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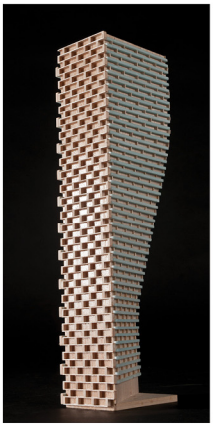
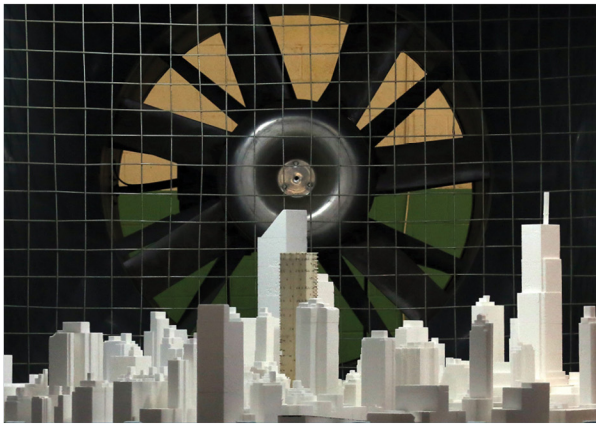
ROADWAY TRAFFIC NOISE ASSESSMENT

315 Chapel Street
Ottawa, Ontario

REPORT: 23-051 – Traffic Noise





August 9, 2023

PREPARED FOR

All Saints Development LP
150 Elgin Street, Suite 1000
Ottawa, ON K2P 1L4

PREPARED BY

Essraa Alqassab, BASc, Junior Environmental Scientist
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EXECUTIVE SUMMARY

This report describes a roadway traffic noise assessment undertaken to satisfy concurrent Zoning By-law Amendment and Site Plan Control application submission requirements for the proposed mixed-use residential development located at 315 Chapel Street in Ottawa, Ontario. The primary sources of roadway traffic noise are Laurier Avenue and Chapel Street. Figure 1 illustrates a complete site plan with surrounding context.

The assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP) and City of Ottawa requirements; (ii) noise level criteria as specified by MECP's and the City of Ottawa's Environmental Noise Control Guidelines (ENCG); (iii) future vehicular traffic volumes based on the City of Ottawa's Official Plan roadway classifications; and (iv) architectural drawings provided by Linebox Studio in July 2023.

The results of the current analysis indicate that POW noise levels will range between 52 and 67 dBA during the daytime period (07:00-23:00) and between 45 and 60 dBA during the nighttime period (23:00-07:00). The highest noise level (67 dBA) occurs at the north façade, which is closer to Laurier Avenue. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA.

Results of the calculations also indicate that the development will require central air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. The following Warning Clause will also be required be placed on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

As noise levels at the rooftop terrace amenity space do not exceed the OLA noise level criterion, acoustic mitigation for this area is not required.

Stationary noise impacts from the environment onto the proposed development are expected to be minimal. The site is not in close proximity to any large mechanical equipment. Furthermore, the setback distance from neighbouring midrise buildings is sufficient in attenuating noise from the rooftop units. Therefore, negative noise impacts are not anticipated.

With regard to stationary noise impacts, a stationary noise study will be performed for the site during the detailed design once mechanical plans for the proposed building become available. This study would assess impacts of stationary noise from rooftop mechanical units serving the proposed building on surrounding noise-sensitive areas. Noise impacts can generally be minimized by judicious selection and placement of the equipment. Where necessary noise screens and silencers can be placed into the design.

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1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by All Saint Development LP to undertake a roadway traffic noise assessment in support of a proposed mixed-use, commercial and residential development located at 315 Chapel Street in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to the assessment of exterior and interior noise levels generated by local roadway traffic.

Our work is based on theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MECP)[2] noise guidelines. Noise calculations were based on architectural drawings provided by Linebox Studio in July 2023, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The subject site is located at 315 Chapel Street in Ottawa; situated at the east intersection of Chapel Street and Laurier Avenue, on a parcel of land bounded by Chapel Street to the southwest, Laurier Avenue to the northwest, Blackburn Avenue to the northeast, and low-rise buildings to the southeast. Throughout this report, Chapel Street is referred to as project west. The existing All Saints Anglican Church building is located on the west of the subject site and is to be retained as part of the Ontario Heritage Act. An existing patio is situated to the north of the noted church. The proposed development comprises a nominally rectangular nine-storey mixed-use residential building and is to be affixed to the polygonal apse to the east of the existing church.

Above two below-grade parking levels, the ground floor of the proposed development includes a library / work amenity area at the northeast corner, a main entrance and dwelling units to the east, building support spaces and bike storage at the southwest corner, a lobby atrium at the northwest corner and a central elevator core. Access to underground parking is provided by a ramp at the southeast corner via a laneway from Blackburn Avenue. Level 2 extends from the east elevation and includes suites along the

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

north, east and south elevations, and an indoor amenity / gym to the west. Level 3 and above are reserved for residential suites. The building steps back from the east, south, and west elevations at Level 4 to accommodate private terraces. Levels 5-9 are reserved for residential use and include protruding private terraces to the east, south, and near the southwest corner. The building extends from the west elevation at Level 6 and steps back from the south elevation at Level 7. A floorplate setback from the north and east elevations creates a private terrace at the northeast corner at Level 7. The roof level is reserved for indoor amenities and the building steps back from all elevations to accommodate an amenity terrace around the perimeter of the level.

Terraces extending less than 4 metres in depth from the façade are not considered as Outdoor Living Areas (OLA) in the ENCG. The only sources of roadway traffic noise are Laurier Avenue and Chapel Street. Figure 1 illustrates a complete site plan with surrounding context.

3. OBJECTIVES

The principal objectives of this study are to (i) calculate the future noise levels on the study buildings produced by local roadway traffic, and (ii) ensure that interior and exterior noise levels do not exceed the allowable limits specified by the City of Ottawa's Environmental Noise Control Guidelines and the MECP Guidelines as outlined in Section 4.2 of this report.

