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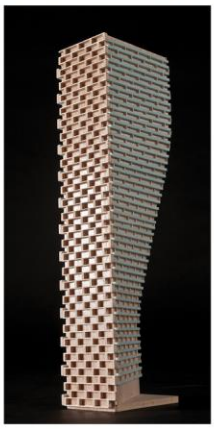
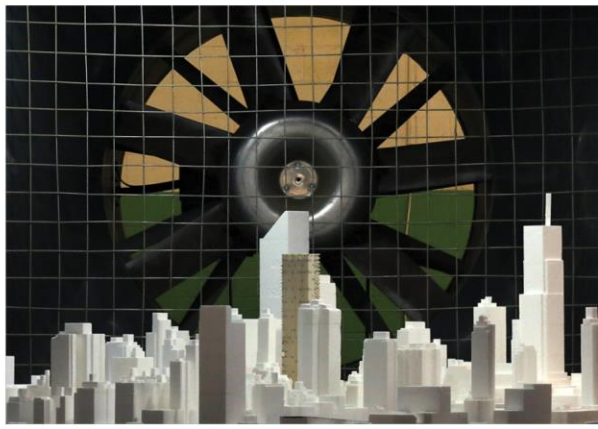
ENGINEERS & SCIENTISTS

DETAILED TRAFFIC NOISE STUDY

155 Dun Skipper Drive
Ottawa, Ontario

REPORT: GW24-142-Detailed Traffic Noise Study





March 25, 2025

DRAFT

PREPARED FOR
2668867 Ontario Inc.
4836 Bank Street
Ottawa, ON, K1X 1G6

PREPARED BY
Benjamin Page, AdvDip., Junior Environmental Scientist
Joshua Foster, P.Eng., Lead Engineer

EXECUTIVE SUMMARY

This report describes a detailed traffic noise study performed for the proposed development located at 155 Dun Skipper Drive in Ottawa, Ontario. The mixed-use development comprises a single, 'L-shaped' building spanning 9 floors. The major contributor to traffic noise is Bank Street.

The assessment is based on theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment, Conservation and Parks (MECP) NPC-300[2] guidelines, site plan drawings provided by Alexander Wilson Architect Inc. in August 2024, with future roadway traffic volumes corresponding with the City of Ottawa's Official Plan (OP) roadway classifications and the Ministry of Transportation Ontario (MTO).

The results of the current analysis indicate that noise levels will range between 63 and 74 dBA during the daytime period (07:00-23:00) and between 62 and 66 dBA during the nighttime period (23:00-07:00). The highest noise level (74 dBA) occurs along the east façade of the building, which is nearest and most exposed to Bank Street. 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 Table 4.

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

Noise levels at level 2 east terrace and level 9 northeast terrace are expected to exceed the 60 dBA OLA noise criterion during the daytime period. If these areas are to be used as outdoor living areas, noise control measures are required to reduce noise levels to below 60 dBA or as close as possible to 55 dBA. Further analysis investigated the noise-mitigating impact of raising the perimeter guards 1.5, 2.0, and 2.5 m above the walking surface.

[1] City of Ottawa Environmental Noise Control Guidelines, January 2016
[2] Ministry of the Environment, Conservation and Parks (MECP), Environmental Noise Guideline – Publication NPC-300, August 2013

Results of the investigation proved that noise levels at the level 2 terrace can be reduced to 62 dBA with a 2.5 m tall noise barrier surrounding the north, east, and south perimeter. A Type B warning clause will also be required in all Agreements of Purchase and Sale and Lease Agreements related to this amenity area, as summarized in Section 6. Noise levels at the level 9 terrace can be reduced to 55 dBA with a 2.5 m tall noise barrier surrounding the north, east, and south perimeter. Figure 4 illustrates the proposed barrier locations.

Gradient conducted a satellite review of the area and found out that there is some mechanical equipment on the rooftop of the nearby Home Hardware building. However, due to the distance between this building and the study site, the equipment is not anticipated to adversely impact the proposed development. Moreover, the proposed development will have upgraded building components and central air conditioning or a similar mechanical system. Regarding stationary noise impacts from the development on the surroundings, these can be minimized by judicious placement of mechanical equipment such as its placement on the central area of a high roof or in a mechanical penthouse, or the incorporation of silencers and noise screens as necessary. Due to the size and nature of the development, the HVAC equipment is expected to be located in the mechanical penthouses. The building will be designed to comply with the ENCG Sound Level Limits and the City of Ottawa Noise By-Law No. 2017-255.

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1. INTRODUCTION

Gradient Wind Engineering Inc. (Gradient Wind) was retained by 2668867 Ontario Inc. to undertake a detailed traffic noise study for the proposed mixed-use development, located at 155 Dun Skipper Drive in Ottawa, Ontario. This report summarizes the methodology, results, and recommendations related to a detailed traffic noise study.

