Roadway Traffic Noise Feasibility Assessment

Summerside West Subdivision Phase 4-6

Ottawa, Ontario

REPORT: GWE17-163 - Traffic Noise Feasibility

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EXECUTIVE SUMMARY

This document describes a traffic noise feasibility assessment of the proposed residential subdivision located at 2564 Tenth Line Road in Ottawa, Ontario, part of Lot 4, Concession 11, which is bounded by Tenth Line Road to the east and Mer Bleu Road to the west. The initial draft plan being considered, comprises of single homes and townhouse units. However, the road network and arrangement of land uses may be subject to change through the development approval process. The major sources of roadway noise are Mer Bleu Road, Tenth Line Road, as well as the proposed Street 11 collector running through the site. Figure 1 illustrates the site location with surrounding context.

The assessment is based on: (i) theoretical noise prediction methods that conform to the Ministry of the Environment and Climate Change (MOECC) 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) draft plan of subdivision received from Caivan Communities.

As the site plan may be subject to change, GWE took the approach to establish noise contours around the site. The contours, based on the City of Ottawa noise criteria, were used to determine what level of noise control for various areas on site would be required. The results of the current study indicate that noise levels due to roadway traffic over the site will range between approximately 40 and 70 dBA during the daytime period (07:00-23:00). The highest roadway traffic noise levels will occur nearest to Mer Bleu Road and Tenth Line Road.

Results of the roadway traffic noise calculations also indicate that outdoor living areas having direct exposure to the noise sources that are within approximately 30 metres of the proposed collector and 145 m of an existing arterial roadway, may require noise control measures. These measures are in Section 5.2, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible.

A detailed roadway traffic noise study will be required at the time of site plan approval to determine specific noise control measures for the development.

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1. INTRODUCTION

Gradient Wind Engineering Inc. (GWE) was retained by 2447591 Ontario Inc. to undertake a roadway traffic noise feasibility assessment of the proposed residential subdivision located at 2564 Tenth Line Road in Ottawa, Ontario, part of Lot 4, Concession 11, which is bounded by Tenth Line Road to the east and Mer Bleu Road to the west. This report summarizes the methodology, results and recommendations related to a roadway traffic noise feasibility assessment, and was prepared in support of the client's draft plan of subdivision applications. GWE's scope of work involved assessing exterior noise levels throughout the site, generated by local roadway traffic. The report also quantitatively addresses any potential noise impacts. The assessment was performed on the basis of theoretical noise calculation methods conforming to the City of Ottawa[1] and Ministry of the Environment and Climate Change[2] guidelines. Noise calculations were based on an initial draftplan of subdivision received from Caivan Communities, with future traffic volumes corresponding to the City of Ottawa's Official Plan (OP) roadway classifications.

2. TERMS OF REFERENCE

The focus of this roadway traffic noise feasibility assessment is a proposed draft plan of subdivision, which is expected to comprise of single homes and townhouse units. The development is expected to contain outdoor living areas in the rear yards of each unit. Phase 2 of the Summerside West development is located directly north of the site, while vacant land occupies the area south of the site. A creek runs diagonally through the site. Figure 1 illustrates the site location with surrounding context.

Due to the current state of the development, the final site configuration is uncertain and may be subject to change. Therefore, GWE took the approach to establish noise contours around the site as per the current plans. The contours, based on the City of Ottawa noise criteria, were used to determine what level of noise control would be required for various areas on site.

Based on the City of Ottawa's Official Plan Schedule E, the major sources of roadway noise are Mer Bleu Road, Tenth Line Road, as well as the proposed Street 11 collector running through the site. There are no other planned Collectors, Major Collectors, or Arterial roadways interior of the site, therefore all local

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

roadways internal to the site have been treated as local roads, which are considered insignificant sources of noise and were not included in the analysis.

3. OBJECTIVES

The principal objective of this work is to calculate the future noise levels on the study site produced by local roadway traffic and explore potential for noise mitigation where required.

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 City of Ottawa's Environmental Noise Control Guidelines (ENCG) specifies that the recommended Outdoor Living Area (OLA) noise limit is 55 dBA during the daytime period. OLA do not need to be considered during the nighttime period.

Predicted noise levels at the outdoor living area dictate the action required to achieve the recommended sound levels. According to the ENCG, if an area is to be used as an outdoor living area (OLA), noise control measures are required to reduce the L_{eq} to 55 dBA. This is typically done with noise control measures outlined in Section 5.2. When noise levels at these areas exceed the criteria, specific Warning Clause requirements may apply. As this is a preliminary assessment, noise control recommendations are of a general nature; specific mitigation requirements would be the work of a future study.

4.3 Roadway Noise Assessment

4.3.1 Theoretical Roadway Traffic Noise Predictions

Noise predictions were determined by computer modelling using two programs. To provide a general sense of noise across the site, the software program *Predictor-Lima*, which incorporates the United States Federal Highway Administration's (FHWA) Transportation Noise Model (TNM) 2.5. This computer program is capable of representing three-dimensional surface and first reflections of sound waves over a suitable spectrum for human hearing. A receptor grid with 5 × 5 m spacing was placed across the study site, along with a number of discrete receptors at key sensitive areas. This program outputs noise contours, however, is not the approved model for roadway predictions by the City of Ottawa. Therefore, the results were confirmed by performing discrete noise calculations with the Ministry of the Environment and Climate Change's (MOECC) computerized noise assessment program, STAMSON 5.04, at key receptor locations coinciding with receptor locations in Predictor as shown in Figures 2-3. Appendix A includes the STAMSON 5.04 input and output data.

