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Noise and Vibration Feasibility Study
Proposed Residential Development
Upper Mill Pond
52 Mill Street
Norwood, ON

Prepared for:

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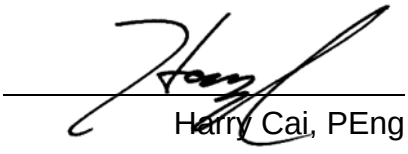

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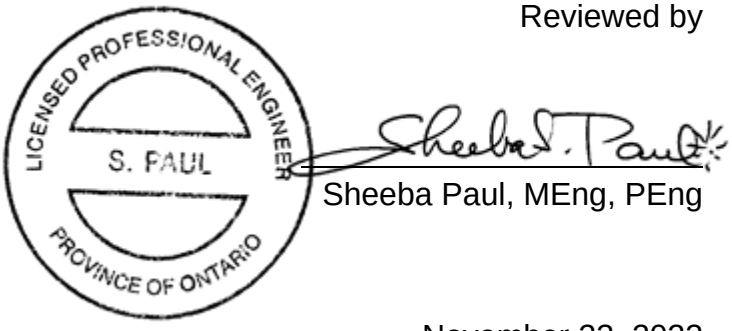

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VERSION CONTROL

Proposed Residential Development, 52 Mill Street, Norwood, Ontario

Ver.	Date	Version Description	Prepared By
1.0	March 29, 2023	Noise and Vibration Feasibility Study for planning and approvals process.	H. Cai/Sheeba Paul
2.0	November 23, 2023	Updated study for revised Draft Plan	H. Cai

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Table of Contents

1 Introduction and Summary

HGC Engineering was retained by CAP Norwood Developments Inc. to conduct a noise and vibration feasibility study for a proposed residential development located at 52 Mill Street in Norwood, Ontario. The residential development will consist of single detached dwellings, medium density dwellings, parkland, stormwater management lands, and interior roadways. The study is required by the Municipality as part of the planning and approvals process.

The primary source of noise is vehicular traffic on Highway 7. A secondary source of noise is rail traffic on the CP Havelock Subdivision railway line adjacent to the north of the site. Rail traffic data was obtained from published rail traffic data by Transport Canada and from site monitoring, and road traffic data was obtained from published traffic data from the Ontario Ministry of Transportation (MTO). Rail and road traffic data was used to predict future traffic sound levels at the proposed building façades and in outdoor living areas. The predicted sound levels were compared to the guidelines of the Ministry of Environment, Conservation and Parks (MECP) to develop noise control recommendations.

This study is an update of the previous study, dated March 29, 2023, to include the latest draft plan.

The results of the study indicate that the proposed development is feasible with the noise control measures described in this report. An acoustical barrier is required along the railway to mitigate sound level excesses in rear yards adjacent to the railway due to rail traffic noise. Central air conditioning and upgraded building constructions are required for the dwellings adjacent to the railway. Forced air ventilation systems with ductwork sized for the future installation of central air conditioning by the occupant are required for dwellings with some exposure to the railway. Noise warning clauses are also required to inform future occupants of the traffic noise impacts, to address sound level excesses, and proximity to existing industrial uses. Brick veneer or masonry equivalent exterior wall construction is required for those dwellings in the first row adjacent to the railway line. For all other dwelling units, building constructions meeting the minimum requirements of the Ontario Building Code will provide sufficient acoustical insulation for indoor spaces.

A computational model was created using acoustical modelling software to assess the potential sound impact of the nearby industry, located the north of the railway tracks and on either side of Asphodel 10th Line, on the proposed development. The modelling results indicate that, with the

recommended 5.5m high acoustical barrier along the railway, the predicted sound levels from nearby stationary sources can be reduced to within the MECP guideline levels. A 70 m setback distance from the nearby sawmill is also required for any proposed 3-storey. Alternatively, a shorter 30 m setback distance from the CP right-of-way is required for any proposed 2-storey or single storey dwellings.

Ground-borne vibration levels from rail pass-bys were measured at the location of the closest proposed dwellings to CP railway right-of-way and were found to be below CP limits. Vibration mitigation is not required for the proposed development.

2 Site Description and Noise Sources

Figure 1 is a key plan indicating the location of the proposed site. The site is located north of Mill Street, West of Asphodel 10th Line, and south of Highway 7. Figure 2 shows the concept draft plan by RFA Planning Consultants dated November 6, 2023.

HGC Engineering personnel visited the site on March 15, 2022 to make observations of the acoustical environment and to take sound measurements. During the site visit, it was noted that the primary source of noise impacting the site was road traffic on Highway 7, with some contribution from the CP Havelock Subdivision railway line immediately north of the site. Negligible impact from road traffic was observed on Mill Street and Asphodel 10th Line. The site is currently occupied by agricultural lands, and contains a detached agricultural/residential building, which will be demolished for the construction of the proposed dwellings. The area around the site is mostly flat and residential. There are existing single detached dwellings immediately to the east, south, and west. There are two at-grade rail crossings near the site, with a crossing at County Road 40 approximately 700 m to the west, and another one immediate northeast of the site at Asphodel 10th Line.

To the north of the site and across the railway line is a wood processing shop (Richard Lutes Cedar Inc) and a used car part store further north. To the northwest of the site is a wood product store (Smart Log). An assessment of the separation distances between the site and the adjacent industries is described in Section 6. The assessment of noise emissions from the wood processing shop is contained in Section 7.

3 Traffic Noise and Vibration Level Criteria

3.1 Road and Rail Traffic Noise

Guidelines for acceptable levels of road and rail traffic noise impacting residential developments are given in the MECP publication NPC-300, "Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning", release date October 21, 2013, and are listed in Table I below. The Railway Association of Canada/Federation of Canadian Municipalities "Report Research Phase 3: Proximity Guidelines and Best Practices" dated November 2006 and Guidelines for New Development in Proximity to Railway Operations dated May 2013 were also reviewed.

The values in Table I are energy equivalent (average) sound levels [L_{EQ}] in units of A-weighted decibels [dBA].

Table I: MECP Road/Rail Traffic Noise Criteria (dBA)

Area	Daytime $L_{EQ\ (16\ hour)}$ Road / Rail	Nighttime $L_{EQ(8\ hour)}$ Road / Rail
Outdoor Living Area	55 dBA / 55 dBA	--
Inside Living/Dining Rooms	50 dBA / 45 dBA	45 dBA / 45 dBA
Inside Bedrooms	45 dBA / 40 dBA	40 dBA / 35 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, a backyard, a terrace, or other area where passive recreation is expected to occur. Small balconies are not considered OLAs for the purposes of assessment. Terraces greater than 4 m in depth (measured perpendicular to the building façade) are considered to be OLAs.

The guidelines in the MECP publication allow the daytime sound levels in an Outdoor Living Area to be exceeded by up to 5 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 practical.

A central air conditioning system as an alternative means of ventilation to open windows is required for dwellings where nighttime sound levels outside bedroom or living/dining room windows exceed

60 dBA or daytime sound levels outside bedroom or living/dining room windows exceed 65 dBA. Forced-air ventilation with ducts sized to accommodate the future installation of air conditioning is required when nighttime sound levels at bedroom or living/dining room windows are in the range of 51 to 60 dBA or when daytime sound levels at bedroom or living/dining room windows are in the range of 56 to 65 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 due to road traffic noise, or when nighttime sound level is greater than 55 dBA or the daytime sound level is greater than 60 dBA due to rail traffic noise. The indoor sound level limits for rail noise sources are 5 dB more stringent than for road sources, to account for the additional low-frequency (rumble) components of locomotives, hence the façade insulation requirements are calculated separately and then combined.

MECP guidelines recommend exterior walls built with a brick veneer or a masonry equivalent construction from foundation to rafters as a minimum construction for any dwellings with a 24 hour L_{EQ} that is greater than 60 dBA, and which are within 100 m of the right of way of the railway. This generally applies only to single family residences; multi-family buildings are typically designed to ensure that noise transmitted through walls is negligible in comparison with the windows. The railways also provide minimum requirements for safety as well as sound and vibration for proposed residential developments located adjacent to their rights-of-way. These include minimum required setbacks, berms, fencing and warning clauses. Appendix A provides the CP principal mainline requirements for residential developments adjacent to a railway right of way.

3.2 Ground-borne Vibration from Rail Traffic

MECP and CP guidelines require measurements of ground-borne vibration when residential dwelling units are to be located within 75 metres of a principal mainline such as the CP Havelock Subdivision.

Vibration is typically measured in terms of oscillatory velocity or acceleration. The CP vibration guidelines are given in terms of ground-borne velocity. In this report, vibration levels are quoted in terms of RMS velocity levels (L_V) in mm/s. The CP guideline limit is 0.14 mm/s. These criteria are included on the plots of the measured vibration levels in Figures 4 to 8.

4 Traffic Noise Assessment

4.1 Rail Traffic Data

Rail traffic data for the CP Havelock Subdivision was obtained from published rail traffic data from Transport Canada and is attached in Appendix B. This line is used for freight operations only and is classified as a principal main line. The maximum permissible train speed in the area of the site is 16 km/h (10 mi/h). In conformance with CP assessment requirements, the maximum speeds, maximum number of cars and locomotives per train were used in the traffic noise analysis to yield a worst-case estimate of train noise. The data was projected to the year 2033 using a 2.5% per year growth rate.

Based on site observations and vibration monitoring data, the actual rail traffic in this area matches with the published rail data, at up to 1 train pass-by per day. It was also observed that the train can pass-by during daytime and nighttime hours. Thus, one train was assumed in the day and night. Table II summarises the CP rail traffic data used in the analysis.

Table II: Rail Traffic Data Projected to Year 2033

Type of Train	Number of Trains Day/ Night	Number of locomotives	Number of cars	Max Speed (KPH)
Freight	1.3 / 1.3	200	2	16

4.2 Road Traffic Data

Traffic data for Highway 7 was obtained from MTO personnel and published road traffic data from the MTO in the form of Summer Annual Daily Traffic (SADT) traffic values, and is provided in Appendix C. The traffic volume was projected to the year 2033 at an annual growth rate of 2.5 %. A projected volume of 17 499 vehicles per day at a posted speed limit of 70 km/h was applied for the analysis. A commercial vehicle percentage of 5 % for medium trucks and 8 % for heavy trucks was applied, as per MTO guidelines. A day/night split of 85 % / 15 % was used.

Table III summarizes the traffic volume data used in this study.

