Environmental Noise Feasibility Study

0 Mount Pleasant Road

Proposed Residential Development

Town of Caledon

June 26, 2018
Project: 117-0503

Prepared for

Tropical Land Developments Limited

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VALCOUSTICS
Canada Ltd.

Version History

Version #	Date	Comments
1.0	June 26, 2018	Issued to Client

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0 Mount Pleasant Road

Proposed Residential Development

Town of Caledon

EXECUTIVE SUMMARY

Valcoustics Canada Ltd. (VCL) was retained to prepare an Environmental Noise Feasibility Study addressing the potential noise impact from the existing environment onto the proposed residential development. The proposed development consists of eight single-family detached dwellings located on the west side of Mount Pleasant Road, north of Hunsden Sideroad, in the Town of Caledon.

The significant noise source in the vicinity is rail traffic on the Canadian Pacific Railway (CPR) MacTier Subdivision. There are no stationary noise sources in the vicinity with the potential to impact the site.

The sound levels on site have been determined and compared with the applicable Ministry of the Environment and Climate Change (MOE), Region of Peel and the Town of Caledon noise guideline limits to determine the need for noise mitigation.

To meet the applicable transportation noise source guideline limits:

- All residential suites in the development require the provision for adding air conditioning.

- Exterior wall construction meeting a Sound Transmission Class (STC) rating of 37 and exterior windows meeting STC 28 will be sufficient to meet the indoor noise criteria. It is expected that these STC requirements can be achieved by using exterior wall and window construction meeting the minimum non-acoustical requirements of the Ontario Building Code (OBC); and

- Final wall and window requirements should be checked when detailed building plans are available.

1.0 INTRODUCTION

VCL was retained to prepare an Environmental Noise Feasibility Study for the proposed development in support of the Draft Plan of Subdivision and Re-zoning applications to the Town of Caledon. The potential sound levels and noise mitigation measures needed for the proposed development to comply with the MOE, the Region of Peel and the Town of Caledon noise guideline requirements are outlined herein.

1.1 THE SITE AND SURROUNDING AREA

The site is bounded by:

- detached single-family dwellings to the north and west;
- Mount Pleasant Road, with future residential development (currently vacant) beyond, to the east; and
- a woodlot to the south.

The closest building facade on the proposed development is beyond 75 m from the railway right-of-way. Therefore, a ground-borne vibration impact study due to the rail activities on the CPR MacTier Subdivision is not required.

Figure 1 shows the Key Plan.

This report is based on the Site Plan, prepared by MMH Architects Inc., last revised May 2, 2018. Figure 2 shows the Site Plan in reduced form.

1.2 THE PROPOSED DEVELOPMENT

The proposed development will consist of eight two-storey detached single-family dwellings. All dwellings will be provided with grade level rear yard amenity areas.

2.0 NOISE SOURCES

2.1 TRANSPORTATION NOISE SOURCES

The noise source with potential to impact the proposed development is rail traffic on the CPR MacTier Subdivision.

The Town of Caledon noise guideline requires that road traffic volumes used in noise impact analyses be based on future road traffic projections of at least 20 years after the completion of the project or ultimate capacity of the road. As ultimate projections for Hunsden Sideroad and Mount Pleasant Road were not available, current volumes were obtained from the Town of Caledon. The traffic volumes are so low that even accounting for a 20-year projection at a growth rate of 2%, compounded annually, traffic on these roadways would not have significant noise impact on the proposed development. Thus, noise from these roadways was not considered further in this assessment.

Rail traffic data applicable to the year 2017 for CPR MacTier Subdivision was obtained from CPR. The rail traffic data was projected to the year 2038 design condition using a growth rate of 2.5%, compounded annually. This is conservative, as the requirement for a 20-year projection is only specified for road traffic volumes. The growth rate is recommended by the railways for preparing environmental noise studies. CPR has indicated that whistles are sounded at the at-grade crossing at Mount Pleasant Road.

The traffic data is shown in Appendix A and summarized in Table 1.

2.2 STATIONARY NOISE SOURCES

There are no stationary noise sources in the vicinity of the site with the potential for significant noise impact.

3.0 ENVIRONMENTAL NOISE GUIDELINES

3.1 MOE PUBLICATION NPC-300

The applicable noise guidelines for new residential development are those in MOE Publication NPC-300, "Environmental Noise Guideline, Stationary and Transportation Sources – Approval and Planning".

The environmental noise guidelines of the MOE, as provided in Publication NPC-300, are discussed briefly below and summarized in Appendix B.

3.1.1 Architectural Elements

In the daytime (0700 to 2300), the indoor criterion for road noise is $L_{eq\ Day}$(1) of 45 dBA for sensitive spaces such as living/dining rooms, dens and bedrooms. At night, the indoor criterion for road noise is $L_{eq\ Night}$(2) of 45 dBA for sensitive spaces such as living/dining rooms and dens and 40 dBA for bedrooms. The architectural design of the building envelope (walls, windows, etc.) must provide adequate sound isolation to achieve these indoor sound level limits. The indoor criteria for rail noise are 5 dBA more stringent than those for the road; that is 40 dBA for living/dining rooms, dens and bedrooms during the daytime and nighttime periods except for bedrooms where the nighttime indoor criterion is 35 dBA. Whistle noise is included in the assessment of architectural elements.

