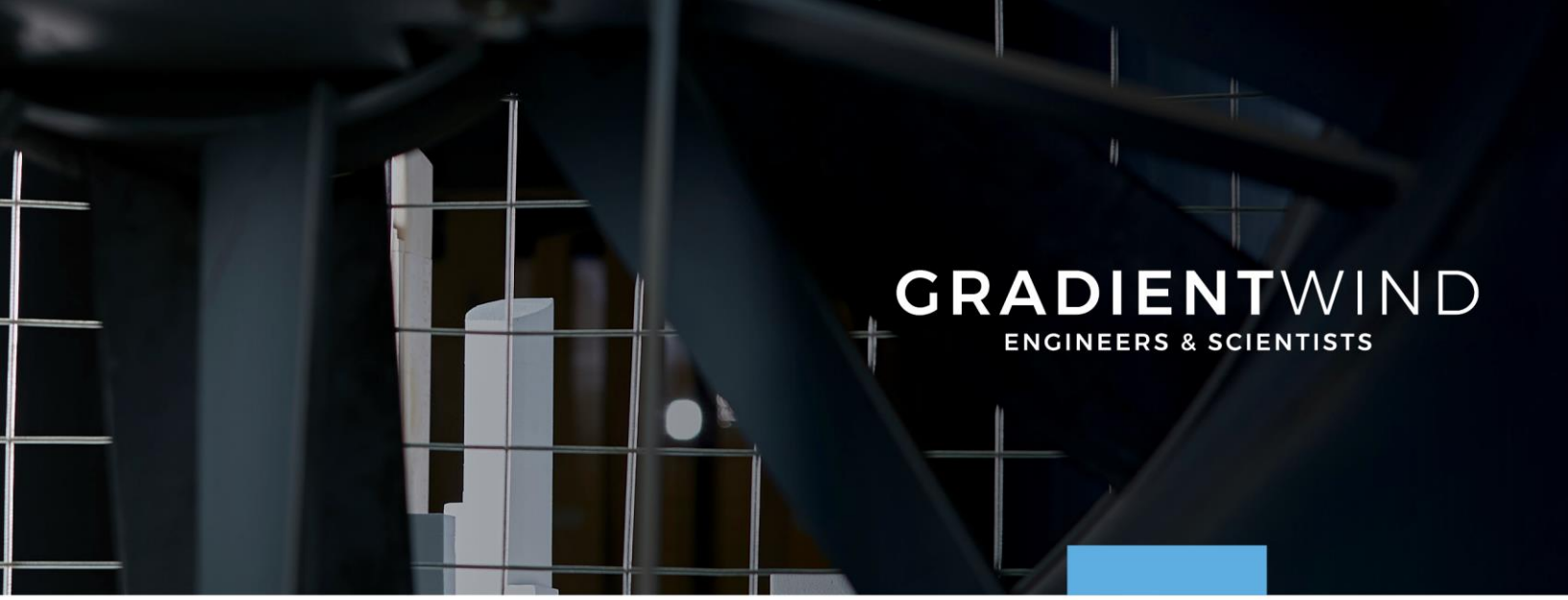

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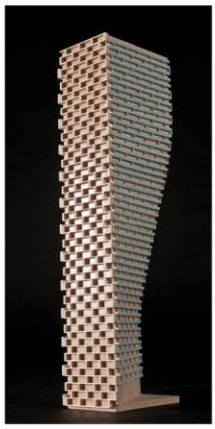
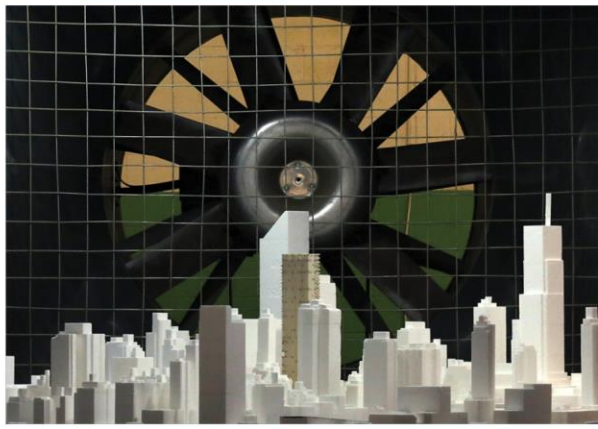
ROADWAY TRAFFIC NOISE ASSESSMENT

979 Wellington Street West
Ottawa, Ontario

Report: 20-211-T.Noise





May 10, 2023

PREPARED FOR
Magil Laurentian Realty Corporation
1170 Peel Street
Montréal, QC H3B 4P2

PREPARED BY
Michael Lafortune, C.E.T., Environmental Scientist
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EXECUTIVE SUMMARY

This report describes a roadway traffic noise assessment to satisfy the requirements for a Site Plan Control application (SPA) submission for a proposed development located at 979 Wellington Street West in Ottawa, Ontario. The development comprises a 12-storey C-shaped building. The major sources of traffic noise are Somerset Street West and Wellington Street West. Figure 1 illustrates a complete site plan with surrounding context.

The assessment is based on (i) theoretical noise prediction methods that conform to the Ministry of the Environment, Conservation and Parks (MECP) and City of Ottawa requirements; (ii) noise level criteria as specified by the City of Ottawa's Environmental Noise Control Guidelines (ENCG); (iii) future vehicular traffic volumes based on the City of Ottawa's Official Plan roadway classifications; and (iv) architectural drawings prepared by RLA Architecture in December 2021.

The results of the current analysis indicate that noise levels will range between 52 and 67 dBA during the daytime period (07:00-23:00) and between 51 and 60 dBA during the nighttime period (23:00-07:00). 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 and summarized in Section 5.2.

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/working environment. A 'Type D' Warning Clause will also be required be placed on all Lease, Purchase and Sale Agreements, as summarized in Section 6. The noise levels at the central, grade-level amenity and rooftop terrace are within the acceptable limits specified by the ENCG, therefore, mitigation is not required.

