

Noise Feasibility Study

Proposed Residential Development

844 Veterans Drive


Barrie, Ontario

Prepared for:

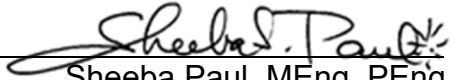
Innovative Planning Solutions
647 Welham Road, Unit 9
Barrie, Ontario
L4N 0B7

Prepared by




Victor Garcia, PEng

Reviewed by


Sheeba Paul, MEng, PEng

September 20, 2022

HGC Project No. 01604154

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1 Introduction and Summary

HGC Engineering was retained by 252286 Ontario Inc. to conduct a noise feasibility study for a proposed residential development to be located at 844 Veterans Drive in the City of Barrie, Ontario. The study is required by the municipality as part of their planning and approvals process.

This report has been updated to include the latest draft plan and updated road traffic data from the City of Barrie.

Road traffic data for Veterans Drive was obtained from City of Barrie personnel. This data was used to predict future traffic sound levels at the proposed dwellings and in the outdoor living areas. The predicted sound levels were evaluated in accordance with Ministry of the Environment, Conservation and Parks (MECP) noise guidelines.

Predicted sound levels exceed MECP guideline limits at the dwelling units closest to Veterans Drive. Central air conditioning is required for the dwellings closest to Veterans Drive. Upgraded building constructions are required for the dwellings closest to Veterans Drive. For the remaining façades any exterior wall, and double glazed window construction meeting the minimum requirements of the Ontario Building Code (OBC) will provide sufficient sound insulation. The MECP guidelines require that warning clauses be used to inform future residents of the traffic noise impacts and to address sound level excesses.



2 Site Description and Noise Sources

Figure 1 is a key plan showing the location of the proposed development. The site is located at 844 Veterans Drive in the City of Barrie, Ontario. Figure 2 shows the proposed draft plan prepared by Innovative Planning Solutions dated July 26, 2022. The proposed development will consist of 10 blocks of townhouses and associated roadways.

The primary source of sound is vehicular traffic on Veterans Drive. Veterans Drive is currently a two-lane roadway (one lane in each direction), with a road widening proposed in the future. The lands surrounding the site are currently agricultural lands with some existing residences. There are no sources of stationary noise within 500 m of the subject site.

3 Sound Level Criteria

Guidelines for acceptable levels of road traffic noise impacting residential developments are outlined in the MECP publication NPC-300 “Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning”, Part C release date October 21, 2013 and are listed in Table 1 below. The values in Table 1 are energy equivalent (average) sound levels [L_{EQ}] in units of A-weighted decibels [dBA].

Table 1: Road Traffic Sound Level Criteria

Area	Daytime L_{EQ} (16 hour) Road	Night-time L_{EQ} (8 hour) Road
Outdoor Living Area	55 dBA	--
Inside Living/Dining rooms	45 dBA	45 dBA
Inside Bedrooms	45 dBA	40 dBA

Daytime refers to the period between 07:00 and 23:00. Nighttime refers to the time period between 23:00 and 07:00. The term Outdoor Living Area (OLA) is used in reference to an outdoor patio, backyard, terrace, or other area where passive recreation is expected to occur.

The MECP guidelines allow the sound levels in an OLA be exceeded by up to 5 dBA (i.e. up to 60 dBA), without mitigation, if warning clauses are placed in the purchase and rental agreements to

the property. Where OLA sound levels exceed 60 dBA, physical mitigation is required to reduce the OLA sound level to below 60 dBA and as close to 55 dBA as technically, economically and administratively feasible.

A central air conditioning system as an alternative means of ventilation to open windows is required for dwellings where nighttime sound levels outside bedroom windows are greater than 60 dBA and where daytime sound levels outside living/dining room windows are 65 dBA or greater. Forced-air ventilation with ducts sized to accommodate the future installation of central air conditioning is required when nighttime sound levels at bedroom windows are in the range of 51 to 60 dBA or when daytime sound levels at living/dining room windows are in the range of 56 to 64 dBA.

Building components such as walls, windows and doors must be designed to achieve indoor sound level criteria when the plane of window nighttime sound level is greater than 60 dBA or the daytime sound level is greater than 65 dBA. The use of warning clauses to notify future residents of possible excesses is also required.