In addition, the MOE requires brick veneer exterior wall construction or masonry equivalent construction from the foundation to the rafters for the first row of dwellings within 100 m of the rail line, when the L_{eq} 24 is greater than 60 dBA.

3.1.2 Ventilation

In accordance with the MOE noise guideline for road traffic sources, if the daytime sound level, $L_{eq\ Day}$, at the exterior face of a noise sensitive window is greater than 65 dBA, means must be provided so that windows can be kept closed for noise control purposes and central air conditioning is required. For daytime sound levels between 56 dBA and 65 dBA inclusive, there need only be the provision for adding air conditioning at a later date. A warning clause advising the occupant of the potential interference with some activities is also required. At nighttime, air conditioning would be required when the sound level exceeds 60 dBA ($L_{eq\ Night}$) at a noise sensitive window (provision for adding air conditioning is required when greater than 50 dBA). Note that railway whistle noise is not included in the assessment of ventilation requirements.

(1) $L_{eq,\ Day}$ 16-hour energy equivalent sound level (0700-2300 hours).
(2) $L_{eq,\ Night}$ 8-hour energy equivalent sound level (0700-2300 hours).

3.1.3 Outdoors

For outdoor amenity areas ("Outdoor Living Areas" - OLA's), the guideline is $L_{eq\ Day}$ of 55 dBA, with an excess not exceeding 5 dBA considered acceptable if it is technically not practicable to achieve the 55 dBA objective, providing warning clauses are registered on title

Note that whistle noise is not included in the assessment of OLA sound levels.

3.2 REGION OF PEEL GUIDELINES

The Region of Peel guidelines are essentially the same as the MOE guidelines except that the nighttime level for triggering the air conditioning requirement is 1 dBA more stringent (i.e., lower) than the level specified by the MOE – i.e., mandatory air conditioning for nighttime sound levels of 60 dBA or greater, and the provision for adding air conditioning for levels between 51 to 59 dBA inclusive.

A maximum desirable sound barrier height of 4 m (relative to roadway centreline) is indicated with a maximum acoustic fence component height of 2.4 m, although a height of no more than 2.0 m is preferred.

Since the development is not adjacent to any regional roads, the Region's sound barrier requirements are not applicable.

3.3 TOWN OF CALEDON

The Town of Caledon's general policy is not to accept the 5 dBA excess above the 55 dBA objective in OLA's. However, an excess may be acceptable if unreasonably high sound barriers are needed to meet the 55 dBA objective.

The Town's maximum acoustic fence height is 2.4 m. Higher barriers can be achieved using a combination of an acoustic fence and a berm. Acoustic fences are to be constructed using wood panels and HSS posts.

Also, road traffic noise impact is to be assessed based on the 20-year traffic forecast for the adjacent roadways and using a traffic speed 10 kph over the posted speed limit.

3.4 FEDERATION OF CANADIAN MUNICIPALITIES AND RAILWAY ASSOCIATION OF CANADA

The standard mitigation requirements outlined in the Federation of Canadian Municipalities and Railway Association of Canada (FCM/RAC) guideline suggests a dwelling setback of 30 m for a residential development adjacent to a principal main line, if in combination with a safety berm at least 2.5 m above the property line grade. A 5.5 m high sound barrier is also suggested (e.g., 3.0 m high acoustic fence atop 2.5 m high safety berm).

Warning clauses are also recommended.

Aside from "standard" requirements regarding the setback of dwellings and safety berm/sound barrier configuration, the sound level design objectives of FCM/RAC are similar to those of the MOE.

4.0 NOISE IMPACT ASSESSMENT

Using the road traffic data in Table 1, the sound levels, in terms of $L_{eq\ Day}$ and $L_{eq\ Night}$, were determined using STAMSON V5.04 – STEAM, the computerized rail traffic noise prediction model of the MOE.

All dwellings in the development will be two storeys. The daytime and nighttime sound levels at the facades of the dwellings were calculated at a height of 4.5 m above grade, representing top floor bedroom windows. The daytime OLA sound levels at the rear yards were calculated at a standing height of 1.5 m above grade, 3 m from the rear wall and aligned with the midpoint of the applicable facade.

Inherent screening of each building due to its orientation to the noise source was taken into account. Table 2 summarizes the predicted sound levels outdoors at specific locations.

A sample sound level calculation is included in Appendix C.

The highest daytime/nighttime sound levels of 52 dBA/53 dBA (excluding whistle noise) and 53 dBA/54 dBA (including whistle noise) are predicted to occur at the south facades of Lot 5. The highest unmitigated daytime OLA sound level of 51 dBA is predicted to occur at the same location.

5.0 NOISE ABATEMENT REQUIREMENTS

The noise control measures can generally be classified into two categories which are interrelated, but which can be treated separately for the most part:

a) Architectural elements to achieve acceptable indoor noise guidelines for transportation sources; and

b) Design features to protect the OLA's.

Noise abatement requirements are summarized in Table 3 and the notes to Table 3.

5.1 INDOORS

5.1.1 Architectural Requirements

The indoor noise exposure guidelines for the transportation sources can be achieved by using appropriate construction for exterior walls, windows and doors. In determining the worst-case architectural requirements for the residential building, wall and window areas were assumed to be 80% and 30%, respectively, on each façade of a corner room with both facades exposed to the source.