Table III: Projected Road Traffic Data

Road Name		Cars	Medium Trucks	Heavy Trucks	Total
Highway 7	Daytime	12 940	744	1 190	14 874
	Nighttime	2 284	131	210	2 625
	Total	**15 224**	**875**	**1 400**	**17 499**

4.3 Road and Rail Traffic Noise Predictions

To assess the levels of road and rail traffic noise which will impact the study area in the future, sound level predictions were made using STAMSON version 5.04, a computer algorithm developed by the MECP. Sample STAMSON output is included in Appendix D. The dwellings were assumed to be 3-storey in height as a conservative estimate since the number of storeys has not yet been determined. While not heard on site, train whistle noise was included in the assessment at the at-grade crossings near the site area as a conservative approach.

Predictions of the traffic sound levels were chosen around the proposed development site to obtain an appropriate representation of future sound levels at various façades. Sound levels were predicted at the plane of the top storey bedroom and/or living/dining room windows during daytime and nighttime hours to investigate ventilation and façade construction requirements. Sound levels were also predicted in possible OLA's to investigate the need for noise barriers. Figure 2 shows the concept draft plan with prediction locations. The results of these predictions are summarized in Table IV and V.

Table IV: Daytime Predicted Traffic Sound Levels [dBA], Without Mitigation

Prediction Location	Description	Daytime – at the Façade $L_{EQ-16\ hr}$		Daytime at Façade Total $L_{EQ-16\ hr}$	Daytime in the OLA Total $L_{EQ-16\ hr}$
		Road	Rail		
[A]	Single detached dwelling backing onto railway	<55	63	64	61
[B]	Single detached dwelling fronting interior roadway	<55	57	58	<55
[C]	3-Storey apartment adjacent to Mill Street	<55	<55	56	<55
[D]	4-plex bungalow adjacent to railway	<55	61	61	60
[E]	3-storey building fronting Asphodel 10th Line	<55	<55	52	<55

Note: façade sound levels include whistle noise

Table V: Nighttime Predicted Traffic Sound Levels [dBA], Without Mitigation

Prediction Location	Description	Nighttime – at the Façade $L_{EQ-8\ hr}$		Nighttime at Façade Total $L_{EQ-8\ hr}$
		Road	Rail	
[A]	Single detached dwelling backing onto railway	<50	66	66
[B]	Single detached dwelling fronting interior roadway	<50	60	60
[C]	3-Storey apartment adjacent to Mill Street	<50	57	58
[D]	4-plex bungalow adjacent to railway	<50	64	64
[E]	3-storey building fronting Asphodel 10th Line	<50	55	55

Note: façade sound levels include whistle noise

5 Traffic Noise Recommendations

The sound level predictions indicate that the future traffic sound levels will exceed MECP guidelines at the proposed development. The following discussion outlines the recommendations for acoustic barrier requirements, ventilation requirements, upgraded building façade construction, and warning clauses to achieve the noise criteria stated in Table I.

5.1 Outdoor Living Areas

General Recommendations

As a general recommendation for residential developments adjacent to a principal mainline, CP Railway recommends a minimum 5.5 m barrier (2.5 m berm and 3.0 m acoustic wall on top above the top of the property line) as indicated in Appendix A. A combination of a crash wall with an acoustic wall on top may also be used. The safety berm is generally required in the event of a derailment. A safety berm is typically not required next to the SWM facility. The concept draft plan shows a proposed safety berm and acoustic fence buffer area along the railway.

Dwellings Adjacent to the Railway

The predicted daytime sound levels in the potential OLA's of the dwellings adjacent to the railway will be in the range of 60 to 61 dBA if the dwellings back onto the railway. These levels are in excess of the MECP's limit of 55 dBA. Physical mitigation in the form of an acoustic barrier is required to address these excesses.

A 5.5 m high barrier along the railway, the location of which is shown on the concept plan, will reduce the sound levels to 56 dBA at potential OLA's of dwellings adjacent to the railway (prediction locations [A] and [D]), which are within the MECP's allowable exceedance range of 5 dBA. CP rail has accepted sound levels up to 60 dBA in the past.

When grading plans are available, the acoustic barrier heights should be refined.

Acoustic barriers can be any combination of an earth berm with an acoustic wall on top. The wall component of the barrier should be of a solid construction with a surface density of no less than 20 kg/m^2. 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 within or below its extent.

5.2 Minimum Setback Distance

CP guidelines stipulates a minimum setback distance of 30 m between new dwellings and the railway right of way. The proposed development plans conform to the setback requirement as the nearest proposed dwelling façade is located more than 30 m way from the rail right-of-way.

5.3 Indoor Living Areas and Ventilation Requirements

Air Conditioning

The predicted future sound levels outside the top storey windows of the dwellings adjacent to the railway will be greater than 60 dBA during nighttime hours and/ 65 dBA during daytime hours. To address these excesses, these units need to be equipped with central air conditioning systems so that windows may remain closed. These units are indicated in Figure 3. Window or through-the-wall air conditioning units are not recommended because of the noise they produce and because the units penetrate through the exterior wall which degrades the overall sound insulating properties of the envelope. The location, installation and sound ratings of the outdoor air conditioning devices should minimize noise impacts and comply with criteria of MECP publication NPC-300, as applicable.

Provision for Air Conditioning

The predicted future sound levels outside the top storey windows of the dwellings with some exposure to the railway will be between 56 and 65 dBA during the daytime hours and/or between 51 to 60 dBA during the nighttime hours. To address these excesses, these dwelling units require provisions for the future installation of central air conditioning systems so that windows may be kept closed. This requirement is typically satisfied through the installation of forced air ventilation systems with ductwork sized for the future installation of central air conditioning by the occupant. These units are indicated in Figure 3. The location, installation and sound ratings of the outdoor air conditioning devices should minimize noise impacts and comply with criteria of MECP publication NPC-300. The installation of central air conditioning for these units will meet and exceed ventilation requirements.

5.4 Building Façade Constructions

The predicted sound levels at the dwellings adjacent to the railway will exceed 60 dBA during daytime and 55 dBA during nighttime due to rail traffic noise. MECP guidelines stipulate that in

such cases, building components including windows, walls, and doors be designed so that the indoor sound levels comply with the noise criteria in Table I.

Calculations were performed to determine the acoustical insulation factors (AIF) 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 (walls, windows and doors) and the floor area of the adjacent room.

Exterior Wall Construction

According to MECP and CP guidelines, the proposed dwellings directly adjacent to the railway line will require a minimum of brick veneer or masonry equivalent construction for the exterior walls from the foundation to rafters.

Acoustical Requirements for Glazing

The required building components are selected based on the AIF value for road and rail traffic. A summary of the STC requirements is given in Table VI for the dwelling façades, based on the possibility of sound entering the building through walls, windows and doors for all of the dwellings. Detailed floor plans and building elevations were not available for review at the time of this report. A window to floor ratio of 50% (40% fixed, 10% operable) for living/dining room and 40% (30% fixed, 10% operable) for bedrooms were assumed to determine preliminary window STC ratings required to mitigate road and rail traffic noise levels.

Table VI: Minimum STC Requirements

Prediction Location	Description	Space	STC Glazing Requirements
[A], [D]	Low density dwelling adjacent to railway	*Living/Dining	STC-29
		*Bedroom	STC-36
--	Other dwellings	+Living/Dining	OBC
		+Bedroom	OBC

Notes: OBC – Ontario Building Code
* Sound entering through windows only since the exterior wall is required to be brick.
+ Sound entering through windows and walls

The glazing requirements can be met using fairly standard sealed units. Operable sections, including doors and operable windows, must be well-fitted and weather-stripped in order to achieve the upper range of target STC values. Acoustical criteria for different blocks and facades can be optimized as part of the detail design of the development, when floor plans and elevations for the buildings are available.

Sample window assemblies which may achieve the STC requirements are summarized in Table VII below. Note that acoustic performance varies with manufacture's construction details, and these are only guidelines to provide some indication of the type of glazing likely to be required; the STC requirements in Table VI are provided as a guideline based on the preliminary drawings. Acoustical test data for the selected assemblies should be requested from the supplier, to ensure that the stated acoustic performance levels will be achieved by their assemblies.

Table VII: Glazing Assemblies for STC Requirements

STC Requirement	Glazing Configuration (STC)
28 – 29	Any double glazed unit
30 – 31	3(13)3
32 – 33	4(10)4
34	4(19)4
35 – 36	6(10)4, 5(16)4

In Table VII, the number outside parentheses indicate minimum pane thicknesses in millimeters and the number in parentheses indicates the minimum inter-pane gap in millimeters.

Further Analysis

When detailed floor plans and building elevations are available for the dwelling units adjacent to the railway, window glazing construction should be refined based on actual window to floor area ratios and the exterior wall construction should be verified to be brick veneer or a masonry equivalent.

5.5 Assessment of Ground-borne Vibration from Rail Traffic

Measurements were performed on the site at grade, at approximately 30 m from the railway right-of-way, as indicated on Figure 2. Unattended vibration measurements using a Svantek 977 Sound Level

Meter with a Wilcoxon Research type 793V velocity transducer was left at the site from March 15, 2022 to March 22, 2022. Vibration measurements were obtained for 5 trains operating on the CP railway. The results of the measurements are presented in Table VIII, showing the maximum vibration level measurements during each of the train pass-bys. Figures 4 to 9 show the pass-bys of 5 trains

Table VIII: Maximum RMS Vibration Velocity Measurements of Train Pass-bys

Train Pass-by	30 m from right of way (mm/s)	Criteria (mm/s)
1	0.08	0.14
2	0.08	
3	0.06	
4	0.08	
5	0.09	

The results indicate that vibration levels are below the CP criteria of 0.14 mm/s and vibration mitigation measures are not required for the proposed development.

6 MECP Guidelines for Land Use Compatibility and Distance Separation

MECP Guidelines D-1, 'Land Use Compatibility' and D-6 'Compatibility Between Industrial Facilities and Sensitive Land Uses' were prepared to address the potential incompatibility of industrial land uses and noise sensitive land uses in relation to land use approvals under the Planning Act. They recommend that studies be conducted to investigate the feasibility of providing sufficient mitigation when noise sensitive land uses are proposed within the potential zone of influence of an existing industry/commercial facility. The mitigation can be provided at the source, or can be incorporated on the development lands where the industrial/commercial facility is operating in compliance with legislated Ministry requirements.

In planning a sensitive land use near an existing industrial/commercial area, guideline D-6 suggests certain potential zones of influence for the industry, depending on the characterization of that industry. Three classes of industry are defined, as follows:

Class I Industrial Facility

A place of business for a small scale, self-contained plant or building which produces/stores a product which is contained in a package and has a low probability of fugitive emissions. Outputs are infrequent, and could be point source or fugitive emissions for any of the following: noise, odour, dust and/or vibration. There are daytime operations only, with infrequent movement of products and/or heavy trucks and no outside storage.

