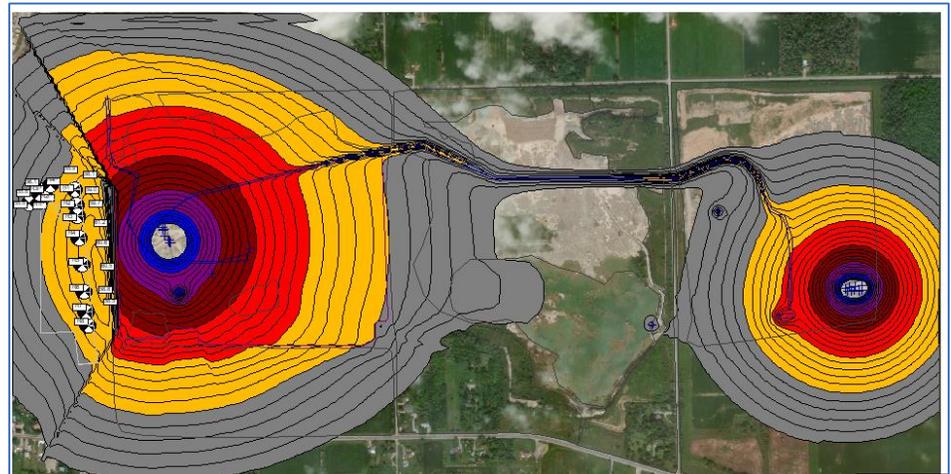


NOISE IMPACT Assessment
For
A Proposed Residential Development
at
281 Chippawa Road
Port Colborne, Ontario
L3K 1T8



Prepared for:

Mr. Terry Graham
2835935 Ontario Inc
247 King Street North Suite 313
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May 25, 2022





NOISE AND VIBRATION IMPACT Assessment
For A Proposed Residential Development
at
281 Chippawa Road
Port Colborne, ON
L3K 1T8

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This document has been prepared for the exclusive reliance and use of 2835935 Ontario Inc and any third party they may designate via a letter of transmittal from LAW Consultants Ltd.



Version Control

Revision	Date	Revision Description	Reviewer Initials
1.0	2022-05-20	Noise Impact Assessment, 281 Chippawa Road, Port Colborne, 2835935 Ontario Inc.	AN



EXECUTIVE SUMMARY

LAW Consultants Ltd. (LAW) was retained by Mr. Terry Graham on behalf of 2835935 Ontario Inc. (the "Client") to prepare a Noise Impact Assessment (NIA) following a request by the local municipality. This report specifically focuses on the predicted impacts of the proposed development on the surrounding noise sensitive land uses. This report also looks at the noise impacts from nearby industrial activities on the proposed development.

2835935 Ontario Inc. is proposing to develop the land located at 281 Chippawa Road. The proposed development includes 169 units with 21 singles lots, 40 semi-detached lots, 108 townhouse units. This study reviews the compatibility of the housing development with the surrounding land uses.

This report also investigates the noise control features that are required for the development in order to meet the noise guidelines of the Ontario Ministry of the Environment, Conservation and Parks (MECP) and to satisfy the requirements of the Municipality and Region of Niagara.

There are no anticipated sources of noise emissions, other than temporary construction noise, associated with the Site development, as the entire Site will be developed as residential houses. Potential construction noise (during development of the Site) is temporary and exempt from MECP guidelines and is not addressed in the scope of this report.

The dominant noise impact on the Subject Site is from stationary noise associated with the operation of Port Colborne Quarry (PCQ) cross the street and traffic noise from Hwy 140. Noise impact from the PCQ operations was conducted using information provided in Golder Associates report on noise impact study completed on behalf of PCQ in December 2020 and limited information provided by PCQ management. The acoustic modelling results at the receptors on Subject Site exceeded the MECP-300 criteria for both Class 2 and Class 4 (if approved by planning department) properties.

The data from a traffic count study conducted by the Ontario Ministry of Transportation in May/June 2018 was used to model the noise impact on the Subject Site. The traffic noise modelling results indicated that the outdoor living areas of the proposed dwellings will be exposed to transportation noise levels above 60 dBA. Consequently, a noise barrier is recommended to be erected along the property fence line to mitigate transportation noise to the levels acceptable to MECP. As indicated in the MECP implementation guidelines, where mitigation is required, or noise may be a concern, future occupants will be advised through warning clauses, as discussed in Section 8 of the report.

The Indoor sound levels at the plane of windows are predicted to exceed the respective MECP Guidelines as summarized in Section 6.0 of this report.



It is recommended that an acoustic consultant to be retained to use the projected daytime and night time sound pressure levels to address sound transmission concerns and determine the required STC values for the living area and bedroom windows.



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Appendix B:	Traffic Noise Modelling Results
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1.0 INTRODUCTION

LAW Consultants Ltd. (LAW) was retained by Mr. Terry Graham on behalf of 2835935 Ontario Inc. (the "Client") to prepare a Noise Impact Assessment (NIA) following a request by the local municipality. This report specifically focuses on the predicted impacts of the proposed development on the surrounding noise sensitive land uses. The report also looks at the noise impacts from nearby industrial activities on the proposed development.

This undertaking is carried out to support an application for zoning By-Law Amendment and plan of subdivision applications. The current plan is for a total of 169 units with 21 singles lots, 40 semi-detached lots, 108 townhouse. Site location and the site plan with surrounding land use are presented in **Figures 1 and 2**. An illustration of the location of the proposed development property plan are presented in **Figures 3**.

This noise impact assessment is required by the City of Port Colborne and focuses on the industrial operations (Port Colborne Quarries) to the east of Hwy 140, which borders the east side of the subject Site. Port Colborne Quarries (PCQ) operates an existing aggregate extraction and processing site of approximately 1,285 acres, Pit 1 through Pit 3. The location of the quarry is presented in **Figure 4**.

The noise impact assessment is completed to achieve the following:

- Assess the noise impact of the proposed development on surrounding areas;
- Estimate the emissions from the current quarry operations;
- Predict the impact of the current quarry operations on the proposed development property through dispersion modelling; and
- Assess any impact of traffic noise along Highway 140 on the proposed development at the Site.

1.1 Subject Site Description

The Subject property is located on the southwest corner of Chippawa Road and Hwy 140. This property is located in an area designated Greenfield Lands and is designated RD (Residential Development) setting at the east end of the City of Port Colborne. Typical land use in the general area is residential and agricultural lands. There is a light industrial and a mineral aggregate operation (Port Colborne Quarries) to the east of Hwy 140, which borders the east side of the Site.

The Site encompasses an area of approximately 16.503 Ac (6.679 ha) is a long irregular rectangle in shape with a frontage of approx. 163.2 metres along Chippawa Road, the eastern boundary of the Site extends approx. 559.8 metres north to south and parallel to Hwy 140. The Site is zoned for Residential Development and is also classified as a Greenfield Area under the City of Port Colborne Development Plan. A copy of the zoning plan is included in **Figure 5**.



1.2 Port Colborne Quarries Site Description

Port Colborne Quarries (PCQ) operates an existing aggregate extraction and processing site of approximately 1,285 acres. The existing quarry (Pit 1, Pit 2 and Pit 3) is bounded by Second Concession Road to the north, Highway 140 to the west, Main Street East (Highway 3) to the south, and 200 metres west of Carl Road to the east. As per the information provided by PCQ management via email and phone conversation, the current operations at the quarry include: extraction, processing and offsite transport. The extracted material is processed using a permanent processing plant located within Pit 1. The processing plant includes: crushers, screens, conveyors, and a wash plant. Drilling and blasting are carried out at the working face of the quarry (Pit 3) to extract material, which is then transported from the working face to the processing plant at Pit 1 using haul trucks. Processed material is stored in various stockpiles before being shipped off-site.

Based on the information provided by PCQ staff, off-site shipping and related material handling activities occur year-round, generally from 7 am to 5 pm, Monday to Friday. Blasting occurs up to three times per week between the hours of 10 am to 4 pm, March through November. Blasting does not take place on weekends and no blasting activities occur during January or February. Extraction and processing occur from March through mid-December, generally from 7 am to 5 pm, Monday to Friday and on Saturdays from June through August.

1.3 Background Information

In December 2020, Golder Associates completed a noise impact assessment on behalf of PCQ in support of an application for licensing an expansion of the extraction face to the west of the current Pit 3. Most of the information provided in this report was taken from Golder Report (Ref # 1771656), dated December 2020; hereinafter referred to as the Golder report. The significant noise sources and the corresponding sound power levels identified at the Golder report together with the information provided via email and a site visit are used for the assessment of noise impact at the subject site. Operating conditions, maximum number of On/Non-Road machinery equipment, and blasting and drilling frequencies were all verified via email and phone conversation with PCQ management.