Based on the assumptions above, exterior wall construction meeting STC 37 and exterior windows meeting STC ratings 28 would be required to meet the indoor noise criteria. Since the dwellings are more than 100 m from the rail line and the L_{eq24} is less than 60 dBA, brick veneer exterior wall construction is not required.

For walls, a typical exterior facade construction which meets the minimum non-acoustical requirements of the OBC would be expected to achieve the requirement of STC 37. For windows, double-glazing configurations meeting the minimum non-acoustical requirements of the OBC would be expected to achieve an STC rating of 28. Note, the window frames themselves must also be designed to ensure that the overall sound isolation performance for the entire window unit

meets the sound isolation requirement. This should be confirmed by the window manufacturer through the submission of acoustical test data.

The final sound isolation requirements should be reviewed when architectural plans are developed. Wall and window constructions should also be reviewed at this point to ensure that they will meet the required sound isolation performance. This is typically required by the Municipality at the time of building permit application.

5.1.2 Ventilation Requirements

Based on the predicted sound levels, all dwellings in the development require the provision for adding air conditioning at a later date. This typically takes the form of a ducted, forced air heating system, suitably sized to accommodate central air conditioning.

5.2 OUTDOORS

The unmitigated daytime OLA sound level at all dwellings are predicted to be lower than 55 dBA. Thus, sound barriers are not required for noise control purposes.

5.3 WARNING CLAUSES

Warning clauses are a tool to inform prospective owners/occupants of potential annoyance due to existing noise sources. Where the guideline sound level limits are exceeded, appropriate warning clauses should be registered on title or included in the development agreement that is registered on title. The warning clauses should also be included in agreements of Offers of Purchase and Sale and lease/rental agreements to make future occupants aware of the potential noise situation.

Table 3 and the notes to Table 3 summarize the warning clauses for the site.

6.0 CONCLUSIONS

With the incorporation of the recommended noise mitigation measures, the applicable MOE noise guidelines can be met, and a suitable acoustical environment provided for the occupants.

The approvals and administrative procedures are available to ensure that the noise requirements are implemented.

7.0 REFERENCES

1. “Environmental Noise Guideline, Stationary and Transportation Sources - Approval and Planning”, Ontario Ministry of the Environment, Publication NPC-300, August 2013.

2. Road and Rail Noise: Effects on Housing”, Canada Mortgage and Housing Corporation, Publication NHA 5156, 81/10.

3. PC STAMSON 5.04, “Computer Program for Road Traffic Noise Assessment”, Ontario Ministry of the Environment.

4. Building Practice Note No. 56: “Controlling Sound Transmission into Buildings”, by J. D. Quirt, Division of Building Research, National Council of Canada, September 1985.

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TABLE 1: RAIL TRAFFIC DATA

Subdivision	Period	Train Type	Maximum # of Trains(2)	Average # of Cars/Train	Average # of Locos/Train	Maximum Speed (kph)
CPR MacTier	Daytime (0700 to 2300)	Freight	9 (15.1)	80	2	88
	Nighttime (2300 to 0700)	Freight	5 (8.4)	80	2	88

Notes:

(1) Obtained from CPR for the year 2017.
(2) The data shown in brackets is projected to the year 2038 at a growth rate of 2.5%, compounded annually.

TABLE 2: PREDICTED UNMITIGATED SOUND LEVELS OUTDOORS

Location(1)	Source	Distance (m)(2)	Excluding Whistle Noise		Including Whistle Noise	
			$L_{eq\ Day}$ (dBA)	$L_{eq\ Night}$ (dBA)	$L_{eq\ Day}$ (dBA)	$L_{eq\ Night}$ (dBA)
Lot 4 (South Face)	CPR MacTier Subdivision	355	52	52	52	53
Lot 4 (OLA)	CPR MacTier Subdivision	375	47	-	-	-
Lot 5 (South Face)	CPR MacTier Subdivision	283	54	54	54	55
Lot 5 (OLA)	CPR MacTier Subdivision	280	52	-	-	-
Lot 8 (South Face)	CPR MacTier Subdivision	376	52	52	53	53
Lot 8 (OLA)	CPR MacTier Subdivision	372	50	-	-	-

Notes:

(1) Daytime/nighttime receptors at the building facades were assessed at the top floor windows at a height of 4.5 m above grade. The OLA sound level was assessed at a standing height of 1.5 m above grade.
(2) Distance indicated is taken from the centreline of the noise source to the point of reception.

TABLE 3: MINIMUM NOISE ABATEMENT MEASURES

Location	Air Conditioning(1)	Exterior Wall(2)	Exterior Window(3)	Sound Barrier(4)	Warning Clauses(5)
Lots 1 to 8	Provision for adding	STC 37	STC 28	None	A + B + C

Notes:

1) Where methods must be provided to allow windows to remain closed for noise control purposes, a commonly used technique is that of air conditioning.

2) STC - Sound Transmission Class Rating (Reference ASTM-E413). Analyses were based upon the assumption that all wall and window areas are as indicated in Section 5.1.1 of text. Requirements should be checked once floor plans have been finalized and exterior wall construction details are defined.

3) STC values are based upon the assumption that all wall and window areas are as indicated in Section 5.1.1 of text. Requirements should be checked once floor plans have been finalized and exterior wall construction details are defined.