4 Traffic Noise Assessment

4.1 Road Traffic Data

Road traffic data for Veterans Drive was obtained from the City of Barrie in the form of Annual Average Daily Traffic Volumes (AADT) for 2018, and is provided in Appendix A. The traffic volumes were grown to the year 2031 using a growth rate of 4.0%/year, and further grown by 2.0%/year to 2041 as requested by the City of Barrie. A commercial vehicle percentage for Veterans Drive of 5.0% was obtained and split into 1.9% medium trucks and 3.1% heavy trucks. A day/night split of 90%/10% was used in the analysis. A speed limit of 80 km/h was used for Veterans Drive. Table 2 summarizes the road traffic data used in the analysis.



Table 2: Projected Road Traffic Data to 2041

Road Name		Cars	Medium Trucks	Heavy Trucks	Total
Veterans Drive	Daytime	17 354	347	566	18 267
	Nighttime	1 928	39	63	2 030
	Total	19 282	386	629	20 297

4.2 Traffic Noise Predictions

To assess the levels of road traffic noise which will impact the site in the future, predictions were made using STAMSON version 5.04, a computer algorithm developed by the MECP. Sample STAMSON output is included in Appendix B.

Predictions of the traffic sound levels were made at various dwellings in the proposed development. The results of these predictions are summarized in Table 3. The acoustic requirements may be subject to modifications if the site plan is changed significantly and when grading information is available.

Sound levels were predicted in the plane of the living/dining room windows during daytime and bedroom windows during nighttime hours to investigate ventilation and building façade construction requirements. Sound levels were also predicted in the rear yard outdoor living areas to investigate the need for acoustic barriers.

Table 3: Future Road Traffic Sound Levels, [dBA], Without Mitigation

Prediction Location	Description	Daytime in OLA L _{EQ-16 hr}	Daytime at Façade L _{EQ-16 hr}	Nighttime at Façade L _{EQ-8 hr}
[A]	Townhouses flanking onto Veterans Drive	67	70	63
[B]	Second unit from Veterans Drive	64	64	58
[C]	Sixth unit from Veterans Drive	60	60	53
[D]	Dwellings further from Veterans Drive	55	55	<50

5 Discussion and Recommendations

The predictions indicate that the future traffic sound levels during the daytime and nighttime at the proposed dwellings closest to the roadway will exceed MECP guidelines. The following discussion outlines recommendations for ventilation requirements, building façade constructions, and warning clauses to achieve the noise criteria stated in Table 1.

5.1 Outdoor Living Areas

The predicted daytime sound levels in the OLA of the end units of Blocks 5 and 10 (prediction location [A]) with flanking exposure to Veterans Drive will be up to 67 dBA, which is 12 dBA in excess of the MECP's limit of 55 dBA. Physical mitigation in the form of acoustic barriers are required. A 2.6 m high acoustic barrier will reduce the sound level in the rear yard to 59 dBA. The 4 dBA excess is acceptable to the MECP if it is acceptable to the municipality with the use of a noise warning clause.

The predicted daytime sound levels in the OLA of the second units from Veterans Drive of Blocks 5 and 10 (prediction location [B]) with some exposure to Veterans Drive will be up to 64 dBA, which is 9 dBA in excess of the MECP's limit of 55 dBA. Physical mitigation in the form of an acoustic barriers are required. A 2.0 m high acoustic barrier will reduce the sound level in the rear yard to 59 dBA. The 4 dBA excess is acceptable to the MECP if it is acceptable to the municipality with use of a noise warning clause.

The predicted daytime sound levels in the OLA of the sixth units from Veterans Drive of Blocks 5 and 10 (prediction location [C]) with some exposure to Veterans Drive will be up to 60 dBA, which is 5 dBA in excess of the MECP's limit of 55 dBA. Physical mitigation in the form of acoustic barriers are not required. The 5 dBA excess is acceptable to the MECP if it is acceptable to the municipality.

The predicted daytime sound levels in the OLA's of the remaining dwellings will be 55 dBA or less meeting the MECP criteria.

As a general note, an acoustic barrier may be a combination of an acoustic wall and an earth berm. The wall component of the barrier should be of a solid construction with a surface density of no less



than 20 kg/m². The walls may be constructed from a variety of materials such as wood, brick, pre-cast concrete or other concrete/wood composite systems provided that it is free of gaps or cracks. The heights and extents of the barriers should be chosen to reduce the sound levels in the OLA's to below 60 dBA and as close to 55 dBA as is technically, administratively and economically feasible, subject to the approval of the municipality respecting any applicable fence height by-laws. Acoustic barrier requirements are shown in Figure 3.

