

**MAPLE LEAF HOMES DEVELOPMENT
1055 KLONDIKE ROAD
NOISE IMPACT FEASIBILITY REPORT**

Prepared By:

NOVATECH

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Novatech File: 117034
Ref: R-2019-139

Submitted: July 26, 2019

July 26, 2019

City of Ottawa
Planning and Infrastructure Approvals
110 Laurier Street West, 4th Floor
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Attention: Gabrielle Schaeffer

**Reference: Maple Leaf Homes Development
1055 Klondike Road
Noise Impact Feasibility Report
Our File No.: 117034**

Enclosed for your review are three (3) copies of the Noise Impact Feasibility Report for Maple Leaf Homes Development located at 1055 Klondike Road. The report is submitted in support of an application for Draft Plan of Subdivision.

This study evaluates the environmental impact of noise from traffic on the outdoor living areas and assesses the feasibility of mitigation measures to attenuate noise to acceptable levels.

Please contact the undersigned should you have any questions or comments pertaining to the enclosed report.

Yours truly,

NOVATECH



Lucas Wilson, P. Eng.
Project Coordinator

Cc: Brian Saumure, Maple Leaf Homes

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1.0 INTRODUCTION

This report is submitted on behalf of the developer, Maple Leaf Homes as part of the Draft Plan of Subdivision process for the proposed Maple Leaf Homes development located at 1055 Klondike Road, herein called the 'Subject Site'. This report assesses the environmental impact of noise on the proposed development and outlines the potential mitigation measures that might be required.

2.0 BACKGROUND

2.1 Project Description

The proposed development is located within the Kanata North Community west of the intersection of Klondike Road and Sandhill Road. The development is approximately 2.44ha and is bounded by Klondike Road to the south, Shirley's Brook to the west and north, and future residential lands to the east. A key plan of the area is presented below in **Figure 1**.



Figure 1: Site Location

The proposed development will consist of 46 townhome units, 12 semi-detached units and 56 apartment units in the medium density block.

This report assesses the impacts of sound from vehicular traffic on the proposed development using the Ministry of the Environment (MOE) Stamson 5.0 software and outlines any necessary noise attenuation requirements for compliance with the City of Ottawa Environmental Noise Control Guidelines (ENCG) and the MOE Environmental Noise Guidelines (MOE Publication NPC-300).

The following describes the existing and planned land uses adjacent to the subject site:

North: To the North of 1055 Klondike, Shirley's Brook Separates the Subject Site from Brookside Subdivision. The existing Brookside Subdivision consists of Single-Family Homes and Town House units.

East: The lands east of the proposed subdivision are currently vacant with plans for further residential development.

South: Klondike Road, a two-lane urban collector road, bounds the Subject Site to the south. The Subject Site is located between March Road and Sandhill Road on the North Side of Klondike Road.

Southeast: To the Southeast of the Subject Site, across Klondike Road, are Brookside Baptist Church and The Greenwoods Academy.

West: The RioCentre Kanata (832-858 March Road) is located to the west of the Subject Site, separated by Shirley's Brook.

Southwest: March Road, a six-lane urban arterial-divided road, is the nearest major intersection to the Southwest with a distance of over 100m from the Subject Site.

Plans are to develop a residential subdivision on the subject site, as shown on **Figure 2 – Concept Plan**, which will consist of 46 townhouse units, 12 semi-detached units and a medium density block (56 units) for a total of 114 units.

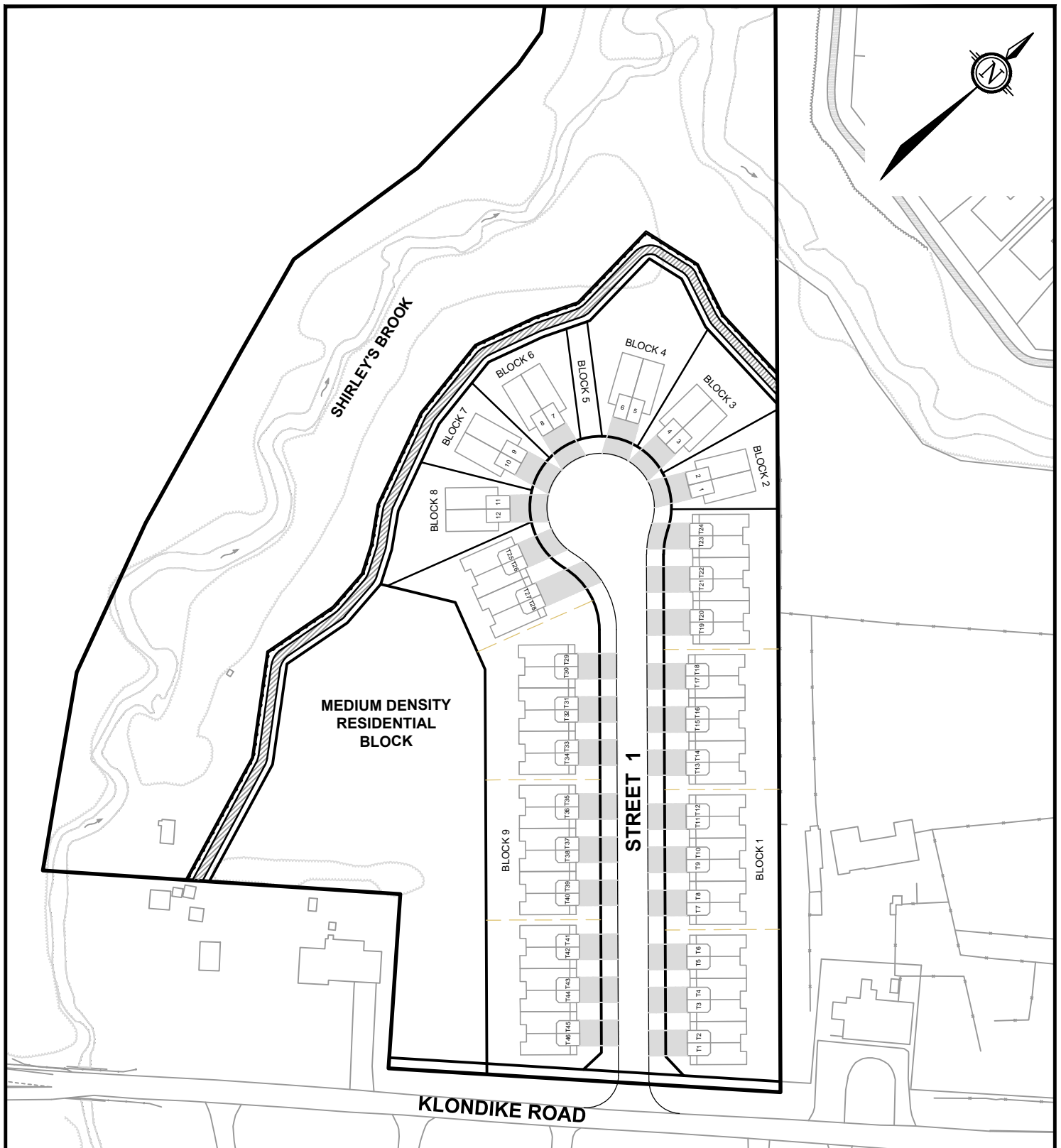
2.2 Noise Sources

The City of Ottawa Official Plan stipulates that a noise study shall be prepared when a new development is proposed within 100 metres of an arterial, major collector or collector roadway, or a rapid-transit corridor.

The potential surface road noise source for this site that was considered for the purposes of this study is Klondike Road and Sandhill Road as all other roadways within the zone of influence were not arterial, major collector or collector roadways. For the purposes of this report, Klondike Road and Sandhill Road will be considered the noise sources.

Klondike Road is classified as an urban collector roadway with a 24.0m protected ROW in the City of Ottawa Transportation Master Plan and Official Plan. Klondike road is classified as a 2-Lane Urban Collector (2-UCU) road with a posted speed of 50km/hr fronting the Subject Site. As per Map 11 in the Transportation Master Plan (TMP), Road Network – 2031 Affordable Network, there are plans to urbanize the existing two-lane rural cross section between March Road and Sandhill Road (2014-2019). Therefore, for the purposes of this report, a 2-Lane Urban Collector (2-UCU) road with an AADT level of 8,000 veh/day and a posted speed of 50km/hr will be utilized. Refer to **Appendix A** for the excerpt from the TMP.

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LEGEND

— SITE BOUNDARY

CITY OF OTTAWA
1055 KLONDIKE ROAD

CONCEPT PLAN

SCALE 1 : 1500 0 15 30 45 60

DATE JULY 2019 JOB 117034 FIGURE FIG 2

Sandhill Road is classified as a 2-Lane Urban Collector (2-UCU) road with a 20.0m protected ROW with an AADT level of 8,000 veh/day and a posted speed limit of 40km/hr.

There is no railway within 250m that impacts the site.

There is no airport noise affecting this site.

There are no stationary noise sources that affect this site, the closest being the mechanical for the Rexall building located over 100m from the Subject Site at 832 March Road.

3.0 CITY OF OTTAWA NOISE CONTROL GUIDELINES

3.1 Sound Level Criteria

The City of Ottawa is concerned with noise from aircraft, roads, transitways, and railways, as expressed in Tables 2.2a: Sound Level Limit for Outdoor Living Areas – Road and Rail, Table 2.2b: Sound Level Limit for Indoor Living Areas Road and Rail, and Table 2.2c: Supplementary Sound Level Limits for Indoor Spaces – Road and Rail of the ENCG. The maximum suggested sound levels for outdoor and indoor living areas between 7am and 11pm are 55 dBA and 45 dBA, respectively. The maximum suggested sound level for indoor bedrooms is 40dBA between 11pm and 7am. For reference, Tables 2.2a, 2.2b and 2.2c of the ENCG are included in **Appendix A**.

Outdoor Living Area and Plane of Window receivers are defined as:

- **Outdoor Living Area (OLA):** The outdoor amenity area provided for quiet enjoyment of the outdoor environment during the daytime period (i.e., backyards, terraces and patios). OLA noise levels are considered 3.0m from the building façade, 1.5m above grade.
- **Plane of Window (POW):** The indoor living space where the sound levels will affect the living room area during daytime hours and bedrooms during nighttime hours. POW noise levels are considered inside the building, 1.5m above the ground for the daytime and 4.5m above the ground for nighttime.

3.2 Alternative Methods for Noise Attenuation

When OLA sound levels are predicted to be approximately equal to or less than 55 dBA attenuation measures are not required. If the predicted noise levels are found to exceed 55 dBA, physical forms of mitigation are suggested, and which may also include the provision of warning clauses to inform purchasers of the expected noise levels and specific mitigation measures.

These attenuation measures may include any or all of the following:

- Distance setback with soft ground;
- Insertion of noise insensitive land uses between the source and sensitive receptor;
- Orientation of building to provide sheltered zones;

- Construction of sound or acoustic barriers;
- Installation of air conditioning and ventilation; and
- Enhanced construction techniques and construction quality.

3.3 Noise Attenuation Requirements

When the noise attenuation measures listed above do not reduce noise levels below 55 dBA in the Outdoor Living Area, control measures (barriers) are required to reduce the L_{eq} below or as close to 55 dBA as technically, economically and administratively feasible.

The noise barriers are to be compliant with the City standard for noise barriers and have the following characteristics:

- Minimum height of 2.2m;
- Situated 0.30m inside the private property line;
- A surface mass density not less than 20kg/sq.m; and
- No holes or gaps.

3.4 Ventilation Requirements

A forced air heating system with provision for a central air conditioning system is required if the plane of window daytime noise levels are between 55 dBA and 65 dBA and/or the nighttime noise levels are between 50 dBA and 60 dBA.

The installation of a central air conditioning system is required when the daytime noise level exceeds 65 dBA and/or the nighttime noise level exceeds 60 dBA.

3.5 Building Component Assessment

When plane of window noise levels exceeds 65 dBA (daytime) or 60 dBA (nighttime) the exterior cladding system of the building envelope must be acoustically assessed to ensure indoor sound criteria are achieved. This includes analysis of the exterior wall, door, and/or glazing system specifications as appropriate.

The NRC research *Acoustic Insulation Factor: A Rating for the Insulation of Buildings against Noise* (June 1980, JD Quirt) is used to assess the building components and the required acoustic insulation factor (AIF). This method is recognized by the City of Ottawa.

The required AIF is based on the Outside L_{eq} , Indoor L_{eq} required, and the number of exterior façade components.

Minimum Required AIF = Outside L_{eq} – Indoor L_{eq} + $10 \log_{10}$ (Number of Components) + 2dB

Where, N = Number of components (walls, windows and roof);

L = Sound Level expressed on a common decibel scale.

3.6 Warning Clauses

When predicted noise levels exceed the specified criteria, the City of Ottawa and the MOE recommend warning clauses be registered as a notice on title and incorporated into the lease/rental/sale agreements to warn potential purchaser/buyers/tenants of the possible elevated noise levels.

Typical warning clauses should be registered as shown below. Warning clauses are extracted from Part 4, Appendix A the City of Ottawa ENCG and excerpts have been provided in **Appendix A** of this report. As stated in the City of Ottawa ENCG, due to the variation of noise impacts for any given site, it may be necessary to amend the example warning clauses to recognize the site conditions in each development.

It is recommended that the following noise clauses be registered on title and incorporated into the agreement of purchase and sales as required. Results can be found in **Table 3** from Section 4.3 of this report:

Type 1

“Purchasers/tenants are advised that sound levels due to increasing road traffic may occasionally interfere with some outdoor activities as the sound levels may exceed the sound level limits of the City and Ministry of the Environment.”

“To help address the need for sound attenuation this development has been designed so as to provide an outdoor amenity area and indoor environment that is within provincial guidelines. Measures for sound attenuation include:

- An acoustic barrier”

“To ensure that provincial sound level limits are not exceeded it is important to maintain sound attenuation features.”

“The acoustic barrier shall be maintained and kept in good repair by the property owner. Any maintenance, repair or replacement is the responsibility of the owner and shall be with the same material or to the same standards, having the same colour, appearance and function of the original.”