4) Sound barriers must be of solid construction with no gaps cracks or holes and must meet a minimum surface density of 20 kg/m². Suitable material can include wood, concrete metal sandwich panel, glazing or a combination of these.

5) The warning clauses to be registered on title and be included in Offers of Purchase and Sale for designated lots:

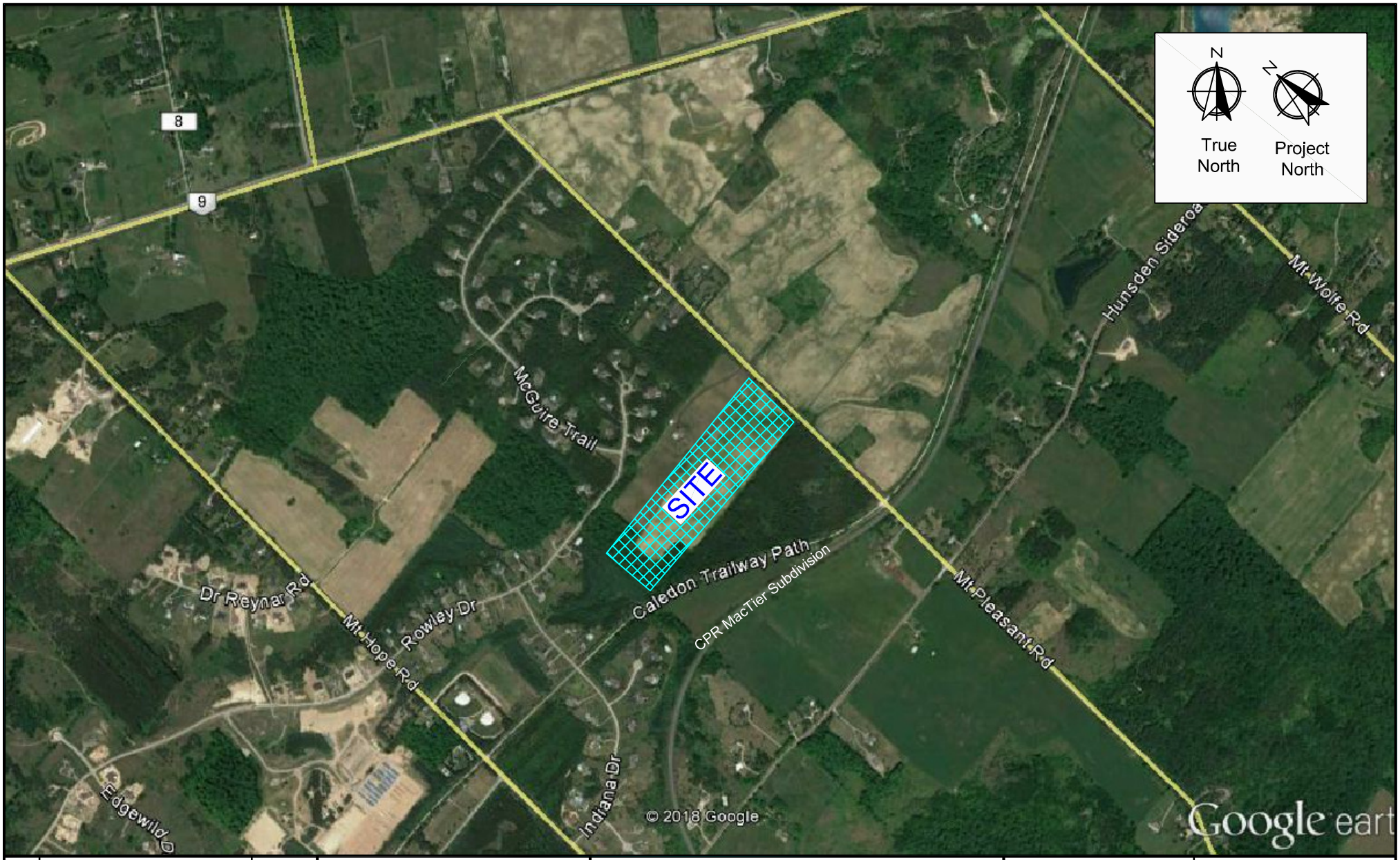
   A. "Purchasers/tenants are advised that despite the inclusion of noise control features in the development and within the building units, sound levels due to increasing rail traffic may on occasions interfere with some activities of the dwelling occupants as the sound levels exceed the sound level limits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

   B. "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."

   C. "Canadian Pacific Limited or its affiliated railway companies has or have a railway right-of-way within 300 m from this dwelling unit. There may be alterations to or expansions of the railway facilities of such right-of-way in the future, including the possibility that Canadian Pacific Limited or its affiliated railway companies as aforesaid, or their assigns or successors may expand their business operations. Such expansion may affect the living and business environment of the residents, tenants and their visitors, employees, customers and patients in the vicinity, notwithstanding the inclusion of any noise and vibration attenuating features in the design of the development. Canadian Pacific Limited, its affiliated railway companies and their successors and assigns will not be responsible for any complaints or claims arising from use of such facilities and/or operations on, over or under the aforesaid right-of-way."

(6) Conventional ventilated attic roof construction meeting OBC requirements is satisfactory.

(7) All exterior doors shall be fully weather-stripped.