5.2 Indoor Living Areas and Ventilation Requirements

Central Air Conditioning

The predicted sound levels outside the top storey bedroom windows of the dwellings with direct exposure to Veterans Drive will be greater than 65 dBA during the daytime hours and 60 dBA during the nighttime hours. To address these excesses, the MECP guidelines recommend that the dwelling unit be equipped with central air conditioning systems, so that the windows can be closed.

Provision for the Future Installation of Air Conditioning

The predicted sound levels at the plane of the second storey bedroom windows of the future dwellings further from Veterans Drive, will be between 56 and 65 dBA during the daytime hours and between 51 and 60 dBA during the nighttime hours. To address these excesses, the MECP guidelines recommend that these dwelling units be equipped with forced air ventilation systems with ducts sized to accommodate the future installation of air conditioning by the occupant.

Figure 3 shows the ventilation requirements for the development. Window or through-the-wall air conditioning units are not recommended for any commercial or residential units because of the noise they produce and because the units penetrate through the exterior wall which degrades the overall noise insulating properties of the envelope. The location, installation and sound ratings of the remaining lots have no specific ventilation requirements.



5.3 Building Façade Constructions

Future sound levels at the facades of the dwellings with direct exposure to Veterans Drive will exceed 65 dBA during the daytime hours and 60 dBA during the nighttime hours. MECP guidelines recommend that the windows, walls and doors be designed so that the indoor sound levels comply with MECP noise criteria.

Floor plans and building elevations were not available at the time of this study. The required building components are selected based on the Acoustical Insulation Factor (AIF) value for road traffic. To do so, calculations were performed to determine the acoustical insulation factors to maintain indoor sound levels within MECP guidelines. The calculation methods were developed by the National Research Council (NRC). They are based on the predicted future sound levels at the building facades, and the anticipated area ratios of the facade components (windows and walls) and the floor area of the adjacent room.

The minimum necessary specification for dwellings closest to Veterans Drive are AIF-30 for living/dining/family rooms and AIF-28 for bedrooms, based on the possibility of sound entering the buildings through windows and walls.

Any exterior wall construction meeting the OBC will be acceptable for all of the dwellings units in the proposed development as long as wall to floor area ratios do not exceed 125%. Any insulated metal exterior door meeting OBC requirements will be sufficient to provide noise insulation.

Any well sealed thermopane unit having a Sound Transmission Class (STC) rating of 30, as long as the window to floor area ratio is less than 25% for living/dining and family rooms and 40% for bedrooms. If sliding patio doors are to be used in the dwellings, they must be included in the window area.

When detailed floor plans and building elevations are available, an acoustical consultant should provide revised glazing STC ratings based on actual window to floor area ratios.

The remaining units within the development will have daytime and nighttime sound levels that are less than 65 and 60 dBA respectively. For these units, any exterior wall, and double glazed window



construction meeting the minimum requirements of the Ontario Building Code (OBC) will provide adequate sound insulation for the dwelling units.

5.4 Warning Clauses

The MECP guidelines recommend that warning clauses be included in the property and tenancy agreements for all lots with anticipated traffic sound level excesses. Examples are provided below.

Suggested wording for future dwellings with sound level excesses the MECP criteria is given below:

Type A:

Purchasers and tenants are advised that sound levels due to increasing road traffic may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the Municipality's and the Ministry of the Environment, Conservation and Parks' noise criteria.

Suggested wording for future dwellings for which physical mitigation has been provided is given below.

Type B:

Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing road traffic may occasionally interfere with some activities of the dwelling occupants as the sound levels exceed the City's and the Ministry of the Environment, Conservation and Parks' noise criteria. The acoustical barrier as installed shall be maintained, repaired or replaced by the owner. Any maintenance, repair or replacement shall be with the same material, to the same standards and having the same colour and appearance of the original.

A suggested wording for future dwellings requiring central air conditioning systems is given below.

Type C:

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, Conservation and Parks.



A suggested wording for future dwellings requiring forced air ventilation systems is given below.

Type D:

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, Conservation and Parks.