Regarding stationary noise, impacts from the surroundings on the study building are expected to be minimal. Sources associated with adjacent commercial and residential buildings are at a sufficient setback distance. Impacts from the development on the surroundings can be minimized by judicious placement mechanical equipment such as its placement on a roof or in a mechanical penthouse, or the incorporation of silencers and noise screens as necessary. It is recommended that any large pieces of HVAC equipment be placed in the middle of the roof, avoiding line of site with the surrounding residential dwellings.

TABLE OF CONTENTS

1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by Magil Laurentian Realty Corporation to undertake a roadway traffic noise assessment to satisfy the requirements for a Site Plan Control application (SPA) for a proposed development located at 979 Wellington Street West 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] guidelines. Noise calculations were based on architectural drawings prepared by RLA Architecture in December 2021, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The focus of this traffic noise assessment is a proposed mixed-use development located at 979 Wellington Street West in Ottawa, Ontario. The subject site occupies a full city block bordered by Hilda Street to the north, Wellington Street West at the east, Garland Street at the south, and Armstrong Street at the west. For ease of description Hilda Street is referred to as project north.

Architectural Rendering, South Perspective
(Courtesy of RLA Architecture)

The development comprises a 12-storey C-shaped building. The ground floor includes retail space along Wellington Street West, residential units along Armstrong and Garland Streets, lobby space, a loading dock, and the entrance to underground parking levels. The central courtyard is accessible from Armstrong street to the west and from Wellington Street

[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

West at the east through a covered passageway. At Level 2 a bridge connects the south and north floorplans, over the covered passageway. At Level 3 the north and south floorplans are fully joined at the east side of the site. Levels 2 and above comprise residential units. The building steps back from the west elevation at Level 5 and from all elevations at Level 10. The roof of the building, at the Mechanical Penthouse Level, will serve as an amenity terrace. As the balconies extend less than 4 metres (m) from the façade, they do not require consideration as outdoor living areas (OLA) in this assessment.

The site is surrounded by primarily low-rise buildings in all directions with isolated mid-rise buildings situated to the immediate north of the site, as well as to the east and southwest of the site. The major sources of roadway traffic noise are Somerset Street West and Wellington Street West. Bayview Road is located just beyond 100 metres (m) from the site, and therefore, is not expected to have a significant influence on the development. Arterial and collector roadways, as well as light rail transit (LRT) systems, located more than 100 m from the site are considered to be insignificant sources of transportation noise as per ENCG Section 2.1. 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 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 retail space, living rooms and sleeping quarters, respectively, for roadway as listed in Table 1. Based on Gradient Wind's experience, indoor noise levels 3 dBA lower than the ENCG limits should be targeted, to account for building deficiencies and to control peak noise. Therefore, the recommended indoor noise levels are 47, 42, and 37 dBA for retail space, living rooms and sleeping quarters, respectively.

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

[3] Adapted from ENCG 2016 – Tables 2.2b and 2.2c

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 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 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 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 Classification	Speed Limit (km/h)	Traffic Volumes
Somerset Street West	2-Lane Urban Arterial (2-UAU)	50	**15,000**
Wellington Street West	2-Lane Urban Arterial (2-UAU)	50	**15,000**

[4] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125
[5] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.8
[6] MECP, Environmental Noise Guidelines, NPC 300 – Part C, Section 7.1.3
[7] City of Ottawa Transportation Master Plan, November 2013

4.2.3 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 taken 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.
- For select sources where appropriate, the receptors considered the proposed building and existing, surrounding buildings as barriers, partially or fully obstructing exposure to the source as illustrated by exposure angles in Figures 4-7.
- Noise receptors were strategically placed at 5 locations around the study area (see Figure 2).
- Receptor distances and exposure angles are illustrated in Figures 4-7.

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 previously mentioned, the windows are the known weak point in a partition.

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:

- 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
- Outdoor noise source type and approach geometry
- Indoor sound level criteria, which varies according to the intended use of a space

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, which was prepared for site plan approval, 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).

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.

[8] Building Practice Note: Controlling Sound Transmission into Buildings by J.D. Quirt, National Research Council of Canada, September 1985
[9] CMHC, Road & Rail Noise: Effects on Housing

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	19.5	POW – Level 6, Southwest Façade of Podium	64	56
2	19.5	POW – Level 6, Southeast Façade of Podium	67	60
3	19.5	POW – Level 6, Northeast Façade of Building	58	51
4	1.5	OLA – Ground Level Amenity	55	N/A*
5	39.5	OLA – Rooftop Terrace	52	N/A*

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

The results of the current analysis indicate that noise levels will range between 52 and 67 dBA during the daytime period (07:00-23:00) and between 51 and 60 dBA during the nighttime period (23:00-07:00). The highest noise level (67 dBA) occurs at the southeast façade of the podium, which is nearest and most exposed to Wellington Street West and Somerset Street West. The noise levels at the central, grade-level amenity and rooftop terrace are within the acceptable limits specified by the ENCG, therefore, no mitigation is required for these areas.

The noise levels predicted due to roadway traffic exceed the criteria listed in Section 4.2 for building components. Upgraded building components, including STC rated glazing elements and exterior walls, will be required where noise levels due to roadway traffic exceed 65 dBA, as discussed in Section 4.2.1. Results of the calculations also indicated that the development will require air conditioning, which will allow occupants to keep windows closed and maintain a comfortable living/working environment. In addition to ventilation requirements, Warning Clauses will also be required to be placed on all Lease, Purchase and Sale Agreements, as summarized in Section 6.

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**

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

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

- **Living Room Windows**

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

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

- **Retail Windows**

(iii) Retail windows facing southeast will require a minimum STC of 20

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

- **Exterior Walls**

(i) Exterior wall components on the southeast façade 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 punch 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. Several manufacturers and various combinations of window components will offer the necessary

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

sound attenuation rating. It is the responsibility of the manufacturer to ensure that the specified window achieves the required STC. This can only be assured by using window configurations that have been certified by laboratory testing. The requirements for STC ratings assume that the remaining components of the building are constructed and installed according to the minimum standards of the Ontario Building Code. 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, a Warning Clause will also be required in all Lease, Purchase and Sale Agreements, as summarized in Section 6.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 52 and 67 dBA during the daytime period (07:00-23:00) and between 51 and 60 dBA during the nighttime period (23:00-07:00). The highest noise level (67 dBA) occurs at the southeast façade of the podium, which is nearest and most exposed to Wellington Street West and Somerset Street West. 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/working environment. The following 'Type D' Warning Clause[11] will also be required be placed on all Lease, Purchase and Sale Agreements.