4. METHODOLOGY

4.1 Background

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

4.2 Roadway Traffic Noise

4.2.1 Criteria for Roadway Traffic Noise

For surface roadway traffic noise, the equivalent sound energy level, L_{eq}, provides a measure of the time varying noise levels, which is well correlated with the annoyance of sound. It is defined as the continuous sound level, which has the same energy as a time varying noise level over a period of time. For roadways, the L_{eq} is commonly calculated on the basis of a 16-hour (L_{eq16}) daytime (07:00-23:00) / 8-hour (L_{eq8}) nighttime (23:00-07:00) split to assess its impact on residential buildings. The City of Ottawa's Environmental Noise Control Guidelines (ENCG) specifies that the recommended indoor noise limit range (that is relevant to this study) is 50, 45 and 40 dBA for living rooms and sleeping quarters respectively for roadway as listed in Table 1.

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

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

Predicted noise levels at the plane of window (POW) dictate the action required to achieve the recommended sound levels. An open window is considered to provide a 10 dBA reduction in noise, while a standard closed window is capable of providing a minimum 20 dBA noise reduction[4]. A closed window due to a ventilation requirement will bring noise levels down to achieve an acceptable indoor environment[5]. Therefore, where noise levels exceed 55 dBA daytime and 50 dBA nighttime, the ventilation

[3] Adapted from ENCG 2016 – Tables 2.2b and 2.2c
[4] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[5] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8

for the building should consider the need for having windows and doors closed, which triggers the need for forced air heating with provision for central air conditioning. Where noise levels exceed 65 dBA daytime and 60 dBA nighttime, air conditioning will be required and building components will require higher levels of sound attenuation[6].

The sound level criterion for outdoor living areas is 55 dBA, which applies during the daytime (07:00 to 23:00). When noise levels exceed 55 dBA, mitigation must be provided to reduce noise levels where technically and administratively feasible to acceptable levels at or below the criterion.

4.2.2 Theoretical Roadway Noise Predictions

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

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

- Truck traffic on all roadways was assumed to comprise 5% heavy trucks and 7% medium trucks, as per ENCG requirements for noise level predictions.
- The day/night split for all streets was taken to be 92%/8%, respectively.
- Ground surfaces were taken to be reflective due to the presence of hard (paved) ground.
- Topography was assumed to be a flat/gentle slope surrounding the study building.
- Noise receptors were placed at 5 locations around the study area (see Figure 2).
- Receptor distances and exposure angles are illustrated in Figures A1-A3.

4.2.3 Roadway Traffic Volumes

The ENCG dictates that noise calculations should consider future sound levels based on a roadway's classification at the mature state of development. Therefore, traffic volumes are based on the roadway classifications outlined in the City of Ottawa's Official Plan (OP) and Transportation Master Plan[7] which

[6] MOECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3
[7] City of Ottawa Transportation Master Plan, November 2013

provide additional details on future roadway expansions. Average Annual Daily Traffic (AADT) volumes are then based on data in Table B1 of the ENCG for each roadway classification. Table 2 (below) summarizes the AADT values used for each roadway included in this assessment.

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Traffic Data	Speed Limit (km/h)	Traffic Volumes
Laurier Avenue	2-Lane Major Collector (2-UMCU)	50	**12,000**
Chapel Street	2-Lane Urban Collector (2-UCU)	40	**8,000**

4.3 Indoor Noise Calculations

The difference between outdoor and indoor noise levels is the noise attenuation provided by the building envelope. According to common industry practice, complete walls and individual wall elements are rated according to the Sound Transmission Class (STC). The STC ratings of common residential walls built in conformance with the Ontario Building Code (2020) typically exceed STC 35, depending on exterior cladding, thickness and interior finish details. For example, brick veneer walls can achieve STC 50 or more. Standard commercially sided exterior metal stud walls have around STC 45. Standard good quality double-glazed non-operable windows can have STC ratings ranging from 25 to 40, depending on the window manufacturer, pane thickness and inter-pane spacing.

As per Section 4.2, when daytime noise levels from road sources at the plane of the window exceed 65 dBA, calculations must be performed to evaluate the sound transmission quality of the building components to ensure acceptable indoor noise levels. The calculation procedure[8] considers:

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

[8] Building Practice Note: Controlling Sound Transmission into Buildings by J.D. Quirt, National Research Council of Canada, September 1985

- Outdoor noise source type and approach geometry

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

[9] CMHC, Road & Rail Noise: Effects on Housing

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

The results of the roadway traffic noise calculations are summarized in Table 3 below. A complete set of input and output data from all STAMSON 5.04 calculations are available in Appendix A.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROAD TRAFFIC

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	STAMSON 5.04 Noise Level (dBA)	
			Day	Night
1	30.9	POW – 9th Floor – North Façade	67	60
2	30.9	POW – 9th Floor – East Façade	63	55
3	30.9	POW – 9th Floor – South Façade	52	45
4	30.9	POW – 9th Floor – West Façade	63	55
5	34.5	OLA – Rooftop Terrace	49	N/A*

*Noise levels during the nighttime are not considered as per ENCG

The results of the current analysis indicate that POW noise levels will range between 52 and 67 dBA during the daytime period (07:00-23:00) and between 45 and 60 dBA during the nighttime period (23:00-07:00). The highest noise level (67 dBA) occurs at the north façade, which is closer to Laurier Avenue.

5.2 Noise Control Measures

The noise levels predicted due to roadway traffic exceed the criteria listed in Section 4.2 for building components. As discussed in Section 4.3, the anticipated STC requirements for windows have been estimated based on the overall noise reduction required for each intended use of space (STC = outdoor noise level – targeted indoor noise levels). As per city of Ottawa requirements, detailed STC calculations will be required to be completed prior to building permit application for each unit type. The STC requirements for the windows are summarized below for various units within the development (see Figure 3):

- **Bedroom Windows of Residential Suites**

(i) Bedroom windows facing north will require a minimum STC of 30

(ii) All other bedroom windows are to satisfy Ontario Building Code (OBC 2020) requirements.

- **Living Room Windows of Residential Suites**

(i) Living room windows facing north will require a minimum STC of 25

(ii) All other living room windows are to satisfy Ontario Building Code (OBC 2020) requirements.