Class II Industrial Facility

A place of business for medium scale processing and manufacturing with outdoor storage of wastes or materials (i.e. it has an open process) and/or there are periodic outputs of minor annoyance. There are occasional outputs of either point source or fugitive emissions for any of the following: noise, odour, dust and/or vibration, and low probability of fugitive emissions. Shift operations are permitted and there is frequent movement of products and/or heavy trucks during daytime hours.

Class III Industrial Facility

A place of business for large scale manufacturing or processing, characterized by: large physical size, outside storage of raw and finished products, large production volumes and continuous movement of products and employees during daily shift operation. It has frequent outputs of major annoyance and there is high probability of fugitive emissions.

For screening purposes, guideline D-6 outlines some potential influence areas for the different classes of industry, as follows. Outside these potential influence areas, it is unlikely that an industry which has been appropriately classified will have significant impact.

Class I – 70 metres
Class II – 300 metres
Class III – 1000 metres

Guideline D-6 acknowledges that the actual influence areas may be less, subject to site specific studies performed in accordance with guideline NPC-300, “Environmental Noise Guideline Stationary and Transportation Sources – Approval and Planning”. Notwithstanding the actual influence area of an industry, in order to minimize the potential for future land use conflicts, the MECP recommends that certain minimum separation distances be respected, as follows:

Class I – 20 metres
Class II – 70 metres
Class III – 300 metres

The MECP recognizes that these minimum separation distances may not always be viable in certain cases, particularly in those cases of redevelopment, infilling and mixed-use areas, where the zoning or official plan has left no available land buffer. In those instances, the overall feasibility of the proposal is based on the anticipated adverse effects from the industrial/commercial use, including any mitigative measures that might be applied to address anticipated impacts.

6.1 Separation Distances to Adjacent Industries

To the north of the site area is a wood processing shop/sawmill (Richard Lutes Cedar Inc), located approximately 20 m away from the northerly development site property line and across the railway line. Figure 9 shows the setback distances of 20 m and 70 m from the sawmill property. Further north of the site is a car parts store (Norwood Auto Wreckers) located approximately 300 m away. To the northwest of the site is a wood product store (Smart Log), located approximately 250 m away. These industries may be classified as Class II industries, as they have some outdoor storage of goods with some open processes.

Accordingly, the proposed development site falls outside of the minimum separation distance of 70 m to the adjacent industries, with the exception of the wood processing shop north of the site located 20 m away from the site's northerly property line. The proposed development site is within the potential influence area of the wood processing shop and the wood product store. While on site, HGC Engineering observed the acoustical environment and have identified that sound emissions from the wood processing shop may impact the proposed development. Sounds from the wood product store were not audible and are not expected to impact the proposed development. An assessment of stationary noise of the wood processing shop is contained in the following Section to determine the noise impact on the development site.

7 Stationary Source Assessment

Noise sources associated with industrial and commercial facilities, such as the wood processing shop, are assessed separately from traffic sources under MECP guidelines. These facilities are considered to be Stationary Sources of Sound and criteria for their assessment are contained below.

7.1 Criteria Governing Stationary (Industrial) Noise Sources

An industrial or commercial facility is classified in MECP guidelines as a stationary source of sound (as opposed to sources such as traffic or construction, for example) for noise assessment purposes. The proposed development is located in an urban acoustical environment classified as Class 2 according to MECP guidelines, which can be characterized by the background sound level being dominated by traffic and human activity during the daytime, and natural sounds during the nighttime.

The façade of a residence, or any associated usable outdoor area, is considered a sensitive point of reception. NPC-300 stipulates that the exclusionary minimum sound level limit for a stationary noise source in an urban Class 2 area is 50 dBA during daytime (07:00 to 19:00) and evening (19:00 to 23:00) hours, and 45 dBA during nighttime hours (23:00 to 07:00) at the plane of window. For outdoor points of reception, the exclusionary minimum sound levels are 50 dBA during daytime hours (07:00 to 19:00) and 45 dBA during evening hours (19:00 – 23:00). If the background sound levels due to road traffic exceed the exclusionary minimum limits, then the background sound level becomes the criterion. The background sound level is defined as the sound level that is present when the stationary source under consideration is not operating, and may include traffic noise and natural sounds. To ensure a conservative analysis, the exclusionary minimum criteria at all receptors will be adopted.

Commercial activities such as the occasional movement of customer vehicles, occasional deliveries, and garbage collection are not of themselves considered to be significant noise sources in the MECP guidelines. Accordingly, these sources have not been considered in this study. Noise from safety equipment (e.g. back-up beepers) are also exempt from consideration. Trucking activities have not been included in this assessment since they will occur on an infrequent basis.

The MECP guidelines stipulate that the sound level impact during a “predicable worst case hour” be considered. This is defined to be an hour when a typically busy “planned and predictable mode of operation” occurs at the subject facility, coincident with a period of minimal background sound. Compliance with MECP criteria generally results in acceptable levels of sound at residential receptors although there may still be residual audibility during periods of low background sound.

7.2 Stationary Source Noise Predictions

Predictive noise modelling was used to assess the sound impact of the nearby wood processing facility at the most critically impacted façades of the proposed development in accordance with MECP guidelines. The noise prediction model was constructed based sound measurements of wood-cutting saws conducted during the site visit, site observations, review of satellite aerial photos, and estimates of sound emission levels of front-end loaders taken from similar past HGC Engineering project files.

Table IX: Source Sound Power Levels [dB re 10-12 W]

Source	Octave Band Centre Frequency [Hz]								Overall [dBA]
	63	125	250	500	1k	2k	4k	8k	
Wood Saw*	95	99	97	103	102	97	90	86	110
Front-end Loader	113	108	104	102	103	100	95	90	107

Note: *a 5 dB tonal penalty has been applied, and included in the shown sound power levels

The above data were inputted into a predictive computer model. The software used for this purpose (*Cadna-A version 2023, build: 197.5343*) is a computer implementation of ISO Standard 9613-2.2 "Acoustics - Attenuation of Sound During Propagation Outdoors." The ISO method accounts for reduction in sound level with distance due to geometrical spreading, air absorption, ground attenuation and acoustical shielding by intervening structures such as buildings and barriers.

The following information and assumptions were used in the analysis.

- The wood processing facility includes areas west and east of Asphodel 10th Line and north of the railway line.
- As per Richard Lutes Cedar Inc. personnel, up to 3 saws and 2 front-end loaders may operate in the facility.
- Closest proposed dwelling façade to the wood processing facility are assumed to be located at the 70 m setback distance line and is shown as R1 in Figure 9. R2 shows the closest façade at 30 m from the railway right-of-way. As a conservative approach, R1 and R2 are assessed as 3-storey buildings.
- Location of the noise sources are shown in Figure 9, with green crosses showing the wood saws, and the green area showing the front-end-loader.

In this impact assessment, we have considered typical worst-case (busiest hour) scenarios for each time period to be as follows:

Assumed daytime worst-case scenario:

- 3 saws each operating for 20 minutes out of an hour.
- 2 front-end loaders operate for up to 20 minutes out of an hour.

Assumed evening/nighttime worst-case scenario:

- Facility not in operation, as per Richard Lutes Cedar personnel.

7.3 Results

The unmitigated sound levels due to stationary noise sources associated with the wood processing shop at the most critical receptor of the proposed development (locations R1 and R2, as described above) are summarized in Table X and presented graphically in Figure 10.

Table X: Predicted Sound Levels from the Nearby Wood Processing Shop on the Proposed Residential Development [dBA], <u>without</u> mitigation

	Daytime at Façade (07:00 – 19:00)	Daytime at OLA (07:00 – 19:00)	Criteria (Daytime)
R1 at 1st storey	**51**	**51**	50
R1 at 2nd storey	**52**		
R1 at 3rd storey	**52**		
R2 at 1st storey	**53**	**54**	
R2 at 2nd storey	**54**		
R2 at 3rd storey	**54**		

Note: **Bold** numbers indicate excess over the applicable criteria.

The results of the calculations indicate that the predicted sound levels due to the operation of the wood processing shop has the potential to exceed the MECP limits at the façades of the proposed dwellings south of the railway line (at R1) during a worst-case operational scenario. Mitigation is required.

7.4 Mitigation

As discussed in Section 5.1, a 5.5 m high acoustic barrier adjacent to the railway line is required to mitigate railway noise in the outdoor living area (OLAs). To address the sound level excesses due to

the operation of the wood processing shop, this 5.5 m high acoustic barrier adjacent to the railway line and a 70 m setback distance from the sawmill will also reduce the sound levels at the proposed 3-storey dwellings and OLA's at the development site to within MECP limits.

Alternatively, if the proposed dwellings in the medium-density block closest to the sawmill are 2-storeys or 1-storey in height, the 5.5 m high acoustic barrier and a 30 m setback from the CP railway will reduce sound levels at the proposed dwellings to within MECP limits. Figure 11 shows the mitigated sound levels of the wood processing shop at the proposed development. The mitigated sound levels are also shown below in Table XI.

Table XI: Predicted Sound Levels from the Nearby Wood Processing Shop on the Proposed Residential Development [dBA], with mitigation

	Daytime at Façade (07:00 – 19:00)	Daytime at OLA (07:00 – 19:00)	Criteria (Daytime)
R1 at 1st storey	45	45	50
R1 at 2nd storey	48		
R1 at 3rd storey	50		
R2 at 1st storey	46	46	
R2 at 2nd storey	50		
R2 at 3rd storey	**52**		

Note: **Bold** numbers indicate excess over the applicable criteria.

8 Warning Clauses

The MECP guidelines recommend that warning clauses be included in the property and tenancy agreements and offers of purchase and sale for all units with anticipated traffic sound level excesses. The following noise warning clauses are required for specific dwellings as indicated in Table XI.

Suggested wording for future dwellings which have sound levels in excess of MECP criteria and will required central air conditioning is given below.

A):

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

Suggested wording for future dwellings which have minor sound level excesses is given below.

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 and rail 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 which have physical noise mitigation provided on site is given below.

C):

That the acoustical berm and/or barrier as installed, shall be maintained, repaired or replaced by the owner. Any maintenance, repair or replacement shall be with the same material, or to the same standards, and having the same colour and appearance of the original.

Suggest wording for future dwellings which will have central air conditioning units to be installed is given below.

D):

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.

Suggested wording for future dwellings which have provisions for central air conditioning to be installed is given below.

E):

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.

Suggested wording for future dwelling units in close proximity to institutional and commercial buildings is given below.

F):

Purchasers are advised that due to the proximity of the existing commercial buildings, sound levels from the facilities may be at times be audible.