These sample clauses are provided by the MECP as examples and can be modified by the Municipality as required.

6 Summary of Recommendations

In summary, HGC Engineering has reviewed the draft plan and performed calculations to determine the potential road traffic noise impact on the residential properties with respect to MECP guidelines. The following are the recommendations.

1. An acoustic barrier is required for dwellings with flanking exposure to Veterans Drive.
2. Central air conditioning is required for dwellings flanking onto Veterans Drive. Forced air ventilation systems with ductwork sized for the future installation of central air conditioning system will be required for dwellings further from Veterans Drive. The location, installation and sound ratings of the air conditioning devices should comply with NPC-300, as applicable.
3. Upgraded building and glazing constructions are required for dwellings with flanking exposure to Veterans Drive. When detailed floor plans and building elevations are available, an acoustical consultant should provide revised glazing STC ratings based on actual window to floor area ratios. Building constructions meeting the minimum requirements of the Ontario Building Code will provide sufficient acoustical insulation for the indoor spaces for the remaining dwellings.
4. Warning clauses should be used to inform future residents of the traffic noise excesses.

The following table summarizes the noise control recommendations and noise warning clauses for the lots in the proposed subdivision. Please see Figure 3, for reference.



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Table 4: Summary of Noise Control Requirements and Noise Warning Clauses

Unit	Acoustic Barrier	Ventilation Requirements	Type of Warning Clause	Required AIF
Eastern end unit of Blocks 5 and 10	✓	Central A/C	B, C	LRDR: AIF-30 BR: AIF-28
Second to 5 th units from east of Blocks 5 and 10	✓	Forced Air	B, D	OBC
Remaining units of Blocks 5 and 10, 1 st to 6 th eastern units of Blocks 4 and 9	--	Forced Air	A, D	OBC
Remaining units	--	--	--	OBC

Notes:

-- no specific requirement

OBC – meeting the minimum requirements of the Ontario Building Code

LRDR – living room/dining room

BR – bedroom

6.1 Implementation

To ensure that the noise recommendations outlined above are fully implemented, it is recommended that:

1. A detailed noise study is required for the dwellings closest to Veterans Drive when grading, floor plans and building elevations are available to refine the requirements.
2. Prior to subdivision approval, the municipality requires a Professional Engineer qualified to provide acoustical engineering services in the Province of Ontario to review the grading plans of lots adjacent to Veterans Drive to certify that the noise control barriers as approved have been incorporated.
3. Prior to assumption for this development, the Municipality’s building inspector or a Professional Engineer qualified to provide acoustical engineering services in the Province of Ontario to shall certify that the noise control measures for the dwellings units have been properly installed and constructed.

Limitations

This document was prepared solely for the addressed party and titled project or named part thereof, and should not be relied upon or used for any other project without obtaining prior written authorization from HGC Engineering. HGC Engineering accepts no responsibility or liability for any consequence of this document being used for a purpose other than for which it was commissioned. Any person or party using or relying on the document for such other purpose agrees, and will by such use or reliance be taken to confirm their agreement to indemnify HGC Engineering for all loss or damage resulting therefrom. HGC Engineering accepts no responsibility or liability for this document to any person or party other than the party by whom it was commissioned.

Any conclusions and/or recommendations herein reflect the judgment of HGC Engineering based on information available at the time of preparation, and were developed in good faith on information provided by others, as noted in the report, which has been assumed to be factual and accurate. Changed conditions or information occurring or becoming known after the date of this report could affect the results and conclusions presented.