Additionally, if a tolerance of 5 dBA is being considered in some areas, it is recommended an additional noise clause be registered on title and incorporated into the agreement of purchase and sales:

Type 2

“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/rail/Light Rail/transitway traffic may, on occasion, interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the City and the Ministry of the Environment by up to 5 dBA.”

“To help address the need for sound attenuation this development has been designed so as to provide an outdoor amenity area and indoor environment that is within provincial guidelines. Measures for sound attenuation include:

- An acoustic barrier”

“To ensure that provincial sound level limits are not exceeded it is important to maintain sound attenuation features.”

“The acoustic barrier shall be maintained and kept in good repair by the property owner. Any maintenance, repair or replacement is the responsibility of the owner and shall be with the same material or to the same standards, having the same colour, appearance and function of the original.”

Type 3

“Purchasers/tenants are advised that sound levels due to increasing road traffic may occasionally interfere with some outdoor activities as the sound levels may exceed the sound level limits of the City and Ministry of the Environment.”

“To help address the need for sound attenuation this development has been designed so as to provide an outdoor amenity area and indoor environment that is within provincial guidelines. Measures for sound attenuation may include:

- Multi-pane glass
- Double brick veneer”

“To ensure that provincial sound level limits are not exceeded it is important to maintain sound attenuation features.”

“This dwelling unit has also been designed with the provision for adding central air conditioning at the occupant’s discretion. Installation of central air conditioning will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the City and the Ministry of the Environment”

Type 4

“Purchasers/tenants are advised that sound levels due to increasing road traffic may occasionally interfere with some outdoor activities as the sound levels may exceed the sound level limits of the City and Ministry of the Environment.”

“To help address the need for sound attenuation this development has been designed so as to provide an outdoor amenity area and indoor environment that is within provincial guidelines. Measures for sound attenuation may include:

- Multi-pane glass
- Double brick veneer
- High sound transmission class walls”

“To ensure that provincial sound level limits are not exceeded it is important to maintain sound attenuation features.”

“This dwelling unit has also been supplied with a central air conditioning system and other measures 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 City and the Ministry of the Environment”

For units with multiple types of warning clauses, similar/identical wording can be combined as to not duplicate wording/information. Specific warning clauses will be identified for each unit during detailed design.

3.7 Summary of Noise Attenuation Requirements

Table 1 summarizes the required noise attenuation measures and warning clauses should sound criteria be exceeded. Excerpts from the MOE NPC-300 and City of Ottawa ENCG documents are included in **Appendix A** for reference.

Table 1: Noise Attenuation Measure Requirements

Assessment Location	L _{eq} (dBA)	Outdoor Control Measures	Indoor Control Measures		Warning Clause
			Ventilation Requirements	Building Components	
Outdoor Living Area (OLA)	Less than 55	None required	N/A	N/A	None required
	Between 55 and 60	Control measures (barriers) may not be required but should be considered	N/A	N/A	Required if resultant L _{eq} exceeds 55 dBA Type 1* or Type 2**
	More than 60	Barriers required	N/A	N/A	Required if resultant L _{eq} exceeds 55 dBA Type 1* or Type 2*
Plane of Living Room Window (POW)	Less than 55	N/A	None Required	None Required	None Required
	Between 55 and 65	N/A	Forced air heating with provision for central air conditioning	None Required	Required Type 3
	More Than 65	N/A	Central Air Conditioning	Acoustical performance of the windows and walls should be specified	Required Type 4
Plane of Bedroom Window (POW)	Less than 50	N/A	None Required	None Required	None Required
	Between 50 and 60	N/A	Forced air heating with provision for central air conditioning	None Required	Required Type 3
	More than 60	N/A	Central Air Conditioning	Acoustical performance of the windows and walls should be specified	Required Type 4

*Type 1 warning clause refers to units requiring a noise barrier that mitigates noise below 55dBA.

**Type 2 warning clause refers to units requiring a noise barrier, but is technically or economically not feasible to reduce levels below 55dBA and a tolerance of up to 5dBA can be granted by the City.

4.0 PREDICTION OF OUTDOOR NOISE LEVELS

4.1 Roadway Traffic

Noise levels from Klondike Road and Sandhill Road were assessed using the ultimate road (as per the 2031 Affordable Network Plan in the TMP) and traffic parameters below from “Appendix B of the City of Ottawa’s Environmental Noise Control Guidelines, 2016”. The posted speed is consistent with the current conditions fronting the Subject Site. The traffic and roadway parameters used for sound level predictions are shown in Table 2.

Table 2: Traffic and Roadway Parameters

	Klondike Road	Sandhill Road
Roadway Classification	2-Lane Urban Collector	2-Lane Urban Collector
Annual Average Daily Traffic (AADT)	8,000 vehicles/day	8,000 vehicles/day
Day/Night Split (%)	92/8	92/8
Medium Trucks (%)	7	7
Heavy Trucks (%)	5	5
Posted Speed	50 km/hr	40 km/hr

For reference, excerpts from the ENCG confirming the Klondike Road and Sandhill Road AADT are included in **Appendix A**.

4.2 Noise Level Analysis

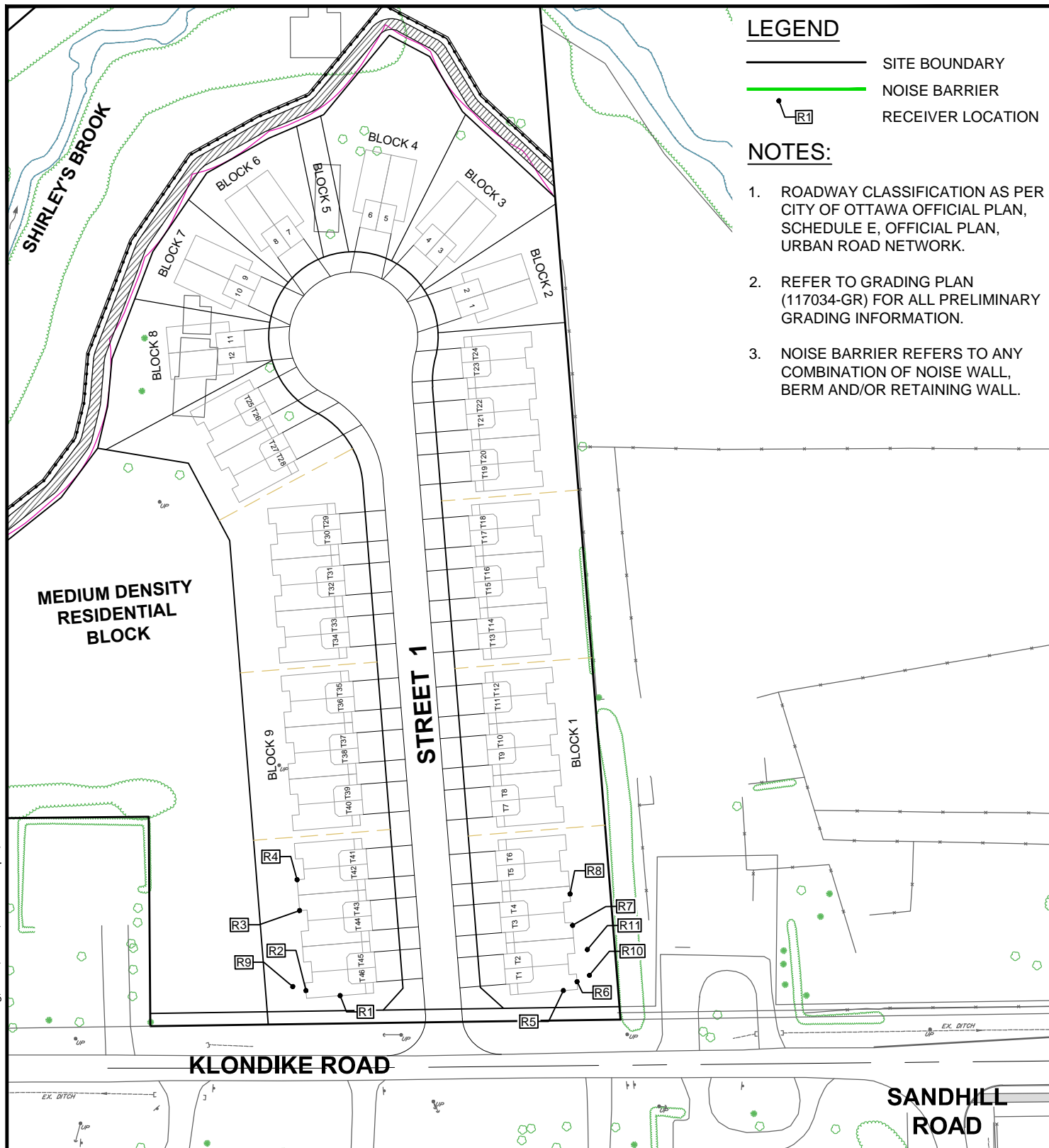
The noise levels were analyzed using Version 5.03 of the STAMSON computer program issued by the MOE. Proposed grades were required for the software and were obtained from preliminary elevations on the Grading Plan (117034-GR), which has been included in **Appendix C** of this report.

Receiver locations used in the noise simulations are shown on **Figure 3 – Receiver Location Plan**.

4.3 Noise Level Results

Simulated noise levels for the units adjacent to Klondike Road and Sandhill Road exceed the allowable noise level criteria, resulting in the requirement for outdoor noise mitigation (noise barriers) and indoor noise mitigation, which may include the installation of forced air ventilation with provision for central air conditioning and warning clauses. The building façade analysis, specific warning clauses and other indoor mitigation details will be confirmed as part of the detailed design.

The predicted noise levels and mitigated noise levels at the selected receiver locations within the development are illustrated in **Table 3**.



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CITY OF OTTAWA
1055 KLONDIKE ROAD

NOISE RECEIVER
LOCATION PLAN

SCALE 1 : 1250

DATE JULY 2019 JOB 117034 FIGURE FIG-3

Table 3: Simulation Results – Outdoor Living Areas

Receiver Location*	File	Calculated Noise Level (dBa) 7:00-23:00		Outdoor Mitigation Method**
		Un-attenuated	Attenuated	
R9	R9.te / R9W.te	61.91	54.99	2.2m Barrier
R10	R10.te / R10W.te	61.01	56.24	2.2m Barrier
R11	R11.te / R11W.te	58.12	54.18	2.2m Barrier

*Locations correspond to receivers found on Figure 3 – Noise Receiver Location Plan

**Barrier height is any combination of noise wall, berm, and/or retaining wall

Since the noise barriers are required to tie into the existing surrounding lands, barrier heights are in reference to the total barrier height above existing ground.

Figures in **Appendix B** show angles and distances used in the detailed modeling calculations. The noise levels for all receiver locations generated from STAMSON are listed in **Table 3** with detailed modeling results in **Appendix B**.

Most of the Subject Site has been oriented to minimize the noise effects from Klondike Road and Sandhill Road with only side yards exposed on the end units against Klondike Road. As a result, only OLAs within close proximity to Klondike Road and Sandhill Road require noise mitigation as units further away have significant shielding.

The predicted daytime and nighttime noise levels and required mitigation for the Plane of Window are shown in **Table 4**.

Table 4: Simulation Results – Plane of Window

Receiver Location*	File	Calculated Noise Level 7:00-23:00 (dBa)	Calculated Noise Level 23:00-7:00 (dBa)	Mitigation Method**
		Un-attenuated	Un-attenuated	
R1	R1.te	63.39	56.00	Indoor Mitigation Required** Warning Clauses
R2	R2.te	60.26	52.8	Indoor Mitigation Required** Warning Clauses
R3	R3.te	55.16	48.06	Indoor Mitigation Required** Warning Clauses
R4	R4.te	53.87	46.84	-
R5	R5.te	63.36	55.98	Indoor Mitigation Required** Warning Clauses
R6	R6.te	59.25	51.96	Indoor Mitigation Required** Warning Clauses
R7	R7.te	55.73	48.65	Indoor Mitigation Required** Warning Clauses
R8	R8.te	54.36	47.36	-

*Locations correspond to receivers found on Figure 3 – Noise Receiver Location Plan

**Indoor mitigation refers to either the installation of forced air ventilation or air conditioning and a building façade analysis.

Figures in **Appendix B** show angles used in the detailed modeling calculations. The noise levels for all receiver locations generated from STAMSON are listed in **Table 4** with detailed modeling results in **Appendix B**.

Indoor mitigation requirements and specific warning clauses will be completed as part of the detailed design as stated in Part 4, Section 3.2 of the ENCG.

For units requiring a building façade analysis during detailed design, when the floor layouts are finalized, the AIF values can be verified to ensure the appropriate window and wall type assemblies are installed to mitigate the predicted noise levels. However, based on past experience, the minimum window and wall type assemblies required by the Ontario Building Code (OBC) will be sufficient to mitigate the indoor noise levels below the City's criteria for most of the site.

Refer to **Figure 4 – Noise Attenuation Measures Plan** for locations and details of required mitigation.

5.0 CONCLUSIONS

An analysis of the roadway traffic along Klondike Road and Sandhill Road indicates attenuation measures will be necessary for the Subject Site.