- **Exterior Walls**

(i) Exterior wall components on the north and east façades will require a minimum STC of 45, which will be achieved with brick cladding or an acoustical equivalent according to NRC test data[10]

The STC requirements apply to windows, doors, spandrel panels and curtainwall elements. Exterior wall components on these façades are recommended to have a minimum STC of 45, where a window/wall system is used. A review of window supplier literature indicates that the specified STC ratings can be achieved by a variety of window systems having a combination of glass thickness and inter-pane spacing. We have specified an example window configuration, however several manufacturers and various combinations of window components, such as those proposed, will offer the necessary sound attenuation rating. The specified STC requirements also apply to swinging and/or sliding patio doors.

Results of the calculations also indicate that the development will require central air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. In addition to ventilation requirements, Warning Clauses will also be required in all Agreements of Purchase and Sale and Lease Agreements, as summarized in Section 6.

As noise levels do not exceed the OLA noise level criterion, acoustic mitigation is not required for the rooftop terrace amenity space.

[10] J.S. Bradley and J.A. Birta. Laboratory Measurements of the Sound Insulation of Building Façade Elements, National Research Council October 2000.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that POW noise levels will range between 52 and 67 dBA during the daytime period (07:00-23:00) and between 45 and 60 dBA during the nighttime period (23:00-07:00). The highest noise level (67 dBA) occurs at the north façade, which is closer to Laurier Avenue. Building components with a higher Sound Transmission Class (STC) rating will be required where exterior noise levels exceed 65 dBA, as indicated in Figure 3.

Results of the calculations also indicate that the development will require central air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living environment. The following Warning Clause[11] will also be required be placed on all Lease, Purchase and Sale Agreements, as summarized below:

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."*

As noise levels do not exceed the OLA noise level criterion, acoustic mitigation is not required for the rooftop terrace amenity space.

Stationary noise impacts from the environment onto the proposed development are expected to be minimal. The site is not in close proximity to any large mechanical equipment. Furthermore, the setback distance from neighbouring midrise buildings is sufficient in attenuating noise from the rooftop units. Therefore, negative noise impacts are not anticipated.

With regard to stationary noise impacts, a stationary noise study will be performed for the site during the detailed design once mechanical plans for the proposed building become available. This study would assess impacts of stationary noise from rooftop mechanical units serving the proposed building on surrounding noise-sensitive areas. Noise impacts can generally be minimized by judicious selection and placement of the equipment. Where necessary noise screens and silencers can be placed into the design.

[11] City of Ottawa Environmental Noise Control Guidelines, January 2016

This concludes our roadway traffic noise assessment and report. If you have any questions or wish to discuss our findings, please advise us. In the interim, we thank you for the opportunity to be of service.

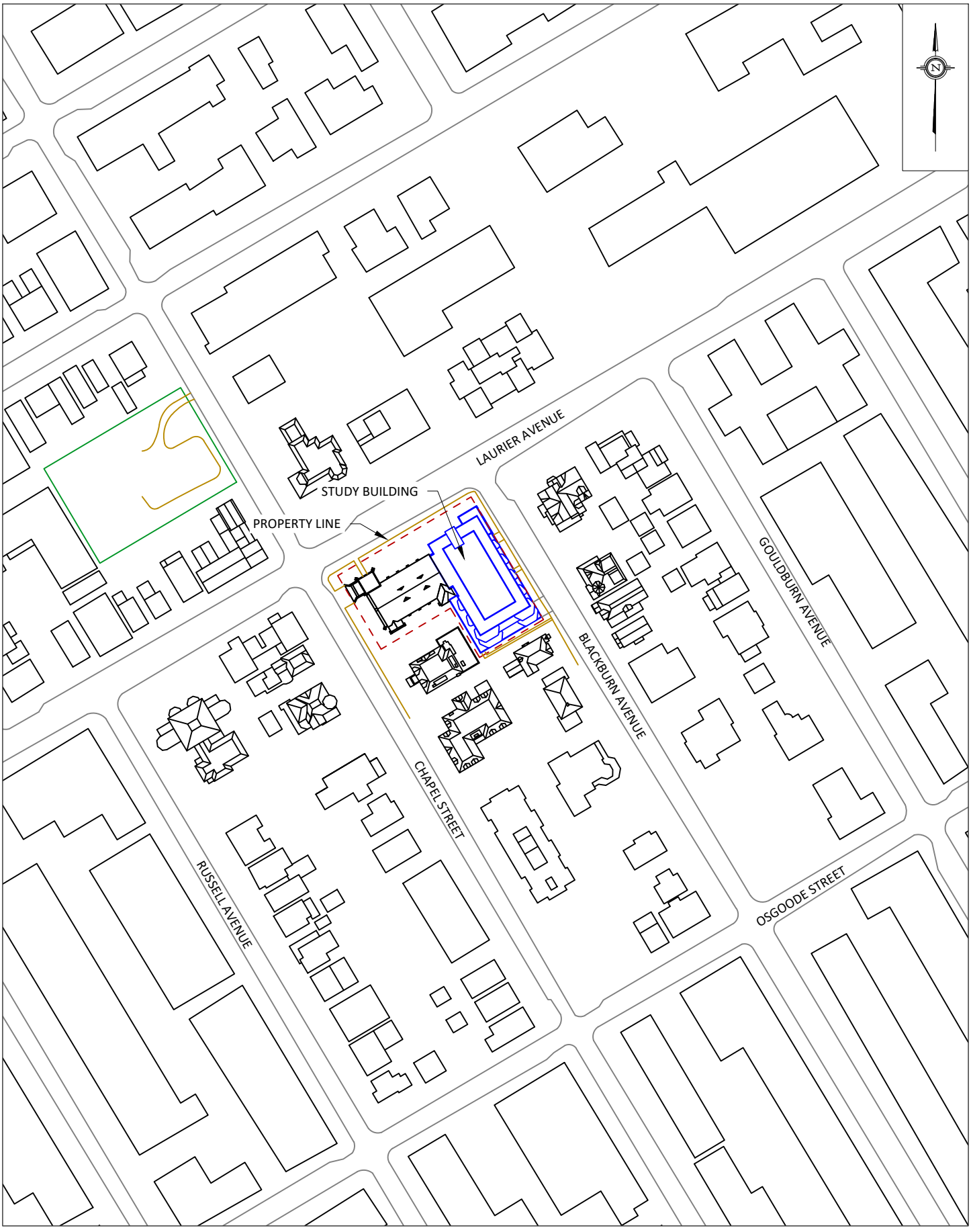
Sincerely,

Gradient Wind Engineering Inc.