The present scope of work involves assessing exterior noise levels at the study site generated by the surrounding transportation sources. The assessment was performed based on theoretical noise calculation methods conforming to the City of Ottawa[3] and Ministry of the Environment, Conservation and Parks (MECP) NPC-300[4] guidelines, architectural drawings provided by Alexander Wilson Architect Inc. in August 2024, with future roadway traffic volumes corresponding with the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The focus of this transportation noise assessment is the proposed mix-use development located at 155 Dun Skipper Drive in Ottawa, Ontario. The subject site is situated on a rectangular parcel of land bounded by Bank Street to the east and Dun Skipper Drive to the north. The proposed mixed-use development comprises a single, 'L-shaped' tower rising 9 floors and topped by a mechanical penthouse. The development includes two levels of underground parking.

Commercial space is located in the eastern section of the ground floor, all remaining floors in the development are residential. Vehicular access to underground parking is provided from the west. At the second level, the building massing steps back from the east creating private terraces. Two future buildings are planned south and west of the study site but are not included in this report.

The primary source of traffic noise is Bank Street. Nearby local roads such as Dun Skipper Drive were deemed insignificant, due to their low traffic volumes. The study site is surrounded by a low-rise residential subdivision and a home improvement store to the west. To the north, an empty lot is located

[3] City of Ottawa Environmental Noise Control Guidelines, January 2016
[4] Ministry of the Environment, Conservation and Parks (MECP), Environmental Noise Guideline – Publication NPC-300, August 2013

across Dun Skipper Drive, and to the south and east, the study site is surrounded by a wooded area and scattered buildings. Figure 1 illustrates a complete site plan with the surrounding context.

Gradient conducted a satellite review of the area and found out that there is some mechanical equipment on the rooftop of the nearby Home Hardware building. However, due to the distance between this building and the study site, the equipment is not anticipated to adversely impact the proposed development. Moreover, the proposed development will have upgraded building components and central air conditioning or a similar mechanical system. Regarding stationary noise impacts from the development on the surroundings, these can be minimized by judicious placement of mechanical equipment such as its placement on the central area of a high roof or in a mechanical penthouse, or the incorporation of silencers and noise screens as necessary. Due to the size and nature of the development, the HVAC equipment is expected to be located in the mechanical penthouses. The building will be designed to comply with the ENCG Sound Level Limits and the City of Ottawa Noise By-Law No. 2017-255.

3. OBJECTIVES

The main goals of this work are to (i) calculate the future noise levels on the study site produced by local transportation, (ii) ensure that interior noise levels do not exceed the allowable limits specified by the City of Ottawa's Environmental Noise Control Guidelines as outlined in Section 4 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 vehicle traffic, 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 NPC-300 guidelines specify that the recommended indoor noise limit range (that is relevant to this study) is 50, 45, and 40 dBA for retail stores, residence living rooms, and sleeping quarters, respectively, as listed in Table 1.

TABLE 1: INDOOR SOUND LEVEL CRITERIA [5]

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 centers, 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[6]. 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 normally triggers the need for central air

[5] Adapted from Table C-2, Part C, Section 3.2.3 of NPC-300
[6] Burberry, P.B. (2014). Mitchell's Environment and Services. Routledge, Page 125

conditioning (or similar systems). Where noise levels exceed 65 dBA daytime, and 60 dBA nighttime building components will require higher levels of sound attenuation[7].

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[8]. Average Annual Daily Traffic (AADT) volumes are then based on data in Table B1 of the ENCG for each roadway classification. The two-kilometre widening of Bank Street from two to four lanes is planned from Leitrim Road to the south of Blais Road. Therefore, Bank Street is taken as a 4-lane urban arterial in this study. Table 2 (below) summarizes the AADT values used for each roadway included in this assessment.

TABLE 2: ROADWAY TRAFFIC DATA

Segment	Roadway Class	Speed Limit (km/h)	Ultimate AADT	Day/Night Split	Truck Volume Percentages	
					Medium Truck	Heavy Truck
Bank Street	4-Lane Urban Arterial Divided (4-UAD)	80	**35,000**	92/8	7	5

4.2.3 Theoretical Traffic 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 a separate line source of noise, and by using proposed and existing building locations as noise barriers. In addition to the traffic volumes summarized in Table 2, theoretical noise predictions were based on the following parameters:

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

- Vehicle parameters used in the study, such as truck traffic volume percentages, posted speed limits, and day/night split, are summarized in Table 2.
- Default ground surfaces were taken to be absorptive due to the presence of lawn and foliage.
- Topography was assumed to be a flat/gentle slope surrounding the study building.
- Noise receptors were strategically placed at 5 locations around the study building (see Figure 2).
- For select sources, where appropriate, the proposed and existing buildings were considered barriers partially or fully obstructing exposure of receptors to the source.
- Receptor distances and exposure angles are illustrated in Figure A1.

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, concrete and masonry walls can achieve STC 50 or more. Curtainwall systems typically provide around STC 35, depending on the glazing elements. 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.