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

CP's standard warning clause which is required for all residential developments located within 300 m of their mainline is given below.

G):

> Warning: Canadian Pacific Railways Company or its assigns or successors in interest has or have a right-of-way within 300 metres from the land subject hereof. There may be alteration to or expansions of the railway facilities on such rights-of-way in the future including the possibility that the railway or its assigns or successors as aforesaid may expand its operations, which expansion may affect the living environment of the residents in the vicinity, notwithstanding the inclusion of any noise and vibration attenuating measures in the design of the development and individual dwellings. CPR will not be responsible for any complaints or claims arising from use of such facilities and/or operations on, over or under the aforesaid rights-of-way.

9 Summary and Recommendations

The following list and Table XII summarize the recommendations made in this report. The reader is referred to Figure 3 and previous sections of the report where these recommendations are applied and discussed in more detail.

For Traffic Noise

1. A 5.5 m high acoustic barrier (2.5 m safety berm and 3.0 m acoustic fence) is required along the railway, as shown on Figure 3. When grading plans are available, acoustic barrier heights should be refined.

2. Central air conditioning will be required for dwellings adjacent to the railway.

3. Forced air ventilation systems with ductwork sized for future installation of central air conditioning systems will be required for the dwellings with some exposure to the railway.

4. Upgraded building constructions are required for the dwellings adjacent to the railway, as detailed in Section 5.3. When detailed floor plans and building elevations are available for the dwelling units with exposure to the roadways, window glazing construction should be refined on actual window to floor ratios.

5. The use of warning clauses in the property and tenancy agreements is recommended to inform future residents of traffic noise issues.

For Stationary Noise

6. If the medium-density dwellings (specifically, the 29 4-plex bungalow units) closest to the sawmill are 3-storeys in height, the 5.5 m high acoustic barrier (2.5 m safety berm and 3.0 m acoustic fence), same as the one mentioned above and in Section 5.1, and a 70 m setback distance from the sawmill will be required to mitigate the noise from the nearby wood processing shop to the north. When grading plans are available, acoustic barrier heights should be refined.

7. Alternatively, if those dwellings closest to the sawmill are 2-storeys or 1-storey in height, a reduced distance setback is feasible. In this case, a 5.5 high acoustic barrier, same as the one mentioned in Section 5.1, and a 30 m setback distance from the CP railway right-of-way will be required to mitigate the noise from the sawmill. When grading plans are available, acoustic barrier heights should be refined.

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

Prediction Location	Description	Acoustic Barrier	Ventilation Requirements*	Type of Warning Clause	Upgraded Glazing Constructions **
[A], [D]	Dwellings adjacent to railway	✓	Central A/C	A, C, D, F, G	LR/DR: STC-29 BR: STC-36
[B], [C]	Dwellings with some exposure to the railway	--	Forced Air	B, E, F, G	OBC
[E], [F], --	Other dwellings	--	--	F, G	OBC

Notes:
* The location, installation and sound rating of the air conditioning condensers must be compliant with MECP Guideline NPC-300, as applicable.
** Units adjacent to the railway will also require exterior wall construction of brick veneer or masonry equivalent.
✓ Outdoor living areas require acoustic barriers. Refer to Section 5.1
OBC – Ontario Building Code LR/DR – Living Room/Dining Room BR – Bedroom

9.1 Implementation

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

1. When grading information is available, the acoustic barrier heights should be refined.

2. Prior to the issuance of building permits for this development, a Professional Engineer qualified to perform acoustical engineering services in the Province of Ontario should review the detailed architectural plans and building elevations to refine glazing requirements based on actual window to floor areas ratios.

3. Prior to the issuance of occupancy permits for this development, the Municipality's building inspector or a Professional Engineer qualified to perform acoustical engineering services in the Province of Ontario should certify that the noise control measures have been properly incorporated, installed, and constructed.

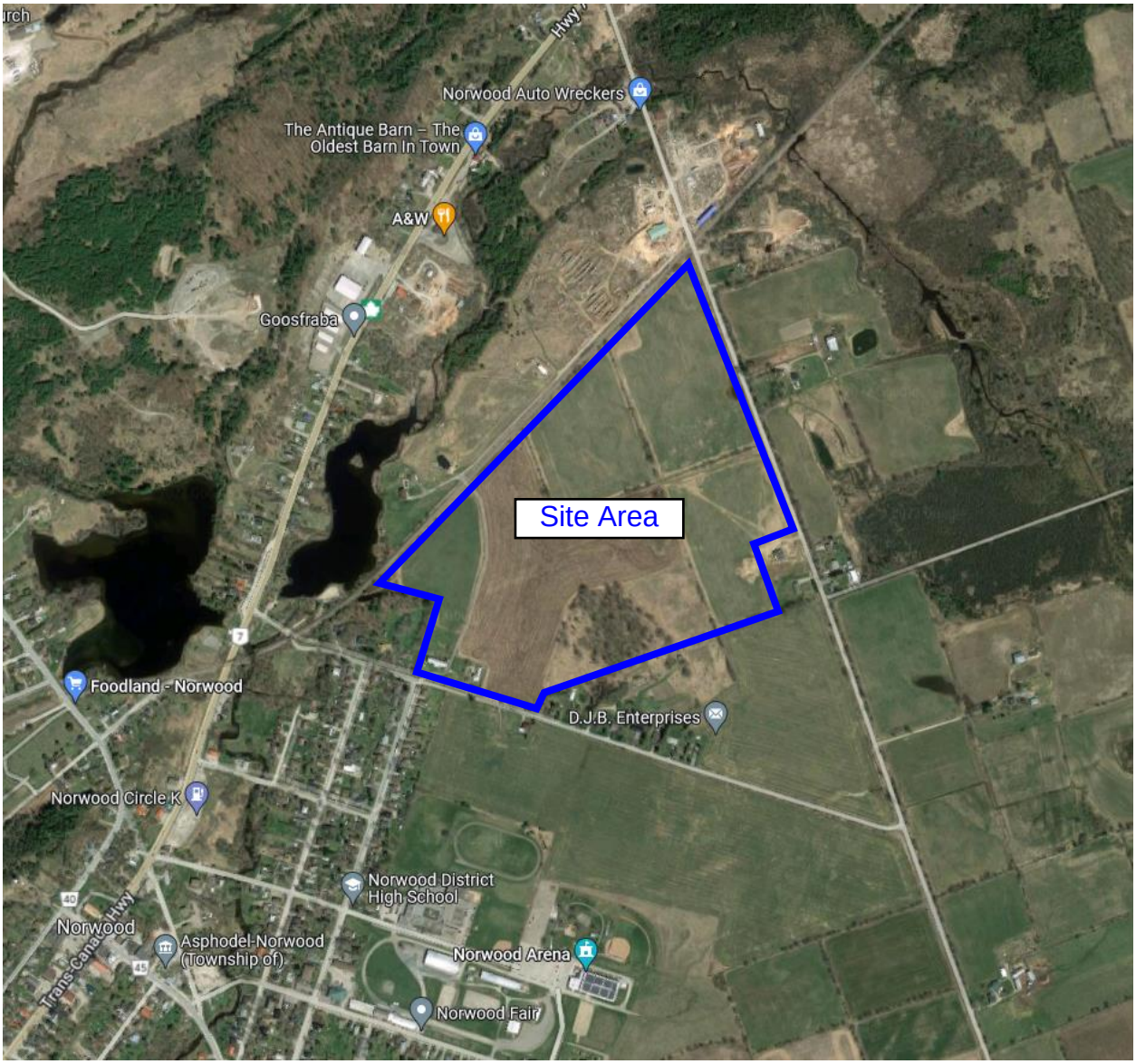


Figure 1: Key Plan

DEVELOPMENT CONCEPT FOR DRAFT PLAN OF SUBDIVISION

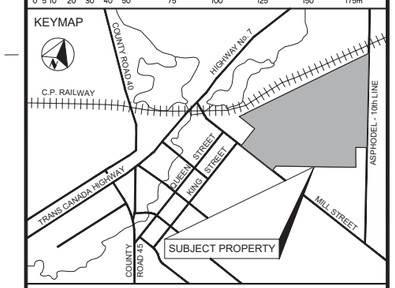
UPPER MILL POND

PART OF BLOCK H, REGISTERED PLAN 6
FORMERLY VILLAGE OF NORWOOD
AND PART OF LOTS 17, 18 AND 19
CONCESSION 9
GEOGRAPHIC TOWNSHIP OF ASPHODEL
TOWNSHIP OF ASPHODEL-NORWOOD
COUNTY OF PETERBOROUGH

SCALE = 1:1500

0 5 10 20 30 40 50 75 100 125 150 175m

KEYMAP



LAND USE SUMMARY

LAND USE	AREA(ha)	AREA%	UNITS	UNITS
12.2m - SINGLE DETACHED LOTS	3.27	9.2	71	
13.7m - SINGLE DETACHED LOTS	3.04	8.6	52	
15.0m - SINGLE DETACHED LOTS	4.41	12.4	73	
6.1m - 2 STOREY TOWNHOUSES (INCLUDING LANES)	4.26	12.0	134	
7.4m - BUNGALOW TOWNHOUSES	2.07	5.8	70	
LOW DENSITY TOTAL - 17.05ha				400
2 - 12 UNIT, 3 STOREY, STACKED TOWNHOUSE BUILDINGS	0.55	1.5	24	
5 - 12 UNIT, 3 STOREY, BUILDINGS	1.21	3.4	60	
3 STOREY APARTMENT BUILDING WITH COMMERCIAL AT GRADE (SOUTH WEST SIDE) 1842sq.m GFA	1.08	3.0	40	
MEDIUM DENSITY CONDOMINIUM BLOCK	4.03	11.4		
29 - 4 PLEX BUNGALOW UNITS			116	
MEDIUM DENSITY TOTAL - 6.87ha				240
PARKLAND, WALKWAYS & SERVICE EASEMENTS	1.84	5.2		
STORM WATER POND	1.75	4.9		
SAFETY BERM & ACOUSTIC FENCE	0.92	2.6		
20.0m MUNICIPAL ROAD ALLOWANCE = 3607.0m (STREETS A, B, C, D, E, F, G & H)	7.07	20.0		
TOTAL	35.50ha	100.0%		640

LOW DENSITY RESIDENTIAL
400 UNITS/17.05ha. = 24 UNITS/ha (NET)

MEDIUM DENSITY RESIDENTIAL
240 UNITS/6.87ha. = 35 UNITS/ha (NET)

OVERALL NET DENSITY
640 UNITS/23.92ha. = 27 UNITS/ha (NET)

SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED ARE CORRECTLY SHOWN.