Essraa Alqassab, BASc
Junior Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File #23-051-Traffic Noise



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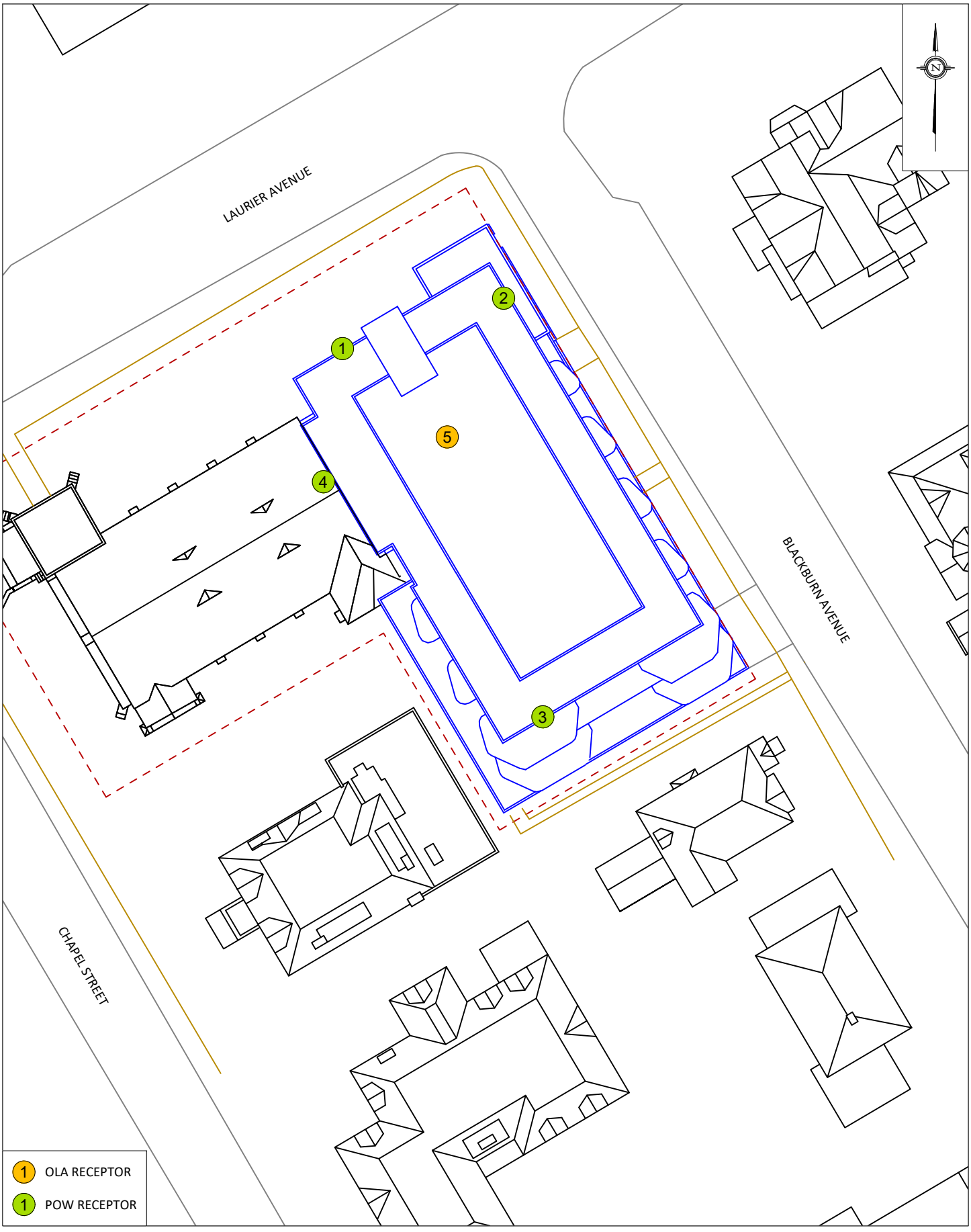
PROJECT	315 CHAPEL STREET, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:2000 (APPROX.)	DRAWING NO.	GW23-051-1
DATE	JUNE 5, 2023	DRAWN BY	E.A.