Roadway noise calculations were performed by treating each road segment as separate line sources of noise. In addition to the traffic volumes summarized in Table 1, 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 was taken to be 92% / 8% respectively for all streets
- Grassland is taken as absorptive ground, while hard ground and existing roadways are taken as reflective ground
- The study site was treated as having flat or gently sloping topography
- No building massing considered in calculations, other than existing dwellings

4.3.2 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[3] (TMP) which provides 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. Upon review of the Transportation Impact Study[4] for the development, roadway traffic data obtained from the ENCG contains higher traffic volumes resulting in higher noise levels. These values are however mandated to be used by the ENCG and future expected noise levels are expected to be lower than the results of this report. Table 1 (below) summarizes the AADT values used for each roadway included in this assessment.

TABLE 1: ROADWAY TRAFFIC DATA

Roadway	Roadway Class	Speed Limit (km/h)	Official Plan AADT
Mer Bleu Road	4-Lane Urban Arterial Divided (4-UAD)	60	**35,000**
Tenth Line Road	4-Lane Urban Arterial Divided (4-UAD)	60	**35,000**
Street 1	2-Lane Collector (2-UCU)	50	**8,000**
Street 11	2-Lane Collector (2-UCU)	50	**8,000**

5. RESULTS AND DISCUSSION

5.1 Roadway Traffic Noise Levels

The results of the roadway traffic noise calculations for the daytime period are shown in Figure 4-5 respectively, which cover the entire study site. Discrete receptors were also placed at ground level at key locations throughout the site. The noise contours were generated using *Predictor-Lima* and verified with discrete receptors using STAMSON 5.04 as shown in Figure 2-3 and summarized in Table 2 below. Receptors 1-3 are located near Mer Bleu Road, Street 11 and Tenth Line Road respectively. Appendix A contains the complete set of input and output data from all STAMSON 5.04 calculations.

[3] City of Ottawa Transportation Master Plan, November 2013
[4] 673 River Road – Transportation Impact Study, PARSONS, June 2017

TABLE 2: EXTERIOR NOISE LEVELS DUE TO ROAD TRAFFIC

Receptor Number	Receptor Location	STAMSON 5.04 Noise Level (dBA)		Predictor-Lima Noise Level (dBA)	
		Day (07:00-23:00)	Night (23:00-07:00)	Day (07:00-23:00)	Night (23:00-07:00)
1	Western Corner	59	52	63	55
2	Block 192	55	48	57	49
3	Block 161	60	53	62	54
4	Block 57	56	48	56	49
5	Block 207	48	40	48	40

As shown above, the results calculated from *Predictor-Lima* generally have good correlation with calculations performed in STAMSON 5.04. A tolerance of 3 dBA between models is generally considered acceptable given human hearing cannot detect a change in sound level of less than 3 dBA. Results of the roadway traffic noise calculations also indicate that outdoor living areas having direct exposure to the noise sources that are within approximately 30 metres of the proposed collector and 145 m of an existing arterial roadway, may require noise control measures. These measures are in Section 5.2, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible.

5.2 Summary of Noise Control Measures

The OLA noise levels predicted due to roadway traffic, at a number of locations, exceed the criteria listed in the ENCG for outdoor living areas, as discussed in Section 4.2. Therefore, noise control measures as described below from Table 2.3a in the ENCG, in order of preference, will be required to reduce the L_{eq} to 55 dBA:

- Distance setback with soft ground
- Insertion of noise insensitive land uses between the source and sensitive points of reception
- Orientation of buildings to provide sheltered zones in rear yards
- Shared outdoor amenity areas
- Earth berms (sound barriers)
- Acoustic barriers

Examining the noise control measures listed above, not all dwelling blocks are oriented to provide screening elements against traffic sources. Short of reorienting these blocks, to reduce the number of instances where dwellings will side or back onto major roadways, the most feasible measures are insertion of earth berms or acoustic wall barriers between the sensitive rear yards and sources of noise. By siding lots onto the collector and arterial roadways the extent of barriers are minimized. The use of earth berms or acoustic barriers will depend on the grading plan when it becomes available. Both options can reduce OLA noise levels to 55 dBA.

Regarding Figure 4-5, the area(s) with noise levels under 55 dBA (yellow and light orange) have no ventilation or mitigation requirements. The area(s) with noise levels between 55 and 65 dBA (orange and red) require forced air heating with provision for central air conditioning with an applicable generic Warning Clause. Finally, the area(s) that represent noise levels above 65 dBA (maroon red) require central air conditioning with an applicable extensive mitigation Warning Clause. Figure 5-6 illustrate the blocks where noise control measures are expected to be required.

6. CONCLUSIONS AND RECOMMENDATIONS

The results of the current study indicate that noise levels due to roadway traffic over the site will range between approximately 40 and 70 dBA during the daytime period (07:00-23:00). The highest roadway traffic noise levels will occur nearest to Mer Bleu Road and Tenth Line Road.

Results of the roadway traffic noise calculations also indicate that outdoor living areas having direct exposure to the noise sources that are within approximately 30 metres of the proposed collector and 145 m of an existing arterial roadway, may require noise control measures. These measures are in Section 5.2, with the aim to reduce the L_{eq} to as close to 55 dBA as technically, economically and administratively feasible.

A detailed roadway traffic noise study will be required at the time of site plan approval to determine specific noise control measures for the development.