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

[11] Ontario Ministry of the Environment and Climate Change – Environmental Noise Guidelines, Publication NPC-300, Queens Printer for Ontario, Toronto, 2013

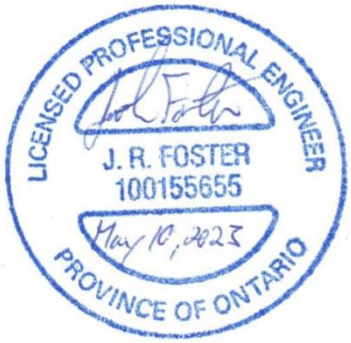
The noise levels at the central, grade-level amenity and rooftop terrace are within the acceptable limits specified by the ENCG, therefore, mitigation is not required.

Regarding stationary noise, impacts from the surroundings on the study building are expected to be minimal. Sources associated with adjacent commercial and residential buildings are at a sufficient setback distance. Impacts from the development on the surroundings can be minimized by judicious placement mechanical equipment such as its placement on a roof or in a mechanical penthouse, or the incorporation of silencers and noise screens as necessary. It is recommended that any large pieces of HVAC equipment be placed in the middle of the roof, avoiding line of site with the surrounding residential dwellings.

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,

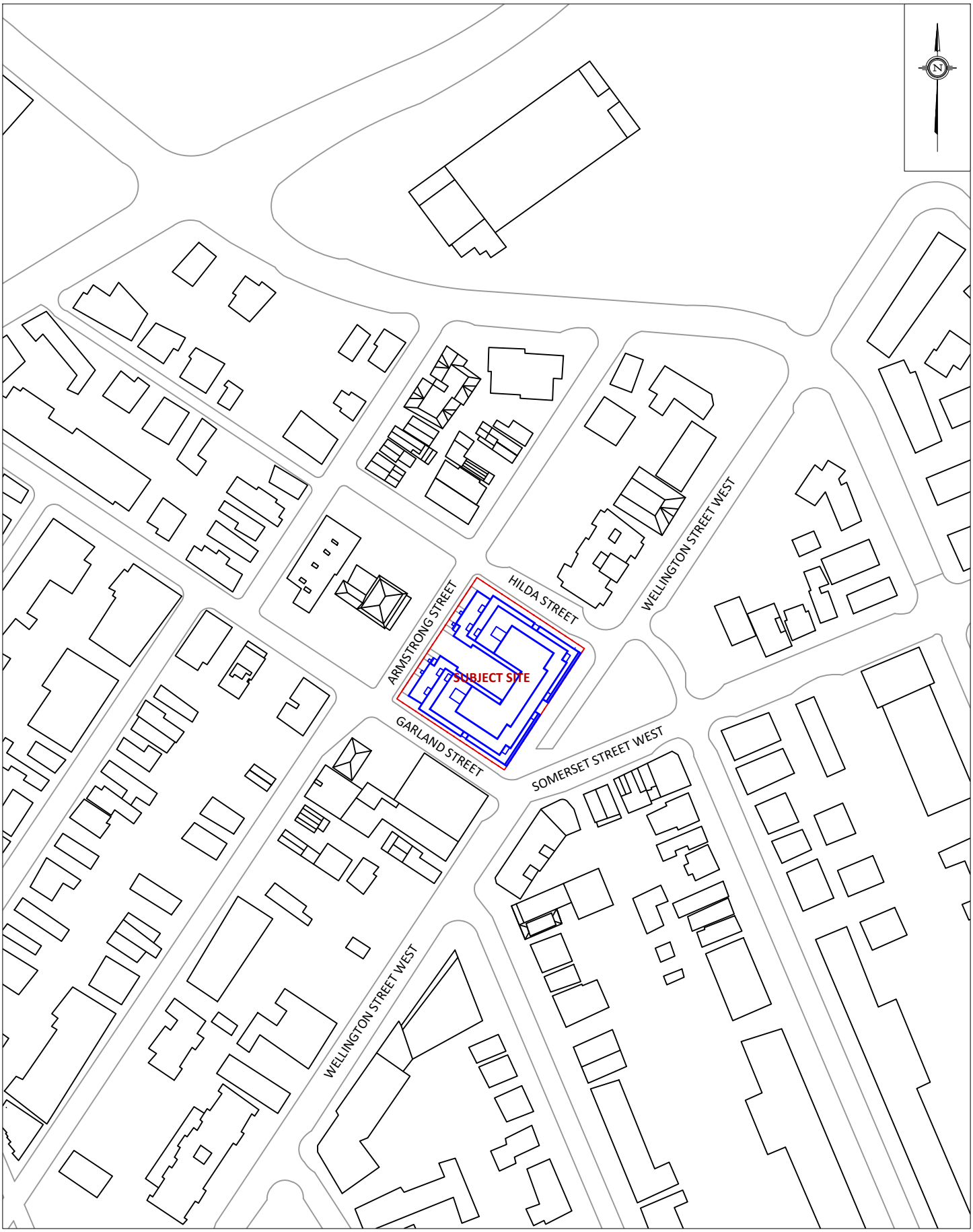
Gradient Wind Engineering Inc.