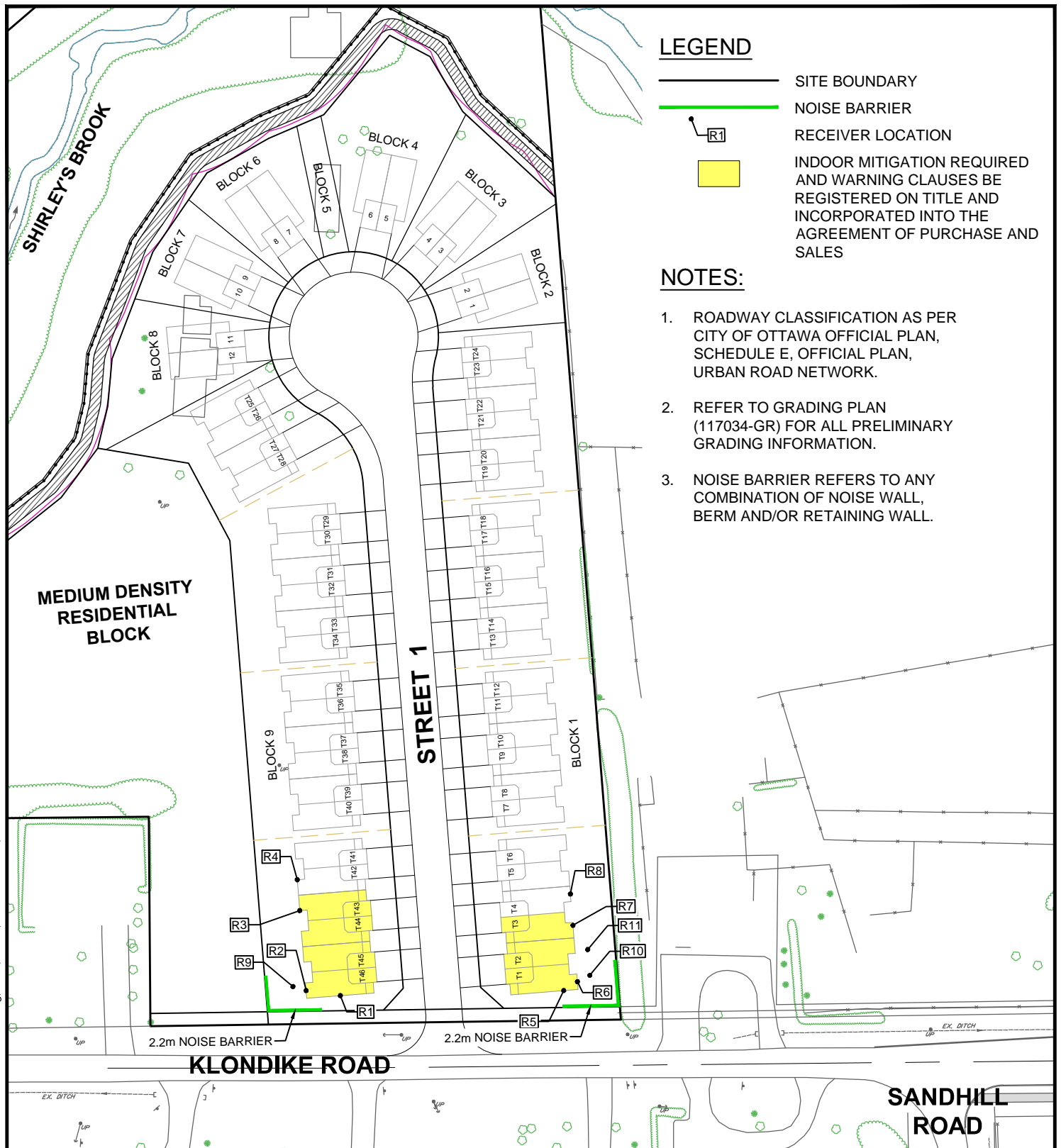
The following is a summary of the attenuation measures and notice requirements to be placed on title for the following units. Lot and Block numbers correspond to **Figure 2 – Concept Plan**:

Residential – Lots 1 and 46

- Installation of a 2.2m Noise Barrier

Residential – Lots 1-3 and 43-46

- Indoor noise mitigation required (may include the installation of forced air ventilation or air conditioning and a building façade analysis). To be confirmed during detailed design;
- Warning Clauses Required, to be confirmed during detailed design.



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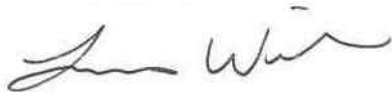
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In closing, Novatech respectfully requests the City of Ottawa accept the findings of this Noise Impact Feasibility Report for 1055 Klondike Road as part of the Draft Plan of Subdivision Approval submission.

NOVATECH

Authored by:



Lucas Wilson, P.Eng.
Project Coordinator

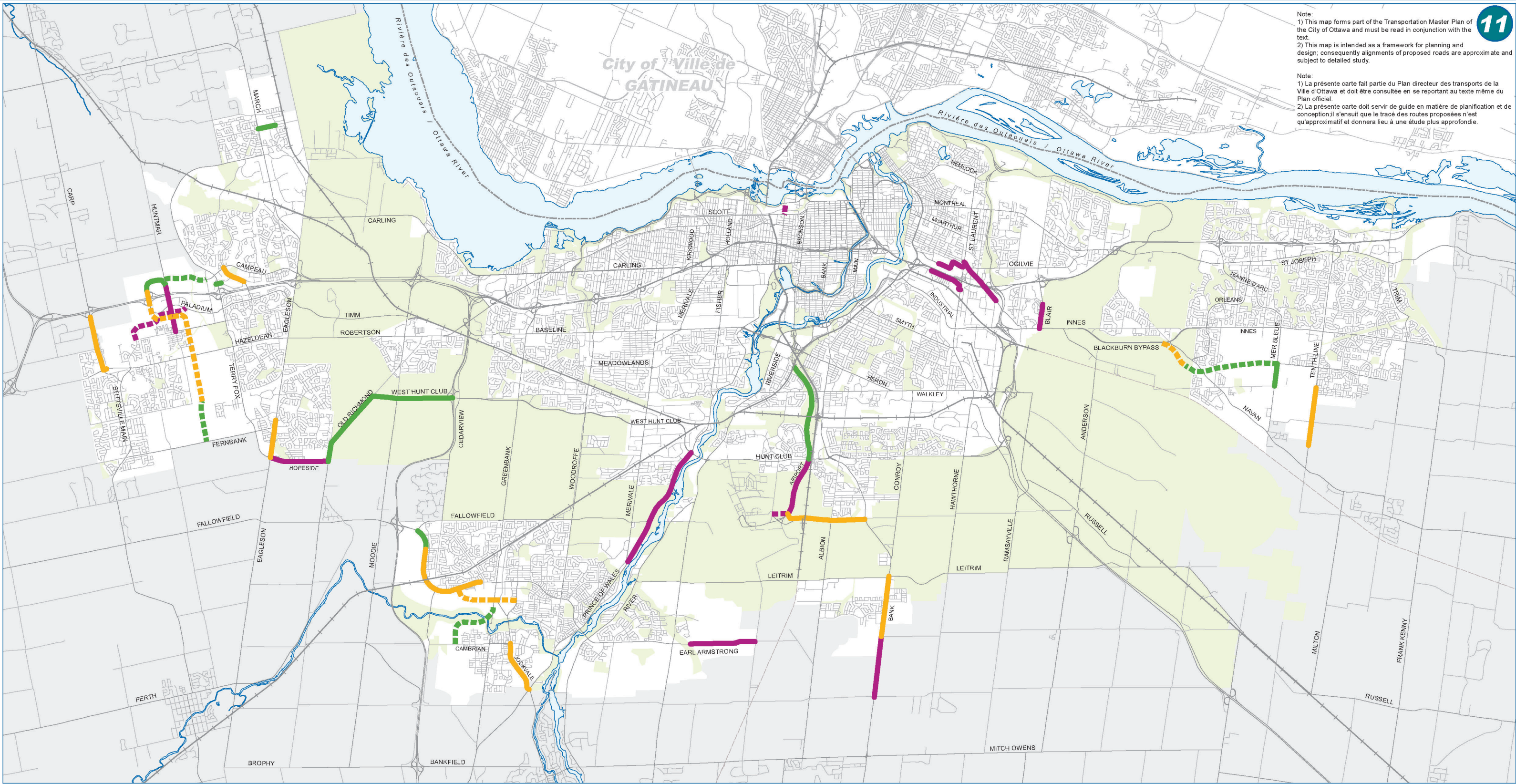
Reviewed by:



Mark Bissett, P.Eng.
Senior Project Manager

APPENDIX A


EXCERPTS FROM THE CITY OF OTTAWA ENVIRONMENTAL NOISE CONTROL GUIDELINES, THE MOE'S NPC-300, THE CITY OF OTTAWA'S TRANSPORTATION MASTER PLAN AND OFFICIAL PLAN



11

Note:
1) This map forms part of the Transportation Master Plan of the City of Ottawa and must be read in conjunction with the text.
2) This map is intended as a framework for planning and design; consequently alignments of proposed roads are approximate and subject to detailed study.

Note:
1) La présente carte fait partie du Plan directeur des transports de la Ville d'Ottawa et doit être consultée en se reportant au texte même du Plan officiel.
2) La présente carte doit servir de guide en matière de planification et de conception; il s'ensuit que le tracé des routes proposées n'est qu'approximatif et donnera lieu à une étude plus approfondie.



1 0.5 0 1 2 3

km

Prepared by: Planning and Growth Management Department,
Mapping & Graphics Unit, 2015 Revision
Préparé par: Service de l'urbanisme et de la gestion de la
croissance, Unité de la cartographie et des graphiques, Révision 2015

Phase 1 (2014 - 2019) Widening


Phase 1 (2014 - 2019) New Road


Phase 2 (2020 - 2025) Widening


Phase 2 (2020 - 2025) New Road


Phase 3 (2026 - 2031) Widening


Phase 3 (2026 - 2031) New Road














Phase 1 (2014 - 2019) Élargissement

Phase 1 (2014 - 2019) Nouvelle route

Phase 2 (2020 - 2025) Élargissement

Phase 2 (2020 - 2025) Nouvelle route

Phase 3 (2026 - 2031) Élargissement

Phase 3 (2026 - 2031) Nouvelle route

TRANSPORTATION MASTER PLAN - Map 11

ROAD NETWORK – 2031 AFFORDABLE NETWORK

PLAN DIRECTEUR DES TRANSPORTS - Carte 11

RÉSEAU ROUTIER - RÉSEAU ABORDABLE 2031

ENVIRONMENTAL NOISE CONTROL GUIDELINES: Introduction and Glossary

January 2016

Table 2.2a: Sound Level Limit for Outdoor Living Areas - Road and Rail

(from NPC-300, 2013 Table C-1)

Time Period	Required Leq (16) (dBA)
16-hour, 07:00 – 23:00	55

Table 2.2b: Sound Level Limit for Indoor Living Areas Road and Rail

(from NPC-300, 2013 Table C-2)

Type of Space	Time Period	Required Leq (dBA)	
		Road	Rail
Living/dining, den areas of residences, hospitals, nursing homes, schools, daycare centres, etc.	07:00 – 23:00	45	40
Living/dining, den areas of residences, hospitals, nursing homes, etc. (except schools or daycare centres)	23:00 – 07:00	45	40
Sleeping quarters	07:00 – 23:00	45	40
	23:00 – 07:00	40	35

The Province also provides for supplementary indoor sound level limits for land uses not generally considered noise sensitive (see Table 2.2c below). These good practice design objectives should be addressed in any noise study prepared for the City. These supplementary sound level limits are based on the windows and doors to an indoor space being closed.

Table 2.2c: Supplementary Sound Level Limits for Indoor Spaces - Road and Rail (adapted from NPC-300 Table C-9)

Type of Space	Time Period	Required Leq (dBA)	
		Road	Rail
General offices, reception areas, retail stores, etc.	16 hours between 07:00 – 23:00	50	45
Theatres, places of worship, libraries, individual or semi-private offices, conference rooms, reading rooms, etc.	16 hours between 07:00 – 23:00	45	40
Sleeping quarters of hotels/motels	8 hours between 23:00 – 07:00	45	40
Sleeping quarters of residences, hospitals, nursing/retirement homes, etc.	8 hours between 23:00 – 07:00	40	35

Appendix B: Table of Traffic and Road Parameters To Be Used For Sound Level Predictions

Table B1 Traffic And Road Parameters To Be Used For Sound Level Predictions

Row Width (m)	Implied Roadway Class	AADT Vehicles/Day	Posted Speed Km/Hr	Day/Night Split %	Medium Trucks %	Heavy Trucks % ¹
NA ²	Freeway, Queensway, Highway	18,333 per lane	100	92/8	7	5
37.5-44.5	6-Lane Urban Arterial-Divided (6-UAD)	50,000	50-80	92/8	7	5
34-37.5	4-Lane Urban Arterial-Divided (4-UAD)	35,000	50-80	92/8	7	5
23-34	4-Lane Urban Arterial-Undivided (4-UAU)	30,000	50-80	92/8	7	5
23-34	4-Lane Major Collector (4-UMCU)	24,000	40-60	92/8	7	5
30-35.5	2-Lane Rural Arterial (2-RAU)	15,000	50-80	92/8	7	5
20-30	2-Lane Urban Arterial (2-UAU)	15,000	50-80	92/8	7	5
20-30	2-Lane Major Collector (2-UMCU)	12,000	40-60	92/8	7	5
30-35.5	2-Lane Outer Rural Arterial (near the extremities of the City) (2-RAU)	10,000	50-80	92/8	7	5
20-30	2-Lane Urban Collector (2-UCU)	8,000	40-50	92/8	7	5

¹ The MOE Vehicle Classification definitions should be used to estimate automobiles, medium trucks and heavy trucks.

² The number of lanes is determined by the future mature state of the roadway.

Environmental Noise Guideline

Stationary and Transportation Sources –
Approval and Planning

Publication NPC-300

Table C-10
Supplementary Indoor Aircraft Noise Limits
(Applicable over 24-hour period)

Type of Space	Indoor NEF/NEP*
General offices, reception areas, retail stores, etc.	15
Individual or semi-private offices, conference rooms, etc.	10
Living/dining areas of residences, sleeping quarters of hotels/motels, theatres, libraries, schools, daycare centres, places of worship, etc.	5
Sleeping quarters of residences, hospitals, nursing/retirement homes, etc.	0

* The indoor NEF/NEP values listed in Table C-10 are not obtained from NEF/NEP contour maps. The values are representative of the indoor sound levels and are used as assessment criteria for the evaluation of acoustical insulation requirements.

C7 Noise Control Measures

The following sections provide MOE guidance for appropriate noise control measures. These sections constitute requirements that are applied to MOE approvals for stationary sources. This information is also provided as guidance which land use planning authorities may consider adopting.

The definition in Part A describes the various types and application of noise control measures. All the noise control measures described in the definition are appropriate to address the impact of noise of transportation sources (road, rail and aircraft) on planned sensitive land uses. Only some of the noise control measures described in the definition are appropriate to address the noise impact of stationary sources on planned sensitive land uses.