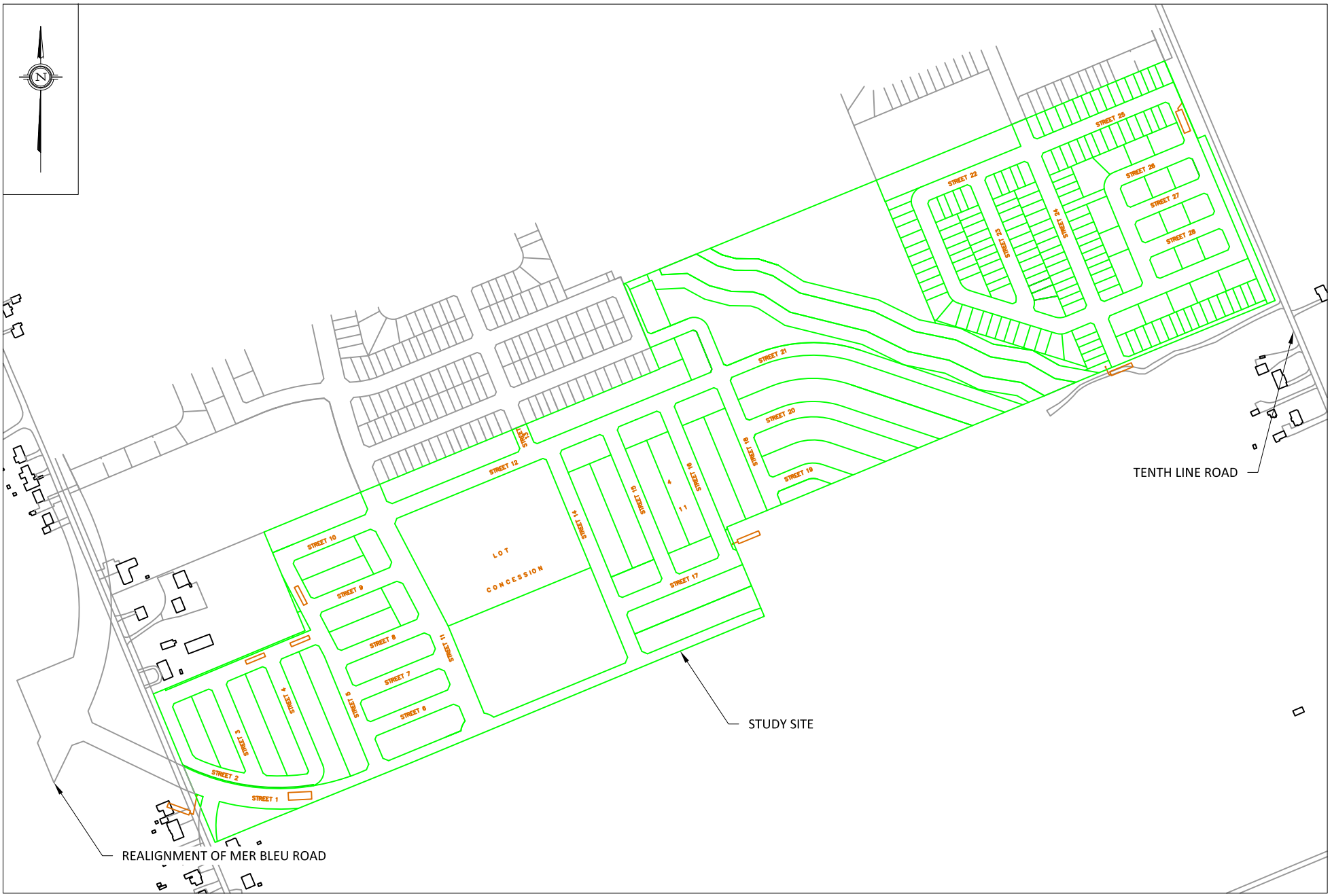
This concludes our assessment and report. If you have any questions or wish to discuss our findings, please advise us. In the interim, we thank you for the opportunity to be of service.

Yours truly,

Gradient Wind Engineering Inc.

Michael Lafortune
Environmental Scientist
GWE17-163 – Traffic Noise Feasibility

Joshua Foster, P.Eng.
Partner



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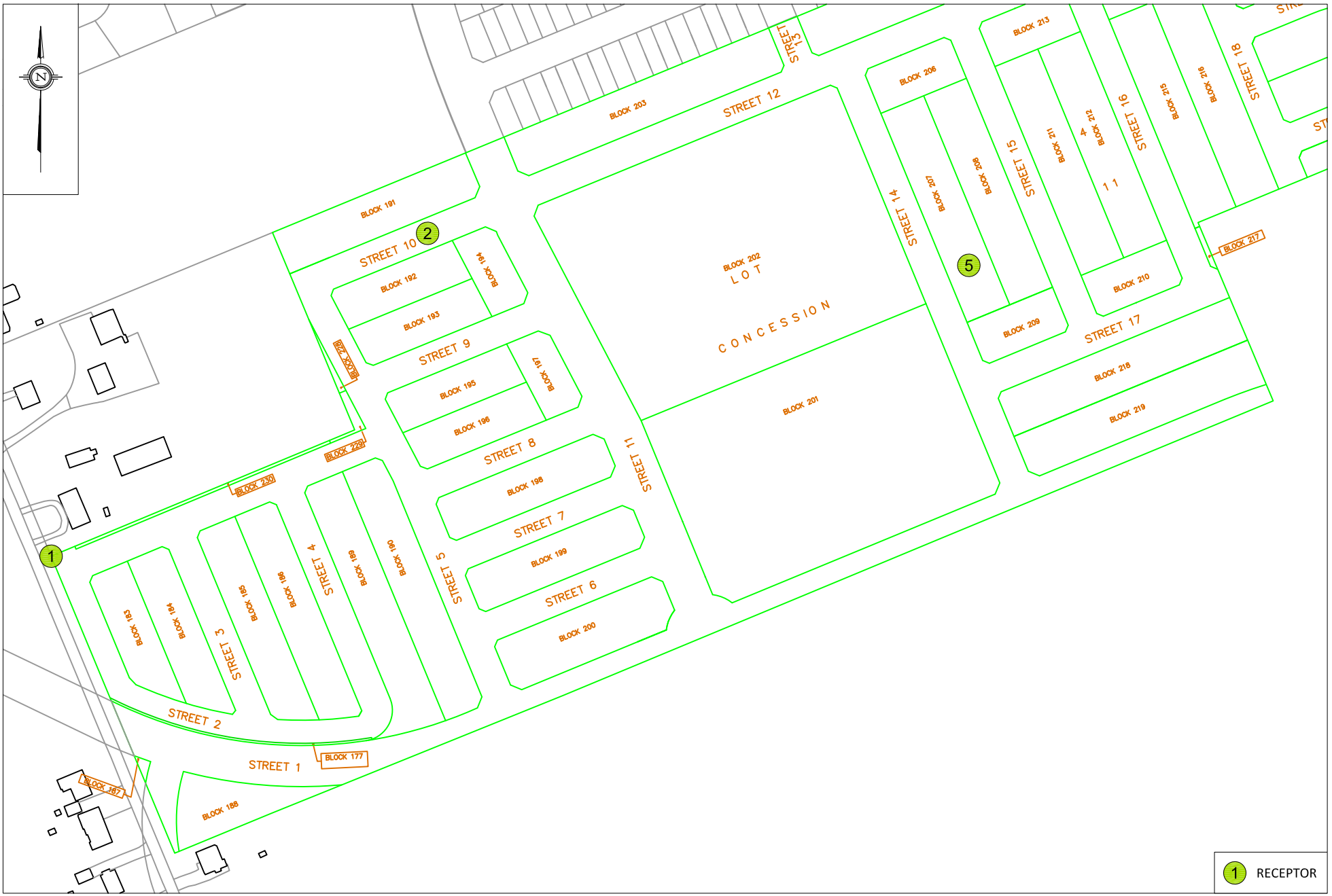
GRADIENT WIND ENGINEERING INC