Michael Lafortune, C.E.T.
Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File 20-211-T.Noise



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PROJECT	979 WELLINGTON STREET WEST, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		
SCALE	1:2000 (APPROX.)	DRAWING NO.	GW20-211-1
DATE	JANUARY 11, 2022	DRAWN BY	M.L.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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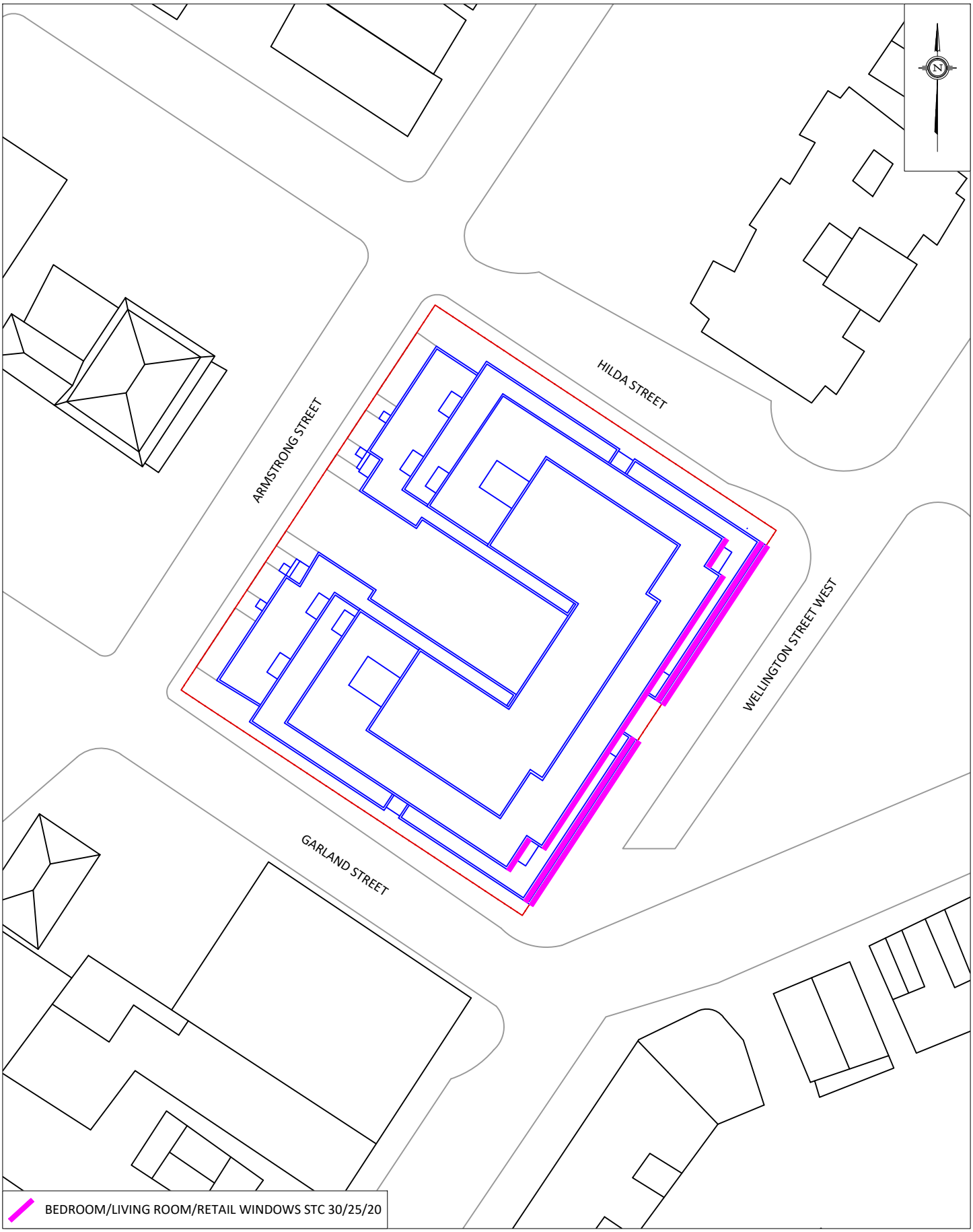
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW20-211-2
DATE	JANUARY 11, 2022	DRAWN BY	T.M.F.

FIGURE 2:
RECEPTOR LOCATIONS



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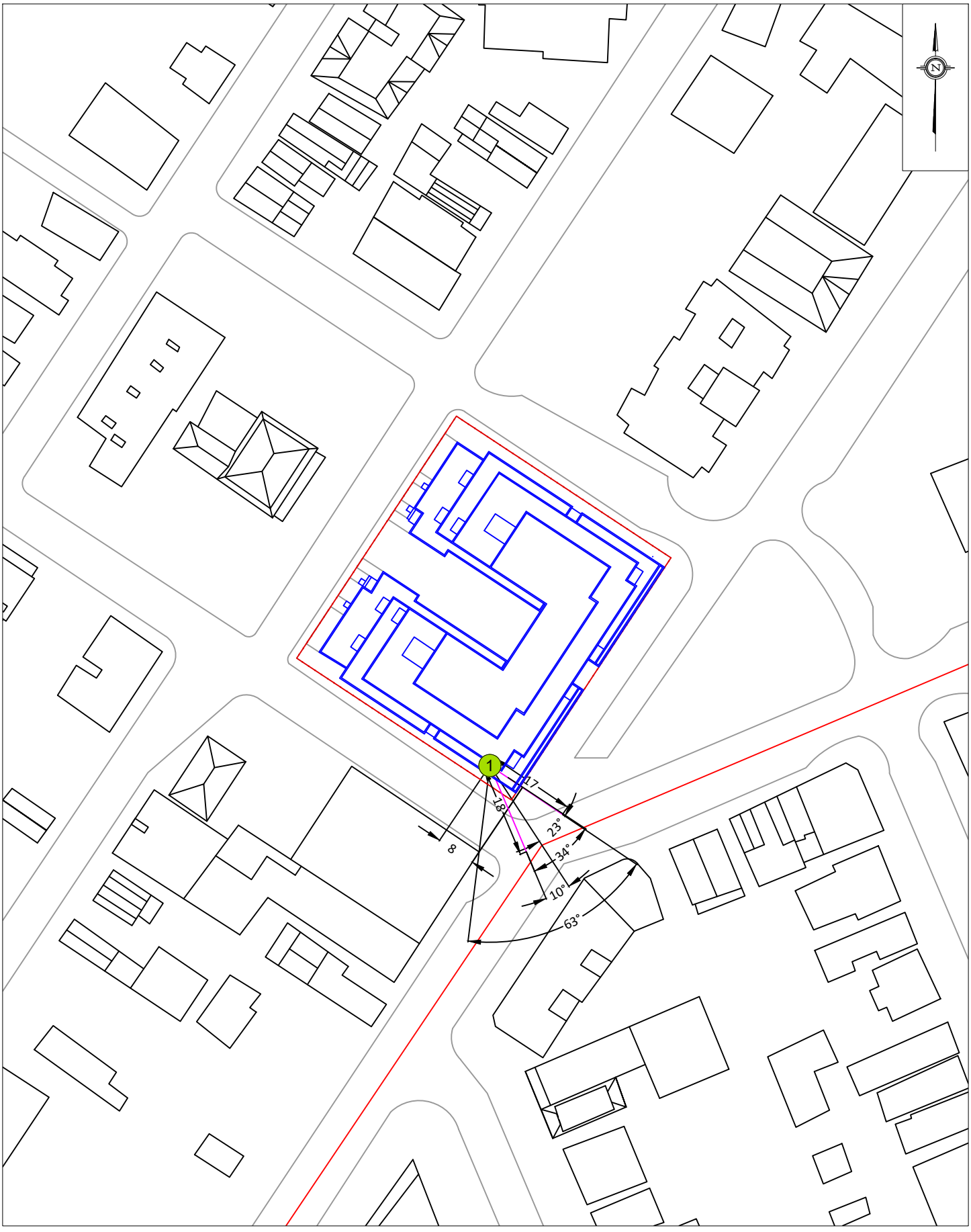
PROJECT	979 WELLINGTON STREET WEST, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:600 (APPROX.)	DRAWING NO.	GW20-211-3
DATE	JANUARY 11, 2022	DRAWN BY	T.M.F.