C7.1 Road Noise Control Measures

C7.1.1 Outdoor Living Areas

If the 16-Hour Equivalent Sound Level, $L_{eq}(16)$ in the OLA is greater than 55 dBA and less than or equal to 60 dBA, noise control measures may be applied to reduce the sound level to 55 dBA. If measures are not provided, prospective purchasers or tenants should be informed of potential noise problems by a warning clause Type A.

If the 16-Hour Equivalent Sound Level, $L_{eq}(16)$ in the OLA is greater than 60 dBA, noise control measures should be implemented to reduce the level to 55 dBA. Only in cases where the required noise control measures are not feasible for technical, economic or administrative reasons would an excess above the limit (55 dBA) be acceptable with a warning clause Type B. In the above situations, any excess above the limit will not be acceptable if it exceeds 5 dBA.

C7.1.2 Plane of a Window – Ventilation Requirements

C7.1.2.1 Daytime Period, 07:00 – 23:00 Hours

Noise control measures may not be required if the L_{eq} (16) daytime sound level in the plane of a bedroom or living/dining room window is less than or equal to 55 dBA. If the sound level in the plane of a bedroom or living/dining room window is greater than 55 dBA and less than or equal to 65 dBA, the dwelling should be designed with a provision for the installation of central air conditioning in the future, at the occupant's discretion. Warning clause Type C is also recommended.

If the daytime sound level in the plane of a bedroom or living/dining room window is greater than 65 dBA, installation of central air conditioning should be implemented with a warning clause Type D. In addition, building components including windows, walls and doors, where applicable, should be designed so that the indoor sound levels comply with the sound level limits in Table C-2. The location and installation of the outdoor air conditioning device should comply with sound level limits of Publication NPC-216, Reference [32], and guidelines contained in Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices, Reference [6], or should comply with other criteria specified by the municipality.

C7.1.2.2 Nighttime Period, 23:00 – 07:00 Hours

Noise control measures may not be required if the L_{eq} (8) nighttime sound level in the plane of a bedroom or living/dining room window is less than or equal to 50 dBA. If the sound level in the plane of a bedroom or living/dining room window is greater than 50 dBA and less than or equal to 60 dBA, the dwelling should be designed with a provision for the installation of central air conditioning in the future, at the occupant's discretion. Warning clause Type C is also recommended.

If the nighttime sound level in the plane of a bedroom or living/dining room window is greater than 60 dBA, installation of central air conditioning should be implemented, with a warning clause Type D. In addition, building components including windows, walls and doors, where applicable, should be designed so that the indoor sound levels comply with the sound level limits in Table C-2. The location and installation of the outdoor air conditioning device should comply with sound level limits of Publication NPC-216, Reference [32], and guidelines contained in Environmental Noise Guidelines for Installation of Residential Air Conditioning Devices, Reference [6], or should comply with other criteria specified by the municipality.

C7.1.3 Indoor Living Areas – Building Components

If the nighttime sound level outside the bedroom or living/dining room windows exceeds 60 dBA or the daytime sound level outside the bedroom or living/dining area windows exceeds 65 dBA, building components including windows, walls and doors, where applicable, should be designed so that the indoor sound levels comply with the

sound level limits in Table C-2. The acoustical performance of the building components (windows, doors and walls) should be specified.

C7.2 Rail Noise Control Measures

C7.2.1 Outdoor Living Areas

Whistle noise is not included in the determination of the outdoor daytime sound level due to railway trains. All the provisions of Section C7.1.1 apply also to noise control requirements for rail noise.

C7.2.2 Plane of a Window – Ventilation Requirements

Whistle noise is not included in the determination of the sound level in the plane of a window. All the provisions of Section C7.1.2 apply also to noise control requirements for rail noise.

C7.2.3 Indoor Living Areas – Building Components

The sound level, L_{eq} , during the daytime (16-hour) and nighttime (8-hour) periods is determined using the prediction method STEAM, Reference [34], immediately outside the dwelling envelope. Whistle noise is included in the determination of the sound level.

If the nighttime sound level outside the bedroom or living/dining room windows exceeds 55 dBA or the daytime sound level outside the bedroom or living/dining area windows exceeds 60 dBA, building components including windows, walls and doors, where applicable, need to be designed so that the indoor sound levels comply with the sound level limits in Table C-2. The acoustical performance of the building components (windows, doors and walls) needs to be specified.

In addition, the exterior walls of the first row of dwellings next to railway tracks are to be built to a minimum of brick veneer or masonry equivalent construction, from the foundation to the rafters when the rail traffic L_{eq} (24-hour), estimated at a location of a nighttime receptor, is greater than 60 dBA, and when the first row of dwellings is within 100 metres of the tracks.

C7.3 Combination of Road and Rail Noise

The noise impact in the OLA and in the plane of a window, and the requirements for outdoor measures, ventilation measures and warning clauses, should be determined by combining road and rail traffic sound levels.

The assessment of the indoor sound levels and the resultant requirement for the acoustical descriptors of the building components should be done separately for road

In Class 4 areas, where windows for noise sensitive spaces are assumed to be closed, the use of central air conditioning may be acceptable if it forms an essential part of the overall building designs.

C7.9 Verification of Noise Control Measures

It is recommended that the implementation of noise control measures be verified by qualified individuals with experience in environmental acoustics.

C8 Warning Clauses

The use of warning clauses or easements in respect of noise are recommended when circumstances warrant. Noise warning clauses may be used to warn of potential annoyance due to an existing source of noise and/or to warn of excesses above the sound level limits. Direction on the use of warning clauses should be included in agreements that are registered on title to the lands in question. The warning clauses would be included in agreements of Offers of Purchase and Sale, lease/rental agreements and condominium declarations. Alternatively, the use of easements in respect of noise may be appropriate in some circumstances. Additional guidance on the use of noise warning clauses is provided in Section C7.1.1, Section C7.1.2.1, Section C7.1.2.2, Section C7.3 and Section C7.4.

C8.1 Transportation Sources

The following warning clauses may be used individually or in combination:

TYPE A: (see Section C7.1.1)

“Purchasers/tenants are advised that sound levels due to increasing road traffic (rail traffic) (air traffic) may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the Municipality and the Ministry of the Environment.”

TYPE B: (see Section C7.1.1 and Section C7.4)

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

TYPE C: (see Section C7.1.2.1, Section C7.1.2.2 and Section C7.4)

“This dwelling unit has been designed with the provision for adding central air conditioning at the occupant’s discretion. Installation of

central air conditioning by the occupant in low and medium density developments will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and the Ministry of the Environment.”

TYPE D: (see Section C7.1.2.1, Section C7.1.2.2 and Section C7.4)

“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.”

C8.2 Stationary Sources

It is not acceptable to use warning clauses in place of physical noise control measures to identify an excess over the MOE sound level limits. Warning clause (Type E) for stationary sources may identify a potential concern due to the proximity of the facility but it is not acceptable to justify exceeding the sound level limits.

TYPE E: (see Section C7.6)

“Purchasers/tenants are advised that due to the proximity of the adjacent industry (facility) (utility), noise from the industry (facility) (utility) may at times be audible.”

C8.3 Class 4 Area Notification

TYPE F: (see Section B9.2 and Section C4.4.2)

“Purchasers/tenants are advised that sound levels due to the adjacent industry (facility) (utility) are required to comply with sound level limits that are protective of indoor areas and are based on the assumption that windows and exterior doors are closed. This dwelling unit has been supplied with a ventilation/air conditioning system which will allow windows and exterior doors to remain closed.”

Appendix A: Warning Clauses

Under the Official Plan and this guideline warning clauses may be required to be incorporated into development through development agreements, registration on title and inclusion in Agreements of Purchase and Sale. This requirement may be included in any development, regardless of whether it is considered a noise sensitive land use.

A warning clause provides recognition for the City, Province landowner or tenants that noise may be a concern, that noise may be audible at times or even quite loud, and, depending on the type of development, provincial guidelines for noise may be exceeded. Warning clauses also recognize that environmental noise is a potential health hazard that does impact people and neighbourhoods. It is for this reason that, unless a non-noise sensitive land use is established, a warning clause should also include noise mitigation.

A warning clause is not considered a form of noise mitigation. It is not acceptable therefore to use warning clauses in place of physical noise control measures to identify an excess over the MOE or City noise limits. The reason for a warning clause on all development is twofold. Firstly, it is important to note that a land use that although the development may not be considered noise sensitive it may include employees or tenants that are personally sensitive to noise. A warning clause provides protection against complaints to the ministry of Environment should provincial guidelines be exceeded. Secondly, a warning clause on title could obviate the need for a new noise study in the future. In a redevelopment scenario the warning clause would provide recognition of the extent noise conditions.

Given the variation in potential intensity and impact of noise it will often be necessary to amend warning clauses to recognize the site specific conditions in each development. Final wording of any warning clause is to be approved by the City.

The following subsections provide example text to be adapted into warning clauses.

Surface Transportation Warning Clauses

Table A1 Surface Transportation Warning Clauses

Type	Example	Notes
Generic	<p><i>Purchasers/tenants are advised that sound levels due to increasing road/rail/Light Rail/transitway traffic may occasionally interfere with some outdoor activities as the sound levels may exceed the sound level limits of the City and the Ministry of the Environment.</i></p> <p><i>To help address the need for sound attenuation this development has been designed so as to provide an outdoor amenity area that is within provincial guidelines. Measures for sound attenuation include:</i></p> <ul style="list-style-type: none"> <i>• A setback of buildings from the noise source and</i> <i>• An acoustic barrier.</i> <p><i>To ensure that provincial sound level limits are not exceeded it is important to maintain sound attenuation features.</i></p> <p><i>The acoustic barrier shall be maintained and kept in good repair by the property owner. Any maintenance, repair or replacement is the responsibility of the owner and shall be with the same material or to the same standards, having the same colour, appearance and function of the original.</i></p> <p><i>Additionally this development includes trees and shrubs to screen the source of noise from occupants.</i></p>	<p>The generic warning clause outlines that MOE sound levels may be exceeded but the indoor environment and outdoor amenity areas are within guidelines.</p> <p>Mitigation measures are described including urban design features.</p> <p>Mention is also made of landscaping to screen the development visually from the source of noise.</p>
Extensive mitigation of indoor and	<p><i>“Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units,</i></p>	<p>The warning clause makes reference to MOE sound levels</p>

Table A1 Surface Transportation Warning Clauses

Type	Example	Notes
outdoor amenity area	<p><i>sound levels due to increasing road/rail/Light Rail/transitway traffic may, on occasion, interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits of the City and the Ministry of the Environment.</i></p> <p><i>To help address the need for sound attenuation this development includes:</i></p> <ul style="list-style-type: none"> • <i>multi-pane glass;</i> • <i>double brick veneer;</i> • <i>an earth berm; and</i> • <i>an acoustic barrier.</i> <p><i>To ensure that provincial sound level limits are not exceeded it is important to maintain these sound attenuation features.</i></p> <p><i>The acoustic barrier shall be maintained and kept in good repair by the property owner. Any maintenance, repair or replacement is the responsibility of the owner and shall be with the same material or to the same standards, having the same colour, appearance and function of the original.</i></p> <p><i>This dwelling unit has also been designed with the provision for adding central air conditioning at the occupant's discretion. Installation of central air conditioning will allow windows and exterior doors to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the City and the Ministry of the Environment.</i></p>	<p>being exceeded from time to time and that there are sound attenuation features and landscaping within the development that should be maintained.</p> <p>An option for air conditioning is noted as well as landscaping to screen the source of noise.</p>

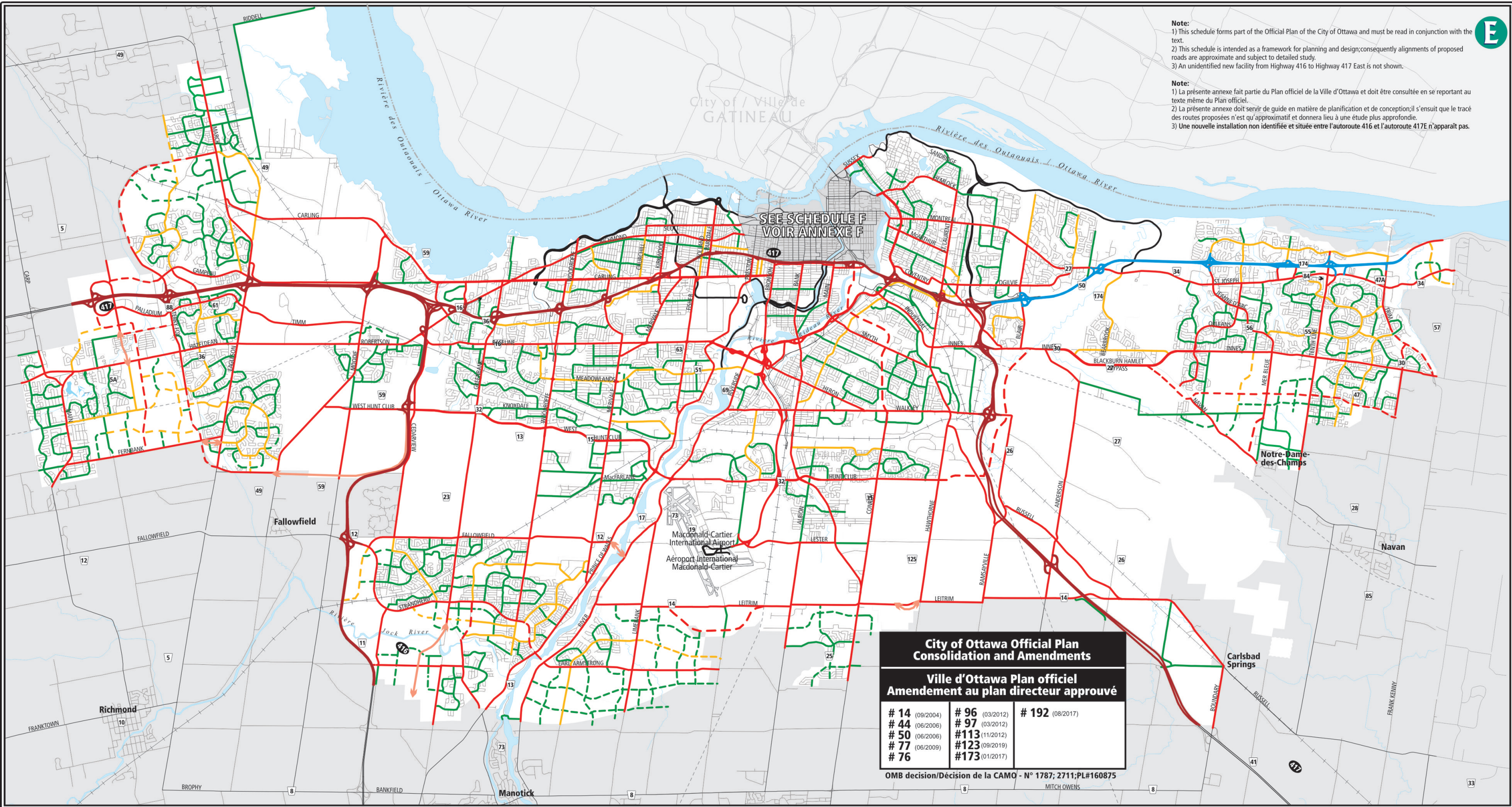
Table A1 Surface Transportation Warning Clauses

Type	Example	Notes
	<i>Additionally this development includes trees and shrubs to screen the source of noise from occupants.</i>	
No outdoor amenity area	<p><i>Purchasers/tenants are advised that sound levels due to increasing road/rail/Light Rail/transitway traffic will interfere with outdoor activities as the sound levels exceed the sound level limits of the City and the Ministry of the Environment.</i></p> <p><i>To help address the need for sound attenuation this development includes:</i></p> <ul style="list-style-type: none"> • multi-pane glass; • double brick veneer; • high sound transmission class walls. <p><i>To ensure that provincial sound level limits are not exceeded it is important to maintain these sound attenuation features.</i></p> <p><i>This dwelling unit has been supplied with a central air conditioning system and other measures 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 City and the Ministry of the Environment</i></p>	This warning clause notes that only an indoor environment is being provided for.