PROJECT	SUMMERSIDE WEST SUBDIVISION PHASE 4-6 ROADWAY TRAFFIC NOISE FEASIBILITY ASSSESSMENT		
SCALE	1:6000 (APPROX.)	DRAWING NO.	GWE17-163-1
DATE	NOVEMBER 6, 2017	DRAWN BY	M.L.

DESCRIPTION

FIGURE 1:
DRAFTPLAN AND SURROUNDING CONTEXT



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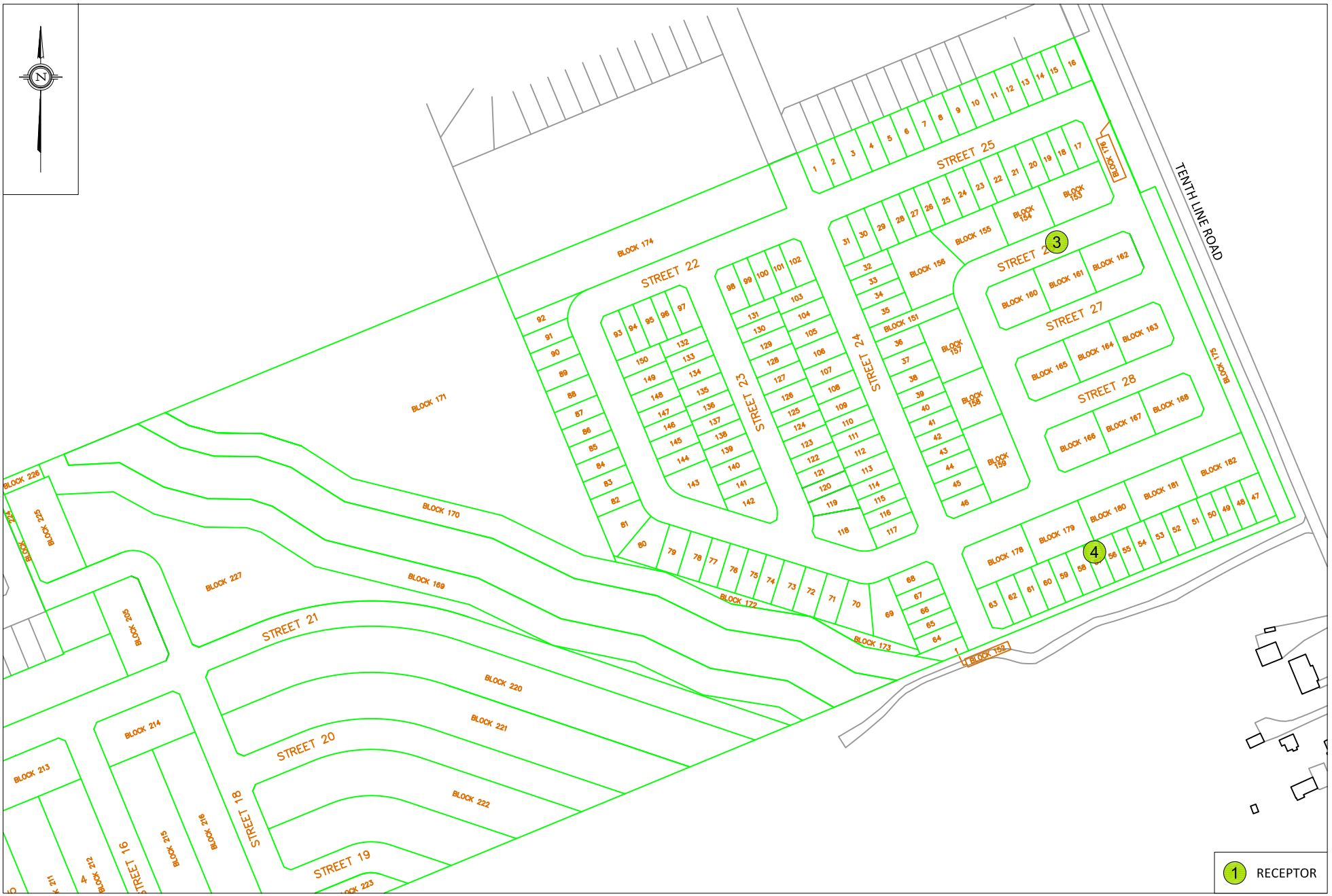
GRADIENT WIND ENGINEERING INC

PROJECT	SUMMERSIDE WEST SUBDIVISION PHASE 4-6 ROADWAY TRAFFIC NOISE FEASIBILITY ASSSESSMENT
SCALE	1:3000 (APPROX.)
DRAWING NO.	GWE17-163-2
DATE	NOVEMBER 6, 2017
DRAWN BY	M.L.