2.0 NOISE SOURCE SUMMARY

2.1 Industrial Noise, PCQ Operations

The current operations at the quarry include: extraction, processing and offsite transport. The extracted material is processed using a permanent processing plant located within Pit 1. The processing plant includes: crushers, screens, conveyors, and a wash plant. Drilling and blasting are carried out at the working face (Pit 3) of the quarry to extract material. The extracted material is then transported from the working face to the processing plant at Pit 1 using haul trucks. Processed material is stored in various stockpiles before being shipped off-site. The processing plant includes the following major pieces of equipment: crushers, screens and a wash plant. The extracted material is hauled from the quarry to the processing plant using Terex60 haul trucks (or equivalent). The drilling work is expected to operate concurrently with



the extraction equipment. Extracted material is loaded on haul trucks and transported to the processing plant using existing haul routes. The primary noise sources from the operation of PCQ are summarized in *Table 2.1* below.

Table 2.1: Facility Noise Source Summary*

Source ID	Source Description	Overall Sound Power Level [dBA] (1)	Source Location	Sound Characteristics	Noise Control Measures
SC_W_UU	Screen 155 E – Upper Deck West	122.5	O	S	U
SC_W_LU	Screen 155 E Lower Deck West	122.5	O	S	U
SC_E_UU	Screen 155 E Upper Deck East	122.5	O	S	U
SC_E_LU	Screen 155 E Lower Deck East	122.5	O	S	U
SC_E_TU	Screen 155 E Top Deck East	122.5	O	S	U
JC_NOR	Jaw Crusher Norberg	110	O	S	U
IC_177	Impact Crusher 177	104	O	S	U
IC_177 mot	Impact Crusher 177 motor	98	O	S	U
IC_187	Impact Crusher 187	103	O	S	U
IC_187 mot	Impact Crusher 187 motor	98	O	S	U
D1_D8	Drill Brown	123.4	O	S/Q	U
T_L2	Truck Load 15 trucks 2 min each	119	O	S	U
T_L1	Truck Load 15 Trucks/2 min each	101.3	O	S	U
P_pit2	Dewatering Pump Pit 2	101.3	O	S	U
P_pit3	Dewatering Pump Pit 3	91.6	O	S	U
L-EA	Loader Excavation	109	O	S	U
SC_155_E_U	Screen 155 East Upper Unit Side	112.8	O	S	U
SC_155_W_	Screen 155 West South Side wall	114	O	S	U
SC_155_E_U	Screen 155 East South Side wall	114			
SC_155_B_S	Screen 155 East Bottom Unit Side	112.8			
SC_155_W_	Screen 155 West Bottom Unit Side	117.9	O	S	U
SC_155_W_	Screen 155 West Upper Unit Side	117.9			
WP_C_W	Wash plant 155E west side walls	105.2	O	S	U
WP_C_E	Wash plant 155E east side walls	105.2	O	S	U
HT_PP_EA_	Haul Truck_PPto EA Empty	107.4	O	S	U
HT_EA_PP_F	Haul Truck_EA to PP full	111.3	O	S	U
HW1	Haul Truck PP to offsite	103.8	O	S	U

Notes:

Source Location:

O located/installed outside the building
I located/installed inside the building

C Cyclic
O Occasional
W Time Weighted (factor applied)

Sound Characteristics:

S Steady
Q Quasi Steady Impulsive
I Impulsive
B Buzzing
T Tonal

Noise Control Measures:

S: silencer, acoustic louver
A: acoustic lining, plenum
B: barrier, berm, screening
L: lagging



Table 3-1 Points of Reception

POR ID	DESCRIPTION	LOCATION OF POR	UTM ZONE 17 N, NAD 1983		RECEPTOR HEIGHT (M)
R1_PW	Townhouse	2 nd flr, Plane of window	644018.9	4752084	4.5
R1_OLA		Outside Living Area	644022.3	4752084	1.5
R2_PW	Townhouse	2 nd flr, Plane of window	644023.5	4752038	4.5
R2_OLA		Outside Living Area	644026.5	4752038	1.5
R3_PW	Townhouse	2 nd flr, Plane of window	644026.3	4752006	4.5
R3_OLA		Outside Living Area	644029.3	4752006	1.5
R4_PW	Townhouse	2 nd flr, Plane of window	644032.6	4751941	4.5
R4_OLA		Outside Living Area	644035.9	4751940	1.5
R5_PW	Townhouse	2 nd flr, Plane of window	644039.7	4751863	4.5
R5_OLA		Outside Living Area	644043.2	4751862	1.5
R6_PW	Townhouse	2 nd flr, Plane of window	644047	4751783	4.5
R6_OLA		Outside Living Area	644050.1	4751783	1.5
R7_PW	Townhouse	2 nd flr, Plane of window	644052.2	4751724	4.5
R7_OLA		Outside Living Area	644061.3	4751684	1.5
R8_PW	Townhouse	2 nd flr, Plane of window	644057	4751684	4.5
R8_OLA		Outside Living Area	644056	4751723	1.5
RE1_PW	274 Chippawa Residential	1st flr, Plane of window	643887.7	4752042	1.5
RE2_PW	272 Chippawa Residential	1st flr, Plane of window	643917.8	4752071	1.5
RE3_PW	270 Chippawa Residential	2 nd flr, Plane of window	643935.7	4752083	4.5
RE4_PW	268 Chippawa Residential	1st flr, Plane of window	643950.5	4752096	1.5

4.0 ASSESSMENT CRITERIA (PERFORMANCE LIMITS)

The dominant transportation noise sources in the area include road traffic on Hwy 140 and Port Colborne Quarry operating cross the Hwy 140 approximately 80 m from the east boundary of the Site. MECP regulates the allowable emission that a facility can emit through the Environmental Compliance Approval process. The MECP publication, NPC-300 “Environmental Noise Guideline – Stationary and Transportation Sources – Approval and Planning” is the applicable noise guideline that outlines the sound level limits at the nearest noise sensitive receptors, PORs in Class 1, Class 2, and Class 3 acoustical environment.

The Site is located in an acoustical Class 2 area defined by NPC-300 as a mixed acoustical environment with an elevated acoustic background during the daytime due to human and commercial/industrial activity and a low ambient sound level during the nighttime period, defined by natural environment and infrequent human activity. The sound limits are expressed in terms of the one-hour Leq, at a point of reception. For



non-impulsive (steady) sources, NPC-300 sets sound limits as the greater of the background sound level in the area or the exclusion limits defined in NPC-300 for Class 2 acoustic environment.

Table 4.1: Exclusionary Sound Level Criteria, L_{EQ} [dBA]

Location	Acoustic Environment	Day Time (07:00 – 19:00)	Evening (19:00 – 23:00)	Night (23:00 – 07:00)
Outdoor Points Reception*	Urban (Class 2) [Class 4]	50 [55]	50 [55] {N/A}	-
Plane of Window of Sound Sensitive Spaces	Urban (Class 2) [Class 4]	50 [60]	45 [60] {N/A}	45 [55] {N/A}

Note:

[..]: applies for Class 4 area;

{N/A}: The plant is not in operation during the evening and nighttime.

The subject property can be designated as a Class 4 Area pursuant to NPC-300 based on the following:

- i. Intended for development with new noise sensitive land use(s) that are not yet built.
- ii. In proximity to existing, lawfully established stationary source(s).
- iii. Has conformation from the land use planning authority as a Class 4 area classification, determined during the land use planning process.

The noise impact assessment and mitigation measures discussed in this report are based on Class 2 property and as well as Class 4 property, if approved by the land use planning authority, in order for the development to show compliance with Class 2 and Class 4 noise limits.

4.2 Road Traffic Noise – Outdoor Living Area (OLA)

The guideline provides the following recommendations for outdoor living area (OLA):

- i. The equivalent noise levels (L_{eq}) in outdoor living areas should not exceed 55 dBA – 16hr L_{eq} ;
- ii. Predicted noise levels between 55 dBA and 60 dBA may be acceptable, provided that the future occupants of the buildings are made aware of the potential noise problems through appropriate warning clauses (see Section 8.0 for Warning Clause);
- iii. Noise levels above 60 dBA are generally not acceptable;
- iv. All unenclosed balconies that are less than 4 m in depth and outside the exterior of the building façade are exempt from meeting the MECP outdoor noise criteria with regards to transportation noise sources. Should the depth of any future balconies and terraces be greater than 4 m, they will be subject to the MECP noise level limit of 55 dBA.



4.3 Road Traffic Noise – Indoor Living Spaces

NPC-300, road traffic noise for indoor living spaces is summarized in Table 4.2 below.