Stationary Source Warning Clauses

The Province notes that it is not acceptable to use warning clauses in place of physical noise control measures to identify an excess over the MOE sound level limits for stationary sources. The generic warning clause for stationary sources (called Type E in NPC-300) may identify a potential concern due to the proximity of the facility but it is not possible to justify exceeding the sound level limits.

The wording of the generic stationary noise warning clause may also be used as the basis for new development adjacent to areas licensed for mineral aggregate extraction.



Note:
1) This schedule forms part of the Official Plan of the City of Ottawa and must be read in conjunction with the text.
2) This schedule is intended as a framework for planning and design; consequently alignments of proposed roads are approximate and subject to detailed study.
3) An unidentified new facility from Highway 416 to Highway 417 East is not shown.

Note:
1) La présente annexe fait partie du Plan officiel de la Ville d'Ottawa et doit être consultée en se reportant au texte même du Plan officiel.
2) La présente annexe doit servir de guide en matière de planification et de conception; il s'ensuit que le tracé des routes proposées n'est qu'approximatif et donnera lieu à une étude plus approfondie.
3) Une nouvelle installation non identifiée et située entre l'autoroute 416 et l'autoroute 417E n'apparaît pas.

SEE SCHEDULE F
VOIR ANNEXE F

City of Ottawa Official Plan Consolidation and Amendments		
Ville d'Ottawa Plan officiel Amendement au plan directeur approuvé		
# 14 (09/2004)	# 96 (03/2012)	# 192 (08/2017)
# 44 (06/2006)	# 97 (03/2012)	
# 50 (06/2006)	# 113 (11/2012)	
# 77 (06/2009)	# 123 (09/2019)	
# 76	# 173 (01/2017)	

OMB decision/Décision de la CAMO - N° 1787; 2711; PL#160875

**Official Plan - Schedule E
Urban Road Network**
**Plan officiel - Annexe E
Routes Arterial - Urbain**

Prepared by: Planning and Growth Management Department, Mapping & Graphics Unit

Préparé par : Service de l'urbanisme et de la gestion de la croissance, Unité de la cartographie et des graphiques

- Provincial Highway

City Freeway

Federally Owned Road

Existing

Proposed

(Alignment defined)
- Route provinciale

Autoroute de ville

Chemins de propriété fédéral

Établie

Proposé

(Alignement déterminée)

- Arterials

Existing

Proposed

(Alignment Defined)

Conceptual

(Alignment Undefined)
- Artère

Établie

Proposé

(Alignement déterminée)

Conceptuelle

(Alignement à déterminer)

- Major Collectors

Existing

Proposed
- Grande collectrice

Établie

Proposé
- Collectors

Existing

Proposed
- Collectrice

Établie

Proposé

APPENDIX B

SOUND LEVEL CALCULATIONS

- Model Results
- Stamson Modelling Angle Figures

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

Road data, segment # 1: Klondike (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: Klondike (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 : 17.00 / 17.00 m
Receiver height      : 1.50 / 4.50 m
Topography          : 1          (Flat/gentle slope; no barrier)
Reference angle      : 0.00
```

Results segment # 1: Klondike (day)

Source height = 1.50 m

ROAD (0.00 + 63.39 + 0.00) = 63.39 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	65.75	0.00	-0.90	-1.46	0.00	0.00	0.00	63.39

Segment Leq : 63.39 dBA

Total Leq All Segments: 63.39 dBA

Results segment # 1: Klondike (night)

Source height = 1.50 m

ROAD (0.00 + 56.00 + 0.00) = 56.00 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.57	58.16	0.00	-0.85	-1.30	0.00	0.00	0.00	56.00

Segment Leq : 56.00 dBA

Total Leq All Segments: 56.00 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.39
 (NIGHT): 56.00

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

Road data, segment # 1: R2 (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: R2 (day/night)

 Angle1 Angle2 : -5.00 deg 90.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 18.08 / 18.08 m
 Receiver height : 1.50 / 4.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00

Results segment # 1: R2 (day)

 Source height = 1.50 m

ROAD (0.00 + 60.26 + 0.00) = 60.26 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-5	90	0.66	65.75	0.00	-1.35	-4.14	0.00	0.00	0.00	60.26

Segment Leq : 60.26 dBA

Total Leq All Segments: 60.26 dBA

Results segment # 1: R2 (night)

 Source height = 1.50 m

ROAD (0.00 + 52.88 + 0.00) = 52.88 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-5	90	0.57	58.16	0.00	-1.27	-4.00	0.00	0.00	0.00	52.88

Segment Leq : 52.88 dBA

Total Leq All Segments: 52.88 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 60.26
 (NIGHT): 52.88

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

Road data, segment # 1: R2 (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: R2 (day/night)

```
-----
Angle1  Angle2      : -5.00 deg  90.00 deg
Wood depth          : 0          (No woods.)
No of house rows    : 0 / 0
Surface             : 1          (Absorptive ground surface)
Receiver source distance : 36.66 / 36.66 m
Receiver height      : 1.50 / 4.50 m
Topography          : 1          (Flat/gentle slope; no barrier)
Reference angle      : 0.00
```

Results segment # 1: R2 (day)

Source height = 1.50 m

ROAD (0.00 + 55.16 + 0.00) = 55.16 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-5	90	0.66	65.75	0.00	-6.44	-4.14	0.00	0.00	0.00	55.16

Segment Leq : 55.16 dBA

Total Leq All Segments: 55.16 dBA

Results segment # 1: R2 (night)

Source height = 1.50 m

ROAD (0.00 + 48.06 + 0.00) = 48.06 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-5	90	0.57	58.16	0.00	-6.09	-4.00	0.00	0.00	0.00	48.06

Segment Leq : 48.06 dBA

Total Leq All Segments: 48.06 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 55.16
 (NIGHT): 48.06

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

Road data, segment # 1: R2 (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: R2 (day/night)