DESCRIPTION

FIGURE 2:
RECEPTOR LOCATIONS - WEST SIDE



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PROJECT	SUMMERSIDE WEST SUBDIVISION PHASE 4-6 ROADWAY TRAFFIC NOISE FEASIBILITY ASSSESSMENT
SCALE	1:3000 (APPROX.)
DRAWING NO.	GWE17-163-3
DATE	NOVEMBER 6, 2017
DRAWN BY	M.L.

DESCRIPTION

FIGURE 3:
RECEPTOR LOCATIONS - EAST SIDE

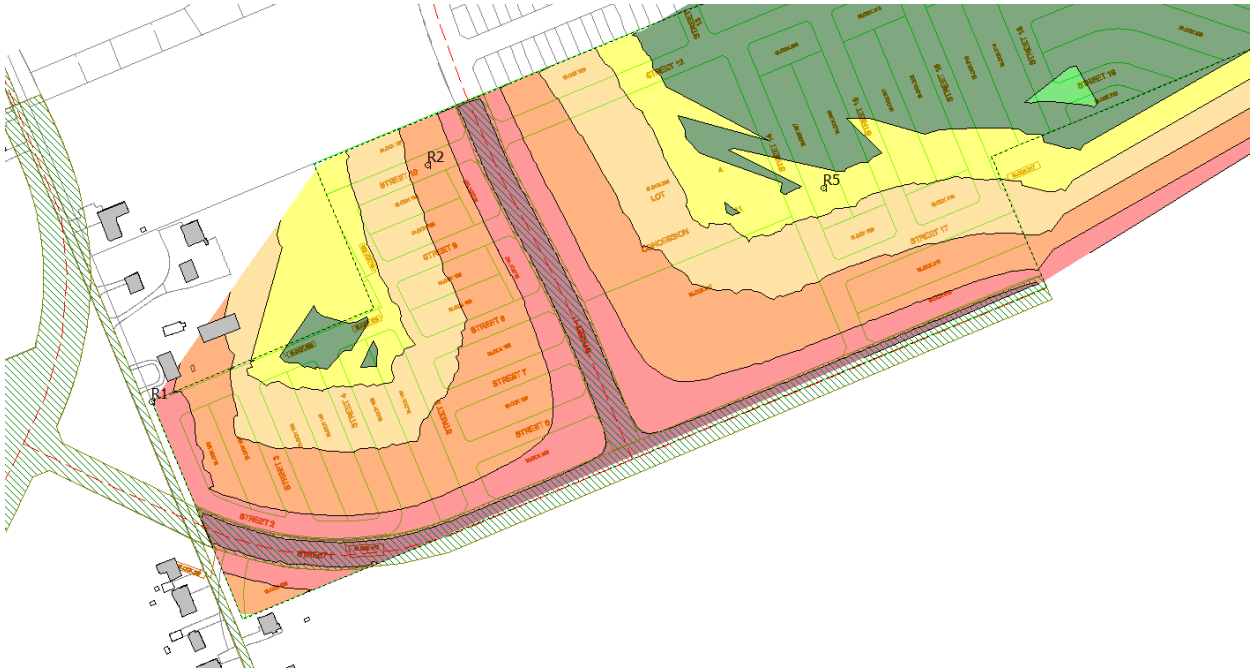


FIGURE 4: GROUND LEVEL NOISE CONTOURS – WEST SIDE (DAYTIME PERIOD)

80 – 85 dB
75 – 80 dB
70 – 75 dB
65 – 70 dB
60 – 65 dB
55 – 60 dB
50 – 55 dB
45 – 50 dB
40 – 45 dB
35 – 40 dB
0 – 35 dB