Table 4.2: Noise Criteria Road Traffic, L_{EQ} [dBA]

Location	Acoustic Environment	Leq (dBA)
Living/dining, den areas of residences	07:00 – 23:00	45 dBA
Living/dining, den areas of residences	23:00 – 07:00	45 dBA
Sleeping quarters (Indoor)	07:00 – 23:00	45 dBA
Sleeping quarters (Indoor)	23:00 – 7:00	40 dBA
Outdoor Living Areas (OLA)	07:00 – 23:00	55 dBA

According to NPC-300, bedrooms are normally required to meet sleeping quarters daytime Leq of 45 dBA and nighttime Leq of 40 dBA. To achieve these indoor levels, the MECP Guidelines provide a basis for the type of windows, exterior walls and doors that will be required based on projected outdoor noise levels. This MECP requirement that a central air conditioning system be installed for the dwelling(s) when the nighttime or daytime outdoor noise levels at the façade of the dwelling are above 60 dBA and 65 dBA, respectively. The provision for adding central air conditioning must be made if the night time sound level is greater than 50 dBA and less than or equal to 60 dBA on the outside face of a bedroom windows or greater than 55 dBA and less than or equal to 65 dBA on the outside face of a living/dining room window. This provision involves a ducted heating system sized to accommodate the addition of central air conditioning by the occupant.

4.4 MECP Model Municipal Noise Control Bylaw

The Corporation of the City of Port Colborne has by-laws (By-Law No. 4588/119/04) to regulate noise, as follows:

Section 5 of the By-law mandates that no person shall emit or cause the emission of sound resulting From any piece of construction equipment of a type referred to in Schedule 4, Publication NPC-115 - Construction Equipment, at a work site, any part of which is located within 600 m of a Residential Area, unless the item of the equipment complies with the residential sound emissions standards set out in Schedule 4- Publication NPC-115-Construction Equipment, as applicable to that of equipment and date of manufacture. Maximum noise emission levels for typical construction equipment are presented Table 4.3.

Table 4.3: NPC-115 Maximum Noise Emission Levels for Typical Construction Equipment

Unit Type	Max. Sound Level ⁽¹⁾ (dBA)	Distance (m)	Power Rating (kW)
Excavation Equipment ⁽²⁾	83	15	<75
	85	15	>75
Pneumatic Equipment ⁽³⁾	85	7	-
Portable Compressors	76	7	-

Note:

(1) Maximum permissible sound levels presented here are for equipment manufactured after Jan. 1, 1981.

(2) Excavation equipment includes bulldozers, backhoes, front end loaders, graders, excavators, steam rollers and other equipment capable of being used for similar applications.



(3) Pneumatic equipment includes pavement breakers.

5.0 NOISE IMPACT ASSESSMENT

5.1 Quarry Noise Calculation Procedure

All relevant sound levels for significant sources of noise emissions are based on the field measurement carried out by Golder at the time of completing the noise impact study for PCQ (Ref # 1771656-R-Rev0). LAW consultants relied on the measured noise levels completed by Golder. Noise emissions from the identified significant noise sources associated with the operations of PCQ, as listed in Table 2.1 above were modelled to determine the predictable worst-case noise levels on the identified representative PORs.

Noise levels were determined for material hauling, extraction, processing and drilling operations with equipment operating on the first lift (i.e., floor of the first lift for the extraction equipment and top of the first lift for the drill) for the respective activity. There is an approximately five (5) foot high berm [..]: along the western boundary of Pit 1 covering the entire length of Pit 1 western boundary. The berm was considered in the modelling.

The predictive analysis was carried out using the commercially available software package Cadna/A V2022 MR1 (32 bit). The predicted levels take into consideration that the sound from a stationary point noise source spreads spherically and attenuates at a rate of 6 dB per doubling of distance. Further, attenuation from barriers, ground effect and air absorption may be included in the analysis as determined from ISO 9613 (part 2), which is the current standard used for outdoor sound propagation predictions. It should be noted that this standard makes provisions to include a correction to address for downwind or ground-based temperature inversion conditions. Noise predictions have been made assuming a downwind or moderate temperature inversion conditions for all PORs, a design condition consistent with the accepted practice of the MECP.

As described in ISO 9613 (Part 2), ground factor values that represent the effect of ground on sound levels range between 0 and 1. Based on the specific site conditions, the ground factor value used in the modelling was a ground factor value of 0.2 within the Site, 0 for water bodies and a value of 1 for all other areas. Attenuation from intervening structures (i.e., stockpiles) and woodlots were conservatively not considered in the noise modelling.

The following assumptions were made in calculating the potential noise levels of the quarry operations on the identified PORs.

- Extraction and processing operations will occur during the daytime period only (7:00 am-7:00 m);
- Equipment list and sound power emissions are consistent to those listed in Table 2-1 (or acoustically equivalent); and
- Haul trucks, while onsite, will typically travel at 35 km/h.



Table 5.1 provides a summary of the predictable worst-case noise levels at each of the identified PORs associated with the daytime operations.

Table 5.1: Predicted Sound Level, Quarry Operations

POR ID	Description	Location of POR	Height	⁽²⁾⁽³⁾ Sound Level at POR (dBA)			⁽⁴⁾ Performance Limit (dBA)			Compliance with
				M	Day	Even	Night	Day	Even	Night
R1_PW	2-Storey Townhouse	PW	4.5	58.1	N/A	N/A	50	N/A	N/A	NO
R1_OLA		OLA	1.5	57.5	N/A	N/A	50	N/A	N/A	NO
R2_PW	2-Storey Townhouse	PW	4.5	59	N/A	N/A	50	N/A	N/A	NO
R2_OLA		OLA	1.5	58.2	N/A	N/A	50	N/A	N/A	NO
R3_PW	2-Storey Townhouse	PW	4.5	59.7	N/A	N/A	50	N/A	N/A	NO
R3_OLA		OLA	1.5	58.6	N/A	N/A	50	N/A	N/A	NO
R4_PW	2-Storey Townhouse	PW	4.5	61.2	N/A	N/A	50	N/A	N/A	NO
R4_OLA		OLA	1.5	59.3	N/A	N/A	50	N/A	N/A	NO
R5_PW	2-Storey Townhouse	PW	4.5	60.6	N/A	N/A	50	N/A	N/A	NO
R5_OLA		OLA	1.5	60.8	N/A	N/A	50	N/A	N/A	NO
R6_PW	2-Storey Townhouse	PW	4.5	60.5	N/A	N/A	50	N/A	N/A	NO
R6_OLA		OLA	1.5	58.5	N/A	N/A	50	N/A	N/A	NO
R7_PW	2-Storey Townhouse	PW	4.5	58.8	N/A	N/A	50	N/A	N/A	NO
R7_OLA		OLA	1.5	56.1	N/A	N/A	50	N/A	N/A	NO
R8_PW	2-Storey Townhouse	PW	4.5	58.5	N/A	N/A	50	N/A	N/A	NO
R8_OLA		OLA	1.5	56.1	N/A	N/A	50	N/A	N/A	NO
RE1_PW	274 Chippawa Residential	PW	1.5	55.5	N/A	N/A	50	N/A	N/A	NO
RE2_PW	272 Chippawa Residential	PW	1.5	55.8	N/A	N/A	50	N/A	N/A	NO
RE3_PW	270 Chippawa Residential	PW	4.5	56.1	N/A	N/A	50	N/A	N/A	NO
RE4_PW	268 Chippawa Residential	PW	1.5	55.9	N/A	N/A	50	N/A	N/A	NO

Notes:

[1] Location of Point of Reception: PW = Plane of nearest window, OLA = Outdoor Living Area

[2] Daytime occurs from 0700-1900h. Evening occurs from 1900-2300h. Night-time occurs from 2300-0700h.

NA-Not Applicable

[3] Worst-case one-hour equivalent sound level from all applicable sources operating in dBA/dBAI. Non-Impulsive (Leq) and Impulsive (LIm).

[4] NPC-300 exclusionary sound levels of one-hour Leq for Class 2 Area for Stationary Sources or LIm for Class 2 for Impulsive Sources.

There are a number of PORs that are impacted by the noise emissions associated with the Processing Plant (Pit 1). The sound pressure level contour plot files and the predicted sound levels at the receptors are provided in **Figure 7**. Sample calculations are also provided in **Appendix C**.



5.2 Road Noise Calculation Procedure

The traffic noise level at the receptor was predicted in accordance with the Ontario Road Noise Analysis Method for Environment and Transportation (ORNAMENT). A copy of the traffic count data together with the traffic noise prediction results from MECP's Road Traffic Noise Prediction Model STAMSON are included in **Appendix A**.

During the May 16, 2022 site visit, various on-site background noise measurements were taken at the site which indicated the background noise dominated by quarry operations and rush hour road traffic on Hwy 140. The traffic noise was monitored at the site's east boundary for a period of 60 minutes. The sound at the east boundary of the subject site was measured at 64.0 dBA.

The forecasted traffic volume for year 2032 is presented in Table 5.2. The reported traffic volume for 24 hrs is split using split ratio of (85/15) % for daytime and nighttime. The predicted sound pressure levels at the receptor(s) are presented in Table 5.3.