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT



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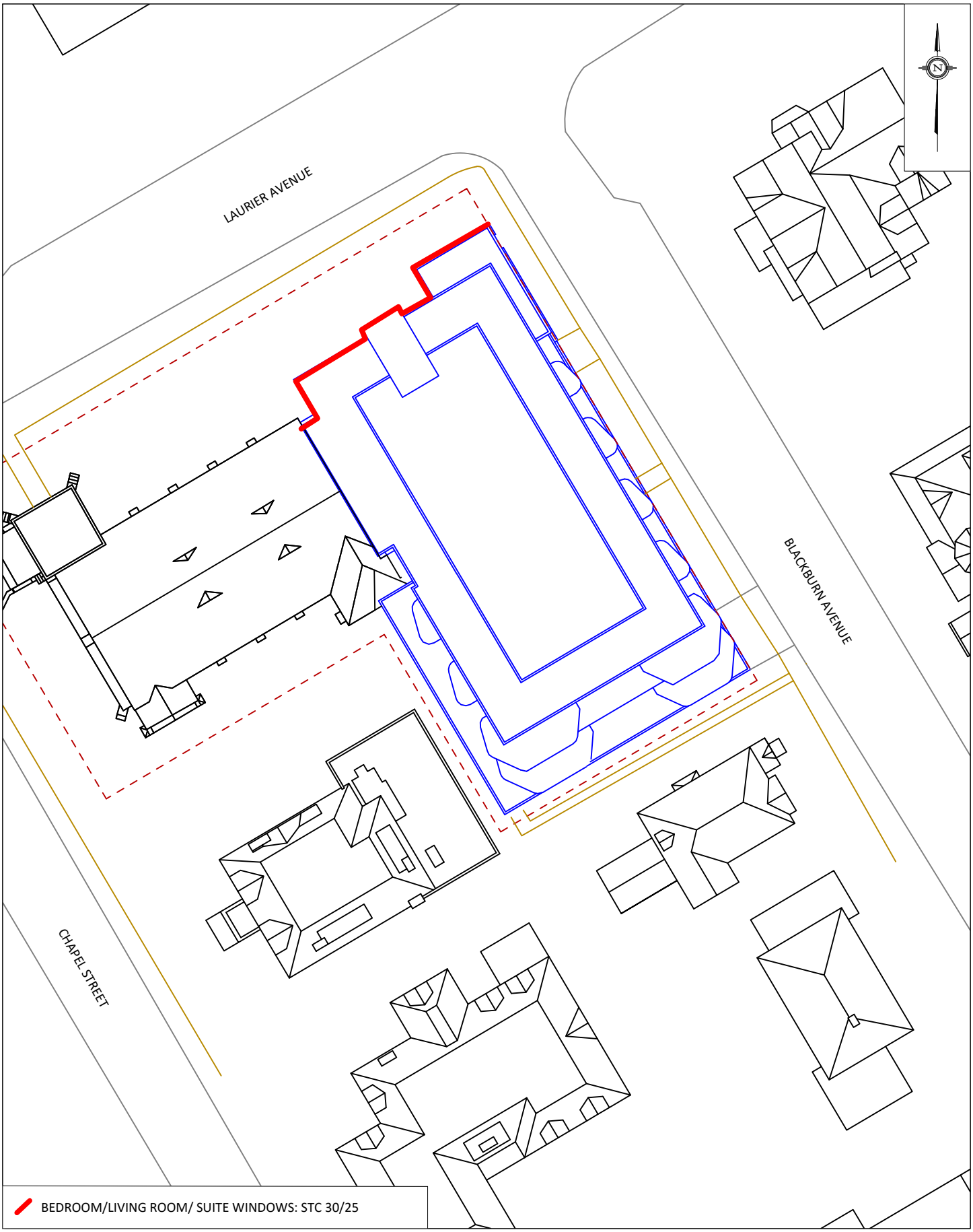
SCALE	1:200 (APPROX.)	DRAWING NO.	GW23-051-2
DATE	JUNE 5, 2023	DRAWN BY	E.A.

FIGURE 2:
RECEPTOR LOCATIONS



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SCALE	1:200 (APPROX.)	DRAWING NO.	GW23-051-3
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FIGURE 3:
STC RECOMMENDATIONS

APPENDIX A

STAMSON CALCULATIONS

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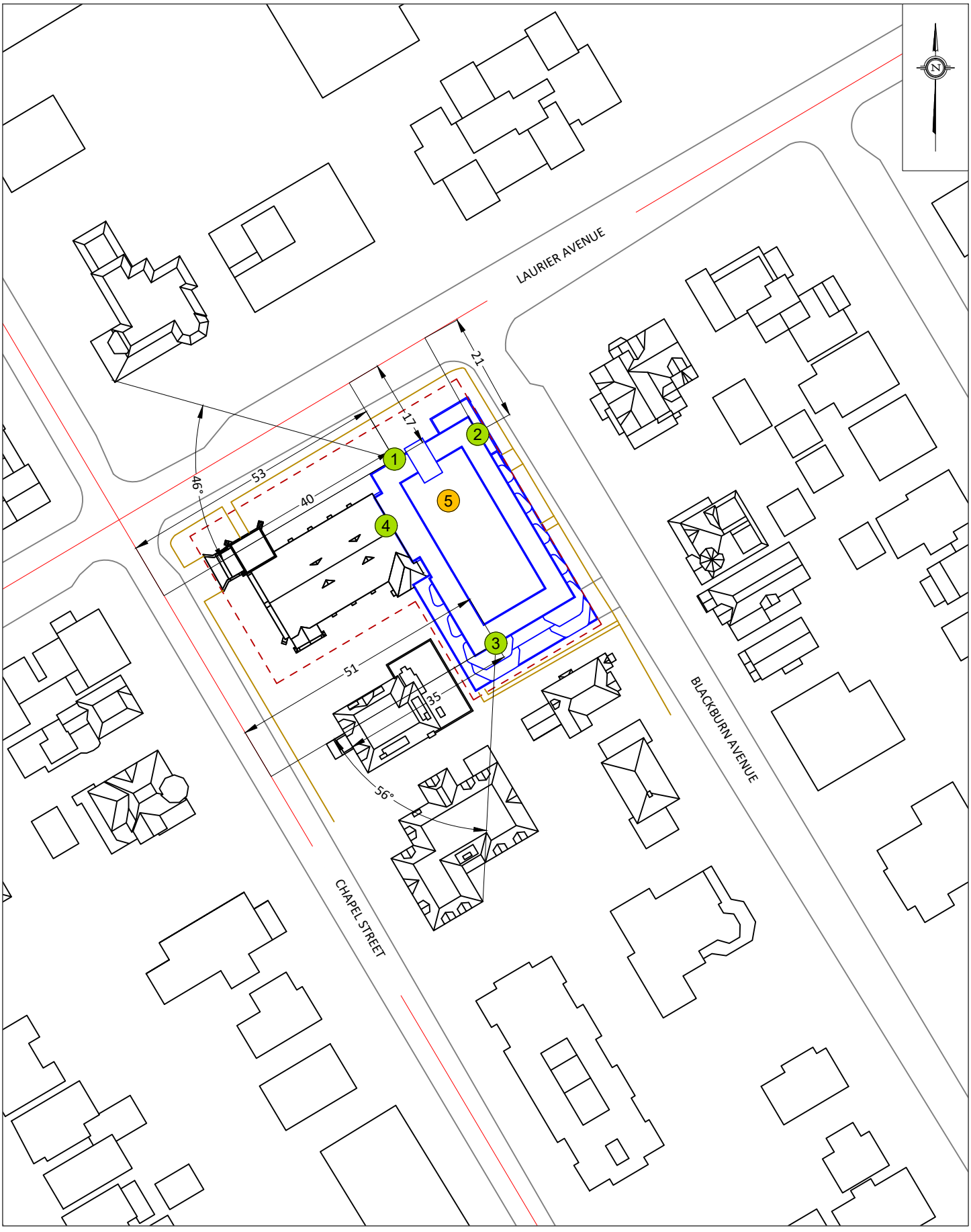