According to the ENCG, when daytime noise levels (from road and rail 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[9] 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

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

- Indoor sound level criteria, which vary according to the intended use of a space.

Based on published research[10], 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. Window STC calculations have therefore been based on the following assumptions:

- Bedrooms are assumed to intermediate level of absorption (0.8 absorption coefficient), while living rooms are assumed to have an intermediate level of absorption (0.8 absorption coefficient). Retail areas were considered to be hard (0.5 absorption coefficient).
- Exterior walls are assumed to have spandrel panels with a minimum STC rating of 50
- Room, window, and wall dimensions are based on the architectural drawings provided by Alexander Wilson Architect Inc. in August 2024

STC calculations were performed based on the method developed by the National Research Council in their Building Practice Note # 56[11].

5. RESULTS

5.1 Roadway Traffic Noise Levels

The results of the roadway noise calculations are summarized in Table 3 below.

TABLE 3: EXTERIOR NOISE LEVELS DUE TO ROADWAY TRAFFIC SOURCES

Receptor Number	Receptor Height Above Grade (m)	Receptor Location	STAMSON Roadway Noise Level (dBA)	
			Day	Night
1	28.8	POW – L9 North Façade	69	62
2	28.8	POW – L9 East Façade	74	66
3	28.8	POW – L9 South Façade	69	62
4	5.7	OLA – L2 East Terrace	71	**N/A***
5	28.8	OLA – L9 Northeast Terrace	63	**N/A***

*Nighttime noise levels not considered as per ENCG

[10] CMHC, Road & Rail Noise: Effects on Housing
[11] Quirt, J.D. Controlling Sound Transmission into Buildings, National Research Council of Canada, Ottawa September 1985

The results of the current analysis indicate that noise levels will range between 63 and 74 dBA during the daytime period (07:00-23:00) and between 62 and 66 dBA during the nighttime period (23:00-07:00). The highest noise level (74 dBA) occurs along the east façade of the building, which is nearest and most exposed to Bank Street.

5.2 On-Building Noise Control Measures - Glazing

The noise levels predicted due to transportation traffic exceed the criteria listed in Section 4.2 for building components. As discussed in Section 4.2, the anticipated STC requirements for windows have been estimated based on results obtained from the BPN 56 methodology. The STC requirements for the windows are summarized below for various units within the development (see Figure 3). While the BPN 56 results have been considered, the final recommendations are based on Gradient Wind's experience and engineering judgement. Where specific updated building components are not identified, bedroom/living room/retail windows are to satisfy Ontario Building Code (OBC 2020) requirements.

- **Bedroom Windows**

(i) Bedroom windows on the east façade will require a minimum STC of 36.

(ii) Bedroom windows on the north and south façades will require a minimum STC of 33.

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

- **Living Room Windows**

(i) Living room windows on the east façade will require a minimum STC of 33.

(ii) Living room windows on the north and south façades will require a minimum STC of 30.

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

- **Retail Windows**

(iv) Retail windows will require a minimum STC of 30.

(v) All other retail windows are to satisfy Ontario Building Code (OBC 2020) requirements

- **Exterior Walls**

(i) Exterior wall components on these façades will require a minimum STC of 50, which will be achieved with brick cladding or an acoustical equivalent according to NRC test data[12]

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

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 50, 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. Several manufacturers and various combinations of window components will offer the necessary sound attenuation rating. The specified STC requirements also apply to swinging and/or sliding doors.

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

5.2.1 On-Building Noise Barrier Calculation

Noise levels at level 2 east terrace and level 9 northeast terrace are expected to exceed the 60 dBA OLA noise criterion during the daytime period. If these areas are to be used as outdoor living areas, noise control measures are required to reduce noise levels to below 60 dBA or as close as possible to 55 dBA. Further analysis investigated the noise-mitigating impact of raising the perimeter guards 1.5, 2.0, and 2.5 m above the walking surface. Table 5 (below) summarizes the results of the barrier investigation.

Results of the investigation proved that noise levels at the level 2 terrace can be reduced to 62 dBA with a 2.5 m tall noise barrier surrounding the north, east, and south perimeter. A Type B warning clause will also be required in all Agreements of Purchase and Sale and Lease Agreements related to this amenity area, as summarized in Section 6. Noise levels at the level 9 terrace can be reduced to 54 dBA with a 2.5 m tall noise barrier surrounding the north, east, and south perimeter. Figure 4 illustrates the proposed barrier locations.

TABLE 5: RESULTS OF NOISE BARRIER INVESTIGATION

Receptor Number	Receptor Height Above Roof (m)	Receptor Location	Daytime L_{eq} Noise Levels (dBA)			
			No Barrier	With 1.5 m Barrier	With 2.0 m Barrier	With 2.5 m Barrier
4	5.7	OLA – L2 East Terrace	71	67	64	**62**
5	28.8	OLA – L9 Northeast Terrace	63	58	56	**55**

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current analysis indicate that noise levels will range between 63 and 74 dBA during the daytime period (07:00-23:00) and between 62 and 66 dBA during the nighttime period (23:00-07:00). The highest noise level (74 dBA) occurs along the east façade of the building, which is nearest and most exposed to Bank Street. 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 Table 4.