No.	Revision/Issue	Date

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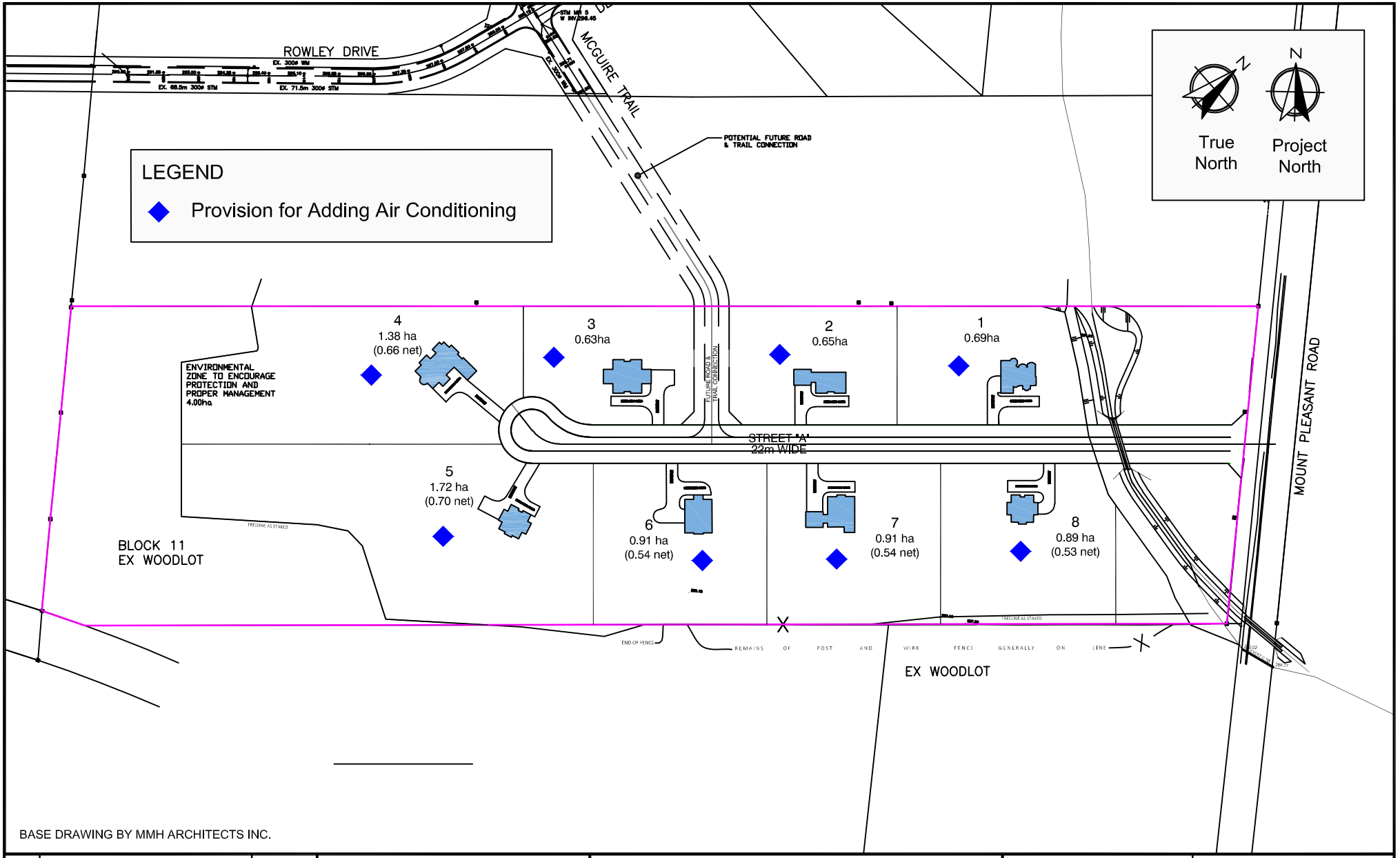
Title: Key Plan		Project No.: 117-0503	Date: May 18, 2018
Project Name: 0 Mount Pleasant Road, Caledon		Scale: N.T.S.	Figure: 1



BASE DRAWING BY MMH ARCHITECTS INC.

No.	Revision/Issue	Date

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Title	Project No.	Date
Site Plan	117-0503	May 18, 2018
Project Name	**Scale**	**Figure**
0 Mount Pleasant Road, Caledon	N.T.S.	2

APPENDIX A
TRAFFIC DATA

Ontario Traffic, Inc.

17705 Leslie St., Unit 6
Newmarket, ON, CANADA L3Y 3E3
Tel: (905) 898-7711 (905) 898-3577 Fax: (905) 898-3664

Site Code: 102
Station ID: C59
Mount Pleasant Rd
btw 2.4km N of Old Church Rd - Hunsden
Date Start: 01-Jun-10
Date End: 01-Jun-10

Start	01-Jun-10	NB		SB		Combined		02-Jun-	NB		SB		Combined	
Time	Tue	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.	Wed	A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
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Vol.		13	39	43	24	49	56							
P.H.F.		0.650	0.975	0.768	0.667	0.817	0.824							

ADT ADT 536 AADT 536

Ontario Traffic, Inc.