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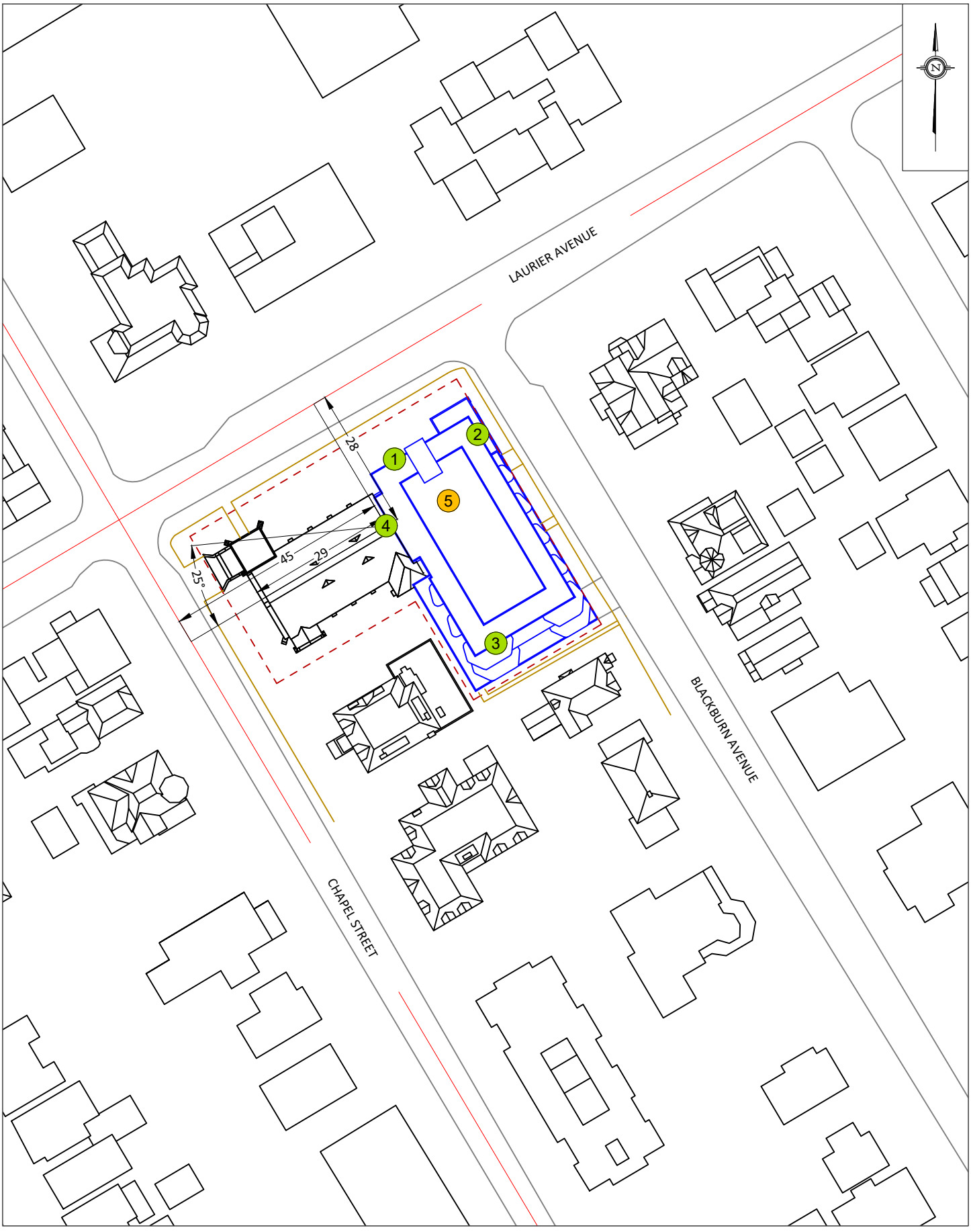
PROJECT	315 CHAPEL STREET, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW23-051-A1
DATE	JUNE 5, 2023	DRAWN BY	E.A.

FIGURE A1:
STAMSON PARAMETERS (1)