Results of the calculations also indicate that the development will require central air conditioning, or a similar system, which will allow occupants to keep windows closed and maintain a comfortable living environment. A Type D Warning Clause will also be required in 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."*

Noise levels at level 2 east terrace and level 9 northeast terrace are expected to exceed the 60 dBA OLA noise criterion during the daytime period. If these areas are to be used as outdoor living areas, noise control measures are required to reduce noise levels to below 60 dBA or as close as possible to 55 dBA. Further analysis investigated the noise-mitigating impact of raising the perimeter guards 1.5, 2.0, and 2.5 m above the walking surface.

Results of the investigation proved that noise levels at the level 2 terrace can be reduced to 62 dBA with a 2.5 m tall noise barrier surrounding the north, east, and south perimeter. A Type B warning clause will also be required in all Agreements of Purchase and Sale and Lease Agreements related to this amenity area, as summarized below. Noise levels at the level 9 terrace can be reduced to 55 dBA with a 2.5 m tall noise barrier surrounding the north, east, and south perimeter. Figure 4 illustrates the proposed barrier locations.

Type B:

> *"Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing road traffic may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the Municipality and the Ministry of the Environment."*

Gradient conducted a satellite review of the area and found out that there is some mechanical equipment on the rooftop of the nearby Home Hardware building. However, due to the distance between this building and the study site, the equipment is not anticipated to adversely impact the proposed development. Moreover, the proposed development will have upgraded building components and central air conditioning or a similar mechanical system. Regarding stationary noise impacts from the development on the surroundings, these can be minimized by judicious placement of mechanical equipment such as its placement on the central area of a high roof or in a mechanical penthouse, or the incorporation of silencers and noise screens as necessary. Due to the size and nature of the development, the HVAC equipment is expected to be located in the mechanical penthouses. The building will be designed to comply with the ENCG Sound Level Limits and the City of Ottawa Noise By-Law No. 2017-255.

This concludes our 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.