Table 5.2: Forecasted Traffic Volume for Year 2032

Direction	Total (24 hour)	Posted Speed (km/hr)	Time	Total (1 hour)	Vehicle	Total
North to South	6490	60	Day	345	Car	327
					Med-Truck	14
					Heavy-Truck	4
			Night	122	Car	116
					Med-Truck	4
					Heavy-Truck	2
South to North	6754	80	Day	359	Car	341
					Med-Truck	14
					Heavy-Truck	4
			Night	127	Car	120
					Med-Truck	5
					Heavy-Truck	2

Note:

No of vehicles for daytime is averaged over 16hrs and for nighttime 8 hrs

Table 5.3: Traffic Noise Calculations Summary

Time Period	Receptor Location	Predicted Traffic Noise Level (dBA)
Daytime	2 nd floor, 4.5 m above ground, Plane of window	63
Nighttime		59
Daytime	1.5 m above ground, 3 m from the building façade	63

Notes:

1: The forecasted year 2032 traffic count for cars is extrapolated at growth rate of 2% over a period of 14 years using traffic volume provided by MTO for Year 2018.

The cumulative noise levels at the receptors due to traffic and the quarry operations are higher than the noise level estimated separately at the receptors.



6.0 NOISE CONTROL RECOMMENDATIONS

6.1 Noise Mitigation, PCQ Operations

The predicted sound level at the onsite receptor(s) to the west of Pit 1 (processing Plant) showed exceedance of 12 dBA. An acoustic barrier (acoustically equivalent berm) is required to be constructed along the west boundary of Pit 1 to reduce noise level at the subject Site. The berm is required to protect respective PORs at the subject Site when material handling and processing occur at Pit 1. The MECP typically requires local barriers to have a minimum surface density of 20 kg/m².

6.2 Noise Mitigation, Traffic Noise

6.2.1 Outdoor Living Area Assessment (NPC-300, Section C7.1.1)

The road noise level predictions indicate that the future noise levels at outdoor living area fronting Hwy 140 is above the applicable limits; i.e., 60 dBA. The worst-case 16-hour equivalent sound level at the OLA for the development was 63 dBA, with the incorporation of OLA barrier walls in the revised site plan the impact will be below the 55 dBA and as such a Type A warning clause is not required. The total recommended height of the acoustic barrier is minimum 3.0 m.

6.2.2 Plane of Window-Ventilation Requirements (NPC-300, Section C7.1.2/C7.1.2.2)

The daytime and nighttime plane of window (POW) noise impact assumes worst-case and direct line of sight exposure of living area windows to the roadway. The noise impact requirements for Plane of Window are presented in Table 6.1.

Table 6.1: NPC-300 POW Noise Impact Requirements

Daytime Level (dBA)	Nighttime Level (dBA)	Ventilation Requirements and Warning Clauses	Special Building Components
55	50	Not Required	Not Required
55-65 [63]	50-60 [59]	Yes, with Type C Warning Clause	Not Required
>65	>60	Yes, with Type D Warning Clause	Yes

Daytime Period

As per requirements of the NPC-300 guidelines, central air conditioning must be included in design of every townhouse, as the daytime sound level is greater than 55 dBA and less than 65 dBA in the plane of bedroom/dining room windows. Installation of central air conditioning by the occupant will allow windows and exterior door to remain closed, thereby ensuring that the indoor sound levels are within the sound level limits of the Municipality and MECP.

Nighttime Period

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. And if 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 4.2.



Please note that the nighttime sound level at the plane of windows is estimated 59 dBA, based on forecasted traffic volume for the year 2032. The sound level may hit 60 dBA or greater if the traffic volume increases for any unforeseeable reason(s) in future. A provision of building components upgrading and Type D warning should be given a serious consideration.

6.2.3 Indoor Living Area-Building Components (NPC-300, Section C7.1.3)

The building must be constructed to standard Ontario Building Code requirements. Improved building components are not required as summarized in Table 6.2. It is also recommended that an acoustic consultant review the final design in light of elevated ambient noise level to determine the required STC values for the living area and bedroom windows and ensure that the noise transmission through the structure is minimized.

Table 6.2: Noise Modelling Results

Point of Reception	Daytime Level (dBA)	Nighttime Level (dBA)	Ventilation/Barrier Requirements (NPC-300)	Warning Clause	Special Building Components
Bedroom Window (POW)	63	59	Provision of Air Conditioning	Type C	Reduction of 19 dBA required. Window STC rating be determined
Outdoor Patio (OLA)	63		Provision of Noise Barrier		N/A

7.0 VIBRATION IMPACT ASSESSMENT

There are two primary sources of ground-borne vibration likely impact the subject Site: Blasting from PCQ operations and construction vibration during the development of the Site. Vibration impact from the blasting operations is beyond the scope of this study and not covered in this report.

As part of the Noise Impact Assessment, the following evaluations are made for the construction vibrations related to the subject site. For evaluating the potential damage effects due to vibration from construction activities at the site, the calculation procedure was used as defined in Section 7.2 of the *Transit Noise and Vibration impact Assessment Manual* (US Federal Transit Administration, September 2018). The assessment criteria defined in this document is less conservative than as defined in the City of Toronto by-law Number 514-2008 (City of Toronto 2008), therefore the city of Toronto criteria was used as a local best practice. The city of Toronto criteria defines the ‘zone of influence’ as the area potentially impacted by vibrations emanating from the construction activity where the peak particle velocity measured at the point of reception is equal to or greater than 5 mm/sec at any frequency.

The required setbacks can be calculated using the reference vibration source levels given in Section 7 of the *Transit Noise and Vibration impact Assessment* and the associated equation;

$$PPV_{equip} = PPV_{ref} \times \left(\frac{25}{D} \right)^{1.5}$$

Where:

- PPV (equip) is the peak particle velocity in in/sec of the equipment adjusted for distance



- PPV (ref) is the reference vibration level in in/sec at 25 feet (7.6 m) from Table 7.4)
- D is the setback distance from the equipment to the receiver.

The following table summarizes the vibration impact of various potential construction processes and the resulting zone of influence setback distances in order to maintain compliance with the construction vibration criteria.



Table 7.1: Vibration Source Levels for Construction Equipment

Standard Potential Equipment	PPV _{ref} at 25 ft (in/sec)	Zone of Influence Setback (m)
Pile Driver Impact Upper Range	1.518	29.94
Pile Driver Impact Typical	0.644	16.90
Pile Driver Sonic Upper Range	0.734	18.44
Pile Driver Sonic Typical	0.17	6.96
Vibratory Roller	0.21	8.01
Hoe Ram	0.089	4.52
Large bulldozer	0.089	4.52
Loaded Trucks	0.076	4.07
Jack Hammer	0.035	2.43
Small bulldozer	0.003	0.47

Once the construction methods of the proposed Facility have been decided, the locations of specific activities should be reviewed in concert with the above zone of influence setbacks to confirm whether or not pre-construction surveys and vibration monitoring are required.

The nearest existing structure is a bungalow building, which is located approximately 39 m cross the street on Chippawa Road from the proposed townhouses foot print. The predicted zone of influence setback distance is approximately less than the largest setback distance listed in the above Table. Thus, the impact of the pile driver, if required near the existing structure, is considered negligible

It should be noted that the setbacks indicated here are the zone of influence setbacks as defined in the City of Toronto By-law (City of Toronto by law 514-2008). This by-law was selected based on the fact that a search for local by-laws did not indicate specific construction by-law locally.

These setback distances do not preclude construction and only indicate that if a structure is within this distance, it should be considered for Pre-construction survey and monitoring during construction. The city of Toronto limits for construction vibration are provide below.

Table 7.2: Prohibited Construction Vibrations

Frequency of Vibration (Hz)	Vibration Peak Particle Velocity, (PPV)(mm/s)	PPV (in/s)
Less than 4	8	0.31
4 to 10	15	0.59
More than 10	25	0.98

Any assessment of construction vibration should also assess the appropriate limits to apply to the nearby structures. Sensitive structures may require even low limits.



7.1 Noise Control Measures for Project Construction

To minimize the potential for construction noise impacts, it is recommended that provisions be written into the contract documentation for the contractor, as outlined below:

- i. Where possible construction should be carried out during the daytime. If construction activities are required outside of these hours, the Contractor should try and minimize the amount of noise being generated;
- ii. There should be explicit indication that Contractors are expected to comply with all applicable requirements of the contract;
- iii. All equipment should be properly maintained to limit noise emissions. As such, all construction equipment should be operated with effective muffling devices that are in good working order;
- iv. The Contract documents should contain a provision that any initial noise complaint will trigger verification that the general noise control measures agreed to be in effect;
- v. Any noise resulting from the operation of construction equipment between the hours of 7:00 pm to 7:00 am, or on Sundays and Holidays, if the noise is audible at a point of reception;
- vi. In the presence of persistent complaints and subject to the results of a field investigation, alternative noise control measures; where reasonably available and economically feasible may be required; and
- vii. It is recommended that the construction vibration should be assessed once construction methods are finalized, confirming the potential zone of influence and requirement for any pre-construction condition surveys and/or vibration monitoring if required.



8.0 NOTES AND WARNING CLAUSES

Purchase and/or lease agreement shall include the following warning clauses.