STEVE GIFFORD
ONTARIO LAND SURVEYOR.

DATE

GIFFORD, HARRIS SURVEYING LTD.
ONTARIO LAND SURVEYORS
255 GLEN MILLER ROAD, UNIT 1, TRENTON ONTARIO
613-392-2177

No.	REVISION	DATE	APPR'D

DRAWN BY: L.B. | CHECKED BY: R.F.A. | DATE: NOV. 6, 2023 | SCALE: 1:1500

METRIC NOTE:
DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO IMPERIAL BY DIVIDING BY 0.3048.

CONTOURS NOTE:
CONTOURS PROVIDED BY CANADIAN LiDAR DATA AND DRAWING AT X.Xm INTERVALS.

NOVEMBER 6, 2023

JOB No. 852

RFA PLANNING CONSULTANT INC
211 Dundas Street East, Suite 202,
Belleville, Ontario, K8N 1E2

Figure 2: Draft Plan Showing Prediction Locations

DEVELOPMENT CONCEPT FOR
DRAFT PLAN OF SUBDIVISION
UPPER MILL POND

PART OF BLOCK H, REGISTERED PLAN 6
FORMERLY VILLAGE OF NORWOOD
AND PART OF LOTS 17, 18 AND 19
CONCESSION 9
GEOGRAPHIC TOWNSHIP OF ASPHODEL
TOWNSHIP OF ASPHODEL-NORWOOD

LEGEND

Central A/C required
Upgraded building construction required. See Section 5.3

Forced air ventilation systems with ductwork sized for the future provision of central A/C by the occupant is required

5.5m high barrier required. See Section 5.1

SAFETY BERM & ACOUSTIC FENCE	0.92	2.6		
20.0m MUNICIPAL ROAD ALLOWANCE = 3607.0m (STREETS A, B, C, D, E, F, G & H)	7.07	20.0		
TOTAL	35.50ha	100.0%		640

LOW DENSITY RESIDENTIAL
400 UNITS/17.05ha. = 24 UNITS/ha (NET)

MEDIUM DENSITY RESIDENTIAL
240 UNITS/6.87ha. = 35 UNITS/ha (NET)

OVERALL NET DENSITY
640 UNITS/23.92ha. = 27 UNITS/ha (NET)

SURVEYOR'S CERTIFICATE

I CERTIFY THAT THE BOUNDARIES OF THE LAND TO BE SUBDIVIDED ARE CORRECTLY SHOWN.

STEVE GIFFORD
ONTARIO LAND SURVEYOR.

DATE

GIFFORD, HARRIS SURVEYING LTD.
ONTARIO LAND SURVEYORS
255 GLEN MILLER ROAD, UNIT 1, TRENTON ONTARIO
613-392-2177

No.	REVISION	DATE	APP'D

DRAWN BY: L.B. | CHECKED BY: R.F.A. | DATE: NOV. 6, 2023 | SCALE: 1:500

METRIC NOTE:
DISTANCES SHOWN ON THIS PLAN ARE IN METRES AND CAN BE CONVERTED TO IMPERIAL BY DIVIDING BY 0.3048.

CONTOURS NOTE:
CONTOURS PROVIDED BY CANADIAN LIDAR DATA AND DRAWING AT X.Xm INTERVALS.

NOVEMBER 6, 2023

JOB No. 852

RFA PLANNING CONSULTANT INC
211 Dundas Street East, Suite 202,
Belleville, Ontario, K8N 1E2

Figure 3: Concept Draft Plan Showing Ventilation and Barrier Requirements

Figure 4a: Pass-by 1 at 30m from railway ROW
Measured Vibratory Velocity Level

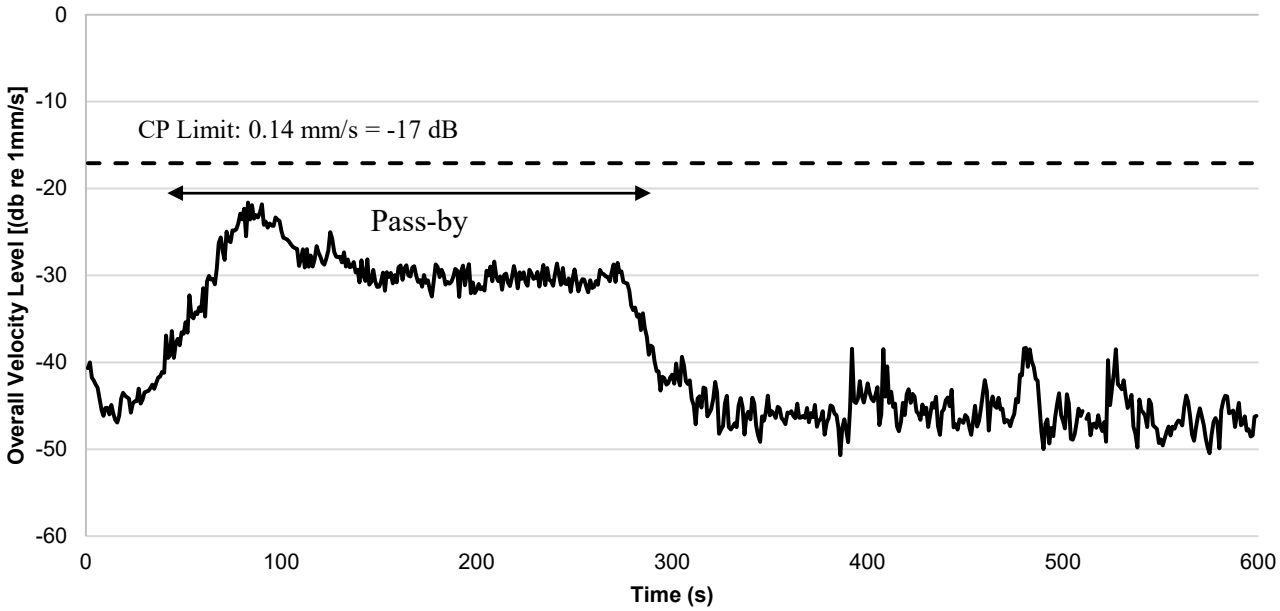


Figure 4b: Pass-by 1
Acceleration Spectrum @ Peak Level (1 sec. Duration)

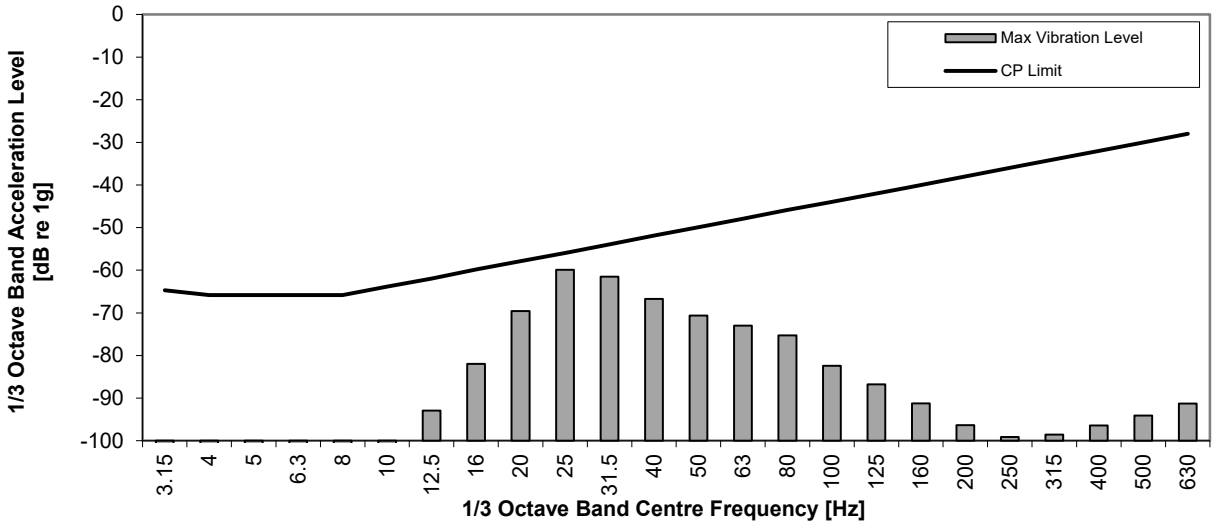


Figure 5a: Pass-by 2 at 30m from railway ROW
Measured Vibratory Velocity Level

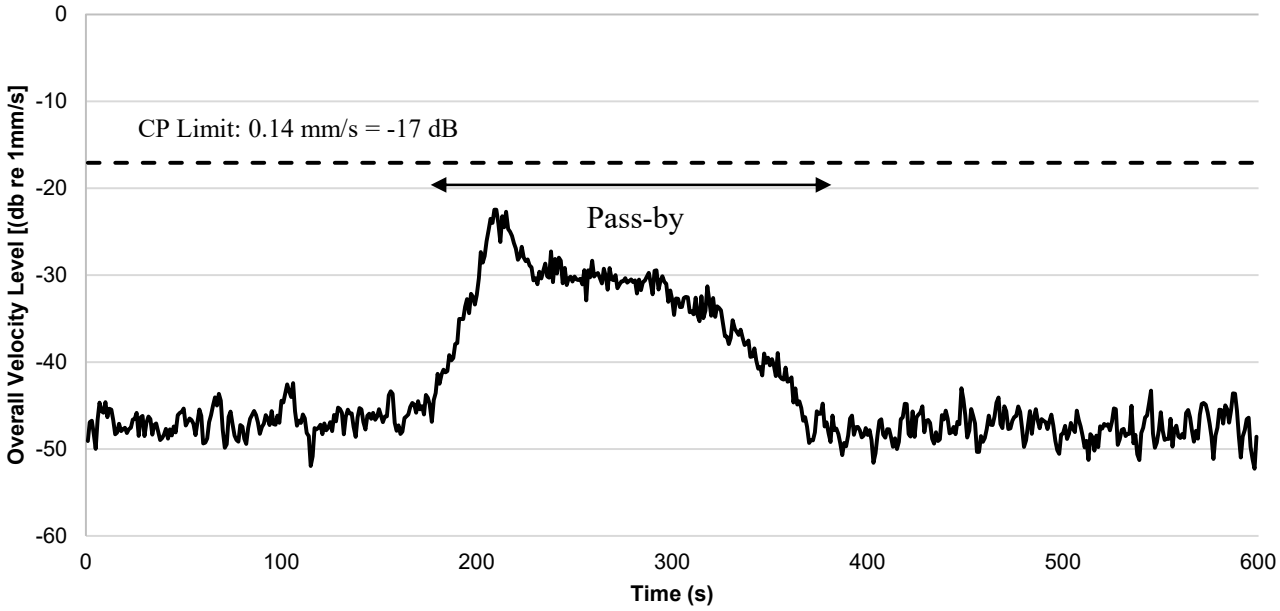


Figure 5b: Pass-by 2
Acceleration Spectrum @ Peak Level (1 sec. Duration)