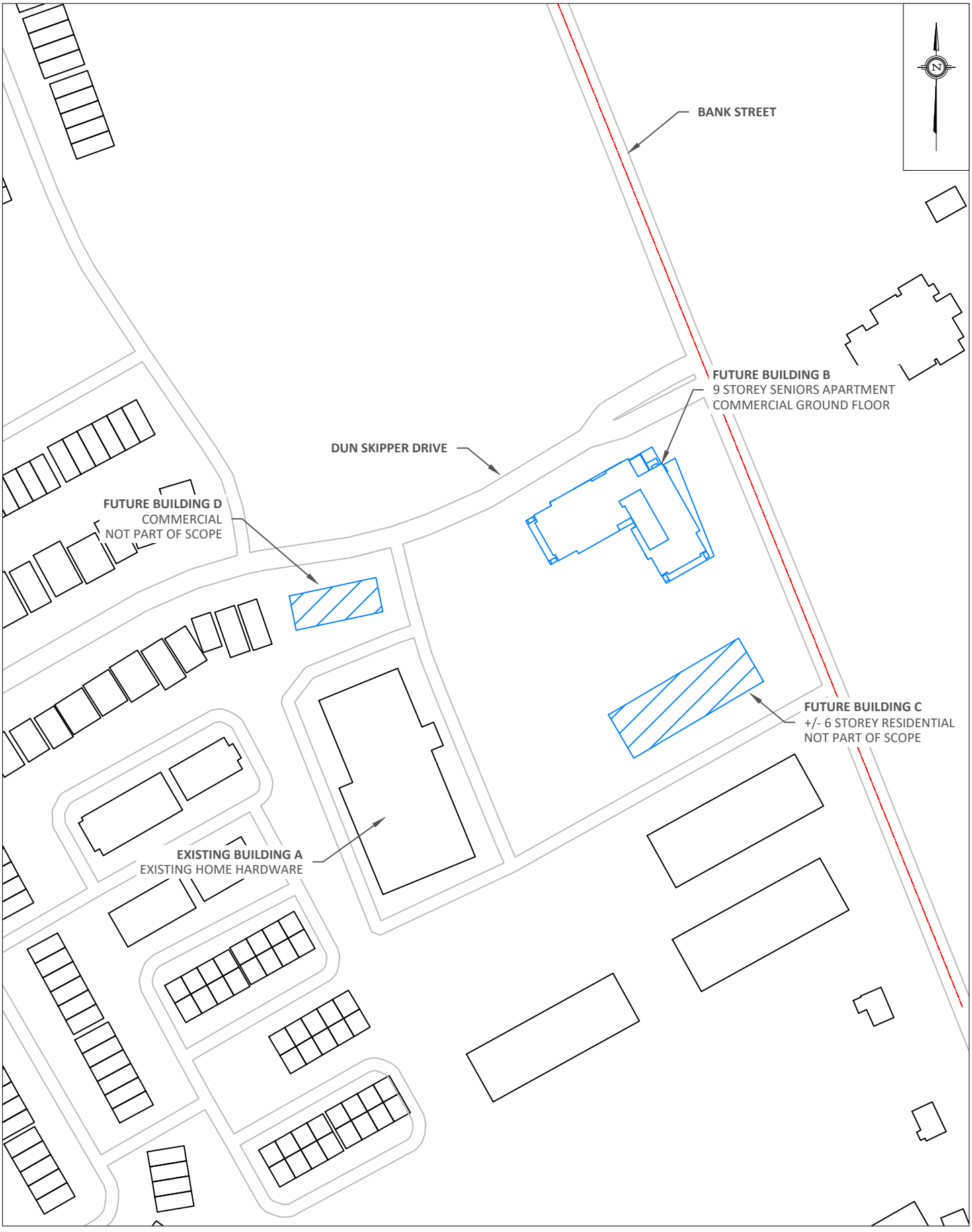
Sincerely,

Gradient Wind Engineering Inc.

Benjamin Page, AdvDip.
Junior Environmental Scientist

Joshua Foster, P.Eng.
Lead Engineer

Gradient Wind File #24-142 – Detailed Traffic Noise Study



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PROJECT	155 DUN SKIPPER DRIVE, OTTAWA DETAILED TRAFFIC NOISE STUDY
SCALE	1:2000 (APPROX.)
DRAWING NO.	GW24-142-1
DATE	MARCH 25, 2025
DRAWN BY	B.P.

DESCRIPTION

FIGURE 1:
SITE PLAN AND SURROUNDING CONTEXT

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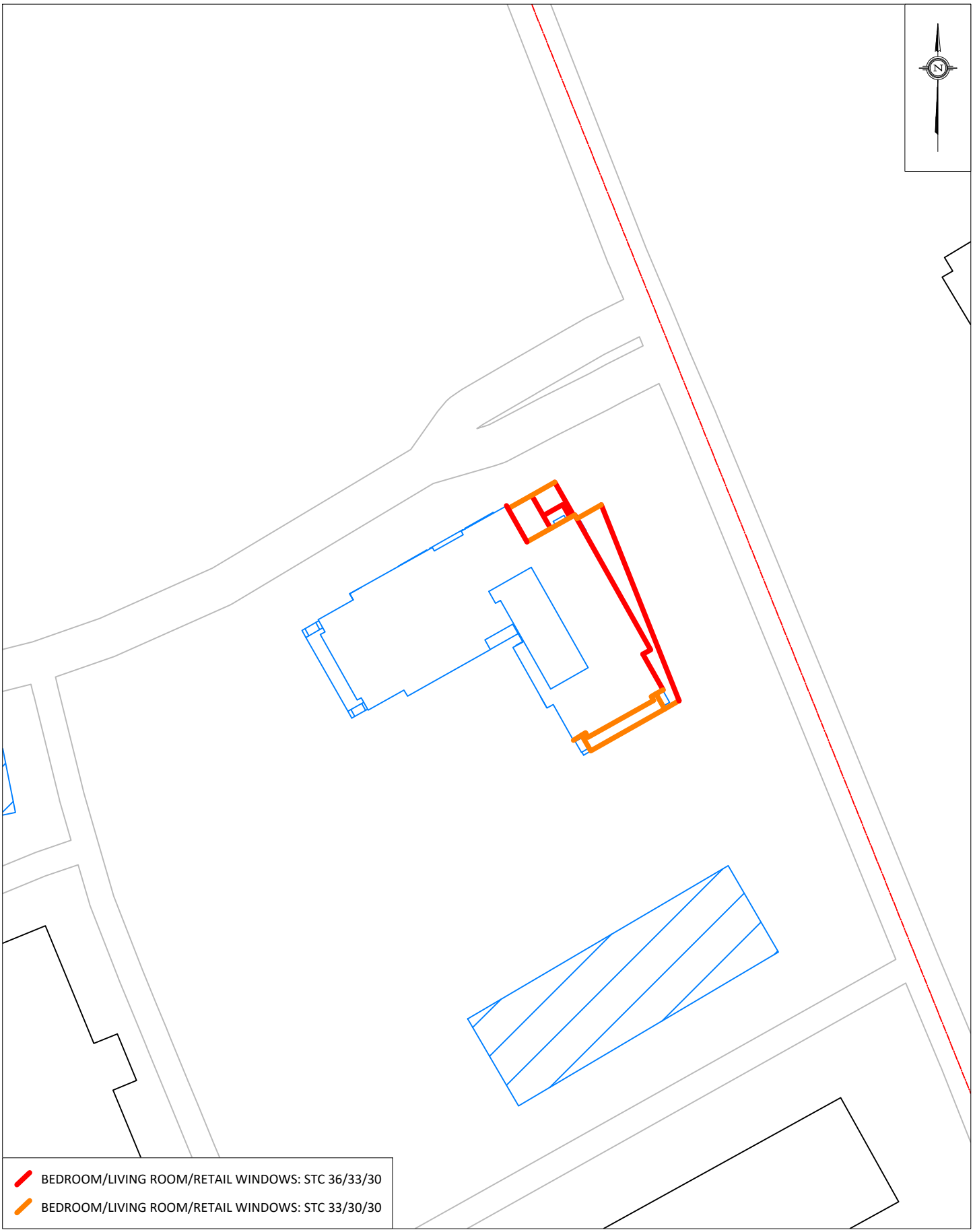
DRAWING NO.	GW24-142-2
DATE	MARCH 25, 2025
DRAWN BY	B.P.