FIGURE 3:
WINDOW STC REQUIREMENTS



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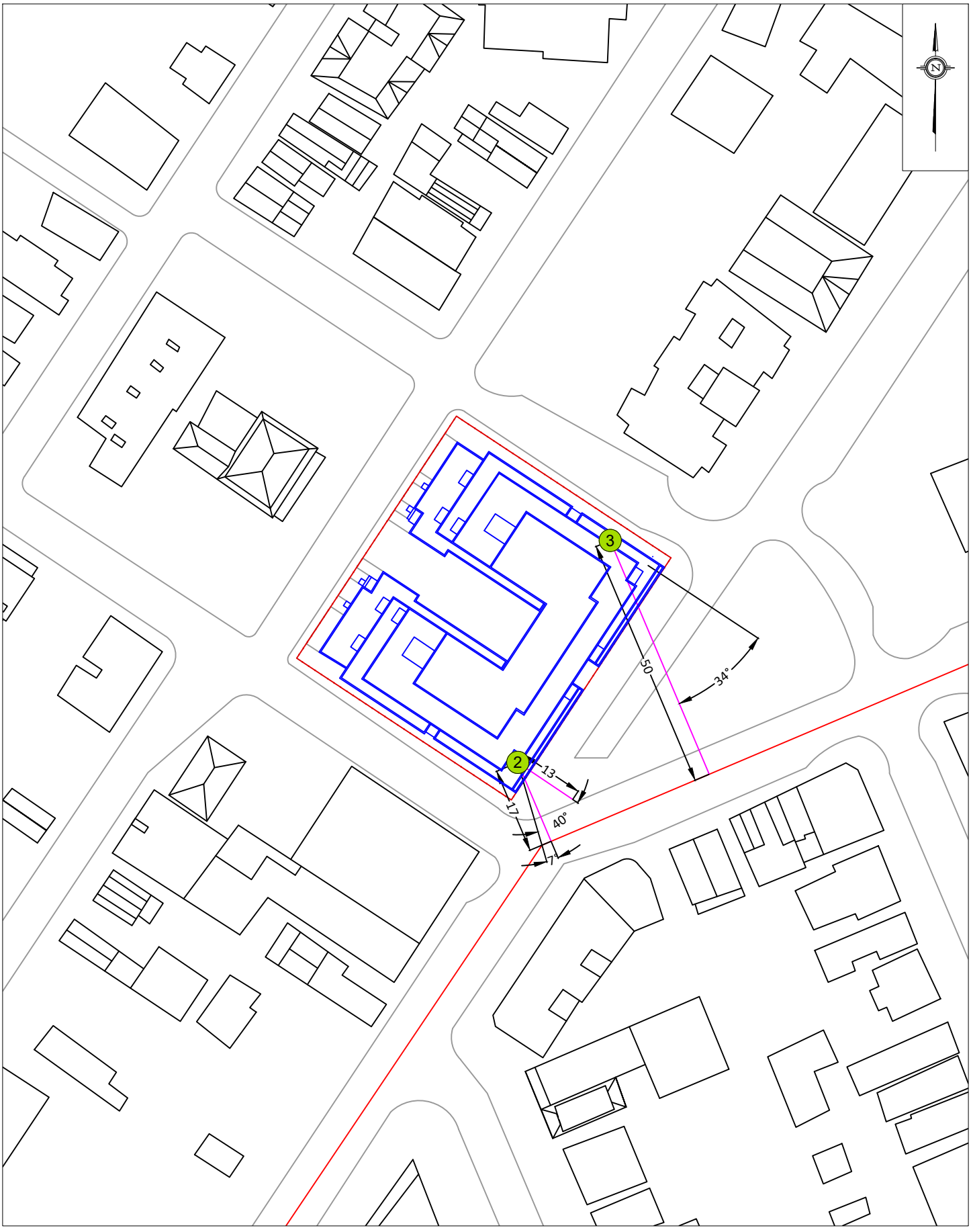
SCALE	1:1000 (APPROX.)
DRAWING NO.	GW20-211-4
DATE	JANUARY 11, 2022
DRAWN BY	T.M.F.