ACOUSTICS



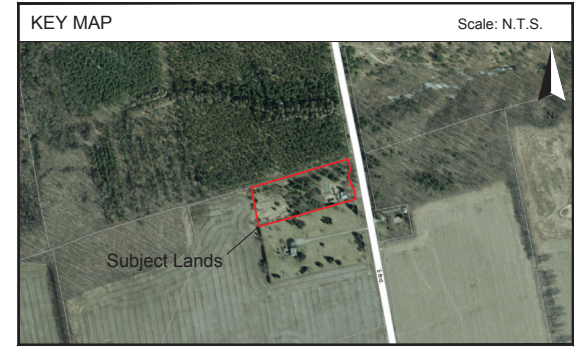
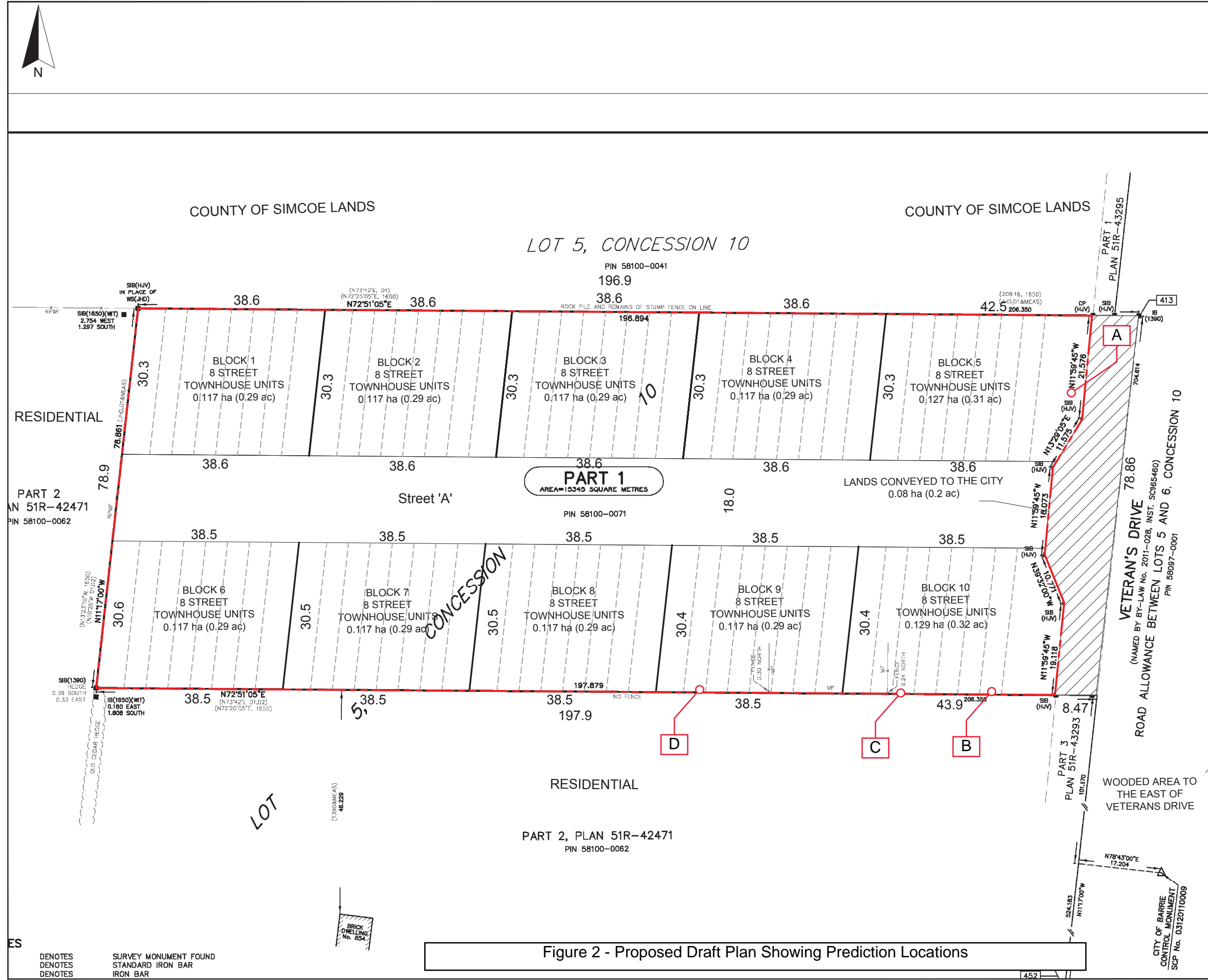
NOISE



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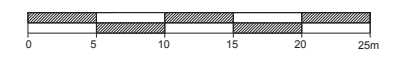


Figure 1 - Key Plan



DRAFT PLAN OF SUBDIVISION

844 Veterans Drive
PART OF LOT 5, CONCESSION 10
(GEOGRAPHIC TOWNSHIP OF INNISFIL)
CITY OF BARRIE
COUNTY OF SIMCOE



LEGEND

--- SUBJECT LANDS (WITHOUT ROAD WIDENING)(1.53ha/3.78ac)

--- LOTS

OWNER'S CERTIFICATE
I HEREBY AUTHORIZE INNOVATIVE PLANNING SOLUTIONS TO PREPARE THIS DRAFT PLAN OF SUBDIVISION AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION FOR APPROVAL.