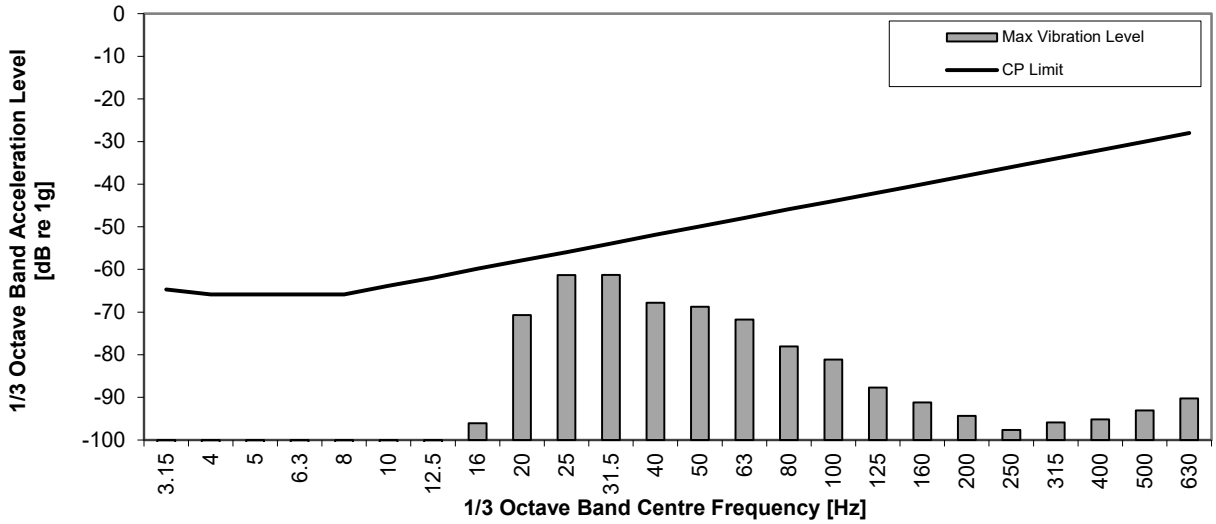


Figure 6a: Pass-by 3 at 30m from railway ROW
Measured Vibratory Velocity Level

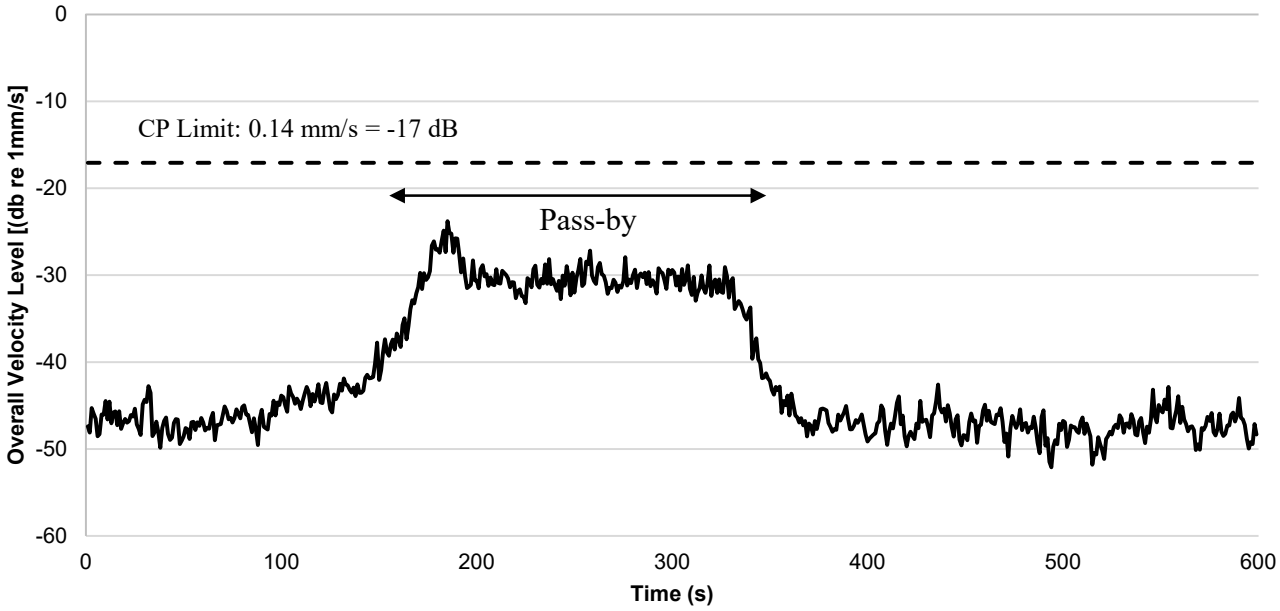


Figure 6b: Pass-by 3
Acceleration Spectrum @ Peak Level (1 sec. Duration)

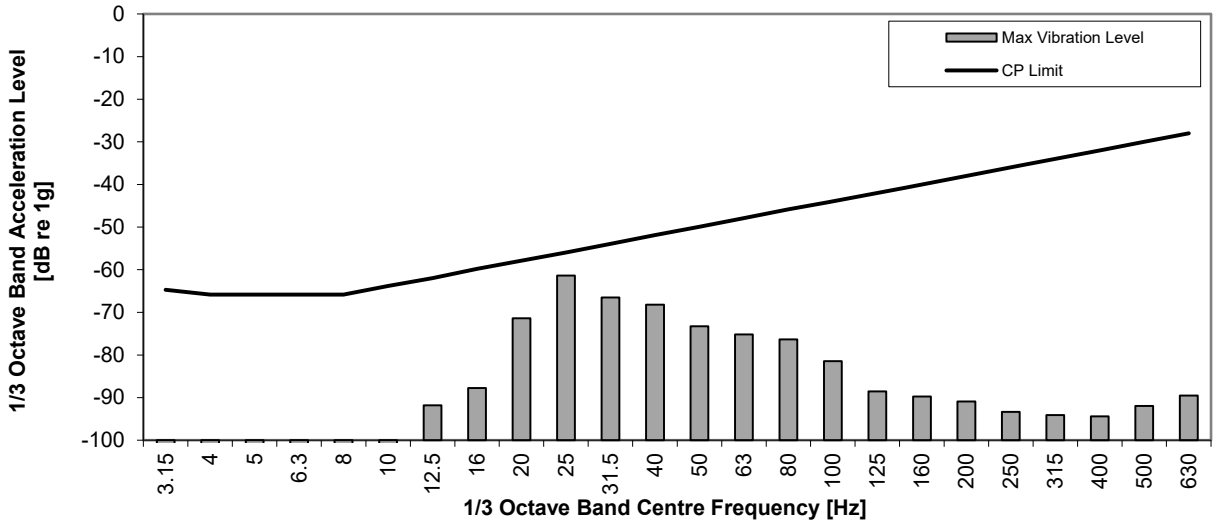


Figure 7a: Pass-by 4 at 30m from railway ROW
Measured Vibratory Velocity Level

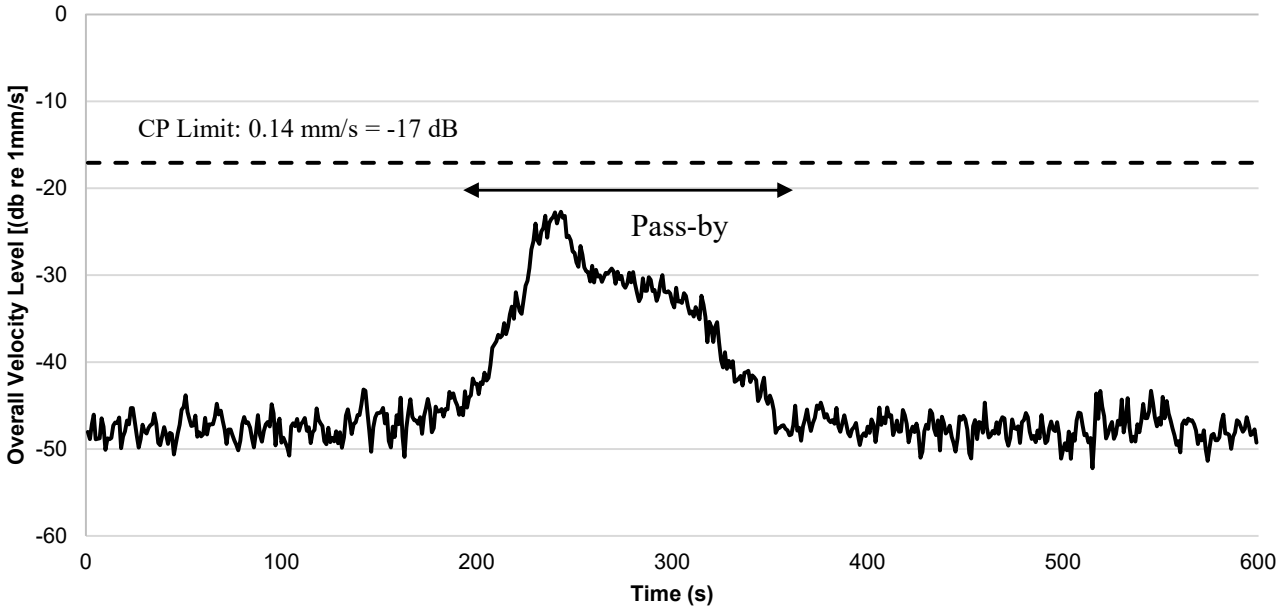


Figure 7b: Pass-by 4
Acceleration Spectrum @ Peak Level (1 sec. Duration)