DESCRIPTION

FIGURE 4:
STAMSON INPUT PARAMETERS - RECEPTORS 1



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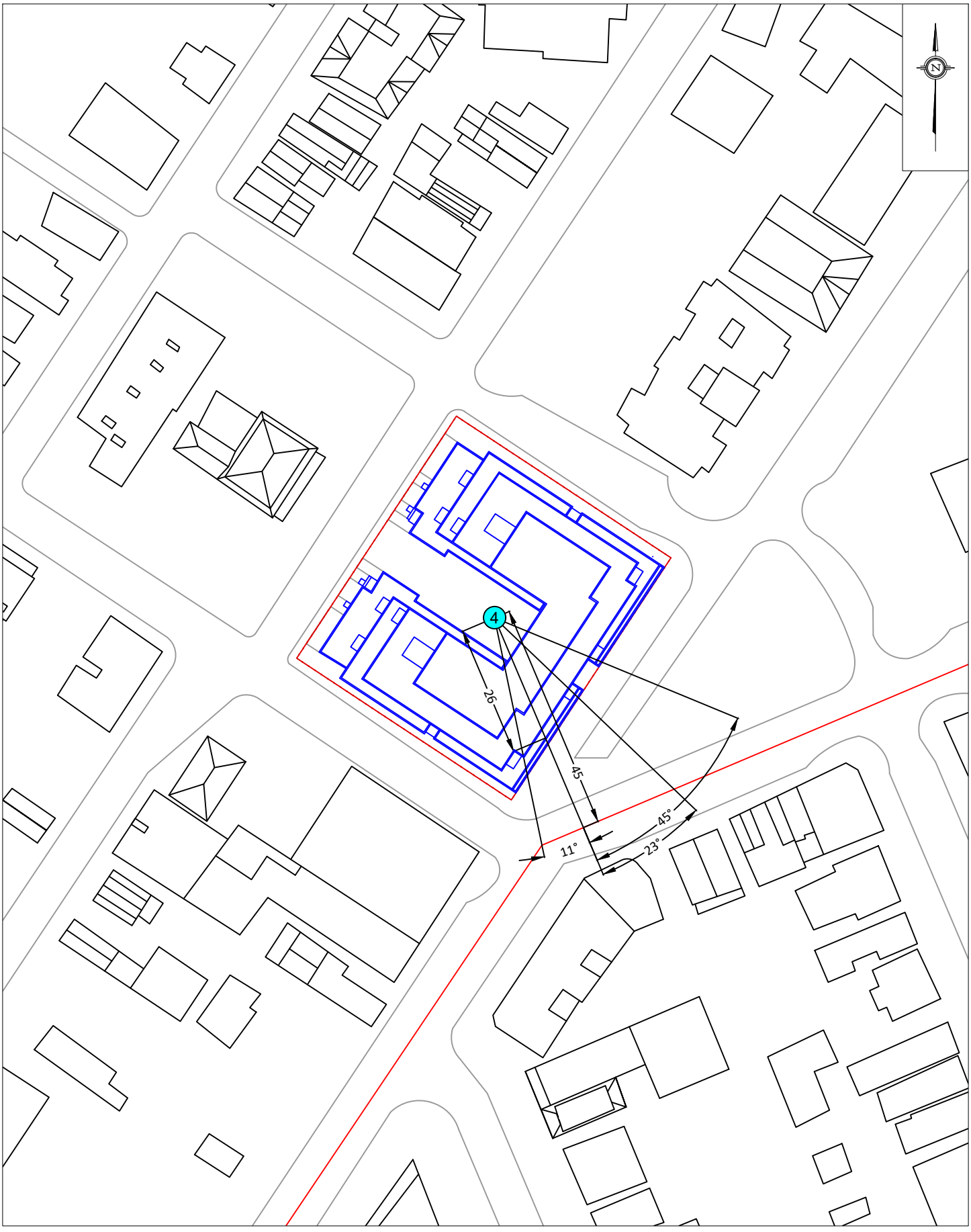
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW20-211-5
DATE	JANUARY 11, 2022	DRAWN BY	T.M.F.

FIGURE 5:
STAMSON INPUT PARAMETERS - RECEPTORS 2 & 3



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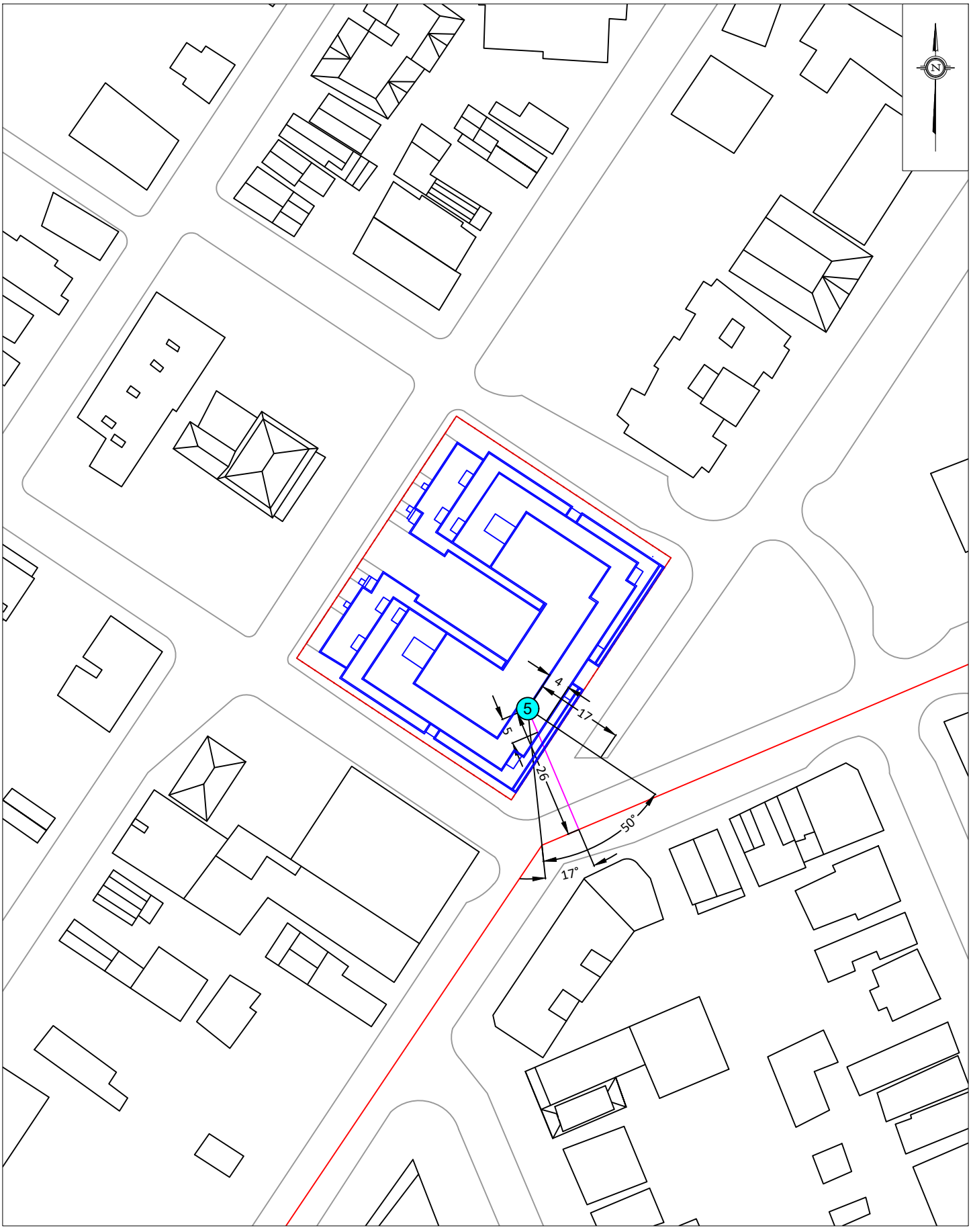
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW20-211-6
DATE	JANUARY 11, 2022	DRAWN BY	T.M.F.

