident but not reflected per unit of surface area. Sound absorption can be specified at individual frequencies or as an average of absorption coefficients (NRC). A dense, non-porous concrete surface typically absorbs 1 to

Assembly	No. Description	STC[1] (OITC)
1	4 in. flat panel, 54 psf	49 (43)
2	5 in. flat panel, 60 psf	52[2]
3	6 in. flat panel, 75 psf	55 (46)
4	Assembly 2 with "Z" furring channels, 1 in. insulation and $^1/_2$ in. gypsum board, 75.5 psf	62
5	Assembly 2 with wood furring, $1^1/_2$ in. insulation and $^1/_2$ in. gypsum board, 73 psf	63
6	Assembly 2 with $^1/_2$ in. space, $1^5/_8$ in. metal stud row, $1^1/_2$ in. insulation and $^1/_2$ in. gypsum board	632
7	8 in. flat panel, 95 psf	58 (50)
8	10 in. flat panel, 120 psf	59[2]

1 The STC of sandwich panels is about the same as the STC of the thickness of the two concrete wythes (ignoring the insulation thickness).
2 Estimated values.

Table 1 Airborne Sound Transmission Class Ratings from Tests of Precast Concrete Assemblies.

Treatment	Increaesd Airborne STC
Wall furring, $^3/_4$ in. insulation and $^1/_2$ in. gypsum board attached to concrete wall	3
Separate metal stud system, $1^1/_2$ in. insulation in stud cavity and $^1/_2$ in. gypsum board attached to concrete wall	5 to 10
Plaster direct to concrete	0

Table 2 Typical Improvements for Wall Treatments Used with Precast Concrete Elements.