DESCRIPTION

FIGURE 2:
TRAFFIC NOISE RECEPTOR LOCATIONS



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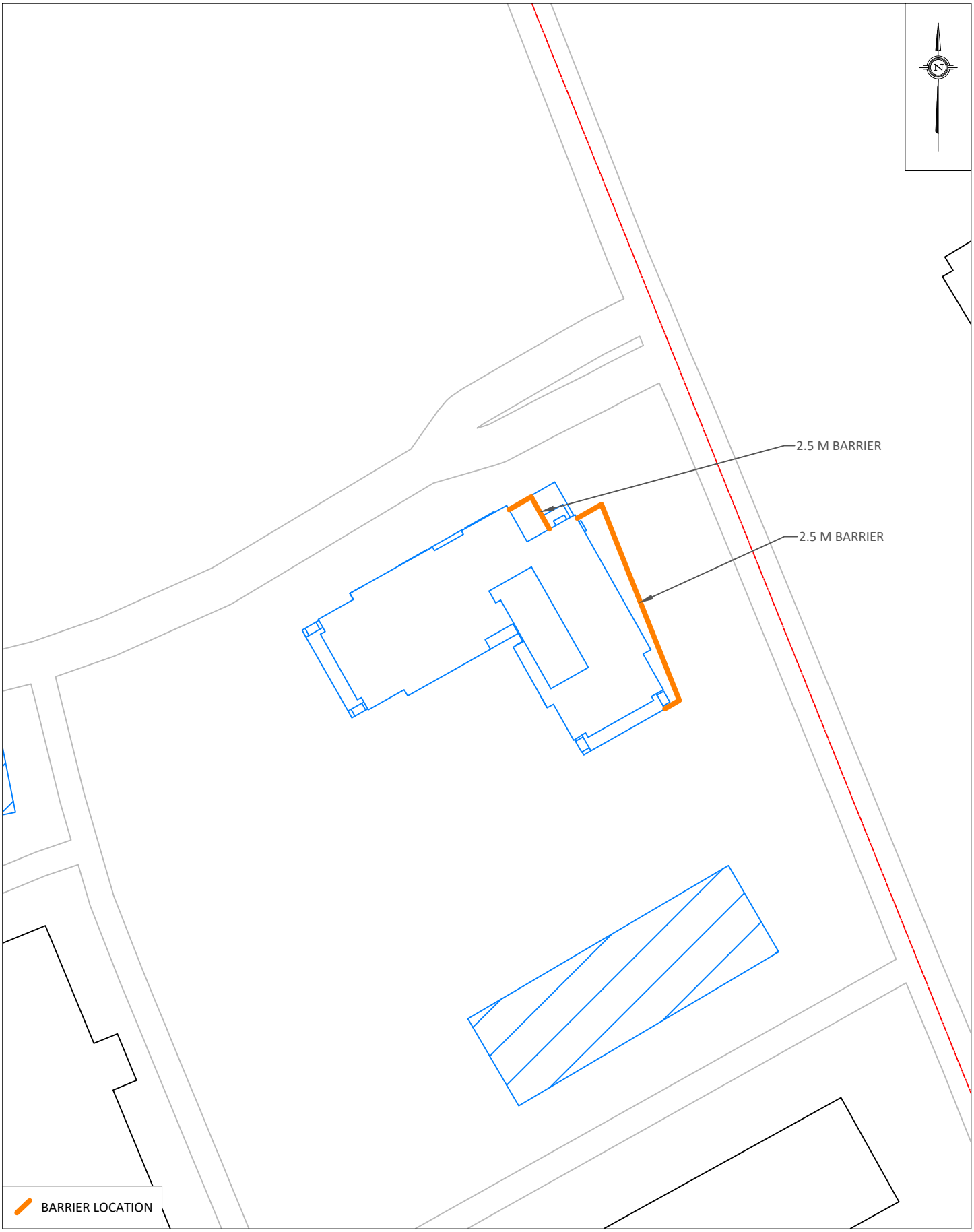
PROJECT	155 DUN SKIPPER DRIVE, OTTAWA DETAILED TRAFFIC NOISE STUDY		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO.	GW24-142-3
DATE	MARCH 25, 2025	DRAWN BY	B.P.