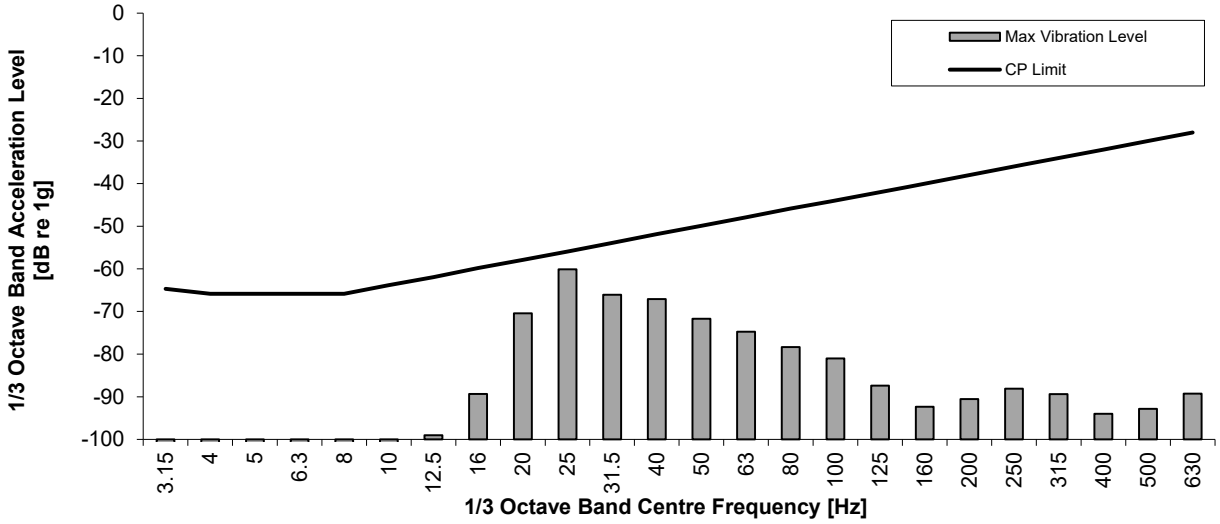


Figure 8a: Pass-by 5 at 30m from railway ROW
Measured Vibratory Velocity Level

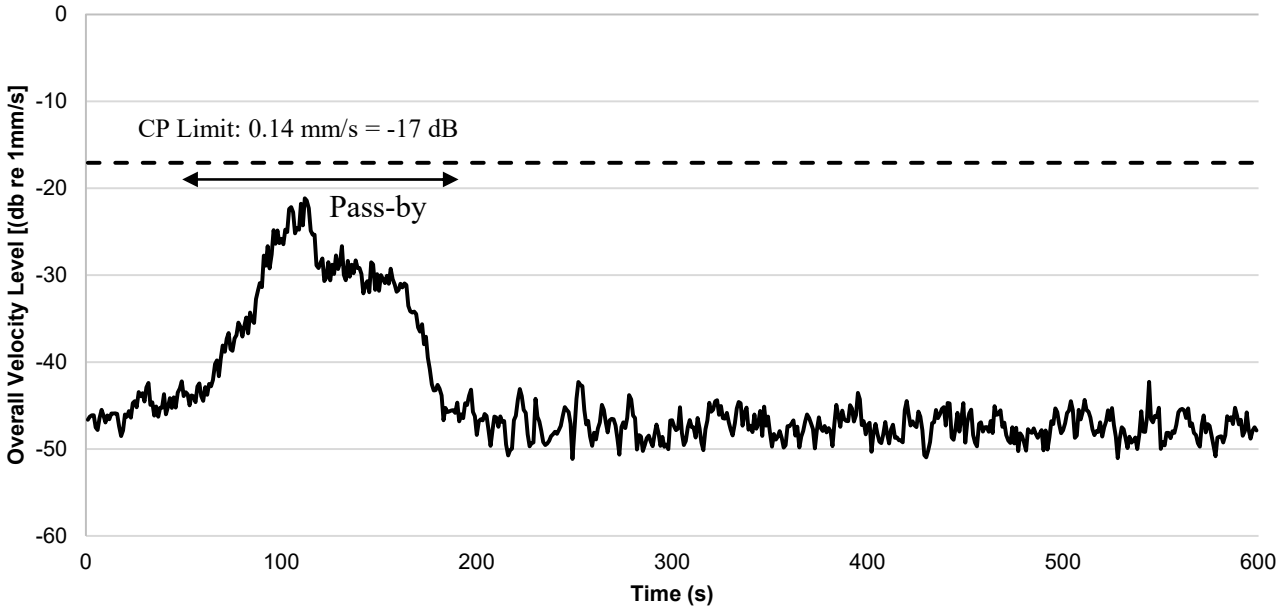
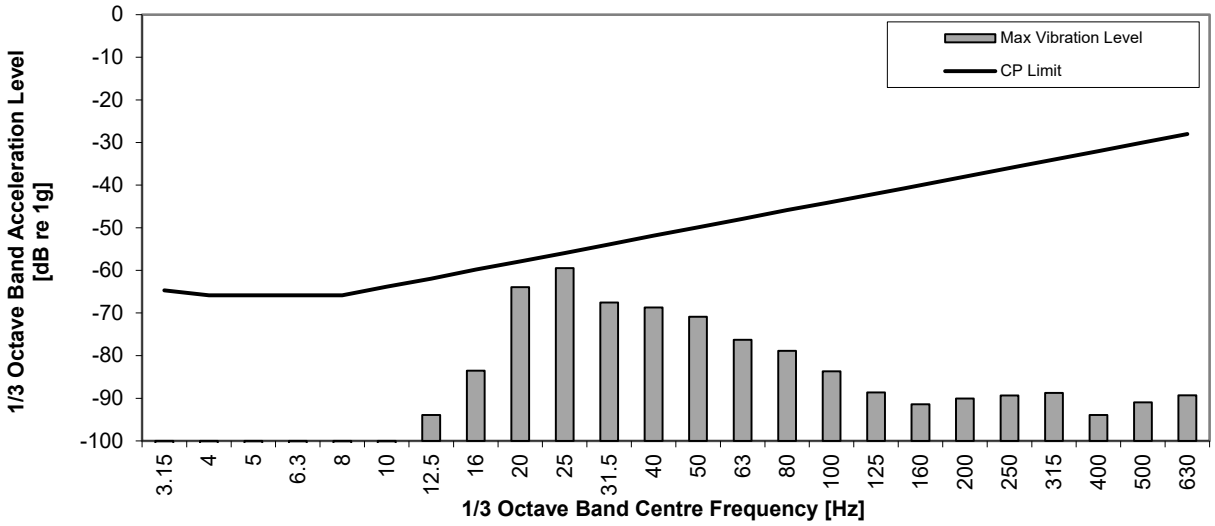


Figure 8b: Pass-by 5
Acceleration Spectrum @ Peak Level (1 sec. Duration)



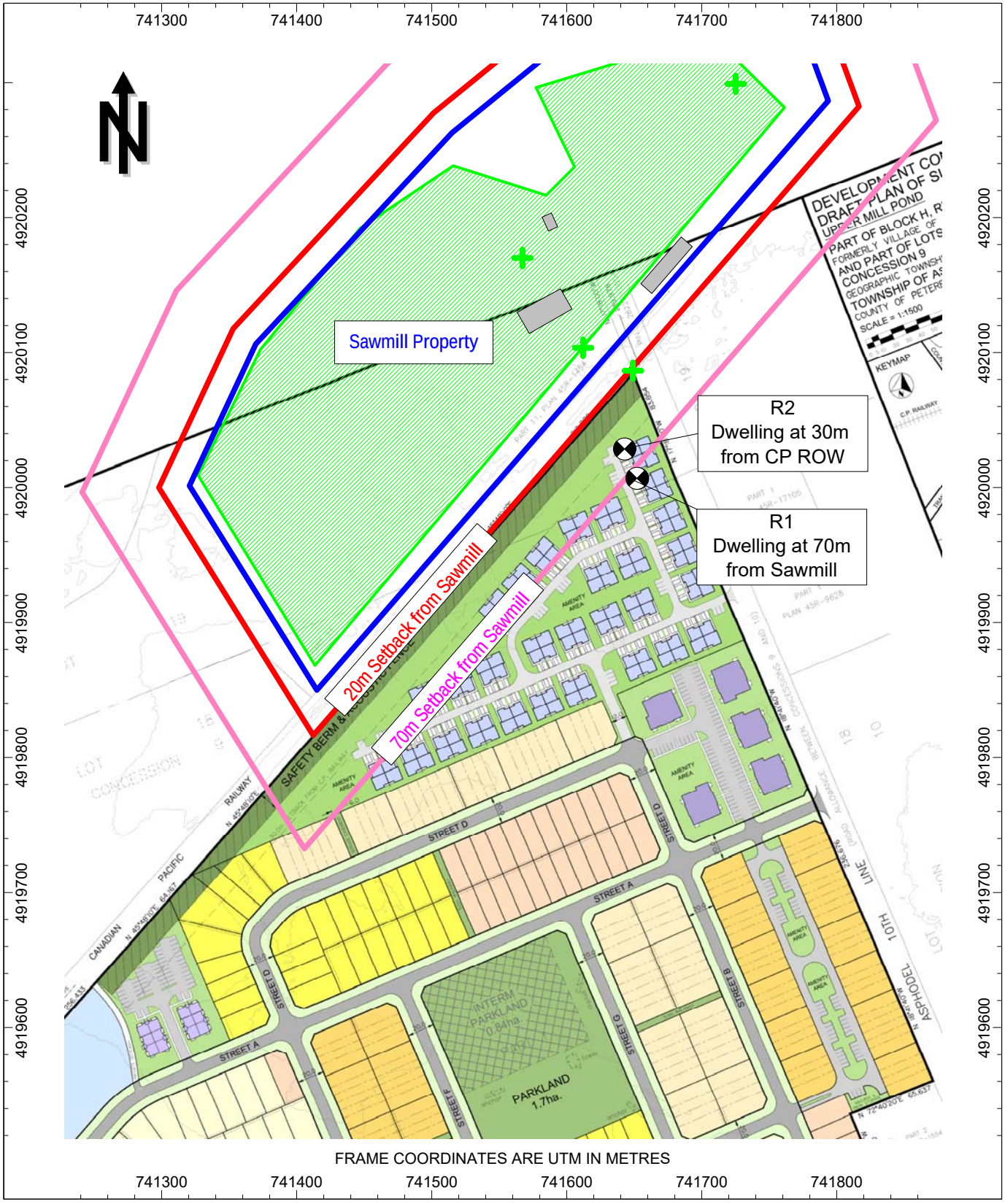


Figure 9: Location of Stationary Noise Sources, Critical Points of Reception and Setback Distances