8.1 Warning Clause:

Transportation Sources, 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."

Stationary Sources, Type E: (see Section C7.6)

It is not acceptable to use warning clauses in place of physical noise control measures to identify an excess over the MECP 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.

"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."

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."

Stationary Sources, Type F: (see Section B9.2 and Section C4.4.2)

This notification is required if the Site to be classified as "Class 4). "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."

8.2 Barriers

The barrier(s) should be erected as required and shall be continuous with no openings through or beneath it, and it shall be of durable material, with a mass of 20 kg. per sq. meter or more. Any gaps under the noise barrier that are necessary for drainage purposes must be minimized and localized and must not deteriorate the acoustical performance.

8.3 Conceptual Plan

The general architectural plans, configuration/layout and grading of the site are integral parts of the noise control system. Any major deviations will require further analysis for verification purposes.



9.0 CONCLUSIONS

The modelling results from the PCQ operations and traffic on Hwy 140 indicate that the predicted noise levels at representative PORs located to the east boundary of the Site and those on Chippawa Street are predicted to exceed the established noise criteria.

The results of this study indicated that the outdoor living areas of the proposed dwellings will be exposed to transportation noise levels above 60dBA. Consequently, a noise barrier as discussed will be required to mitigate transportation noise to the levels acceptable to MECP. As indicated in the MECP implementation guidelines, where mitigation is required, or noise may be a concern, future occupants will be advised through warning clauses.

The Indoor sound levels at the plane of windows are predicted to exceed the respective MECP Guidelines as summarized in Section 6.0 of this report. The projected daytime and night time Leq 's will be used by an acoustical engineer to determine the required STC values for the living area and bedroom windows.

An acoustic barrier (acoustically equivalent berm) is required to be constructed along the west boundary of Pit 1 to reduce noise impact from the PCQ operations at the subject Site. The berm is required to protect respective PORs at the subject Site when material handling and processing occur at Pit 1. The MECP typically requires local barriers to have a minimum surface density of 20 kg/m².

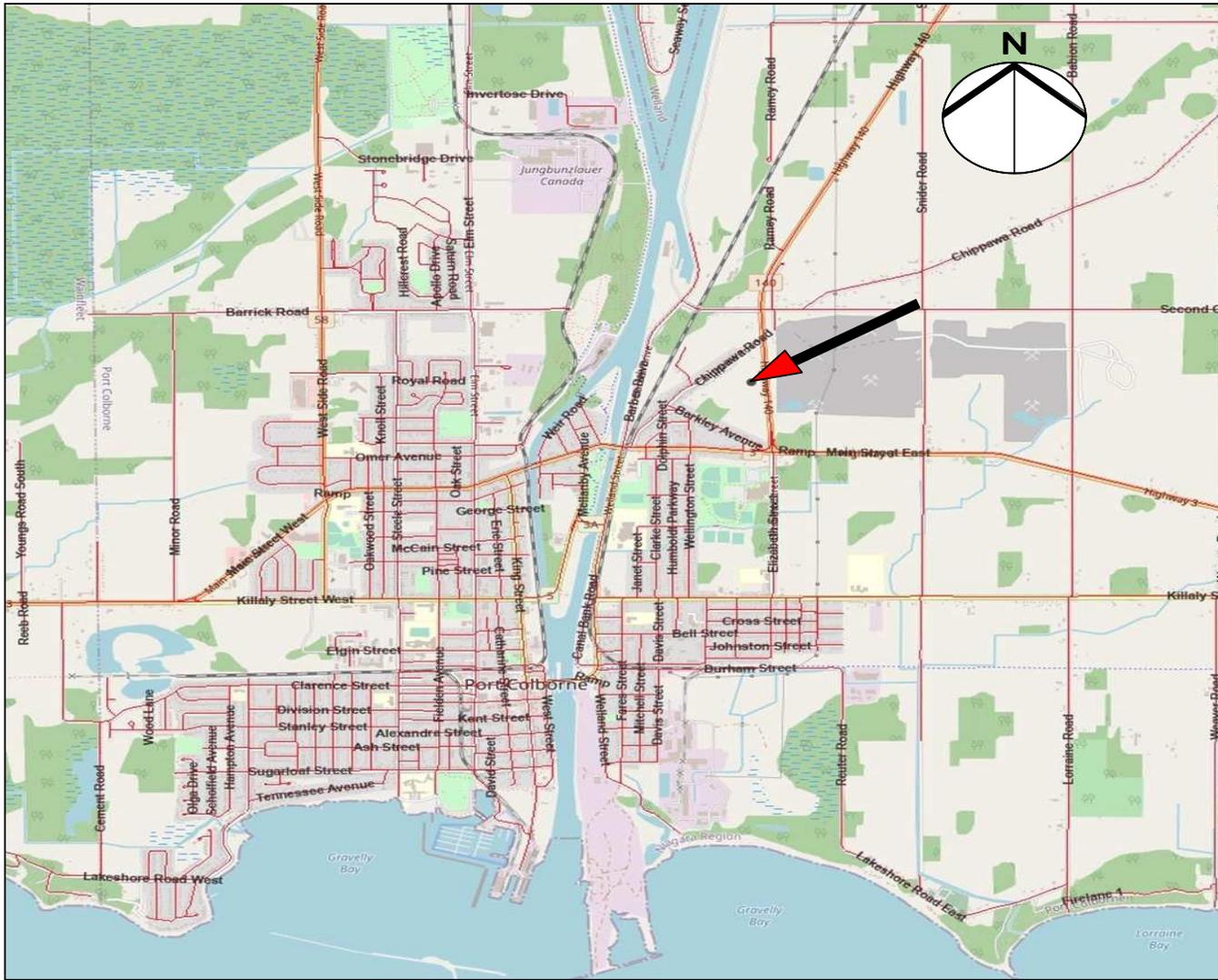


REFERENCES

1. Ontario Ministry of the Environment, Conservation and Parks Publication NPC-300, *Environmental Noise Guideline, Stationery and Transportation Sources -Approval and Planning*, August, 2013;
2. International Organization for Standardization, "Acoustics - Attenuation of Sound during Propagation Outdoors - Part 2: General Method of Calculation," ISO-9613-2, Switzerland, 1996;
3. ORNAMENT – "Ontario Road Noise Analysis Method for Environmental and Transportation", Ontario Ministry of the Environment, October 1989.



FIGURES



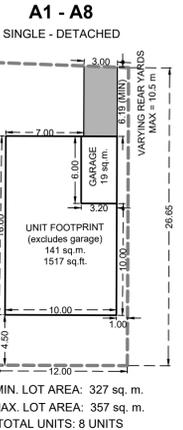
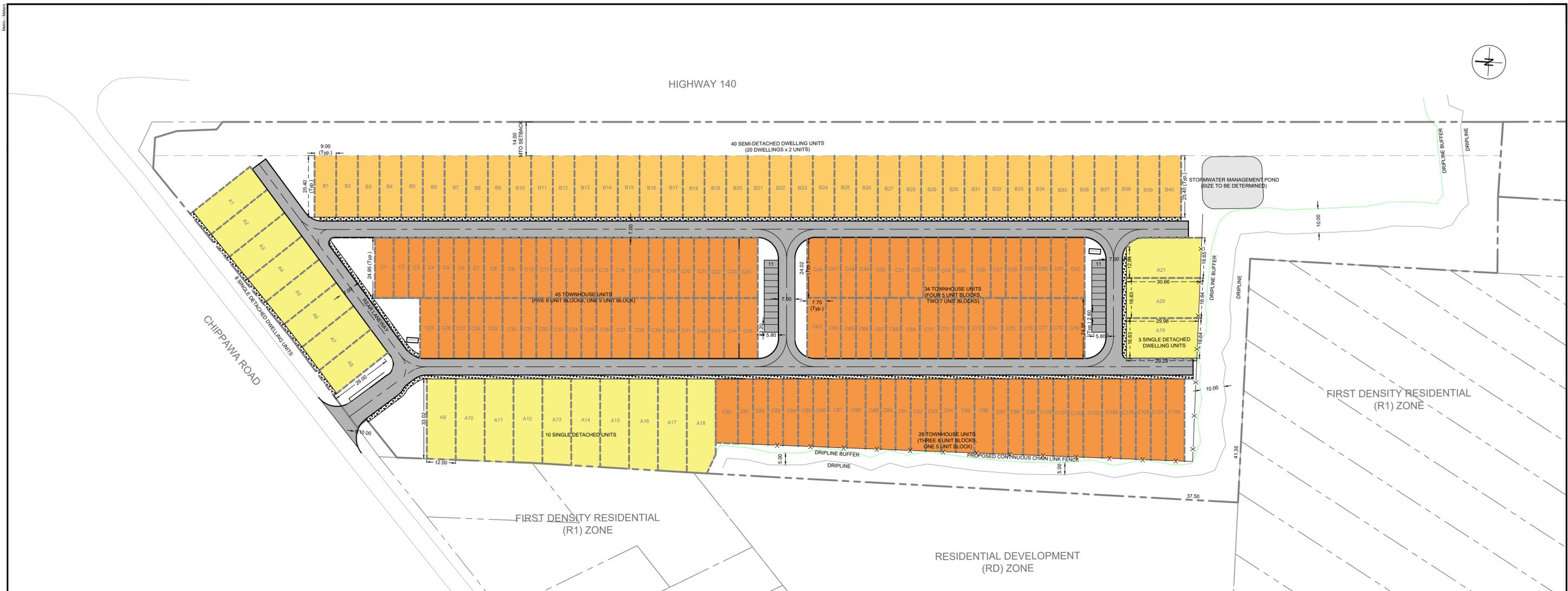
LEGEND:

<p>Site Location Plan</p>		<p>Client: 2835935 Ontario Inc. 247 King StreetN, Suite 313 Alliston, ON, L9R 1N4</p>
		
<p>Date: April 2022</p>	<p>PROJECT NO: P21-1034</p>	<p>Figure 1</p>

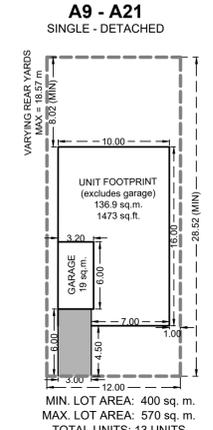


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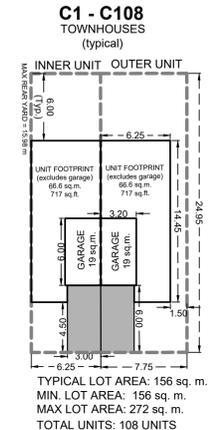
Site Plan and Surrounding Land Use		Client: 2835935 Ontario Inc. 247 King StreetN, Suite 313 Alliston, ON, L9R 1N4
 		
Date: April 2022	PROJECT NO: P21-1034	Figure 2



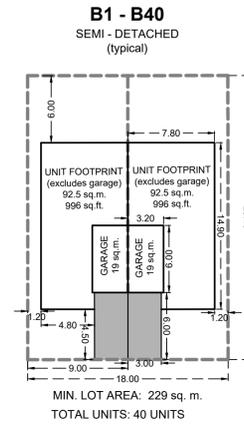
	REQUIRED	PROVIDED
MIN LOT FRONTAGE	12 m	12 m
MIN LOT AREA	0.04 ha	0.0327 ha
MIN FRONT YARD	6.5 m	4.5 m
MIN SIDE YARD	1 m	1 m
MIN REAR YARD	6 m	6 m
MAX LOT COVERAGE	50%	49%
MAX HEIGHT	11 m	Comply
MIN LANDSCAPED AREA	25%	45%



	REQUIRED	PROVIDED
MIN LOT FRONTAGE	12 m	12 m
MIN LOT AREA	0.04 ha	0.04 ha
MIN FRONT YARD	6.5 m	4.5 m
MIN SIDE YARD	1 m	1 m
MIN REAR YARD	6 m	8 m
MAX LOT COVERAGE	50%	40%
MAX HEIGHT	11 m	Comply
MIN LANDSCAPED AREA	25%	49%



	REQUIRED	PROVIDED
MIN LOT FRONTAGE	6 m	6.25m
MIN LOT AREA	0.02 ha	0.0156 ha
MIN FRONT YARD	6.5 m	4.5 m
MIN INT SIDE YARD	3 m	3 m
MIN EXT SIDE YARD	4.5 m	Comply
MIN REAR YARD	6 m	6 m
MAX HEIGHT	11 m	2 storeys
MIN LANDSCAPED AREA	25%	33%



	REQUIRED	PROVIDED
MIN LOT FRONTAGE	18 m	18 m
MIN LOT AREA	0.05 ha	0.045 ha
MIN FRONT YARD	6.5 m	4.5 m
MIN INT SIDE YARD	1.2 m	1.2 m
MIN REAR YARD	6 m	6 m
MAX LOT COVERAGE	50%	48.6%
MAX HEIGHT	11 m	Comply
MIN LANDSCAPED AREA	25%	43%

SITE STATISTICS	
TOTAL UNITS	169
SITE AREA	6.647 ha
DENSITY	25.4 UNITS/ha
PARKING	191 SPACES (1.13 PER UNIT)

TYPICAL UNIT DIMENSIONS

17 Jan 2023
PRELIMINARY

issue	issued for	date	init.
H	REVIEW	14 DEC 2022	EP
G	REVIEW	09 DEC 2022	EP
F	REVIEW	04 AUG 2022	RM
E	REVIEW	22 JUL 2022	RM
D	REVIEW	19 JUL 2022	RM
C	REVIEW	11 MAY 2022	NS
B	REVIEW	18 JAN 2022	NS
A	REVIEW	25 OCT 2021	NS

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All construction to be in accordance with the current Ontario Building Code and all applicable Ontario regulations.
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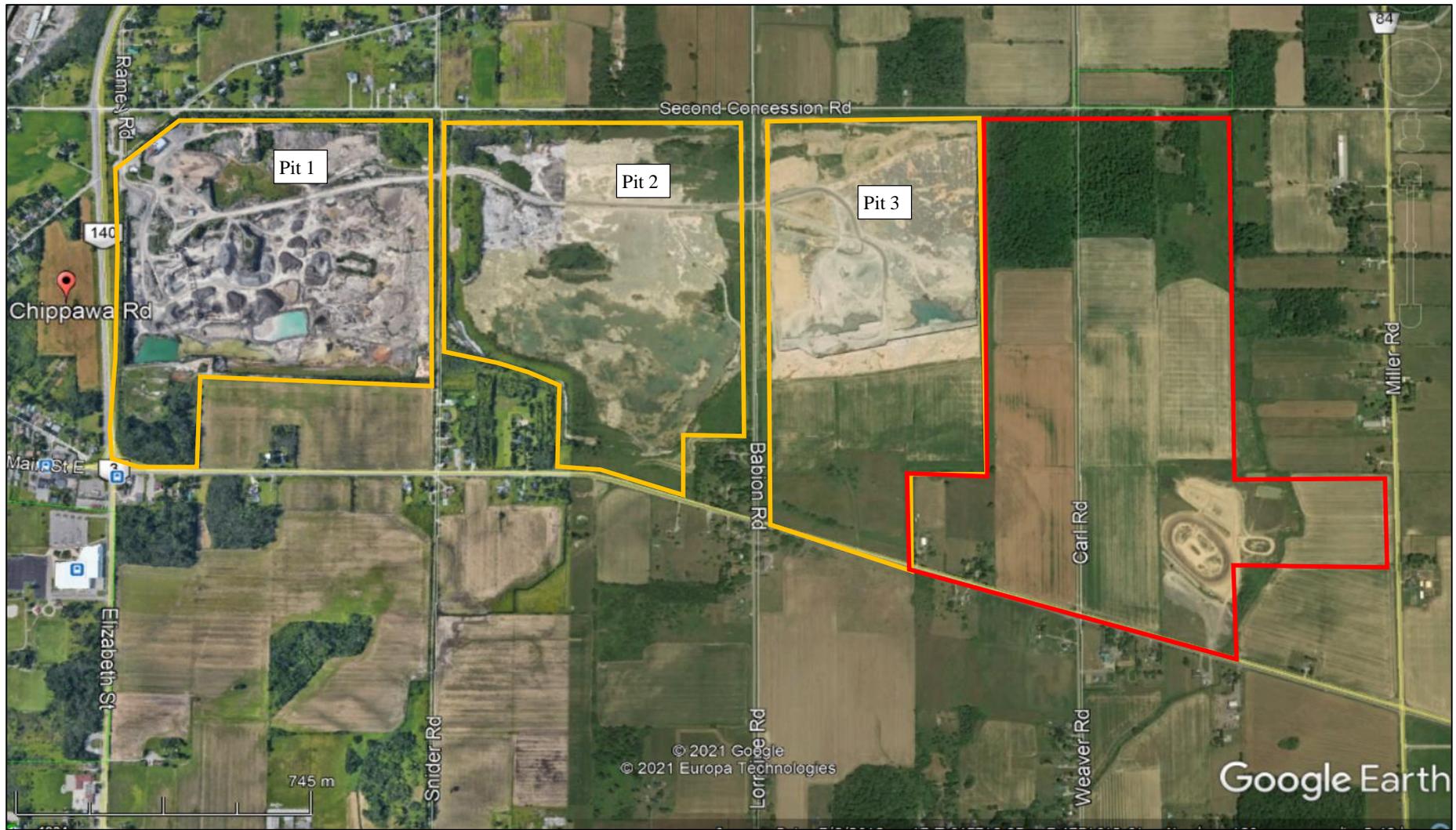
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date: _____
CAD file: 21092-PLAN-REVISED-C-SHADES.dwg