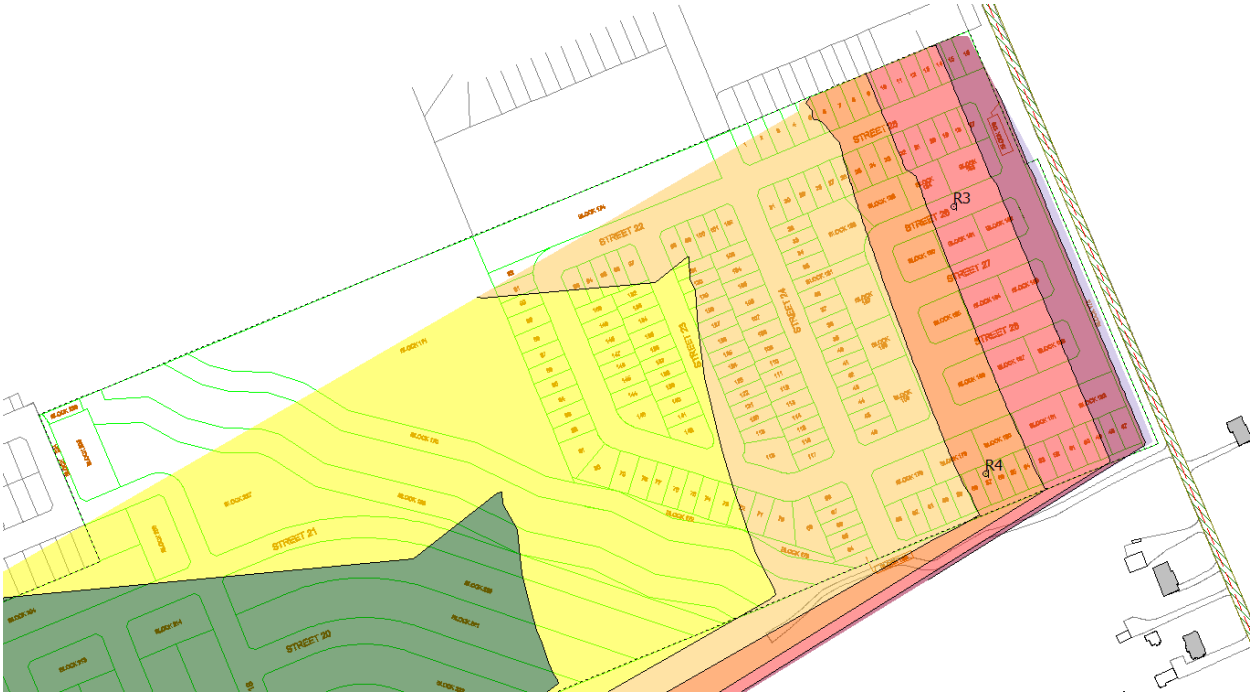
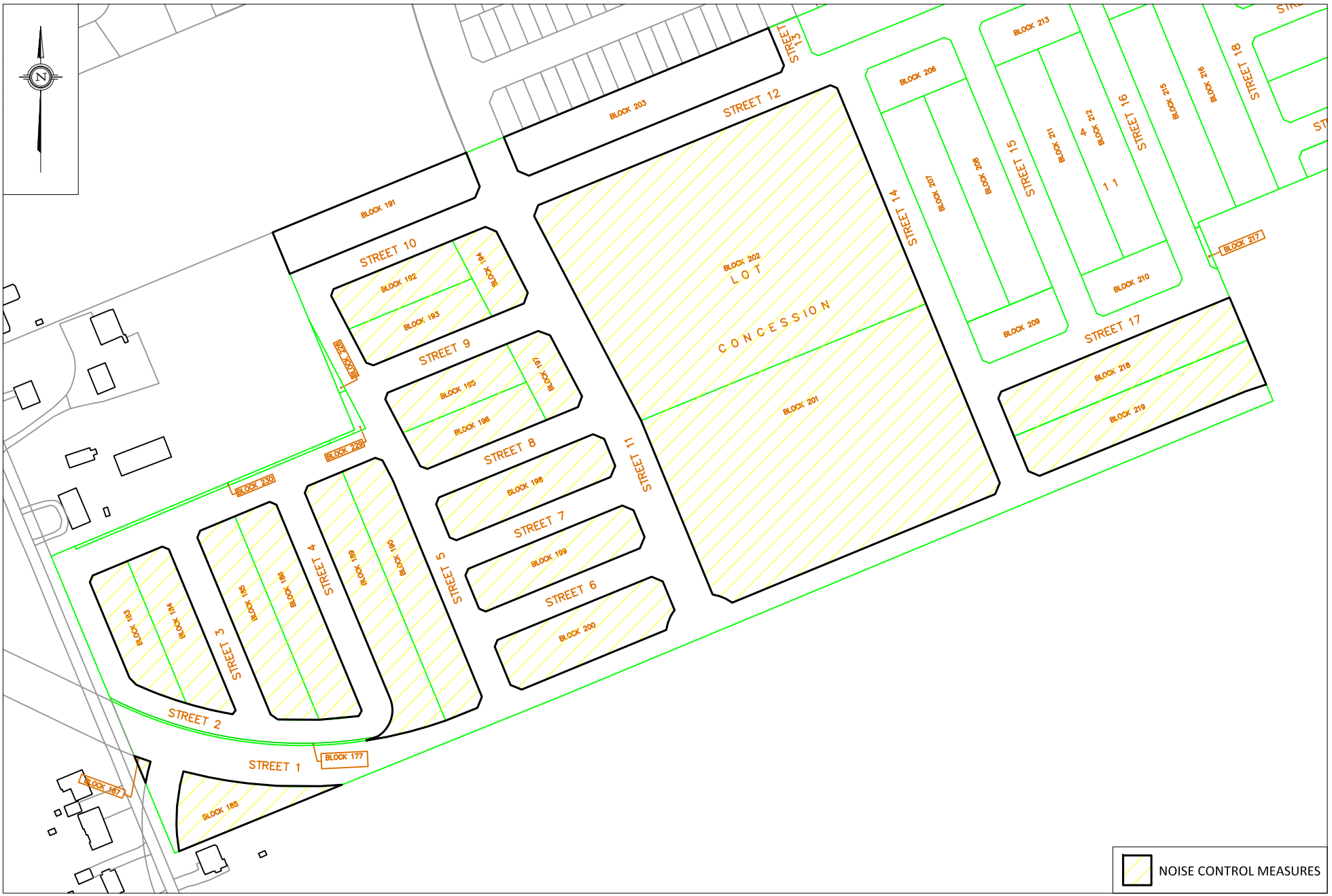


FIGURE 5: GROUND LEVEL NOISE CONTOURS – EAST SIDE (DAYTIME PERIOD)

- *80 – 85 dB*
- *75 – 80 dB*
- *70 – 75 dB*
- *65 – 70 dB*
- *60 – 65 dB*
- *55 – 60 dB*
- *50 – 55 dB*
- *45 – 50 dB*
- *40 – 45 dB*
- *35 – 40 dB*
- *0 – 35 dB*