FIGURE 6:
STAMSON INPUT PARAMETERS - RECEPTOR 4



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PROJECT	979 WELLINGTON STREET WEST, OTTAWA ROADWAY TRAFFIC NOISE ASSESSMENT		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW20-211-7
DATE	JANUARY 11, 2022	DRAWN BY	T.M.F.

FIGURE 7:
STAMSON INPUT PARAMETERS - RECEPTOR 5

APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

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```
STAMSON 5.0        NORMAL REPORT        Date: 05-04-2021 15:40:22
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Wellington (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Wellington (day/night)
--------------------------------------------
Angle1   Angle2           :  23.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  17.00 / 17.00  m
Receiver height           :  19.50 / 19.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :  63.00 deg   Angle2 : 90.00 deg
Barrier height            :  14.00 m
Barrier receiver distance :   8.00 / 8.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: Somerset (day/night)
---------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    Percentage of Annual Growth         :   0.00
    Number of Years of Growth           :   0.00
    Medium Truck % of Total Volume      :   7.00
    Heavy Truck  % of Total Volume      :   5.00
    Day (16 hrs) % of Total Volume      :  92.00

Data for Segment # 2: Somerset (day/night)
-------------------------------------------
Angle1   Angle2           : -34.00 deg   -10.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  18.00 / 18.00  m
Receiver height           :  19.50 / 19.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Wellington (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 !       19.50 !       11.03 !        11.03

ROAD (61.40 + 51.89 + 0.00) = 61.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
    23     63   0.00  68.48   0.00  -0.54  -6.53   0.00   0.00   0.00
61.40
-------------------------------------------------------------------------------
--
    63     90   0.00  68.48   0.00  -0.54  -8.24   0.00   0.00  -7.80
51.89
-------------------------------------------------------------------------------
--

Segment Leq : 61.87 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 58.94 + 0.00) = 58.94 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -34    -10   0.00  68.48   0.00  -0.79  -8.75   0.00   0.00   0.00
58.94
-------------------------------------------------------------------------
--

Segment Leq : 58.94 dBA

Total Leq All Segments: 63.66 dBA
```

```
Results segment # 1: Wellington (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 !       19.50 !       11.03 !        11.03

ROAD (53.81 + 44.30 + 0.00) = 54.27 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
    23     63   0.00  60.88   0.00  -0.54  -6.53   0.00   0.00   0.00
53.81
-------------------------------------------------------------------------------
--
    63     90   0.00  60.88   0.00  -0.54  -8.24   0.00   0.00  -7.80
44.30
-------------------------------------------------------------------------------
--

Segment Leq : 54.27 dBA
```

```
Results segment # 2: Somerset (night)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 51.34 + 0.00) = 51.34 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -34    -10   0.00  60.88   0.00  -0.79  -8.75   0.00   0.00   0.00
51.34
-------------------------------------------------------------------------------
--

Segment Leq : 51.34 dBA

Total Leq All Segments: 56.06 dBA



TOTAL Leq FROM ALL SOURCES (DAY): 63.66
                           (NIGHT): 56.06
```

```
STAMSON 5.0        NORMAL REPORT        Date: 05-04-2021 15:40:28
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Wellington (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Wellington (day/night)
--------------------------------------------
Angle1   Angle2           :  40.00 deg   90.00 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           :  19.50 / 19.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Somerset (day/night)
---------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Somerset (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   7.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  17.00 / 17.00  m
Receiver height           :  19.50 / 19.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Wellington (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 62.92 + 0.00) = 62.92 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
    40     90   0.00  68.48   0.00   0.00  -5.56   0.00   0.00   0.00
62.92
-------------------------------------------------------------------------------
--

Segment Leq : 62.92 dBA


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

Source height = 1.50 m

ROAD (0.00 + 65.25 + 0.00) = 65.25 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90      7   0.00  68.48   0.00  -0.54  -2.69   0.00   0.00   0.00
65.25
-------------------------------------------------------------------------------
--

Segment Leq : 65.25 dBA

Total Leq All Segments: 67.25 dBA
```

```
Results segment # 1: Wellington (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 55.32 + 0.00) = 55.32 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
    40     90   0.00  60.88   0.00   0.00  -5.56   0.00   0.00   0.00
55.32
-------------------------------------------------------------------------
--

Segment Leq : 55.32 dBA


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

Source height = 1.50 m

ROAD (0.00 + 57.65 + 0.00) = 57.65 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90      7   0.00  60.88   0.00  -0.54  -2.69   0.00   0.00   0.00
57.65
-------------------------------------------------------------------------
--