17705 Leslie St., Unit 6
Newmarket, ON, CANADA L3Y 3E3
Tel: (905) 898-7711 (905) 898-3577 Fax: (905) 898-3664

Site Code: 134
Station ID: T7
Hunsden Sdrd
btw Mount Pleasant Rd - Mount Wolfe Rd
Date Start: 27-May-10
Date End: 27-May-10

Start	27-May-10	EB		WB		Combined		28-May-	EB		WB		Combined	
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05:30		0	***3***	0	***0***	0	***3***		*	*	*	*	*	*
05:45		1	***2***	0	***0***	1	***2***		*	*	*	*	*	*
06:00		0	***3***	1	***4***	1	***7***		*	*	*	*	*	*
06:15		1	2	0	0	1	2		*	*	*	*	*	*
06:30		0	1	1	0	1	1		*	*	*	*	*	*
06:45		1	0	***2***	1	***3***	1		*	*	*	*	*	*
07:00		0	1	***2***	2	***2***	3		*	*	*	*	*	*
07:15		0	0	***3***	2	***3***	2		*	*	*	*	*	*
07:30		0	4	***3***	0	***3***	4		*	*	*	*	*	*
07:45		0	0	1	1	1	1		*	*	*	*	*	*
08:00		0	1	2	0	2	1		*	*	*	*	*	*
08:15		0	1	3	1	3	2		*	*	*	*	*	*
08:30		1	1	1	0	2	1		*	*	*	*	*	*
08:45		1	2	2	1	3	3		*	*	*	*	*	*
09:00		0	0	0	0	0	0		*	*	*	*	*	*
09:15		1	0	0	0	1	0		*	*	*	*	*	*
09:30		0	0	2	0	2	0		*	*	*	*	*	*
09:45		0	0	0	0	0	0		*	*	*	*	*	*
10:00		***1***	0	0	0	1	0		*	*	*	*	*	*
10:15		***0***	0	1	0	1	0		*	*	*	*	*	*
10:30		***1***	0	0	0	1	0		*	*	*	*	*	*
10:45		***2***	1	1	0	3	1		*	*	*	*	*	*
11:00		0	0	0	1	0	1		*	*	*	*	*	*
11:15		1	0	1	0	2	0		*	*	*	*	*	*
11:30		0	0	0	0	0	0		*	*	*	*	*	*
11:45		0	0	0	1	0	1		*	*	*	*	*	*
Total		11	55	27	38	38	93		0	0	0	0	0	0
Day Total		66		65		131			0		0		0	
% Total		8.4%	42.0%	20.6%	29.0%				0.0%	0.0%	0.0%	0.0%		
Peak		10:00	05:15	06:45	05:15	06:45	05:15							
Vol.		4	13	10	9	11	22							
P.H.F.		0.500	0.650	0.833	0.450	0.917	0.550							

ADT | ADT 131 | AADT 131

Seema Nagaraj

From: Josie Tomei <Josie_Tomei@cpr.ca>
Sent: Tuesday, August 22, 2017 8:50 AM
To: Seema Nagaraj
Subject: RE: Rail traffic data request/confirmation (VCL File: 112-013-200)

Hi Seema,
It is the same line with the same traffic. The 2015 data would be acceptable to use.

Josie Tomei SR/WA
Specialist Real Estate Sales & Acquisitions
905-803-3429
800-1290 Central Parkway West
Mississauga, ON L5C 4R3

From: Seema Nagaraj [mailto:seema@valcoustics.com]
Sent: Monday, August 21, 2017 5:51 PM
To: Josie Tomei
Subject: Rail traffic data request/confirmation (VCL File: 112-013-200)

Hi Josie,

We are preparing an environmental noise report for a proposed development near Mill Street and 4th Line in Tottenham (see attached image for specific location). We have rail data from 2015 for a site to the south in Caledon. Would this data be applicable for our site or would we have to purchase new data?

Thank you,

Seema Nagaraj, Ph.D., P.Eng.
Acoustical Engineer

VALCOUSTICS Canada Ltd.
consulting acoustical engineers
30 Wertheim Court, Unit 25
Richmond Hill, Ontario
Canada L4B 1B9
Tel: 905-764-5223 ext. 243
Fax: 905-764-6813
solutions@valcoustics.com

Real Estate and Facility Management
800 – 1290 Central Parkway West
Mississauga, ON, L5C 4R3
www.cpr.ca

July 9, 2015

Via e-mail: seema@valcoustics.com

Seema Nagaraj, Ph.D., EIT
Valcoustics Canada Ltd.
30 Wertheim Court, Unt 25
Richmond Hill, ON L4B 1B9

Dear Sir:

Re: Rail Traffic Volumes, CP Mileage 30.46 to 31.31 Mactier Subdivision Caledon, Ontario

This is in reference to your e-mail of July 3, 2015 requesting rail traffic data for a noise study in the vicinity of Hunsden Sideroad and Mt. Pleasant Road in Caledon, CP Rail corridor mile 30.46 to 31.31 of the Mactier Subdivision.

The information requested is as follows:

1. Number of freight trains 0700 to 2300: 9
   Number of freight trains 2300 to 0700: 5
2. Average number of cars per train: 80
   Maximum cars per train: 146
3. Number of Locomotives per train: 2 average, 4 maximum
4. Type of Trains: freight
5. Maximum speed: 55 mph
6. Grade crossings with whistle blowing are located at Mount Hope Road, Hunsden Sideroad and Mt. Pleasant Road. Please note, the whistle signal may be used in any dangerous situation when suitable warning is required.
7. There is a siding track that starts approximately 675 feet south of Hunsden Road and extends approximately 2800 feet north of Mount Pleasant Road. Trains meet and slow down entering and exiting the siding. Both of the road crossings are occupied by double tracks.