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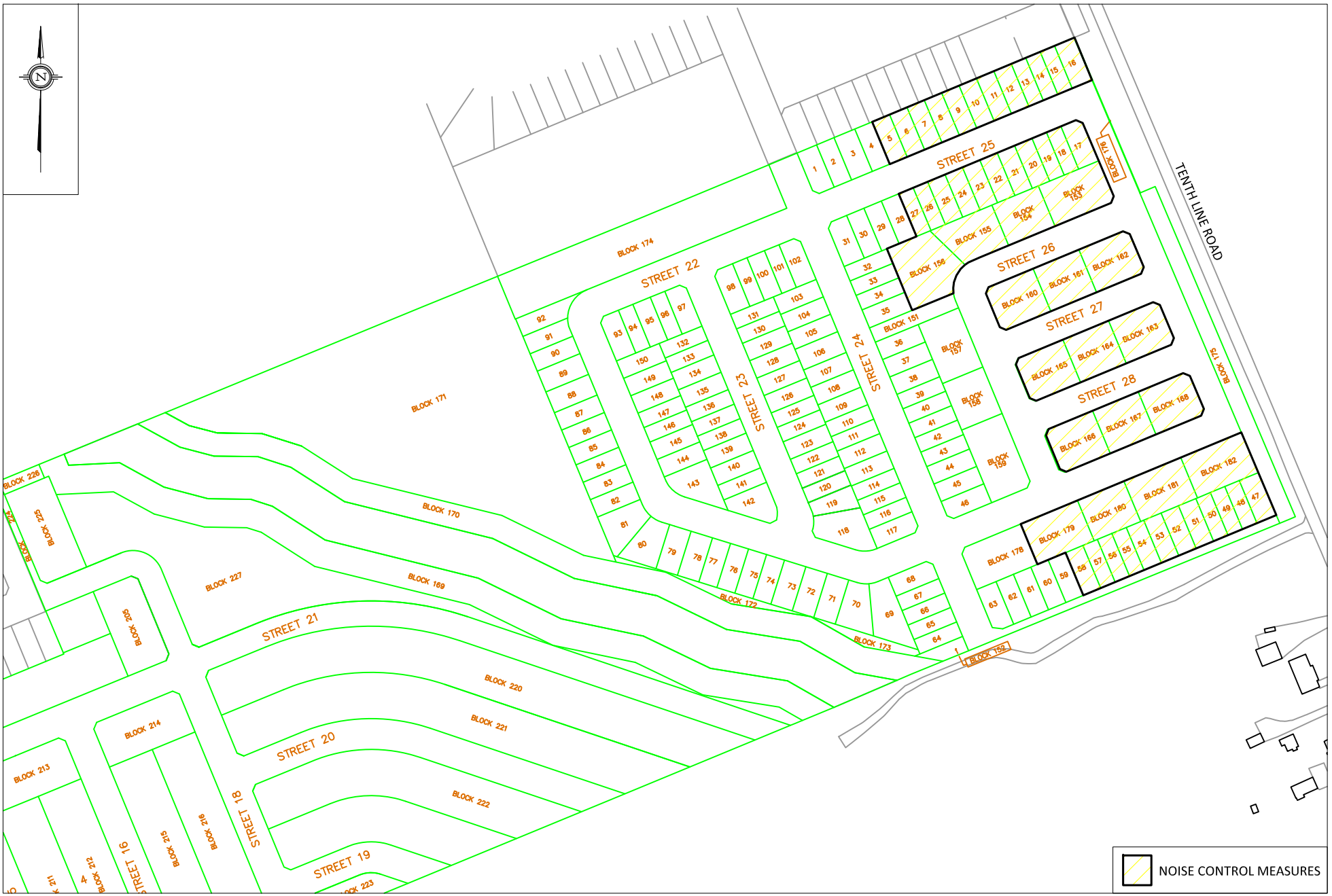
PROJECT	SUMMERSIDE WEST SUBDIVISION PHASE 4-6 ROADWAY TRAFFIC NOISE FEASIBILITY ASSSESSMENT
SCALE	1:3000 (APPROX.)
DRAWING NO.	GWE17-163-6
DATE	NOVEMBER 6, 2017
DRAWN BY	M.L.

DESCRIPTION

FIGURE 6:
NOISE CONTROL MEASURES - WEST SIDE



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PROJECT	SUMMERSIDE WEST SUBDIVISION PHASE 4-6 ROADWAY TRAFFIC NOISE FEASIBILITY ASSSESSMENT
SCALE	1:3000 (APPROX.)
DRAWING NO.	GWE17-163-7
DATE	NOVEMBER 6, 2017
DRAWN BY	M.L.