FIGURE 3:
STC WINDOW REQUIREMENTS



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SCALE	1:1000 (APPROX.)
DRAWING NO.	GW24-142-4
DATE	MARCH 25, 2025
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DESCRIPTION

FIGURE 4:
PROPOSED BARRIER LOCATIONS

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PROJECT	155 DUN SKIPPER DRIVE, OTTAWA DETAILED TRAFFIC NOISE STUDY		DESCRIPTION
SCALE	1:1000 (APPROX.)	DRAWING NO. GW24-142-A1	FIGURE A1: RECEPTOR DISTANCES AND EXPOSURE ANGLES
DATE	MARCH 25, 2025	DRAWN BY B.P.	

APPENDIX A

STAMSON 5.04 – INPUT AND OUTPUT DATA

127 WALGREEN ROAD, OTTAWA, ON, CANADA K0A 1L0 | 613 836 0934
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STAMSON 5.0 NORMAL REPORT Date: 24-03-2025 13:59:14
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R1.te Time Period: Day/Night 16/8 hours
Description:

```
Road data, segment # 1: Bank (day/night)
----------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    80 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):  35000
    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: Bank (day/night)
----------------------------------------
Angle1   Angle2           : -90.00 deg   0.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  35.00 / 35.00  m
Receiver height           :  28.80 / 28.80  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

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

Source height = 1.50 m

ROAD (0.00 + 69.48 + 0.00) = 69.48 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.00  76.17   0.00  -3.68  -3.01   0.00   0.00   0.00  69.48
-------------------------------------------------------------------------------

Segment Leq : 69.48 dBA

Total Leq All Segments: 69.48 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 61.88 + 0.00) = 61.88 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90      0   0.00  68.57   0.00  -3.68  -3.01   0.00   0.00   0.00  61.88
-------------------------------------------------------------------------------

Segment Leq : 61.88 dBA

Total Leq All Segments: 61.88 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 69.48
                           (NIGHT): 61.88
```

STAMSON 5.0 NORMAL REPORT Date: 24-03-2025 14:00:32
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R2.te Time Period: Day/Night 16/8 hours
Description:

```
Road data, segment # 1: Bank (day/night)
----------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    80 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):  35000
    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: Bank (day/night)
----------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  27.00 / 27.00  m
Receiver height           :  28.80 / 28.80  m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00

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

Source height = 1.50 m

ROAD (0.00 + 73.61 + 0.00) = 73.61 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  76.17   0.00  -2.55   0.00   0.00   0.00   0.00  73.61
-------------------------------------------------------------------------------

Segment Leq : 73.61 dBA

Total Leq All Segments: 73.61 dBA
```

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

Source height = 1.50 m

ROAD (0.00 + 66.02 + 0.00) = 66.02 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.00  68.57   0.00  -2.55   0.00   0.00   0.00   0.00  66.02
-------------------------------------------------------------------------------

Segment Leq : 66.02 dBA

Total Leq All Segments: 66.02 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 73.61
                           (NIGHT): 66.02
```

STAMSON 5.0 NORMAL REPORT Date: 24-03-2025 14:00:54
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R3.te Time Period: Day/Night 16/8 hours
Description:

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

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 80 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): 35000
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: Bank (day/night)

Angle1 Angle2 : 0.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 36.00 / 36.00 m
Receiver height : 28.80 / 28.80 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Bank (day)

Source height = 1.50 m

ROAD (0.00 + 69.35 + 0.00) = 69.35 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
0	90	0.00	76.17	0.00	-3.80	-3.01	0.00	0.00	0.00	69.35

Segment Leq : 69.35 dBA

Total Leq All Segments: 69.35 dBA

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

Source height = 1.50 m

ROAD (0.00 + 61.76 + 0.00) = 61.76 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
     0     90   0.00  68.57   0.00  -3.80  -3.01   0.00   0.00   0.00  61.76
-------------------------------------------------------------------------------

Segment Leq : 61.76 dBA

Total Leq All Segments: 61.76 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 69.35
                           (NIGHT): 61.76
```