The information provided is based on rail traffic over the past month to date. Variations of the above may exist on a day-to-day basis. Specific measurements may also vary significantly depending on customer needs.

Yours truly,

Josie Tomei
Specialist Real Estate Sales
& Acquisitions – Ontario
905-803-3429
josie_tomei@cpr.ca

APPENDIX B

ENVIRONMENTAL NOISE GUIDELINES

APPENDIX B

ENVIRONMENTAL NOISE GUIDELINES

MINISTRY OF THE ENVIRONMENT AND CLIMATE CHANGE (MOE)

Reference: MOE Publication NPC-300, October 2013: *"Environmental Noise Guideline, Stationary and Transportation Source – Approval and Planning"*.

SPACE	SOURCE	TIME PERIOD	CRITERION
Living/dining, den areas of residences, hospitals, nursing homes, schools, daycare centres, etc.	Road	07:00 to 23:00	45 dBA
	Rail	07:00 to 23:00	40 dBA
	Aircraft	24-hour period	NEF/NEP 5
Living/dining, den areas of residences, hospitals, nursing homes, etc. (except schools or daycare centres)	Road	23:00 to 07:00	45 dBA
	Rail	23:00 to 07:00	40 dBA
	Aircraft	24-hour period	NEF/NEP 5
Sleeping quarters	Road	07:00 to 23:00	45 dBA
	Rail	07:00 to 23:00	40 dBA
	Aircraft	24-hour period	NEF/NEP 0
Sleeping quarters	Road	23:00 to 07:00	40 dBA
	Rail	23:00 to 07:00	35 dBA
	Aircraft	24-hour period	NEF/NEP 0
Outdoor Living Areas	Road and Rail	07:00 to 23:00	55 dBA
Outdoor Point of Reception	Aircraft	24-hour period	NEF/NEP 30#
	Stationary Source		
	Class 1 Area	07:00 to 19:00(1)	50* dBA
		19:00 to 23:00(1)	50* dBA
	Class 2 Area	07:00 to 19:00(2)	50* dBA
		19:00 to 23:00(2)	45* dBA
	Class 3 Area	07:00 to 19:00(3)	45* dBA
		19:00 to 23:00(3)	40* dBA
	Class 4 Area	07:00 to 19:00(4)	55* dBA
		19:00 to 23:00(4)	55* dBA

…./cont'd

SPACE	SOURCE	TIME PERIOD	CRITERION
Plane of a Window of Noise Sensitive Spaces	Stationary Source		
	Class 1 Area	07:00 to 19:00(1)	50* dBA
		19:00 to 23:00(1)	50* dBA
		23:00 to 07:00(1)	45* dBA
	Class 2 Area	07:00 to 19:00(2)	50* dBA
		19:00 to 23:00(2)	50* dBA
		23:00 to 07:00(2)	45* dBA
	Class 3 Area	07:00 to 19:00(3)	45* dBA
		19:00 to 23:00(3)	45* dBA
		23:00 to 07:00(3)	40* dBA
	Class 4 Area	07:00 to 19:00(4)	60* dBA
		19:00 to 23:00(4)	60* dBA
		23:00 to 07:00(4)	55* dBA

\# may not apply to in-fill or re-development.
* or the minimum hourly background sound exposure $L_{eq(1)}$, due to road traffic, if higher.
(1) Class 1 Area: Urban.
(2) Class 2 Area: Urban during day; rural-like evening and night.
(3) Class 3 Area: Rural.
(4) Class 4 Area: Subject to land use planning authority's approval.

Reference: MOE Publication ISBN 0-7729-2804-5, 1987: *"Environmental Noise Assessment in Land-Use Planning"*.

EXCESS ABOVE RECOMMENDED SOUND LEVEL LIMITS (dBA)	CHANGE IN SUBJECTIVE LOUDNESS ABOVE	MAGNITUDE OF THE NOISE PROBLEM	NOISE CONTROL MEASURES (OR ACTION TO BE TAKEN)
No excess (<55 dBA)	—	No expected noise problem	None
1 to 5 inclusive (56 to 60 dBA)	Noticeably louder	Slight noise impact	If no physical measures are taken, then prospective purchasers or tenants should be made aware by suitable warning clauses.
6 to 10 inclusive (61 - 65 dBA)	Almost twice as loud	Definite noise impact	Recommended.
11 to 15 inclusive (66 - 70 dBA)	Almost three times as loud	Serious noise impact	Strongly Recommended.
16 and over (>70 dBA)	Almost four times as loud	Very serious noise impact	Strongly Recommended (may be mandatory).