DATE _____ OWNER'S NAME:
2528286 Ontario Inc. &
2431805 Ontario Inc.

SURVEYOR'S CERTIFICATE
I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

DATE _____ SURVEYOR'S NAME:
Holding Jones Vanderveen Inc.

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT

- a) SHOWN ON PLAN
- b) SHOWN ON PLAN
- c) SEE KEY PLAN
- d) RESIDENTIAL
- e) SHOWN ON PLAN
- f) SHOWN ON PLAN
- g) SHOWN ON PLAN
- h) MUNICIPAL WATER
- i) SAND, SILT GLACIAL TILL
- j) SHOWN ON PLAN
- k) MUNICIPAL WATER & SEWAGE
- l) NONE

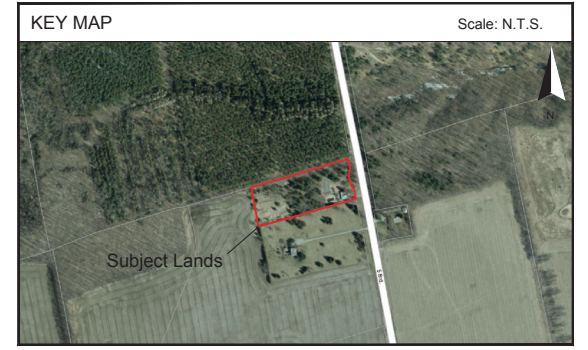
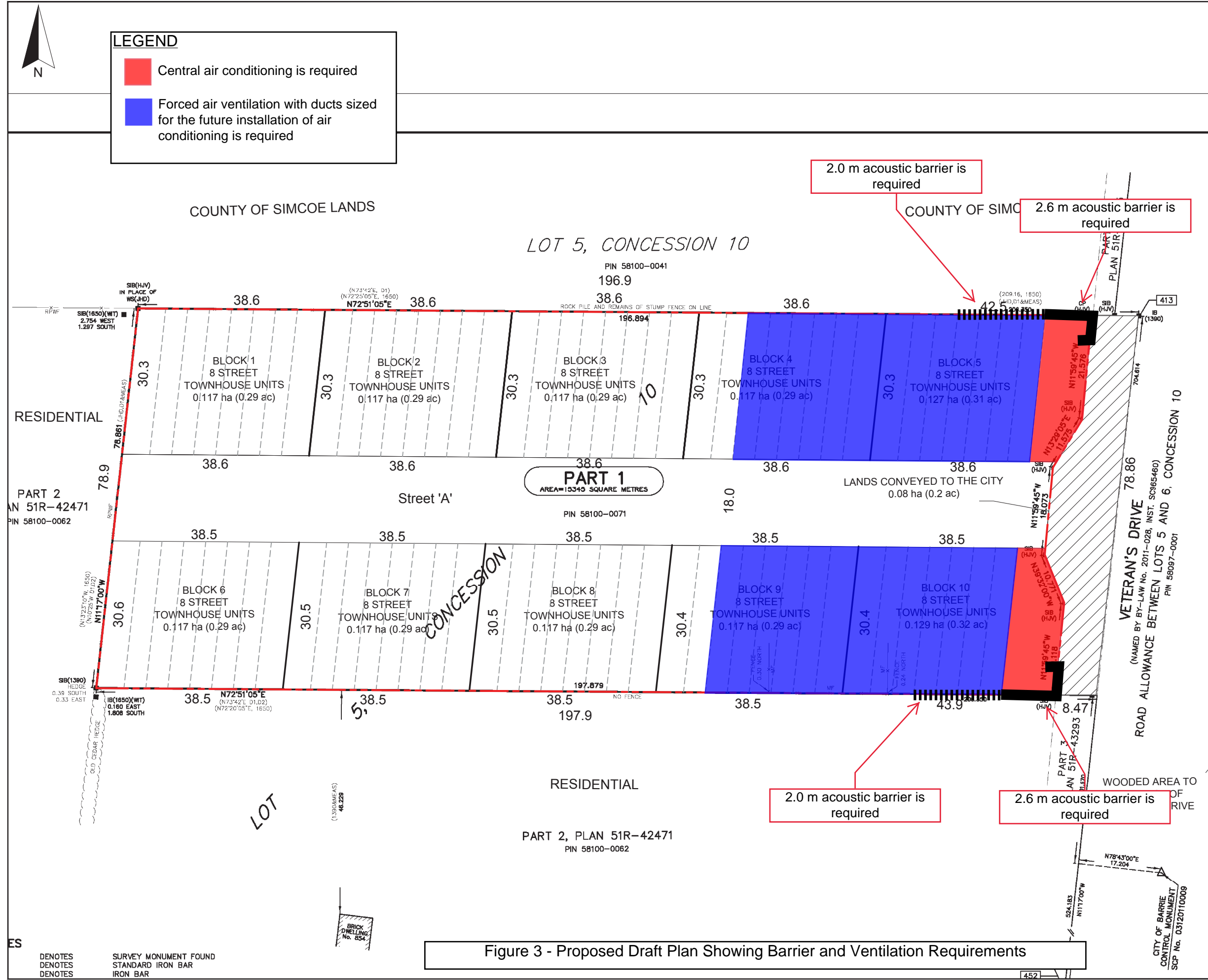
LAND USE STATISTICS