```
-----
Angle1  Angle2      : -5.00 deg  90.00 deg
Wood depth          : 0          (No woods.)
No of house rows    : 0 / 0
Surface             : 1          (Absorptive ground surface)
Receiver source distance : 43.85 / 43.85 m
Receiver height     : 1.50 / 4.50 m
Topography          : 1          (Flat/gentle slope; no barrier)
Reference angle     : 0.00
```

Results segment # 1: R2 (day)

Source height = 1.50 m

ROAD (0.00 + 53.87 + 0.00) = 53.87 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-5	90	0.66	65.75	0.00	-7.73	-4.14	0.00	0.00	0.00	53.87

Segment Leq : 53.87 dBA

Total Leq All Segments: 53.87 dBA

Results segment # 1: R2 (night)

Source height = 1.50 m

ROAD (0.00 + 46.84 + 0.00) = 46.84 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-5	90	0.57	58.16	0.00	-7.31	-4.00	0.00	0.00	0.00	46.84

Segment Leq : 46.84 dBA

Total Leq All Segments: 46.84 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 53.87
 (NIGHT): 46.84

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

Road data, segment # 1: Klondike (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: Klondike (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 : 17.25 / 17.25 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: Sandhill (day/night)

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 40 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Sandhill (day/night)

Angle1 Angle2 : 14.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 90.02 / 90.02 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Klondike (day)

Source height = 1.50 m

ROAD (0.00 + 63.29 + 0.00) = 63.29 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	65.75	0.00	-1.01	-1.46	0.00	0.00	0.00	63.29

Segment Leq : 63.29 dBA

Results segment # 2: Sandhill (day)

Source height = 1.50 m

ROAD (0.00 + 45.51 + 0.00) = 45.51 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
14	90	0.66	63.96	0.00	-12.92	-5.52	0.00	0.00	0.00	45.51

Segment Leq : 45.51 dBA

Total Leq All Segments: 63.36 dBA

Results segment # 1: Klondike (night)

Source height = 1.50 m

ROAD (0.00 + 55.90 + 0.00) = 55.90 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.57	58.16	0.00	-0.95	-1.30	0.00	0.00	0.00	55.90

Segment Leq : 55.90 dBA

Results segment # 2: Sandhill (night)

Source height = 1.50 m

ROAD (0.00 + 38.81 + 0.00) = 38.81 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
14	90	0.57	56.36	0.00	-12.22	-5.33	0.00	0.00	0.00	38.81

Segment Leq : 38.81 dBA

Total Leq All Segments: 55.98 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.36
(NIGHT): 55.98

Filename: r6.te Time Period: Day/Night 16/8 hours
Description: POW

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

Angle1 Angle2 : -90.00 deg -4.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 19.64 / 19.64 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: Sandhill (day/night)

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 40 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Sandhill (day/night)

Angle1 Angle2 : 16.00 deg 86.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 86.80 / 86.80 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Klondike (day)

Source height = 1.50 m

ROAD (0.00 + 59.06 + 0.00) = 59.06 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-4	0.66	65.75	0.00	-1.94	-4.75	0.00	0.00	0.00	59.06

Segment Leq : 59.06 dBA

Results segment # 2: Sandhill (day)

Source height = 1.50 m

ROAD (0.00 + 45.57 + 0.00) = 45.57 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
16	86	0.66	63.96	0.00	-12.66	-5.73	0.00	0.00	0.00	45.57

Segment Leq : 45.57 dBA

Total Leq All Segments: 59.25 dBA

Results segment # 1: Klondike (night)

Source height = 1.50 m

ROAD (0.00 + 51.74 + 0.00) = 51.74 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-4	0.57	58.16	0.00	-1.84	-4.58	0.00	0.00	0.00	51.74

Segment Leq : 51.74 dBA

Results segment # 2: Sandhill (night)

Source height = 1.50 m

ROAD (0.00 + 38.85 + 0.00) = 38.85 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
16	86	0.57	56.36	0.00	-11.97	-5.54	0.00	0.00	0.00	38.85

Segment Leq : 38.85 dBA

Total Leq All Segments: 51.96 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 59.25
(NIGHT): 51.96

Filename: r7.te Time Period: Day/Night 16/8 hours
Description: POW

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

Angle1 Angle2 : -90.00 deg -4.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 32.82 / 32.82 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: Sandhill (day/night)

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 40 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Sandhill (day/night)

Angle1 Angle2 : 23.00 deg 86.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 87.66 / 87.66 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Klondike (day)

Source height = 1.50 m

ROAD (0.00 + 55.36 + 0.00) = 55.36 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-4	0.66	65.75	0.00	-5.64	-4.75	0.00	0.00	0.00	55.36

Segment Leq : 55.36 dBA

Results segment # 2: Sandhill (day)

Source height = 1.50 m

ROAD (0.00 + 44.84 + 0.00) = 44.84 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
23	86	0.66	63.96	0.00	-12.73	-6.39	0.00	0.00	0.00	44.84

Segment Leq : 44.84 dBA

Total Leq All Segments: 55.73 dBA

Results segment # 1: Klondike (night)

Source height = 1.50 m

ROAD (0.00 + 48.24 + 0.00) = 48.24 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-4	0.57	58.16	0.00	-5.34	-4.58	0.00	0.00	0.00	48.24

Segment Leq : 48.24 dBA

Results segment # 2: Sandhill (night)

Source height = 1.50 m

ROAD (0.00 + 38.15 + 0.00) = 38.15 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
23	86	0.57	56.36	0.00	-12.04	-6.17	0.00	0.00	0.00	38.15

Segment Leq : 38.15 dBA

Total Leq All Segments: 48.65 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 55.73
(NIGHT): 48.65

Filename: r8.te Time Period: Day/Night 16/8 hours
Description: POW

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

Angle1 Angle2 : -90.00 deg -4.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 40.16 / 40.16 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: Sandhill (day/night)

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 40 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Sandhill (day/night)