STAMSON 5.0 NORMAL REPORT Date: 24-03-2025 14:36:02
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R4.te Time Period: Day/Night 16/8 hours
Description:

```
Road data, segment # 1: Bank (day/night)
----------------------------------------
Car traffic volume  : 28336/2464  veh/TimePeriod  *
Medium truck volume :  2254/196   veh/TimePeriod  *
Heavy truck volume  :  1610/140   veh/TimePeriod  *
Posted speed limit  :    80 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):  35000
    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: Bank (day/night)
----------------------------------------
Angle1   Angle2           : -90.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  26.00 / 26.00  m
Receiver height           :   5.70 / 5.70   m
Topography                :      2       (Flat/gentle slope; with barrier)
Barrier angle1            : -90.00 deg   Angle2 : 90.00 deg
Barrier height            :   4.20 m
Barrier receiver distance :   2.00 / 2.00   m
Source elevation          :   0.00 m
Receiver elevation        :   0.00 m
Barrier elevation         :   0.00 m
Reference angle           :   0.00
```

```
Results segment # 1: Bank (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 !        5.70 !        5.38 !         5.38

ROAD (0.00 + 71.26 + 0.00) = 71.26 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.28  76.17   0.00  -3.06  -0.73   0.00   0.00  -0.27  72.11*
   -90     90   0.53  76.17   0.00  -3.66  -1.24   0.00   0.00   0.00  71.26
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 71.26 dBA

Total Leq All Segments: 71.26 dBA

Barrier table for segment # 1: Bank (day)
-----------------------------------------

Barrier ! Elev of !  Road   ! Tot Leq !
Height  ! Barr Top!  dBA    !   dBA   !
--------+---------+---------+---------+
   5.70 !    5.70 !   66.96 !   66.96 !
   6.20 !    6.20 !   64.30 !   64.30 !
   6.70 !    6.70 !   61.98 !   61.98 !
   7.20 !    7.20 !   60.27 !   60.27 !
   7.70 !    7.70 !   58.97 !   58.97 !
   8.20 !    8.20 !   58.07 !   58.07 !
   8.70 !    8.70 !   57.48 !   57.48 !
   9.20 !    9.20 !   57.00 !   57.00 !
   9.70 !    9.70 !   56.58 !   56.58 !
  10.20 !   10.20 !   56.26 !   56.26 !
```

```
Results segment # 1: Bank (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 !        5.70 !        5.38 !         5.38

ROAD (0.00 + 63.67 + 0.00) = 63.67 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     90   0.28  68.57   0.00  -3.06  -0.73   0.00   0.00  -0.27  64.51*
   -90     90   0.53  68.57   0.00  -3.66  -1.24   0.00   0.00   0.00  63.67
-------------------------------------------------------------------------------

 * Bright Zone !

Segment Leq : 63.67 dBA

Total Leq All Segments: 63.67 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 71.26
                           (NIGHT): 63.67
```

STAMSON 5.0 NORMAL REPORT Date: 24-03-2025 14:36:20
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: R5.te Time Period: Day/Night 16/8 hours
Description:

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

Car traffic volume : 28336/2464 veh/TimePeriod *
Medium truck volume : 2254/196 veh/TimePeriod *
Heavy truck volume : 1610/140 veh/TimePeriod *
Posted speed limit : 80 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

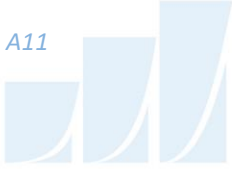
* Refers to calculated road volumes based on the following input:

24 hr Traffic Volume (AADT or SADT): 35000
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: Bank (day/night)

Angle1 Angle2 : -90.00 deg 17.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 38.00 / 38.00 m
Receiver height : 28.80 / 28.80 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 17.00 deg
Barrier height : 27.30 m
Barrier receiver distance : 3.00 / 3.00 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

```
Results segment # 1: Bank (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 !       28.80 !       26.64 !        26.64

ROAD (0.00 + 63.46 + 0.00) = 63.46 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     17   0.00  76.17   0.00  -4.04  -2.26   0.00   0.00  -6.41  63.46
-------------------------------------------------------------------------------

Segment Leq : 63.46 dBA

Total Leq All Segments: 63.46 dBA

Barrier table for segment # 1: Bank (day)
-----------------------------------------

Barrier ! Elev of !  Road   ! Tot Leq !
Height  ! Barr Top!  dBA    !   dBA   !
--------+---------+---------+---------+
  28.80 !   28.80 !   57.55 !   57.55 !
  29.30 !   29.30 !   56.05 !   56.05 !
  29.80 !   29.80 !   54.77 !   54.77 !
  30.30 !   30.30 !   53.75 !   53.75 !
  30.80 !   30.80 !   53.08 !   53.08 !
  31.30 !   31.30 !   52.58 !   52.58 !
  31.80 !   31.80 !   52.21 !   52.21 !
  32.30 !   32.30 !   51.91 !   51.91 !
  32.80 !   32.80 !   51.68 !   51.68 !
  33.30 !   33.30 !   51.48 !   51.48 !
```

```
Results segment # 1: Bank (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 !       28.80 !       26.64 !        26.64

ROAD (0.00 + 55.87 + 0.00) = 55.87 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------------
   -90     17   0.00  68.57   0.00  -4.04  -2.26   0.00   0.00  -6.41  55.87
-------------------------------------------------------------------------------

Segment Leq : 55.87 dBA

Total Leq All Segments: 55.87 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.46
                           (NIGHT): 55.87
```