LAND USE	BLOCK No.	UNITS	AREA (ha)
RESIDENTIAL	1-10	80	1.19
LANDS CONVEYED TO CITY			0.08
STREET 'A'			0.34

IPS INNOVATIVE PLANNING SOLUTIONS
PLANNERS • PROJECT MANAGERS • LAND DEVELOPERS
647 WELHAM ROAD, UNIT 9, BARRIE, ON, L4N 0B7
tel: 705-812-3281 fax: 705-812-3438 e: info@ipsconsultinginc.com www.ipsconsultinginc.com

Date: July 26, 2022
File: 16-664
Drawn By: JV
Checked: DV

ES
DENOTES SURVEY MONUMENT FOUND
DENOTES STANDARD IRON BAR
DENOTES IRON BAR



DRAFT PLAN OF SUBDIVISION

844 Veterans Drive
PART OF LOT 5, CONCESSION 10
(GEOGRAPHIC TOWNSHIP OF INNISFIL)
CITY OF BARRIE
COUNTY OF SIMCOE
Scale 1:500

LEGEND

- SUBJECT LANDS (WITHOUT ROAD WIDENING)(1.53ha/3.78ac)
- LOTS

OWNER'S CERTIFICATE
I HEREBY AUTHORIZE INNOVATIVE PLANNING SOLUTIONS TO PREPARE THIS DRAFT PLAN OF SUBDIVISION AND SUBMIT THIS DRAFT PLAN OF SUBDIVISION FOR APPROVAL.

SURVEYOR'S CERTIFICATE
I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED AND THEIR RELATIONSHIP TO ADJACENT LANDS ARE ACCURATELY AND CORRECTLY SHOWN.

DATE: _____ OWNER'S NAME: 2528286 Ontario Inc. & 2431805 Ontario Inc.

DATE: _____ SURVEYOR'S NAME: Holding Jones Vanderveen Inc.

ADDITIONAL INFORMATION REQUIRED UNDER SECTION 51(17) OF THE PLANNING ACT

- a) SHOWN ON PLAN
- b) SHOWN ON PLAN
- c) SEE KEY PLAN
- d) RESIDENTIAL
- e) SHOWN ON PLAN
- f) SHOWN ON PLAN
- g) SHOWN ON PLAN
- h) MUNICIPAL WATER
- i) SAND, SILT GLACIAL TILL
- j) SHOWN ON PLAN
- k) MUNICIPAL WATER & SEWAGE
- l) NONE

LAND USE STATISTICS

LAND USE	BLOCK No.	UNITS	AREA (ha)
RESIDENTIAL	1-10	80	1.19
LANDS CONVEYED TO CITY			0.08
STREET 'A'			0.34

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Date: July 26, 2022 Drawn By: JV
File: 16-664 Checked: DV

APPENDIX A

Road Traffic Data



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Victor Garcia

From: Justin MacDonald <Justin.MacDonald@barrie.ca>
Sent: August 26, 2022 8:39 AM
To: Victor Garcia
Subject: RE: Road Traffic Data Request - Veterans Drive, Barrie, Ontario

Good morning Victor,

The information provided in 2017 was based on our 2016 TMP and the City since approved the 2019 TMP. Please refer to the updated information below:

McKay Road

ADT - 3000 (2018) –

Growth rate - 9% per annum to a horizon of 2031 and 2% per annum to a horizon year of 2041

Medium and Heavy Vehicles – 9%

Veteran's Drive

ADT – 10,000 (2018)

Growth rate - 4% per annum to a horizon of 2031 and 2% per annum to a horizon year of 2041

Medium and Heavy Vehicles – 5%

Thanks.