APPENDIX C

SAMPLE SOUND LEVEL CALCULATION

```
STAMSON 5.04        NORMAL REPORT        Date: 18-05-2018 14:56:20
MINISTRY OF THE ENVIRONMENT AND CLIMATE CHANGE / NOISE ASSESSMENT

Filename: 20l4_sf.te           Time Period: Day/Night 16/8 hours
Description: Lot 4 - South Face - No whistle


Rail data, segment # 1: CPR MacTier (day/night)
-----------------------------------------------
Train            ! Trains      ! Speed !# loc !# Cars! Eng  !Cont
Type             !             !(km/h) !/Train!/Train! type !weld
-----------------+-------------+-------+------+------+------+----
* 1. Freight     !  15.1/8.4   !  88.0 !  2.0 ! 80.0 !Diesel! Yes

* The identified number of trains have been adjusted for
  future growth using the following parameters:

Train type:         ! Unadj. ! Annual % ! Years of !
 No  Name           ! Trains ! Increase !  Growth  !
--------------------+--------+----------+----------+
  1. Freight        !   9.0/5.0   !    2.50  !   21.00  !

Data for Segment # 1: CPR MacTier (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  : 355.00 / 355.00 m
Receiver height           :   4.50 / 4.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
No Whistle
Reference angle           :   0.00

Results segment # 1: CPR MacTier (day)
--------------------------------------

LOCOMOTIVE (0.00 + 51.30 + 0.00) = 51.30 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90     90   0.50  73.01 -20.54  -1.17   0.00   0.00   0.00  51.30
-------------------------------------------------------------------------

WHEEL (0.00 + 42.98 + 0.00) = 42.98 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90     90   0.60  66.32 -21.99  -1.35   0.00   0.00   0.00  42.98
-------------------------------------------------------------------------

Segment Leq : 51.90 dBA

Total Leq All Segments: 51.90 dBA
```

Results segment # 1: CPR MacTier (night)

LOCOMOTIVE (0.00 + 51.77 + 0.00) = 51.77 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.50	73.47	-20.54	-1.17	0.00	0.00	0.00	51.77

WHEEL (0.00 + 43.44 + 0.00) = 43.44 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.60	66.78	-21.99	-1.35	0.00	0.00	0.00	43.44

Segment L_{eq} : 52.37 dBA

Total L_{eq} All Segments: 52.37 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 51.90
(NIGHT): 52.37

```
STAMSON 5.04        NORMAL REPORT        Date: 18-05-2018 14:56:50
MINISTRY OF THE ENVIRONMENT AND CLIMATE CHANGE / NOISE ASSESSMENT

Filename: 20wl4_sf.te          Time Period: Day/Night 16/8 hours
Description: Lot 4 - South Face - With whistle

Rail data, segment # 1: CPR MacTier (day/night)
-----------------------------------------------
Train            ! Trains      ! Trains      ! Speed !# loc !# Cars! Eng
!Cont
Type             ! (Left)      ! (Right)     !(km/h) !/Train!/Train! type
!weld
-----------------+-------------+-------------+-------+------+------+------+-
---
  1. Freight     !   7.6/4.2   !   7.6/4.2   !  88.0 !  2.0 ! 80.0 !Diesel!
Yes

Data for Segment # 1: CPR MacTier (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  : 355.00 / 355.00 m
Receiver height           :   4.50 / 4.50   m
Topography                :      1       (Flat/gentle slope; no barrier)
Whistle Angle             :    -59 deg   Track 1
Reference angle           :   0.00

Results segment # 1: CPR MacTier (day)
--------------------------------------

LOCOMOTIVE (0.00 + 51.33 + 0.00) = 51.33 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90     90   0.50  73.04 -20.54  -1.17   0.00   0.00   0.00  51.33
-------------------------------------------------------------------------

WHEEL (0.00 + 43.00 + 0.00) = 43.00 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -90     90   0.60  66.35 -21.99  -1.35   0.00   0.00   0.00  43.00
-------------------------------------------------------------------------

LEFT WHISTLE (0.00 + 36.62 + 0.00) = 36.62 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -70    -59   0.50  71.02 -20.54 -13.86   0.00   0.00   0.00  36.62
-------------------------------------------------------------------------

RIGHT WHISTLE (0.00 + 42.07 + 0.00) = 42.07 dBA
Angle1 Angle2  Alpha RefLeq  D.Adj  F.Adj  W.Adj  H.Adj  B.Adj SubLeq
-------------------------------------------------------------------------
   -59    -28   0.50  71.02 -20.54  -8.41   0.00   0.00   0.00  42.07
-------------------------------------------------------------------------

Segment Leq : 52.47 dBA

Total Leq All Segments: 52.47 dBA
```

Results segment # 1: CPR MacTier (night)

LOCOMOTIVE (0.00 + 51.77 + 0.00) = 51.77 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.50	73.47	-20.54	-1.17	0.00	0.00	0.00	51.77

WHEEL (0.00 + 43.44 + 0.00) = 43.44 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.60	66.78	-21.99	-1.35	0.00	0.00	0.00	43.44

LEFT WHISTLE (0.00 + 37.05 + 0.00) = 37.05 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-70	-59	0.50	71.46	-20.54	-13.86	0.00	0.00	0.00	37.05

RIGHT WHISTLE (0.00 + 42.51 + 0.00) = 42.51 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-59	-28	0.50	71.46	-20.54	-8.41	0.00	0.00	0.00	42.51

Segment L_{eq} : 52.91 dBA

Total L_{eq} All Segments: 52.91 dBA

TOTAL L_{eq} FROM ALL SOURCES (DAY): 52.47
(NIGHT): 52.91