Segment Leq : 57.65 dBA

Total Leq All Segments: 59.65 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 67.25
                           (NIGHT): 59.65
```

```
STAMSON 5.0        NORMAL REPORT        Date: 05-04-2021 15:40:34
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Somerset (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Somerset (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   -34.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  50.00 / 50.00  m
Receiver height           :  19.50 / 19.50  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Somerset (day)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.18 + 0.00) = 58.18 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -34   0.00  68.48   0.00  -5.23  -5.07   0.00   0.00   0.00
58.18
-------------------------------------------------------------------------
--

Segment Leq : 58.18 dBA

Total Leq All Segments: 58.18 dBA


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

Source height = 1.50 m

ROAD (0.00 + 50.58 + 0.00) = 50.58 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -90    -34   0.00  60.88   0.00  -5.23  -5.07   0.00   0.00   0.00
50.58
-------------------------------------------------------------------------
--

Segment Leq : 50.58 dBA

Total Leq All Segments: 50.58 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 58.18
                           (NIGHT): 50.58
```

```
STAMSON 5.0        NORMAL REPORT        Date: 05-04-2021 15:40:41
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Somerset1 (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Somerset1 (day/night)
--------------------------------------------
Angle1   Angle2           : -90.00 deg   -23.00 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           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : -45.00 deg
Barrier height            :  38.00 m
Barrier receiver distance :  26.00 / 26.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: Somerset2 (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Somerset2 (day/night)
--------------------------------------------
Angle1   Angle2           : -23.00 deg   11.00 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           :   1.50 / 1.50   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -23.00 deg   Angle2 : 11.00 deg
Barrier height            :  38.00 m
Barrier receiver distance :  26.00 / 26.00  m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Somerset1 (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 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 38.31 + 54.58) = 54.68 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90    -45   0.00  68.48   0.00  -4.77  -6.02   0.00   0.00 -19.38
38.31
-------------------------------------------------------------------------------
--
   -45    -23   0.00  68.48   0.00  -4.77  -9.13   0.00   0.00   0.00
54.58
-------------------------------------------------------------------------------
--

Segment Leq : 54.68 dBA
```

```
Results segment # 2: Somerset2 (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 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 36.47 + 0.00) = 36.47 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -23     11   0.00  68.48   0.00  -4.77  -7.24   0.00   0.00 -20.00
36.47
-------------------------------------------------------------------------------
--

Segment Leq : 36.47 dBA

Total Leq All Segments: 54.75 dBA
```

```
Results segment # 1: Somerset1 (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 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 30.71 + 46.98) = 47.08 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90    -45   0.00  60.88   0.00  -4.77  -6.02   0.00   0.00 -19.38
30.71
-------------------------------------------------------------------------------
--
   -45    -23   0.00  60.88   0.00  -4.77  -9.13   0.00   0.00   0.00
46.98
-------------------------------------------------------------------------------
--

Segment Leq : 47.08 dBA
```

```
Results segment # 2: Somerset2 (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 !        1.50 !        1.50 !         1.50

ROAD (0.00 + 28.87 + 0.00) = 28.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -23     11   0.00  60.88   0.00  -4.77  -7.24   0.00   0.00 -20.00
28.87
-------------------------------------------------------------------------------
--

Segment Leq : 28.87 dBA

Total Leq All Segments: 47.15 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 54.75
                           (NIGHT): 47.15
```

```
STAMSON 5.0        NORMAL REPORT        Date: 05-04-2021 15:40:47
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Somerset (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Somerset (day/night)
-------------------------------------------
Angle1   Angle2           : -90.00 deg   17.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  26.00 / 26.00  m
Receiver height           :  39.50 / 39.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 17.00 deg
Barrier height            :  38.00 m
Barrier receiver distance :   5.00 / 5.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Road data, segment # 2: Wellington (day/night)
----------------------------------------------
Car traffic volume  : 12144/1056  veh/TimePeriod  *
Medium truck volume :   966/84    veh/TimePeriod  *
Heavy truck volume  :   690/60    veh/TimePeriod  *
Posted speed limit  :    50 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  15000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Wellington (day/night)
--------------------------------------------
Angle1   Angle2           :  50.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      2       (Reflective ground surface)
Receiver source distance  :  17.00 / 17.00  m
Receiver height           :  39.50 / 39.50  m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            :  50.00 deg   Angle2 : 90.00 deg
Barrier height            :  38.00 m
Barrier receiver distance :   4.00 / 4.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Somerset (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 !       39.50 !       32.19 !        32.19

ROAD (0.00 + 48.98 + 0.00) = 48.98 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     17   0.00  68.48   0.00  -2.39  -2.26   0.00   0.00 -14.85
48.98
-------------------------------------------------------------------------------
--

Segment Leq : 48.98 dBA
```

```
Results segment # 2: Wellington (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 !       39.50 !       30.56 !        30.56

ROAD (0.00 + 49.14 + 0.00) = 49.14 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
    50     90   0.00  68.48   0.00  -0.54  -6.53   0.00   0.00 -12.26
49.14
-------------------------------------------------------------------------------
--

Segment Leq : 49.14 dBA

Total Leq All Segments: 52.07 dBA
```

```
Results segment # 1: Somerset (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 !       39.50 !       32.19 !        32.19

ROAD (0.00 + 41.39 + 0.00) = 41.39 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
   -90     17   0.00  60.88   0.00  -2.39  -2.26   0.00   0.00 -14.85
41.39
-------------------------------------------------------------------------------
--

Segment Leq : 41.39 dBA
```

```
Results segment # 2: Wellington (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 !       39.50 !       30.56 !        30.56

ROAD (0.00 + 41.55 + 0.00) = 41.55 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------------
--
    50     90   0.00  60.88   0.00  -0.54  -6.53   0.00   0.00 -12.26
41.55
-------------------------------------------------------------------------------
--

Segment Leq : 41.55 dBA

Total Leq All Segments: 44.48 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 52.07
                           (NIGHT): 44.48
```