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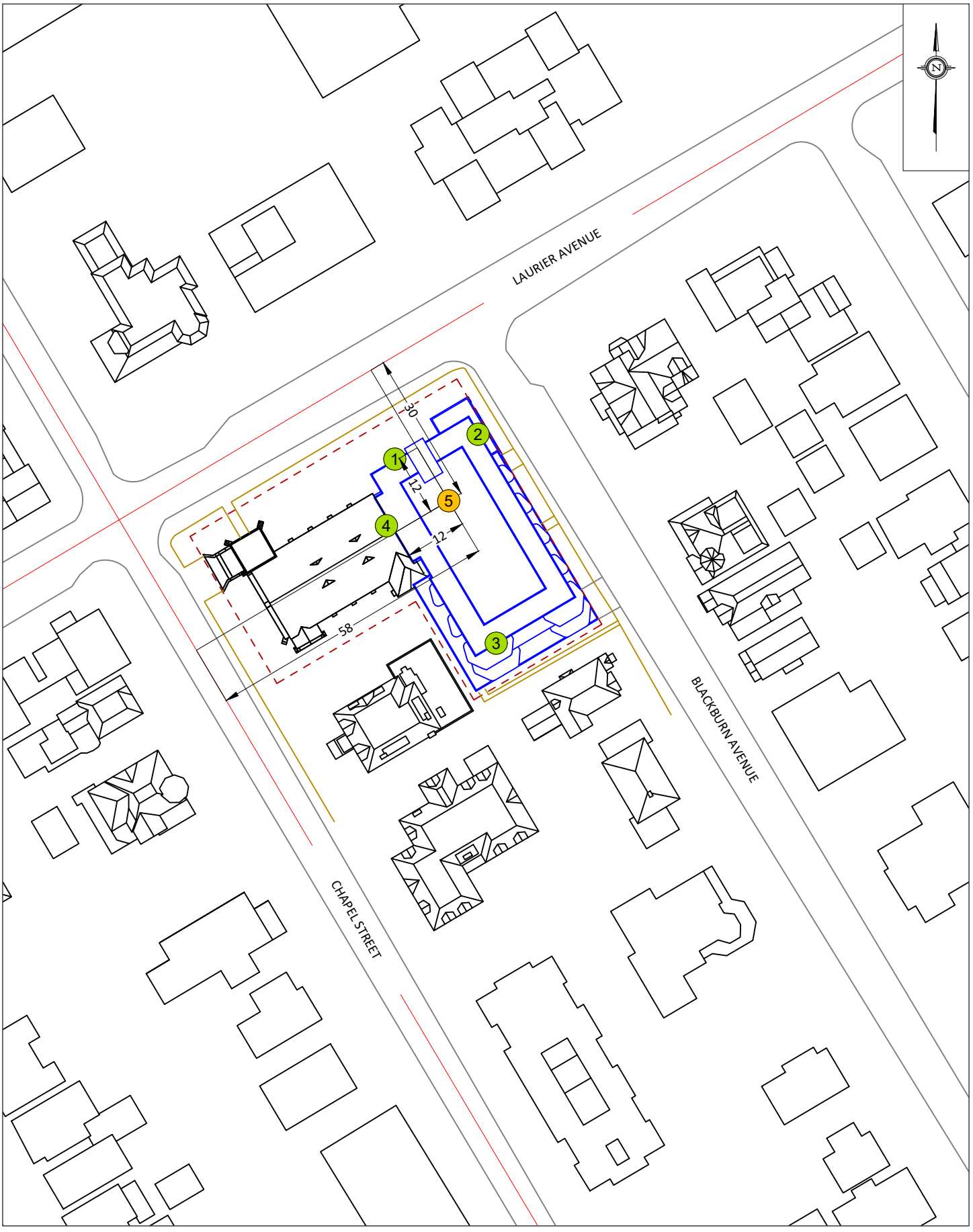
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW23-051-A2
DATE	JUNE 5, 2023	DRAWN BY	E.A.

FIGURE A2:
STAMSON PARAMETERS (2)



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SCALE	1:1000 (APPROX.)	DRAWING NO.	GW23-051-A3
DATE	JUNE 5, 2023	DRAWN BY	E.A.