Angle1 Angle2 : 27.00 deg 86.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 88.13 / 88.13 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Klondike (day)

Source height = 1.50 m

ROAD (0.00 + 53.90 + 0.00) = 53.90 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-4	0.66	65.75	0.00	-7.10	-4.75	0.00	0.00	0.00	53.90

Segment Leq : 53.90 dBA

Results segment # 2: Sandhill (day)

Source height = 1.50 m

ROAD (0.00 + 44.39 + 0.00) = 44.39 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
27	86	0.66	63.96	0.00	-12.77	-6.80	0.00	0.00	0.00	44.39

Segment Leq : 44.39 dBA

Total Leq All Segments: 54.36 dBA

Results segment # 1: Klondike (night)

Source height = 1.50 m

ROAD (0.00 + 46.86 + 0.00) = 46.86 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-4	0.57	58.16	0.00	-6.72	-4.58	0.00	0.00	0.00	46.86

Segment Leq : 46.86 dBA

Results segment # 2: Sandhill (night)

Source height = 1.50 m

ROAD (0.00 + 37.72 + 0.00) = 37.72 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
27	86	0.57	56.36	0.00	-12.07	-6.57	0.00	0.00	0.00	37.72

Segment Leq : 37.72 dBA

Total Leq All Segments: 47.36 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 54.36
(NIGHT): 47.36

Filename: r9.te Time Period: Day/Night 16/8 hours
Description: OLA

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

Angle1 Angle2 : -50.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 19.02 / 19.02 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Klondike (day)

Source height = 1.50 m

ROAD (0.00 + 61.91 + 0.00) = 61.91 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-50	90	0.66	65.75	0.00	-1.71	-2.13	0.00	0.00	0.00	61.91

Segment Leq : 61.91 dBA

Total Leq All Segments: 61.91 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 61.91

Filename: r9w.te Time Period: Day/Night 16/8 hours
 Description: OLA - 2.2m Wall

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

 Angle1 Angle2 : -50.00 deg 90.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0 / 0
 Surface : 1 (Absorptive ground surface)
 Receiver source distance : 19.02 / 19.02 m
 Receiver height : 1.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : -50.00 deg Angle2 : 90.00 deg
 Barrier height : 2.20 m
 Barrier receiver distance : 5.48 / 5.48 m
 Source elevation : 77.83 m
 Receiver elevation : 77.95 m
 Barrier elevation : 77.98 m
 Reference angle : 0.00

Results segment # 1: Klondike (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 !	1.43 !	79.41

ROAD (0.00 + 54.99 + 0.00) = 54.99 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----
-50	90	0.53	65.75	0.00	-1.58	-1.97	0.00	0.00	-7.21	54.99
-----	-----	-----	-----	-----	-----	-----	-----	-----	-----	-----

Segment Leq : 54.99 dBA

Total Leq All Segments: 54.99 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 54.99

Filename: r10.te Time Period: Day/Night 16/8 hours
Description: OLA

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

Angle1 Angle2 : -90.00 deg 41.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 21.05 / 21.05 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: Sandhill (day/night)

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 40 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Sandhill (day/night)

Angle1 Angle2 : 17.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 83.89 / 83.89 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Klondike (day)

Source height = 1.50 m

ROAD (0.00 + 60.88 + 0.00) = 60.88 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	41	0.66	65.75	0.00	-2.44	-2.42	0.00	0.00	0.00	60.88

Segment Leq : 60.88 dBA

Results segment # 2: Sandhill (day)

Source height = 1.50 m

ROAD (0.00 + 45.76 + 0.00) = 45.76 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
17	90	0.66	63.96	0.00	-12.41	-5.78	0.00	0.00	0.00	45.76

Segment Leq : 45.76 dBA

Total Leq All Segments: 61.01 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 61.01

Filename: r10w.te Time Period: Day/Night 16/8 hours
Description: OLA - 2.2m Wall

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

Angle1 Angle2 : -90.00 deg 41.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 21.05 / 21.05 m
Receiver height : 1.50 / 4.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 41.00 deg
Barrier height : 2.20 m
Barrier receiver distance : 7.43 / 7.43 m
Source elevation : 77.08 m
Receiver elevation : 75.63 m
Barrier elevation : 75.63 m
Reference angle : 0.00

Road data, segment # 2: Sandhill (day/night)

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 40 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Sandhill (day/night)

Angle1 Angle2 : 17.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 83.89 / 83.89 m

Receiver height : 1.50 / 4.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : 17.00 deg Angle2 : 90.00 deg
 Barrier height : 2.20 m
 Barrier receiver distance : 6.10 / 6.10 m
 Source elevation : 74.77 m
 Receiver elevation : 75.63 m
 Barrier elevation : 75.50 m
 Reference angle : 0.00

Results segment # 1: Klondike (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	!
		2.01	!
			77.64

ROAD (0.00 + 56.10 + 0.00) = 56.10 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	41	0.53	65.75	0.00	-2.25	-2.26	0.00	0.00	-5.14	56.10

Segment Leq : 56.10 dBA

Results segment # 2: Sandhill (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	!
		1.57	!
			77.07

ROAD (0.00 + 41.13 + 0.00) = 41.13 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
17	90	0.53	63.96	0.00	-11.42	-5.48	0.00	0.00	-5.92	41.13

Segment Leq : 41.13 dBA

Total Leq All Segments: 56.24 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 56.24

Filename: r11.te Time Period: Day/Night 16/8 hours
Description: OLA

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

Angle1 Angle2 : -90.00 deg 14.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 27.07 / 27.07 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Road data, segment # 2: Sandhill (day/night)

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 40 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Sandhill (day/night)

Angle1 Angle2 : 21.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 84.28 / 84.28 m