Justin MacDonald, C.E.T., PTP
Project Delivery – Transportation Planning, Development Services
The City of Barrie
Mobile 705-734-8020

Please consider the environment before printing this email.

From: Victor Garcia <vgarcia@hgcengineering.com>
Sent: Tuesday, August 23, 2022 11:03 AM
To: Justin MacDonald <Justin.MacDonald@barrie.ca>
Subject: Road Traffic Data Request - Veterans Drive, Barrie, Ontario

Hi Justin,

HGC Engineering is preparing a noise feasibility study for a proposed development located at 844 Veterans Drive in Barrie, Ontario. A google link is included for your reference:

<https://goo.gl/maps/r93ZbkXLRQZENZ8G6>

We currently have the attached data from a previous iteration of this report. Is this data still valid?

Thanks,

Victor Garcia, P.Eng
Associate

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Howe Gastmeier Chapnik Limited

APPENDIX B

Sample STAMSON 5.04 Output



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Total Leq All Segments: 69.68 dBA↑
Results segment # 1: Veterans (night)

Source height = 1.33 m

ROAD (0.00 + 63.16 + 0.00) = 63.16 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.58	65.33	0.00	-0.86	-1.31	0.00	0.00	0.00	63.16

Segment Leq : 63.16 dBA

Total Leq All Segments: 63.16 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 69.68 dBA
(NIGHT): 63.16 dBA

Filename: aola.te Time Period: 16 hours

Description: OLA of townhouses with flanking onto Veterans Day Drive, with 2.6 m acoustic barrier

Road data, segment # 1: Veterans

Car traffic volume : 17354 veh/TimePeriod *
Medium truck volume : 347 veh/TimePeriod *
Heavy truck volume : 566 veh/TimePeriod *
Posted speed limit : 80 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Veterans

Angle1 Angle2 : -90.00 deg 45.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 21.50 m
Receiver height : 1.50 m
Topography : 2 (Flat/gentle slope; with barrier)
Barrier angle1 : -90.00 deg Angle2 : 45.00 deg
Barrier height : 2.60 m
Barrier receiver distance : 9.00 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Road data, segment # 2: Veterans

Car traffic volume : 17354 veh/TimePeriod *
Medium truck volume : 347 veh/TimePeriod *
Heavy truck volume : 566 veh/TimePeriod *
Posted speed limit : 80 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: Veterans

Angle1 Angle2 : 45.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 21.50 m



ACOUSTICS



NOISE



VIBRATION

Receiver height : 1.50 m
 Topography : 2 (Flat/gentle slope; with barrier)
 Barrier angle1 : 45.00 deg Angle2 : 90.00 deg
 Barrier height : 7.00 m
 Barrier receiver distance : 3.00 m
 Source elevation : 0.00 m
 Receiver elevation : 0.00 m
 Barrier elevation : 0.00 m
 Reference angle : 0.00[^]
 Results segment # 1: Veterans

Source height = 1.33 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.33	1.50	1.43	1.43

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	45	0.51	71.85	0.00	-2.36	-2.10	0.00	0.00	-8.33	59.06

Segment Leq : 59.06 dBA

Results segment # 2: Veterans

Source height = 1.33 m

Barrier height for grazing incidence

Source Height (m)	Receiver Height (m)	Barrier Height (m)	Elevation of Barrier Top (m)
1.33	1.50	1.48	1.48

ROAD (0.00 + 46.68 + 0.00) = 46.68 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
45	90	0.25	71.85	0.00	-1.95	-7.27	0.00	0.00	-15.95	46.68

Segment Leq : 46.68 dBA

Total Leq All Segments: 59.30 dBA

TOTAL Leq FROM ALL SOURCES: 59.30 dBA



ACOUSTICS



NOISE



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