FIGURE A3:
STAMSON PARAMETERS (3)

```
STAMSON 5.0        NORMAL REPORT        Date: 05-06-2023 11:03:42
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Laurier (day/night)
-------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    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):  12000
    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: Laurier (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  :  30.00 / 30.00  m
Receiver height           :  34.50 / 34.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  33.00 m
Barrier receiver distance :  12.00 / 12.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00


Road data, segment # 2: Chapel (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: Chapel (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  :  58.00 / 58.00  m
Receiver height           :  34.50 / 34.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  33.00 m
Barrier receiver distance :  12.00 / 12.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00


Results segment # 1: Laurier (day)
----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       34.50 !       21.30 !        21.30

ROAD (0.00 + 47.15 + 0.00) = 47.15 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90    0.00  67.51   0.00  -3.01   0.00   0.00   0.00 -17.35
47.15
-------------------------------------------------------------------------------
--
```

```
Segment Leq : 47.15 dBA


Results segment # 2: Chapel (day)
---------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       34.50 !       27.67 !        27.67

ROAD (0.00 + 44.13 + 0.00) = 44.13 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  -5.87   0.00   0.00   0.00 -13.96
44.13
-------------------------------------------------------------------------------
--

Segment Leq : 44.13 dBA

Total Leq All Segments: 48.91 dBA


Results segment # 1: Laurier (night)
------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       34.50 !       21.30 !        21.30

ROAD (0.00 + 39.55 + 0.00) = 39.55 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     90   0.00  59.91   0.00  -3.01   0.00   0.00   0.00 -17.35
39.55
```

```
-------------------------------------------------------------------------------
--

Segment Leq : 39.55 dBA


Results segment # 2: Chapel (night)
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       34.50 !       27.67 !        27.67

ROAD (0.00 + 36.53 + 0.00) = 36.53 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  -5.87   0.00   0.00   0.00 -13.96
36.53
-------------------------------------------------------------------------------
--

Segment Leq : 36.53 dBA

Total Leq All Segments: 41.31 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 48.91
                           (NIGHT): 41.31
```

```
STAMSON 5.0        NORMAL REPORT        Date: 05-06-2023 11:04:08
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Laurier (day/night)
-------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    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):  12000
    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: Laurier (day/night)
-----------------------------------------
Angle1   Angle2           :   0.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  21.00 / 21.00  m
Receiver height           :  30.90 / 30.90  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00


Results segment # 1: Laurier (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 63.04 + 0.00) = 63.04 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     90   0.00  67.51   0.00  -1.46  -3.01   0.00   0.00   0.00
63.04
```

```
-------------------------------------------------------------------------------
--

Segment Leq : 63.04 dBA

Total Leq All Segments: 63.04 dBA


Results segment # 1: Laurier (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 55.44 + 0.00) = 55.44 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
     0     90   0.00  59.91   0.00  -1.46  -3.01   0.00   0.00   0.00
55.44
-------------------------------------------------------------------------------
--

Segment Leq : 55.44 dBA

Total Leq All Segments: 55.44 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 63.04
                           (NIGHT): 55.44
```

```
STAMSON 5.0        NORMAL REPORT        Date: 05-06-2023 11:28:58
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Chapel (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 # 1: Chapel (day/night)
----------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  51.00 / 51.00  m
Receiver height           :  30.90 / 30.90  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -56.00 deg   Angle2 : 0.00 deg
Barrier height            :  13.00 m
Barrier receiver distance :  35.00 / 35.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00


Results segment # 1: Chapel (day)
---------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
```

```
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       30.90 !       10.72 !        10.72

ROAD (51.40 + 44.15 + 0.00) = 52.15 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -56   0.00  63.96   0.00  -5.31  -7.24   0.00   0.00   0.00
51.40
-------------------------------------------------------------------------
--
   -56      0   0.00  63.96   0.00  -5.31  -5.07   0.00   0.00  -9.42
44.15
-------------------------------------------------------------------------
--

Segment Leq : 52.15 dBA

Total Leq All Segments: 52.15 dBA


Results segment # 1: Chapel (night)
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       30.90 !       10.72 !        10.72

ROAD (43.81 + 36.56 + 0.00) = 44.56 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -56   0.00  56.36   0.00  -5.31  -7.24   0.00   0.00   0.00
43.81
-------------------------------------------------------------------------
--
   -56      0   0.00  56.36   0.00  -5.31  -5.07   0.00   0.00  -9.42
36.56
-------------------------------------------------------------------------
--

Segment Leq : 44.56 dBA
```

```
Total Leq All Segments: 44.56 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 52.15
                           (NIGHT): 44.56
```

```
STAMSON 5.0        NORMAL REPORT        Date: 05-06-2023 11:29:19
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Chapel (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 # 1: Chapel (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  :  45.00 / 45.00  m
Receiver height           :  30.90 / 30.90  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 25.00 deg
Barrier height            :  13.00 m
Barrier receiver distance :  29.00 / 29.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00


Road data, segment # 2: Laurier (day/night)
-------------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    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):  12000
    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: Laurier (day/night)
-----------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  28.00 / 28.00  m
Receiver height           :  30.90 / 30.90  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 0.00 deg
Barrier height            :  14.00 m
Barrier receiver distance :   7.00 / 7.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00


Results segment # 1: Chapel (day)
---------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       30.90 !       11.95 !        11.95

ROAD (0.00 + 51.21 + 54.76) = 56.35 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     25   0.00  63.96   0.00  -4.77  -1.95   0.00   0.00  -6.03
51.21
-------------------------------------------------------------------------
--
    25     90   0.00  63.96   0.00  -4.77  -4.42   0.00   0.00   0.00
54.76
```

```
-------------------------------------------------------------------------------
--

Segment Leq : 56.35 dBA


Results segment # 2: Laurier (day)
----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       30.90 !       23.55 !        23.55

ROAD (0.00 + 61.79 + 0.00) = 61.79 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90      0   0.00  67.51   0.00  -2.71  -3.01   0.00   0.00  -0.04
61.75*
   -90      0   0.00  67.51   0.00  -2.71  -3.01   0.00   0.00   0.00
61.79
-------------------------------------------------------------------------------
--

 * Bright Zone !

Segment Leq : 61.79 dBA

Total Leq All Segments: 62.88 dBA


Results segment # 1: Chapel (night)
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       30.90 !       11.95 !        11.95

ROAD (0.00 + 43.62 + 47.17) = 48.76 dBA
```

```
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     25   0.00  56.36   0.00  -4.77  -1.95   0.00   0.00  -6.03
43.62
-------------------------------------------------------------------------
--
    25     90   0.00  56.36   0.00  -4.77  -4.42   0.00   0.00   0.00
47.17
-------------------------------------------------------------------------
--

Segment Leq : 48.76 dBA


Results segment # 2: Laurier (night)
------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       30.90 !       23.55 !        23.55

ROAD (0.00 + 54.19 + 0.00) = 54.19 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      0   0.00  59.91   0.00  -2.71  -3.01   0.00   0.00  -0.04
54.15*
   -90      0   0.00  59.91   0.00  -2.71  -3.01   0.00   0.00   0.00
54.19
-------------------------------------------------------------------------
--

 * Bright Zone !

Segment Leq : 54.19 dBA

Total Leq All Segments: 55.28 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 62.88
```

(NIGHT): 55.28

```
STAMSON 5.0        NORMAL REPORT        Date: 05-06-2023 11:29:27
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Laurier (day/night)
----------------------------------------
Car traffic volume  :  9715/845   veh/TimePeriod  *
Medium truck volume :   773/67    veh/TimePeriod  *
Heavy truck volume  :   552/48    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):  12000
    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: Laurier (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  :  30.00 / 30.00  m
Receiver height           :  34.50 / 34.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  33.00 m
Barrier receiver distance :  12.00 / 12.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00


Road data, segment # 2: Chapel (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: Chapel (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  :  58.00 / 58.00  m
Receiver height           :  34.50 / 34.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :  33.00 m
Barrier receiver distance :  12.00 / 12.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00


Results segment # 1: Laurier (day)
----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       34.50 !       21.30 !        21.30

ROAD (0.00 + 47.15 + 0.00) = 47.15 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  67.51   0.00  -3.01   0.00   0.00   0.00 -17.35
47.15
-------------------------------------------------------------------------
--

Segment Leq : 47.15 dBA
```

```
Results segment # 2: Chapel (day)
---------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       34.50 !       27.67 !        27.67

ROAD (0.00 + 44.13 + 0.00) = 44.13 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  -5.87   0.00   0.00   0.00 -13.96
44.13
-------------------------------------------------------------------------
--

Segment Leq : 44.13 dBA

Total Leq All Segments: 48.91 dBA


Results segment # 1: Laurier (night)
------------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       34.50 !       21.30 !        21.30

ROAD (0.00 + 39.55 + 0.00) = 39.55 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90     90   0.00  59.91   0.00  -3.01   0.00   0.00   0.00 -17.35
39.55
-------------------------------------------------------------------------
--
```

```
Segment Leq : 39.55 dBA


Results segment # 2: Chapel (night)
-----------------------------------

Source height = 1.50 m

Barrier height for grazing incidence
------------------------------------
Source      ! Receiver    ! Barrier     ! Elevation of
Height  (m) ! Height  (m) ! Height  (m) ! Barrier Top  (m)
------------+-------------+-------------+--------------
       1.50 !       34.50 !       27.67 !        27.67

ROAD (0.00 + 36.53 + 0.00) = 36.53 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  -5.87   0.00   0.00   0.00 -13.96
36.53
-------------------------------------------------------------------------------
--

Segment Leq : 36.53 dBA

Total Leq All Segments: 41.31 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 48.91
                           (NIGHT): 41.31
```