DESCRIPTION

FIGURE 7:
NOISE CONTROL MEASURES - EAST SIDE

APPENDIX A

STAMSON 5.04 - INPUT AND OUTPUT DATA

```
STAMSON 5.0        NORMAL REPORT        Date: 06-11-2017 12:51:28
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Mer Bleu (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  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  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: Mer Bleu (day/night)
-------------------------------------------
Angle1   Angle2           : -56.00 deg   48.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  83.00 / 83.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Street1 (day/night)
------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    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):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Street1 (day/night)
-----------------------------------------
Angle1   Angle2           : -79.00 deg   46.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  74.00 / 74.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Mer Bleu (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 58.54 + 0.00) = 58.54 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -56     48   0.66  73.68   0.00 -12.33  -2.80   0.00   0.00   0.00
58.54
-------------------------------------------------------------------------
--

Segment Leq : 58.54 dBA


Results segment # 2: Street1 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 51.90 + 0.00) = 51.90 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -79     46   0.66  65.75   0.00 -11.51  -2.35   0.00   0.00   0.00
51.90
-------------------------------------------------------------------------
--

Segment Leq : 51.90 dBA

Total Leq All Segments: 59.39 dBA
```

```
Results segment # 1: Mer Bleu (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 50.94 + 0.00) = 50.94 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -56     48   0.66  66.08   0.00 -12.33  -2.80   0.00   0.00   0.00
50.94
-------------------------------------------------------------------------
--

Segment Leq : 50.94 dBA


Results segment # 2: Street1 (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 44.30 + 0.00) = 44.30 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -79     46   0.66  58.16   0.00 -11.51  -2.35   0.00   0.00   0.00
44.30
-------------------------------------------------------------------------
--

Segment Leq : 44.30 dBA

Total Leq All Segments: 51.79 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 59.39
                           (NIGHT): 51.79
```

```
STAMSON 5.0        NORMAL REPORT        Date: 31-10-2017 10:37:36
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Street11 (day/night)
----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    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):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Street11 (day/night)
------------------------------------------
Angle1   Angle2           : -71.00 deg   73.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  50.00 / 50.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Street11 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 55.26 + 0.00) = 55.26 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -71     73   0.66  65.75   0.00  -8.68  -1.81   0.00   0.00   0.00
55.26
-------------------------------------------------------------------------
--

Segment Leq : 55.26 dBA

Total Leq All Segments: 55.26 dBA


Results segment # 1: Street11 (night)
------------------------------------

Source height = 1.50 m

ROAD (0.00 + 47.67 + 0.00) = 47.67 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -71     73   0.66  58.16   0.00  -8.68  -1.81   0.00   0.00   0.00
47.67
-------------------------------------------------------------------------
--

Segment Leq : 47.67 dBA

Total Leq All Segments: 47.67 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 55.26
                           (NIGHT): 47.67
```

```
STAMSON 5.0        NORMAL REPORT        Date: 31-10-2017 10:37:42
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Tenth Line (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  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  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: Tenth Line (day/night)
---------------------------------------------
Angle1   Angle2           : -68.00 deg   68.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  :  75.00 / 75.00  m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Tenth Line (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 60.12 + 0.00) = 60.12 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -68     68   0.66  73.68   0.00 -11.60  -1.96   0.00   0.00   0.00
60.12
-------------------------------------------------------------------------
--

Segment Leq : 60.12 dBA

Total Leq All Segments: 60.12 dBA


Results segment # 1: Tenth Line (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 52.52 + 0.00) = 52.52 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -68     68   0.66  66.08   0.00 -11.60  -1.96   0.00   0.00   0.00
52.52
-------------------------------------------------------------------------
--

Segment Leq : 52.52 dBA

Total Leq All Segments: 52.52 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 60.12
                           (NIGHT): 52.52
```

```
STAMSON 5.0        NORMAL REPORT        Date: 31-10-2017 16:02:16
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Tenth Line (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  :    60 km/h
Road gradient       :     0 %
Road pavement       :     1 (Typical asphalt or concrete)

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

    24 hr Traffic Volume (AADT or SADT):  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: Tenth Line (day/night)
---------------------------------------------
Angle1   Angle2           : -51.00 deg   51.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 125.00 / 125.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Tenth Line (day)
-------------------------------------

Source height = 1.50 m

ROAD (0.00 + 55.53 + 0.00) = 55.53 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -51     51   0.66  73.68   0.00 -15.29  -2.86   0.00   0.00   0.00
55.53
-------------------------------------------------------------------------
--

Segment Leq : 55.53 dBA

Total Leq All Segments: 55.53 dBA


Results segment # 1: Tenth Line (night)
---------------------------------------

Source height = 1.50 m

ROAD (0.00 + 47.93 + 0.00) = 47.93 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -51     51   0.66  66.08   0.00 -15.29  -2.86   0.00   0.00   0.00
47.93
-------------------------------------------------------------------------
--

Segment Leq : 47.93 dBA

Total Leq All Segments: 47.93 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 55.53
                           (NIGHT): 47.93
```

```
STAMSON 5.0        NORMAL REPORT        Date: 06-11-2017 12:53:28
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

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


Road data, segment # 1: Street11 (day/night)
----------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    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):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 1: Street11 (day/night)
-------------------------------------------
Angle1   Angle2           : -29.00 deg   90.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 225.00 / 225.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Road data, segment # 2: Street1 (day/night)
------------------------------------------
Car traffic volume  :  6477/563   veh/TimePeriod  *
Medium truck volume :   515/45    veh/TimePeriod  *
Heavy truck volume  :   368/32    veh/TimePeriod  *
Posted speed limit  :    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):   8000
    Percentage of Annual Growth        :   0.00
    Number of Years of Growth          :   0.00
    Medium Truck % of Total Volume     :   7.00
    Heavy Truck  % of Total Volume     :   5.00
    Day (16 hrs) % of Total Volume     :  92.00

Data for Segment # 2: Street1 (day/night)
-----------------------------------------
Angle1   Angle2           : -45.00 deg   45.00 deg
Wood depth                :      0       (No woods.)
No of house rows          :      0 / 0
Surface                   :      1       (Absorptive ground surface)
Receiver source distance  : 141.00 / 141.00 m
Receiver height           :   1.50 / 1.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Reference angle           :   0.00
```

```
Results segment # 1: Street11 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 43.34 + 0.00) = 43.34 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -29     90   0.66  65.75   0.00 -19.52  -2.89   0.00   0.00   0.00
43.34
-------------------------------------------------------------------------
--

Segment Leq : 43.34 dBA


Results segment # 2: Street1 (day)
----------------------------------

Source height = 1.50 m

ROAD (0.00 + 46.28 + 0.00) = 46.28 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -45     45   0.66  65.75   0.00 -16.15  -3.32   0.00   0.00   0.00
46.28
-------------------------------------------------------------------------
--

Segment Leq : 46.28 dBA

Total Leq All Segments: 48.06 dBA
```

```
Results segment # 1: Street11 (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 35.74 + 0.00) = 35.74 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -29     90   0.66  58.16   0.00 -19.52  -2.89   0.00   0.00   0.00
35.74
-------------------------------------------------------------------------
--

Segment Leq : 35.74 dBA


Results segment # 2: Street1 (night)
-----------------------------------

Source height = 1.50 m

ROAD (0.00 + 38.69 + 0.00) = 38.69 dBA
Angle1 Angle2  Alpha RefLeq  P.Adj  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj
SubLeq
-------------------------------------------------------------------------
--
   -45     45   0.66  58.16   0.00 -16.15  -3.32   0.00   0.00   0.00
38.69
-------------------------------------------------------------------------
--

Segment Leq : 38.69 dBA

Total Leq All Segments: 40.47 dBA




TOTAL Leq FROM ALL SOURCES (DAY): 48.06
                           (NIGHT): 40.47
```