Receiver height : 1.50 / 4.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Klondike (day)

Source height = 1.50 m

ROAD (0.00 + 57.88 + 0.00) = 57.88 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	14	0.66	65.75	0.00	-4.26	-3.62	0.00	0.00	0.00	57.88

Segment Leq : 57.88 dBA

Results segment # 2: Sandhill (day)

Source height = 1.50 m

ROAD (0.00 + 45.36 + 0.00) = 45.36 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
21	90	0.66	63.96	0.00	-12.44	-6.15	0.00	0.00	0.00	45.36

Segment Leq : 45.36 dBA

Total Leq All Segments: 58.12 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 58.12

Filename: R11W.te Time Period: Day/Night 16/8 hours
Description: OLA - 2.2m Wall

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

Angle1 Angle2 : -90.00 deg 14.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 27.07 / 27.07 m
Receiver height : 1.50 / 4.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -69.00 deg Angle2 : 14.00 deg
Barrier height : 2.20 m
Barrier receiver distance : 13.43 / 13.43 m
Source elevation : 77.08 m
Receiver elevation : 75.57 m
Barrier elevation : 75.63 m
Reference angle : 0.00

Road data, segment # 2: Sandhill (day/night)

Car traffic volume : 6477/563 veh/TimePeriod *
Medium truck volume : 515/45 veh/TimePeriod *
Heavy truck volume : 368/32 veh/TimePeriod *
Posted speed limit : 40 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 8000
Percentage of Annual Growth : 0.00
Number of Years of Growth : 0.00
Medium Truck % of Total Volume : 7.00
Heavy Truck % of Total Volume : 5.00
Day (16 hrs) % of Total Volume : 92.00

Data for Segment # 2: Sandhill (day/night)

Angle1 Angle2 : 21.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0 / 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 84.28 / 84.28 m
Receiver height : 1.50 / 4.50 m
Topography : 2 (Flat/gentle slope; with barrier)

Barrier angle1 : 21.00 deg Angle2 : 90.00 deg
 Barrier height : 2.20 m
 Barrier receiver distance : 6.40 / 6.40 m
 Source elevation : 77.08 m
 Receiver elevation : 75.57 m
 Barrier elevation : 75.34 m
 Reference angle : 0.00

Results segment # 1: Klondike (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	! Receiver ! Height (m)	! Barrier ! Height (m)	! Elevation of ! Barrier Top (m)
1.50	!	1.50	!
		2.19	!
			77.82

ROAD (47.06 + 52.95 + 0.00) = 53.95 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	-69	0.66	65.75	0.00	-4.26	-14.44	0.00	0.00	0.00	47.06
-69	14	0.53	65.75	0.00	-3.92	-3.88	0.00	0.00	-5.00	52.95

Segment Leq : 53.95 dBA

Results segment # 2: Sandhill (day)

Source height = 1.50 m

Barrier height for grazing incidence

Source Height (m)	! Receiver ! Height (m)	! Barrier ! Height (m)	! Elevation of ! Barrier Top (m)
1.50	!	1.50	!
		1.84	!
			77.18

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
21	90	0.53	63.96	0.00	-11.46	-5.82	0.00	0.00	-5.29	41.39

Segment Leq : 41.39 dBA

Total Leq All Segments: 54.18 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 54.18

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Facsimile (613) 254-5867
Website www.novatech-eng.com



RECEIVER LOCATION



NOISE BARRIER

CITY OF OTTAWA
1055 KLONDIKE ROAD

RECEIVER LOCATIONS
R1 & R3

SCALE
1 : 500

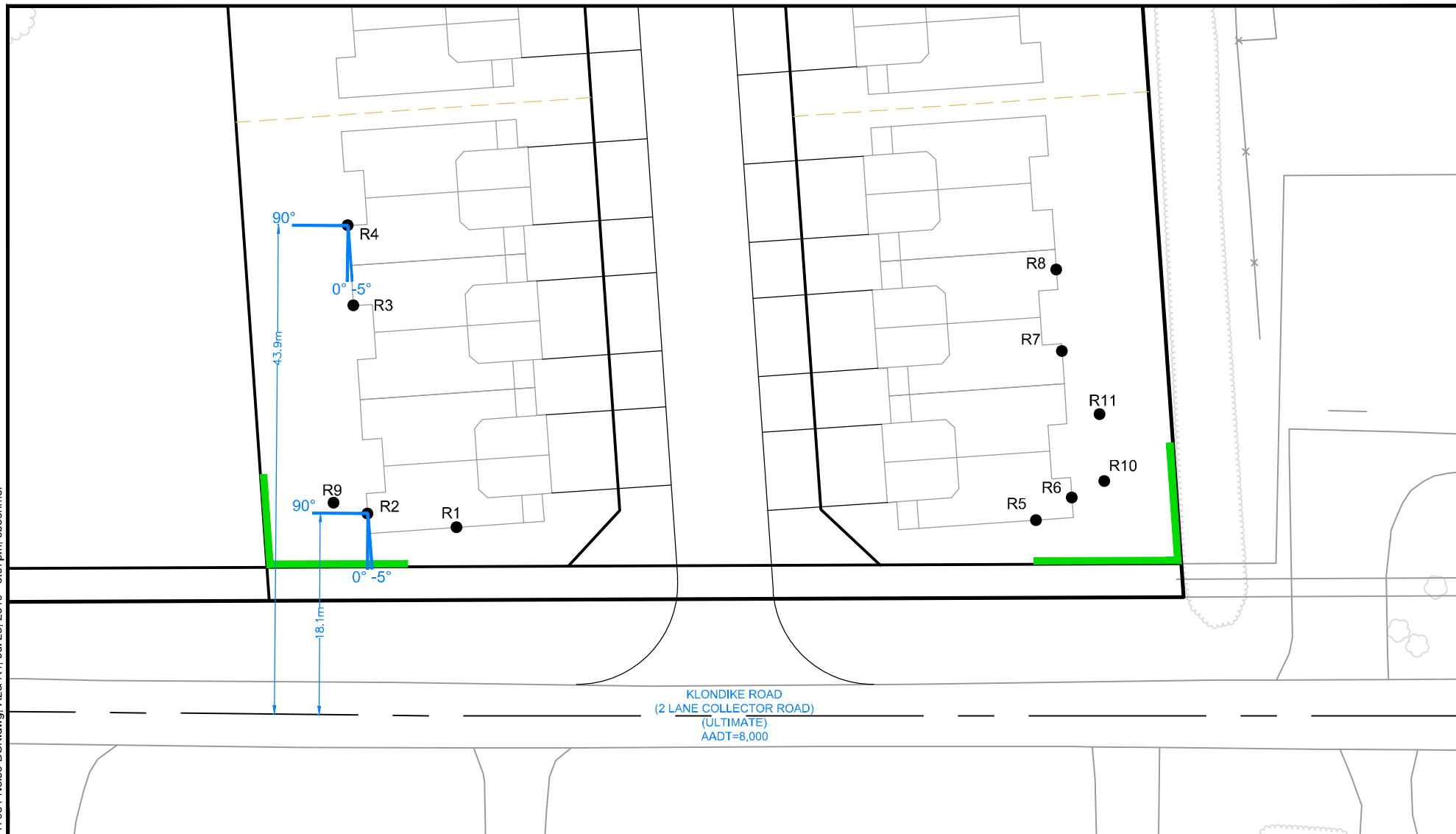


DATE
JULY 2019

JOB
117034

FIGURE
FIG-1

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RECEIVER LOCATION



NOISE BARRIER

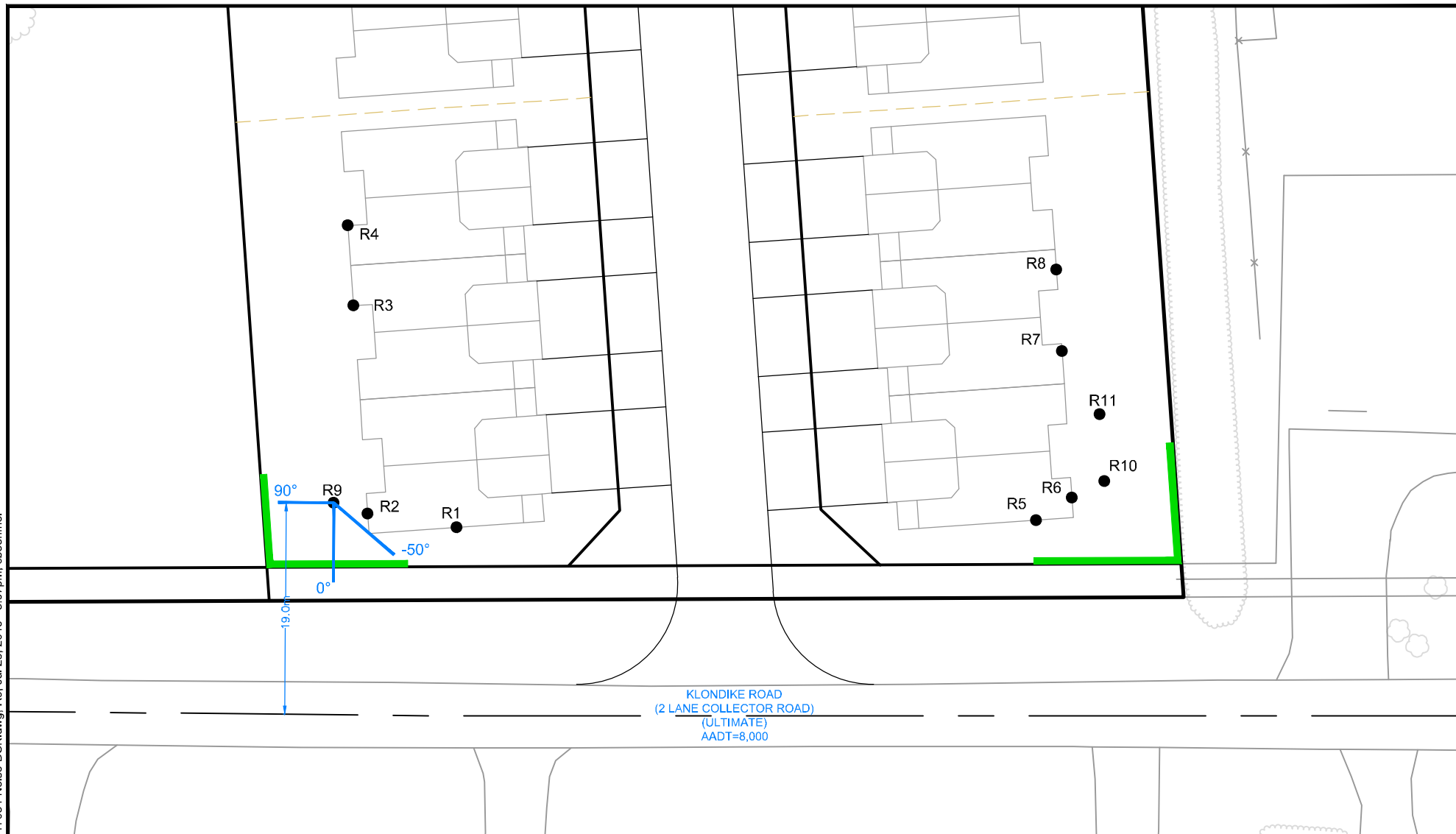
CITY OF OTTAWA
1055 KLONDIKE ROAD

RECEIVER LOCATIONS
R2 & R4

SCALE 1 : 500
0 5m 10m 20m

DATE JULY 2019 JOB 117034 FIGURE FIG-2

M:\2017\117034\DATA\Calculations\Noise\Figures\117034-Noise-DSK.dwg, R9, Jul 25, 2019 - 3:07pm, cboehmer



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RECEIVER LOCATION



NOISE BARRIER

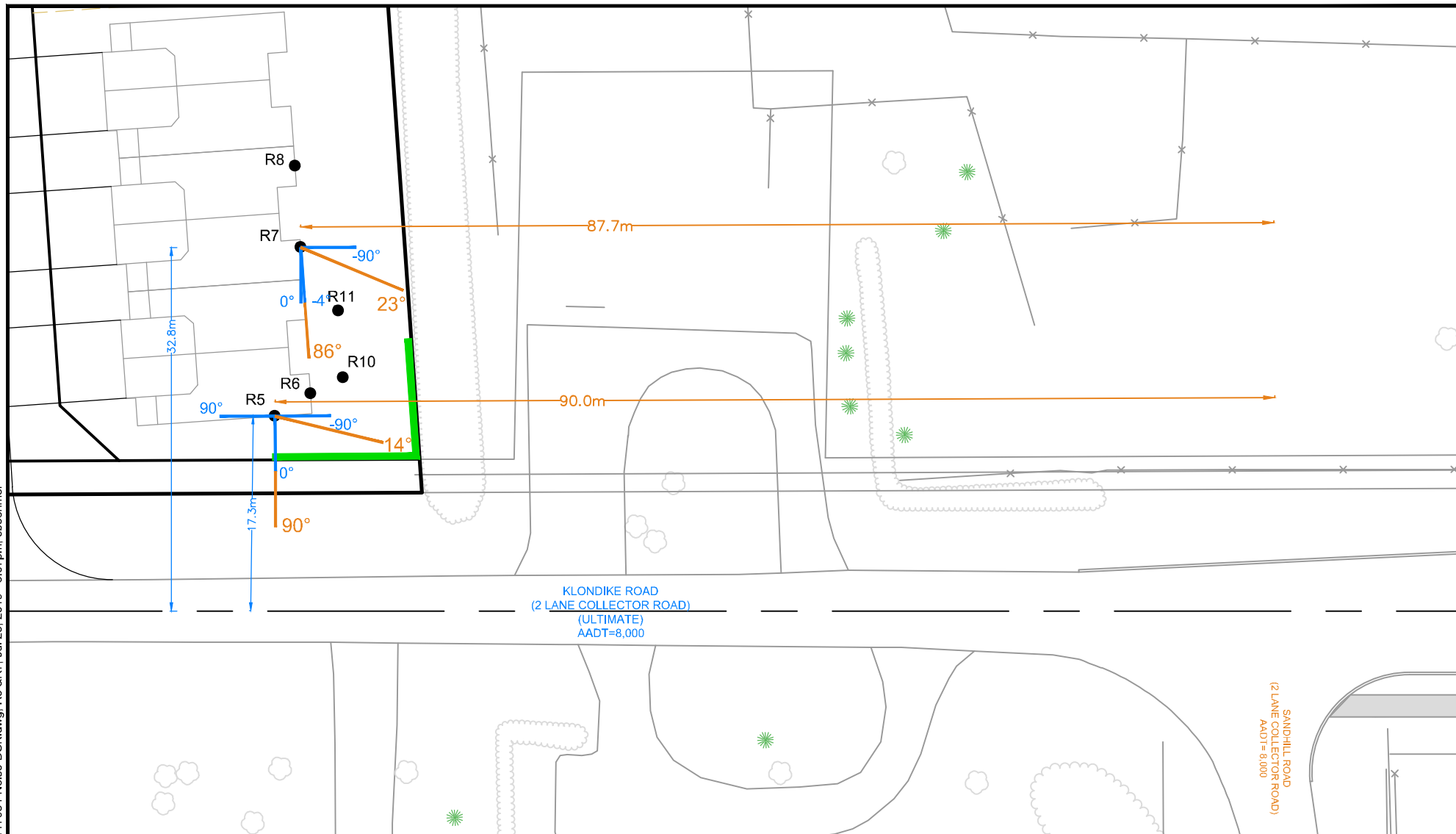
CITY OF OTTAWA
1055 KLONDIKE ROAD

RECEIVER LOCATION
R9

SCALE 1 : 500
0 5m 10m 20m

DATE JULY 2019 JOB 117034 FIGURE FIG-3

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RECEIVER LOCATION



NOISE BARRIER

CITY OF OTTAWA
1055 KLONDIKE ROAD

RECEIVER LOCATIONS
R5 & R7

SCALE 1 : 500

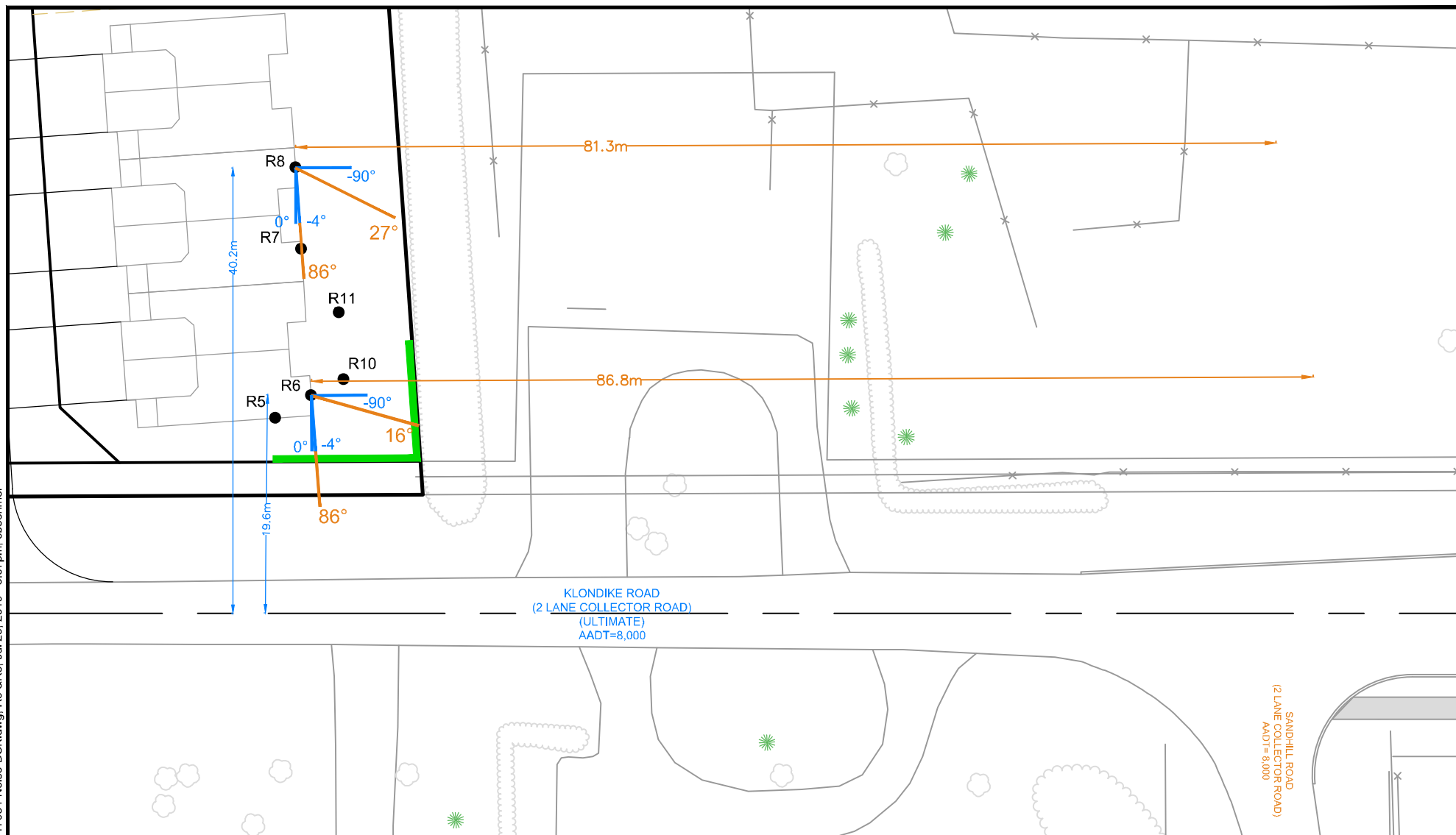


DATE JULY 2019

JOB 117034

FIGURE FIG-4

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RECEIVER LOCATION

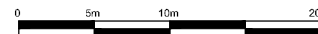


NOISE BARRIER

CITY OF OTTAWA
1055 KLONDIKE ROAD

RECEIVER LOCATIONS
R6 & R8

SCALE 1 : 500

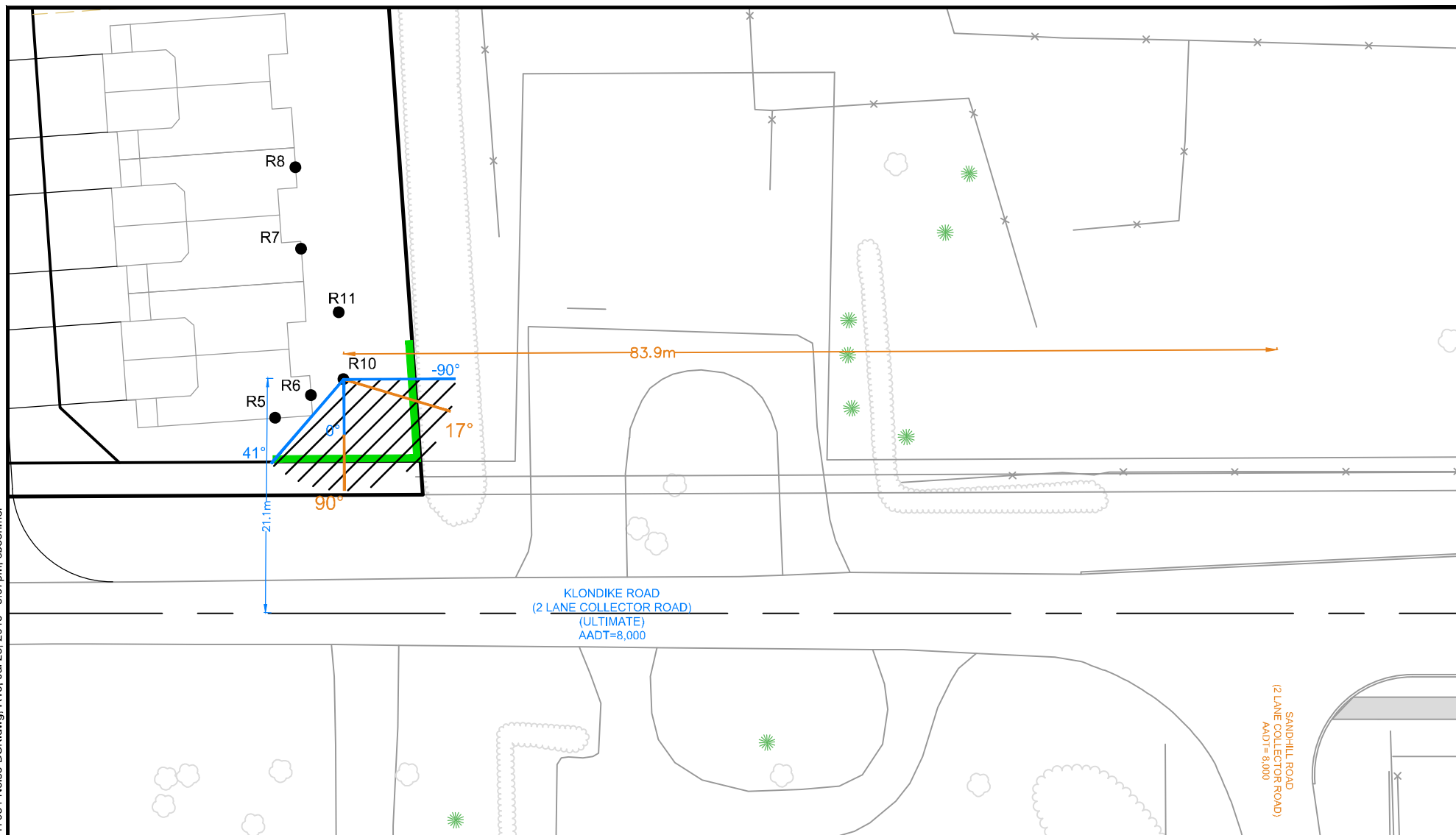


DATE JULY 2019

JOB 117034

FIGURE FIG-5

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- RECEIVER LOCATION
- NOISE BARRIER
- ▨ BARRIER ANGLE

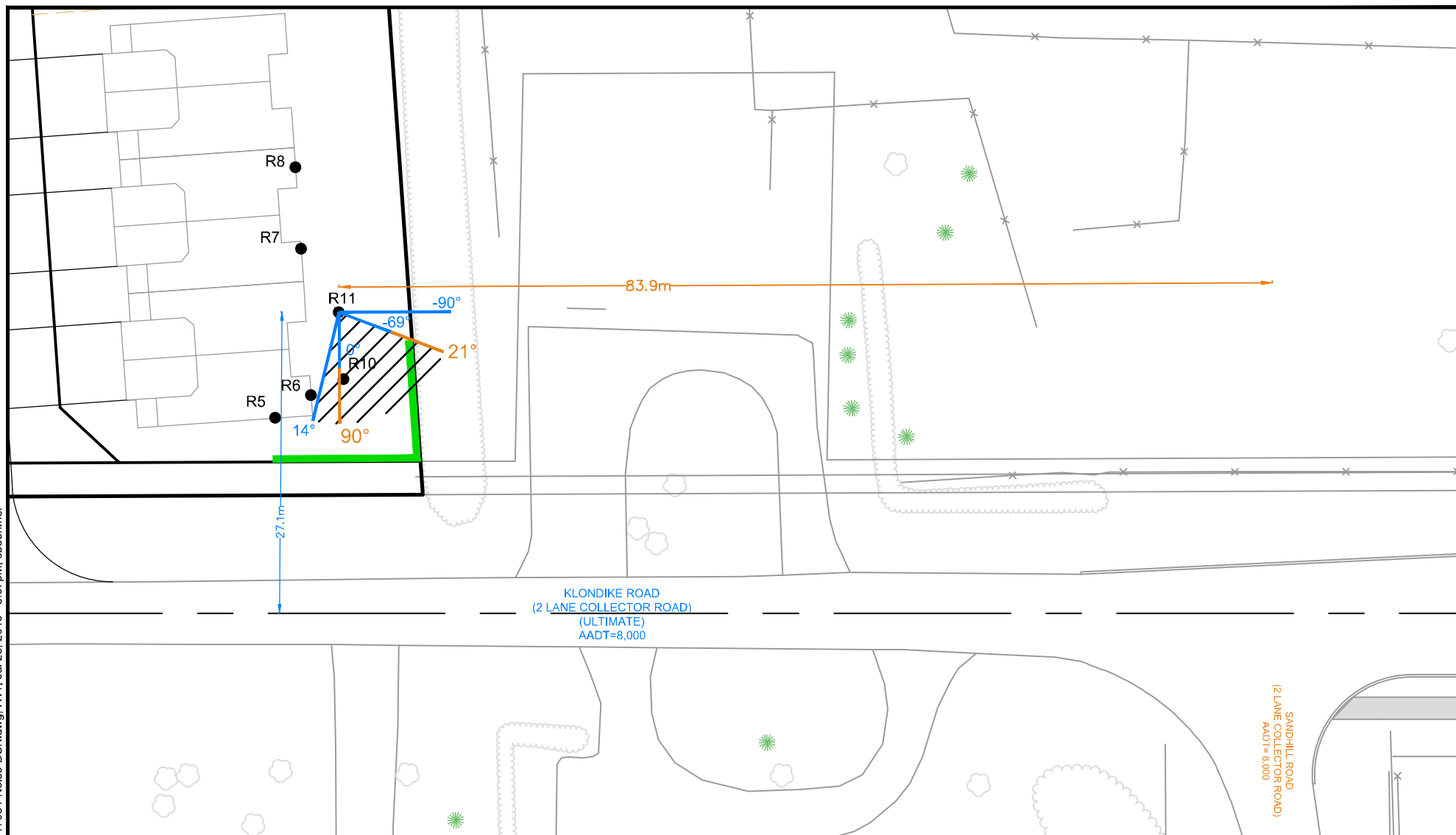
CITY OF OTTAWA
1055 KLONDIKE ROAD

RECEIVER LOCATION
R10

SCALE 1 : 500

DATE JULY 2019 JOB 117034 FIGURE FIG-6

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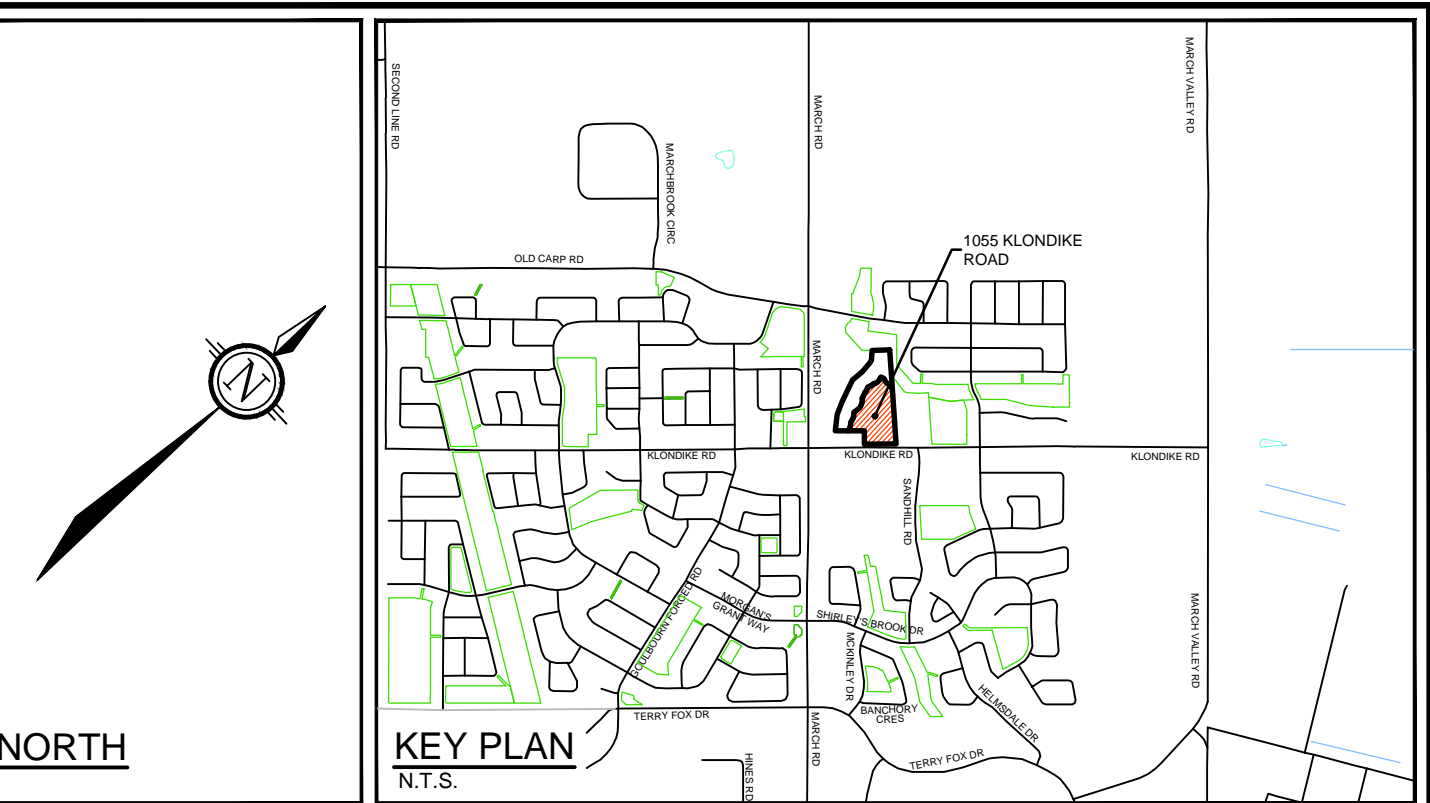
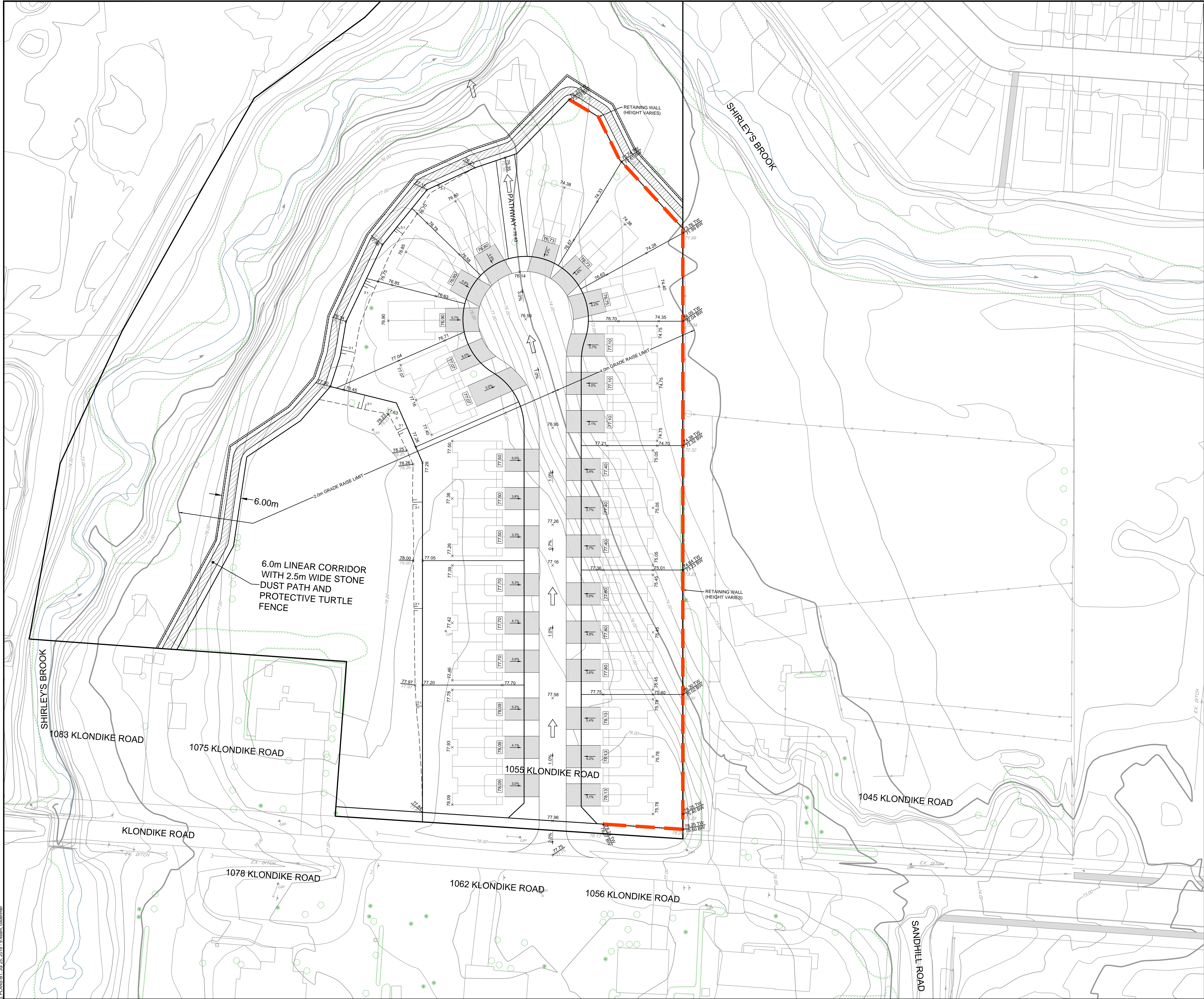
- RECEIVER LOCATION
- NOISE BARRIER
- ▨ BARRIER ANGLE

CITY OF OTTAWA
1055 KLONDIKE ROAD

RECEIVER LOCATION
R11

SCALE 1 : 500 0 5m 10m 20m

DATE JULY 2019 JOB 117034 FIGURE FIG-7



- LEGEND**
- PROPOSED GRADE AND DIRECTION OF FLOW
 - PROPOSED ELEVATION
 - EXISTING ELEVATION
 - PROPOSED TOP OF WALL ELEVATION
 - PROPOSED BOTTOM OF WALL ELEVATION
 - EXISTING ELEVATION
 - TERRACING (3:1 MAX)
 - PROPOSED RETAINING WALL
 - MAJOR OVERLAND FLOW DIRECTION

NOTE:
THE POSITION OF ALL POLE LINES, CONDUITS,
WATERMAINS, SEWERS AND OTHER
UNDERGROUND AND OVERGROUND UTILITIES AND
STRUCTURES IS NOT NECESSARILY SHOWN ON
THE CONTRACT DRAWINGS, AND WHERE SHOWN,
THE ACCURACY OF THE POSITION OF SUCH
UTILITIES AND STRUCTURES IS NOT GUARANTEED.
BEFORE STARTING WORK, DETERMINE THE EXACT
LOCATION OF ALL SUCH UTILITIES AND
STRUCTURES AND ASSUME ALL LIABILITY FOR
DAMAGE TO THEM.

No.	REVISION	DATE	BY
1.	DRAFT PLAN SUBMISSION	JUL 26/19	MAB

SCALE

1:500

0 5 10 15 20

DESIGN	FOR REVIEW ONLY
LRW	
CHECKED	MAB
DRAWN	DTD
CHECKED	MAB
APPROVED	JGR

L.R. WILSON
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CITY OF OTTAWA
1055 KLONDIKE ROAD

PRELIMINARY GRADING PLAN

PROJECT No.	REV	REV # 1
117034-0		
DRAWING No.		117034-GR

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PLANSET 117034-0117034\Novus\0117034

APPENDIX C

GRADING PLAN – 117034-GR