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drawing title
CONCEPT PLAN

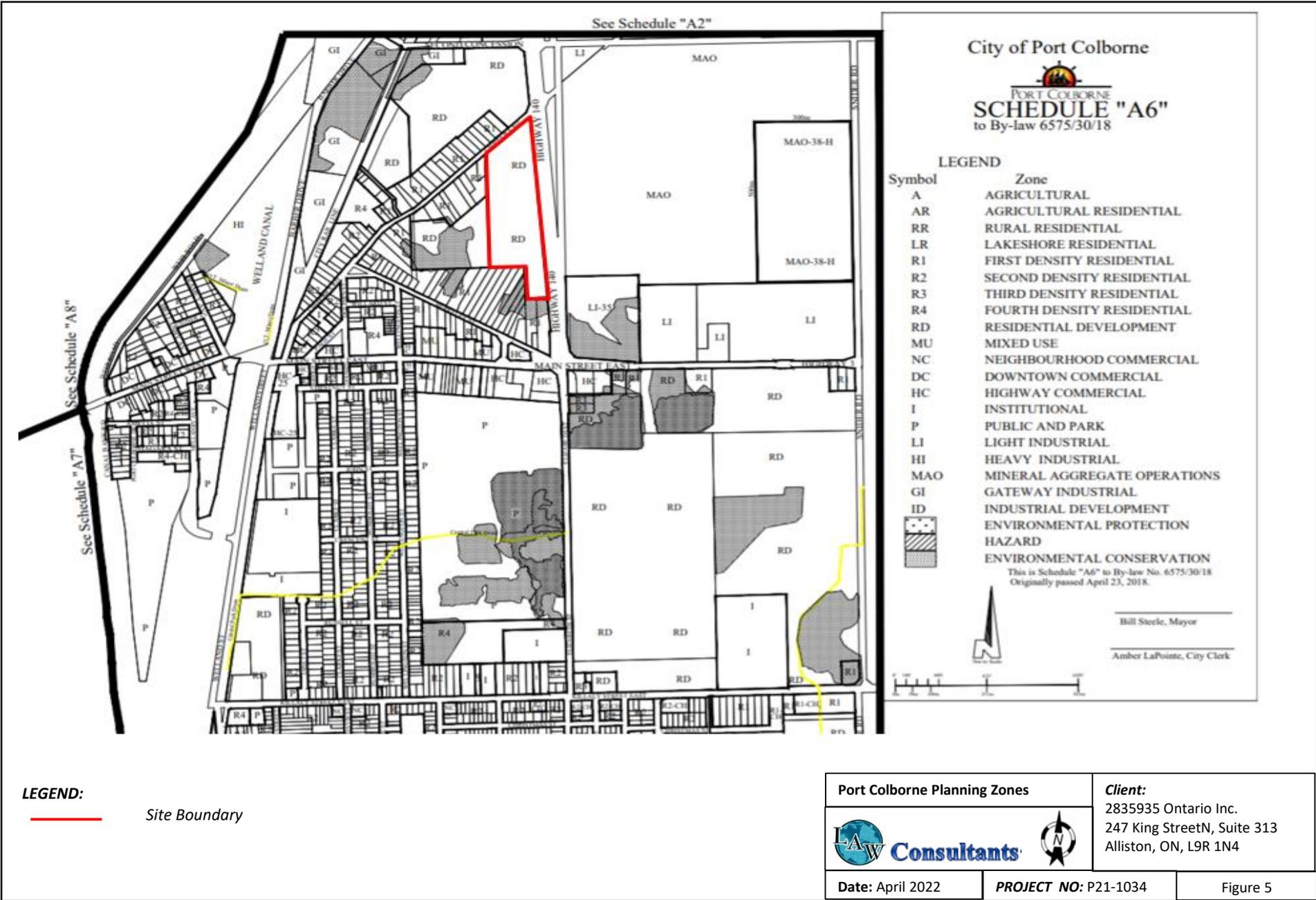
drawn by	designed by
EP	EP
scale	date
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job number	issue
21092	H
drawing number	
21092-CP	



LEGEND:

- Property Boundary
- Proposed Quarry Extension

Port Colborne Quarry Location		Client: 2835935 Ontario Inc. 247 King StreetN, Suite 313 Alliston, ON, L9R 1N4
 		
Date: April 2022	PROJECT NO: P21-1034	Figure 3



City of Port Colborne

PORT COLBORNE
SCHEDULE "A6"
 to By-law 6575/30/18

LEGEND

Symbol	Zone
A	AGRICULTURAL
AR	AGRICULTURAL RESIDENTIAL
RR	RURAL RESIDENTIAL
LR	LAKESHORE RESIDENTIAL
R1	FIRST DENSITY RESIDENTIAL
R2	SECOND DENSITY RESIDENTIAL
R3	THIRD DENSITY RESIDENTIAL
R4	FOURTH DENSITY RESIDENTIAL
RD	RESIDENTIAL DEVELOPMENT
MU	MIXED USE
NC	NEIGHBOURHOOD COMMERCIAL
DC	DOWNTOWN COMMERCIAL
HC	HIGHWAY COMMERCIAL
I	INSTITUTIONAL
P	PUBLIC AND PARK
LI	LIGHT INDUSTRIAL
HI	HEAVY INDUSTRIAL
MAO	MINERAL AGGREGATE OPERATIONS
GI	GATEWAY INDUSTRIAL
ID	INDUSTRIAL DEVELOPMENT
[Symbol]	ENVIRONMENTAL PROTECTION
[Symbol]	HAZARD
[Symbol]	ENVIRONMENTAL CONSERVATION

This is Schedule "A6" to By-law No. 6575/30/18
 Originally passed April 23, 2018.

Bill Steele, Mayor
 Amber LaPointe, City Clerk



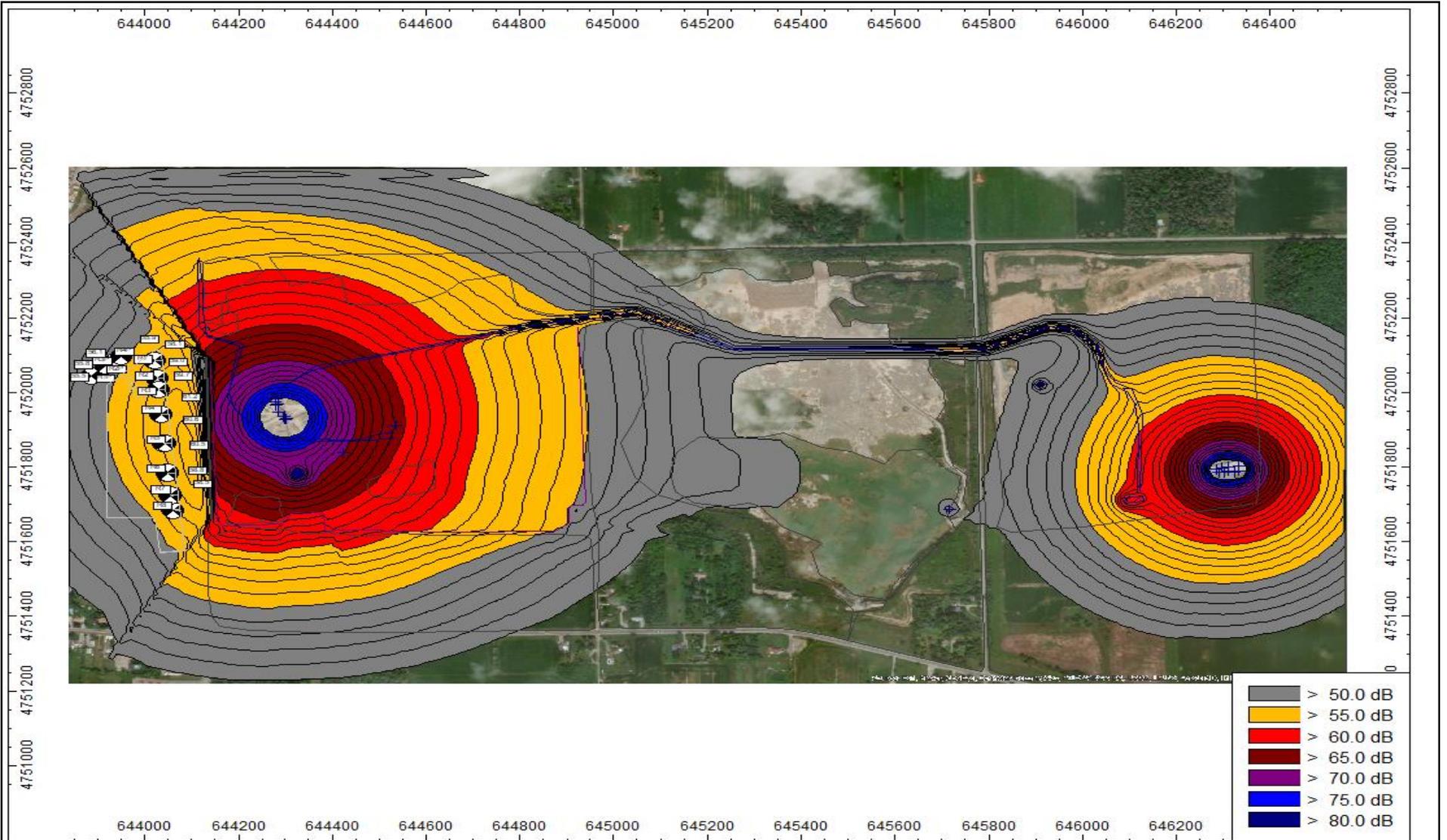
LEGEND:
 [Red line symbol] Site Boundary

Port Colborne Planning Zones		Client: 2835935 Ontario Inc. 247 King StreetN, Suite 313 Alliston, ON, L9R 1N4
Date: April 2022	PROJECT NO: P21-1034	Figure 5



LEGEND:

Onsite Points of Receptions		Client: 2835935 Ontario Inc. 247 King StreetN, Suite 313 Alliston, ON, L9R 1N4	
			
Date: May 2022	PROJECT NO: P21-1034	Figure 6	



LEGEND:

Noise Contours Plot



Client:

2835935 Ontario Inc.
247 King StreetN, Suite 313
Alliston, ON, L9R 1N4

Date: May 2022

PROJECT NO: P21-1034

Figure 7



APPENDIX A
TRAFFIC COUNT PROVIDED BY MTO

Maximum 24h traffic volume from 30 May, 2018 to 6 Jun, 2018:

A) Fri- 6/1/2018 Total =4909 from North to South

B) Fri- 6/1/2018 Total =5109 from South to North

2032 estimation:

A compound growth of 2% per annum was used in the analysis to estimate future traffic volume.

<i>Year</i>	<i>Total traffic volume (North to South)</i>
2018	4909
2019	5008
2020	5109
2021	5212
2022	5317
2023	5424
2024	5533
2025	5645
2026	5759
2027	5875
2028	5994
2029	6114
2030	6237
2031	6362
2032	6490

<i>Year</i>	<i>Total traffic volume (South to North)</i>
2018	5109
2019	5212
2020	5317
2021	5424
2022	5533
2023	5645
2024	5759
2025	5875
2026	5994
2027	6115
2028	6238
2029	6363
2030	6491
2031	6621
2032	6754

2032 traffic volume per hour:

Direction	Total (24 hour)	Time	Total (1 hour)	Vehicle	Total(1 hour)	
North to South	6490	Day	345	Car	327	
				Med-Truck	14	
				Heavy-Truck	4	
		Night	122	122	Car	116
					Med-Truck	4
					Heavy-Truck	2
South to North	6754	Day	359	Car	341	
				Med-Truck	14	
				Heavy-Truck	4	
		Night	127	127	Car	120
					Med-Truck	5
					Heavy-Truck	2



APPENDIX B
TRAFFIC NOISE MODELLING RESULTS

Filename: 2032-Day-Pw Time Period: 1 hours
 Description:

Road data, segment # 1: SouthtoNorth

 Car traffic volume : 341 veh/TimePeriod
 Medium truck volume : 14 veh/TimePeriod
 Heavy truck volume : 4 veh/TimePeriod
 Posted speed limit : 80 km/h
 Road gradient : 0 %
 Road pavement : 1 (Typical asphalt or concrete)

Data for segment # 1: SouthtoNorth

 Angle1 Angle2 : -90.00 deg 90.00 deg
 wood depth : 0 (No woods.)
 No of house rows : 0
 Surface : 2 (Reflective ground surface)
 Receiver source distance : 45.00 m
 Receiver height : 4.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00

±
 Road data, segment # 2: NorthtoSouth

 Car traffic volume : 327 veh/TimePeriod
 Medium truck volume : 14 veh/TimePeriod
 Heavy truck volume : 4 veh/TimePeriod
 Posted speed limit : 60 km/h
 Road gradient : 0 %
 Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: NorthtoSouth

 Angle1 Angle2 : -90.00 deg 90.00 deg
 wood depth : 0 (No woods.)
 No of house rows : 0
 Surface : 2 (Reflective ground surface)
 Receiver source distance : 41.00 m
 Receiver height : 4.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00

±
 Results segment # 1: SouthtoNorth

 Source height = 1.03 m

ROAD (0.00 + 61.14 + 0.00) = 61.14 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	w.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	65.92	0.00	-4.77	0.00	0.00	0.00	0.00	61.14

Segment Leq : 61.14 dBA

±
 Results segment # 2: NorthtoSouth

 Source height = 1.04 m

ROAD (0.00 + 58.49 + 0.00) = 58.49 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	w.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	62.86	0.00	-4.37	0.00	0.00	0.00	0.00	58.49

Segment Leq : 58.49 dBA

Total Leq All Segments: 63.02 dBA

±

TOTAL Leq FROM ALL SOURCES: 63.02

Filename: 2032-Night-PW Time Period: 1 hours
 Description:

Road data, segment # 1: SouthtoNorth

 Car traffic volume : 120 veh/TimePeriod
 Medium truck volume : 5 veh/TimePeriod
 Heavy truck volume : 2 veh/TimePeriod
 Posted speed limit : 80 km/h
 Road gradient : 0 %
 Road pavement : 1 (Typical asphalt or concrete)

Data for segment # 1: SouthtoNorth

 Angle1 Angle2 : -90.00 deg 90.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0
 Surface : 2 (Reflective ground surface)
 Receiver source distance : 45.00 m
 Receiver height : 4.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00

±
 Road data, segment # 2: NorthtoSouth

 Car traffic volume : 116 veh/TimePeriod
 Medium truck volume : 4 veh/TimePeriod
 Heavy truck volume : 2 veh/TimePeriod
 Posted speed limit : 60 km/h
 Road gradient : 0 %
 Road pavement : 1 (Typical asphalt or concrete)

Data for segment # 2: NorthtoSouth

 Angle1 Angle2 : -90.00 deg 90.00 deg
 Wood depth : 0 (No woods.)
 No of house rows : 0
 Surface : 2 (Reflective ground surface)
 Receiver source distance : 41.00 m
 Receiver height : 4.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00

±
 Results segment # 1: SouthtoNorth

 Source height = 1.12 m

ROAD (0.00 + 56.99 + 0.00) = 56.99 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	w.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	61.76	0.00	-4.77	0.00	0.00	0.00	0.00	56.99

Segment Leq : 56.99 dBA

±
 Results segment # 2: NorthtoSouth

 Source height = 1.13 m

ROAD (0.00 + 54.24 + 0.00) = 54.24 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	w.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	58.61	0.00	-4.37	0.00	0.00	0.00	0.00	54.24

Segment Leq : 54.24 dBA

Total Leq All segments: 58.84 dBA

±
 TOTAL Leq FROM ALL SOURCES: 58.84
 ±

Filename: 2032-Day-OLA Time Period: 1 hours
 Description:

Road data, segment # 1: SouthtoNorth

 Car traffic volume : 341 veh/TimePeriod
 Medium truck volume : 14 veh/TimePeriod
 Heavy truck volume : 4 veh/TimePeriod
 Posted speed limit : 80 km/h
 Road gradient : 0 %
 Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: SouthtoNorth

 Angle1 Angle2 : -90.00 deg 90.00 deg
 wood depth : 0 (No woods.)
 No of house rows : 0
 Surface : 2 (Reflective ground surface)
 Receiver source distance : 42.00 m
 Receiver height : 1.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00

§
 Road data, segment # 2: NorthtoSouth

 Car traffic volume : 327 veh/TimePeriod
 Medium truck volume : 14 veh/TimePeriod
 Heavy truck volume : 4 veh/TimePeriod
 Posted speed limit : 60 km/h
 Road gradient : 0 %
 Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 2: NorthtoSouth

 Angle1 Angle2 : -90.00 deg 90.00 deg
 wood depth : 0 (No woods.)
 No of house rows : 0
 Surface : 2 (Reflective ground surface)
 Receiver source distance : 38.00 m
 Receiver height : 1.50 m
 Topography : 1 (Flat/gentle slope; no barrier)
 Reference angle : 0.00

§
 Results segment # 1: SouthtoNorth

 Source height = 1.03 m

ROAD (0.00 + 61.44 + 0.00) = 61.44 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	w.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	65.92	0.00	-4.47	0.00	0.00	0.00	0.00	61.44

Segment Leq : 61.44 dBA

§
 Results segment # 2: NorthtoSouth

 Source height = 1.04 m

ROAD (0.00 + 58.82 + 0.00) = 58.82 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	w.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.00	62.86	0.00	-4.04	0.00	0.00	0.00	0.00	58.82

Segment Leq : 58.82 dBA

Total Leq All Segments: 63.33 dBA

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TOTAL Leq FROM ALL SOURCES: 63.33



APPENDIX C
CADNA SAMPLE CALCULATIONS