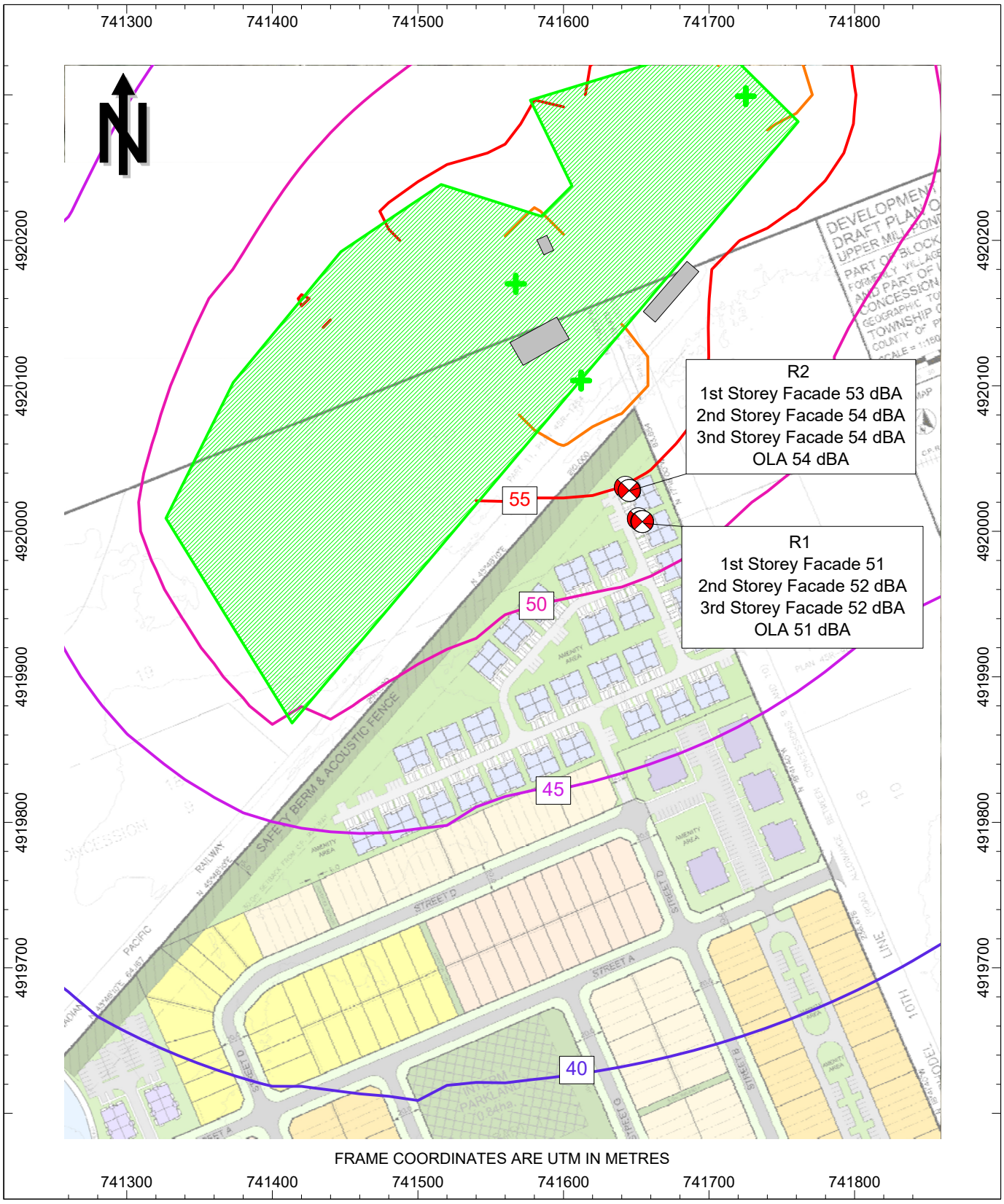


Figure 10: Stationary Noise Impact - Unmitigated
Sound Level Contours Shown for Prediction Height of 7.5m

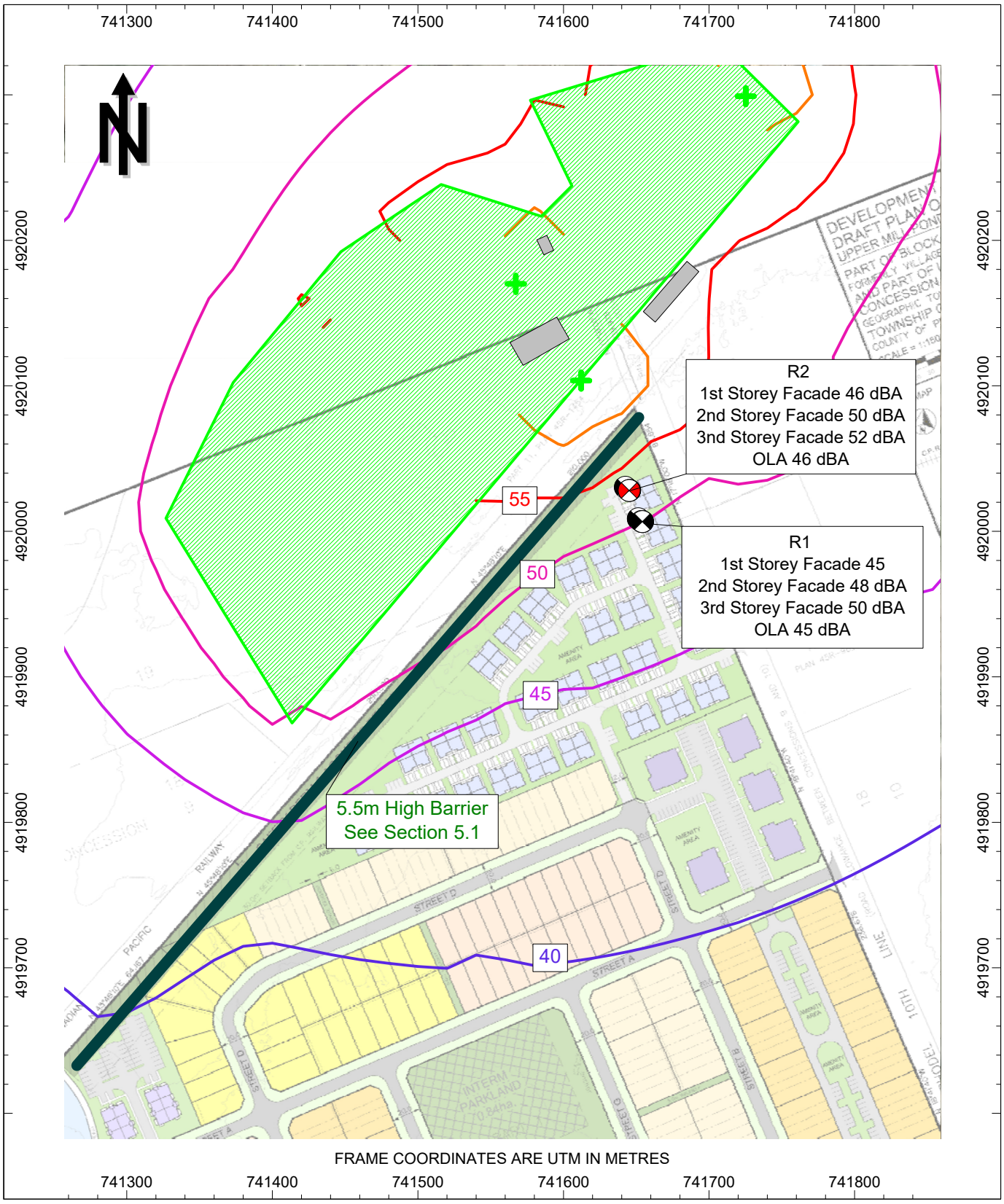


Figure 11: Stationary Noise Impact - Mitigated
Sound Level Contours Shown for Prediction Height of 7.5m

Appendix A

CP Principal Mainline Requirements

CANADIAN PACIFIC RAILWAY

PRINCIPAL MAIN LINE REQUIREMENTS

1. Berm, or combination berm and noise attenuation fence, having extensions or returns at the ends, to be erected on adjoining property, parallel to the railway right-of-way with construction according to the following:

   a) Minimum total height 5.5 metres above top-of-rail;
   b) Berm minimum height 2.5 metres and side slopes not steeper than 2.5 to 1.
   c) Fence, or wall, to be constructed without openings and of a durable material weighing not less than 20 kg. per square metre (4 lb/sq.ft.) of surface area.

   No part of the berm/noise barrier is to be constructed on railway property.

   A clause should be inserted in all offers of purchase and sale or lease, and be registered on title or included in the lease for each dwelling affected by any noise and vibration attenuation measures, advising that any berm, fencing, or vibration isolation features implemented are not to be tampered with or altered, and further that the owner shall have the sole responsibility for and shall maintain these features.

   Dwellings must be constructed such that the interior noise levels meet the criteria of the appropriate Ministry. A noise study should be carried out by a professional noise consultant to determine what impact, if any, railway noise would have on residents of proposed subdivisions and to recommend mitigation measures, if required. The Railway may consider other measures recommended by the study.

2. Setback of dwellings from the railway right-of-way to be a minimum of 30 metres. While no dwelling should be closer to the right-of-way than the specified setback, an unoccupied building, such as a garage, may be built closer. The 2.5 metre high earth berm adjacent to the right-of-way must be provided in all instances.

3. Ground vibration transmission to be estimated through site tests. If in excess of the acceptable levels, all dwellings within 75 metres of the nearest track should be protected. The measures employed may be:

   a) Support the building on rubber pads between the foundation and the occupied structure so that the maximum vertical natural frequency of the structure on the pads is 12 Hz;
   b) Insulate the building from the vibration originating at the railway tracks by an intervening discontinuity or by installing adequate insulation outside the building, protected from the compaction that would reduce its effectiveness so that vibration in the building became unacceptable; or
   c) Other suitable measures that will retain their effectiveness over time.

4. A clause should be inserted in all offers of purchase and sale or lease and in the title deed or lease of each dwelling within 300m of the railway right-of-way, warning prospective purchasers or tenants of the existence of the Railway's operating right-of-way; the possibility of alterations including the possibility that the Railway may expand its operations, which expansion may affect the living environment of the residents notwithstanding the inclusion of noise and vibration attenuating measures in the design of the subdivision and individual units, and that the Railway will not be responsible for complaints or claims arising from the use of its facilities and/or operations.

5. Any proposed alterations to the existing drainage pattern affecting railway property must receive prior concurrence from the Railway, and be substantiated by a drainage report to be reviewed by the Railway.

6. A 1.83 metre high chain link security fence be constructed and maintained along the common property line of the Railway and the development by the developer at his expense, and the developer is made aware of the necessity of including a covenant running with the lands, in all deeds, obliging the purchasers of the land to maintain the fence in a satisfactory condition at their expense.

7. Any proposed utilities under or over railway property to serve the development must be approved prior to their installation and be covered by the Railway's standard agreement.

Appendix B

Rail Traffic Information

Rank	TC Number	Railway Company	Region	Province	Access	Jurisdiction	Mile	Subdivision	Spur Mile	Spur Name	Location	Latitude	Longitude	Road Authority	Protection	Accident	Fatality	Injury	Total Trains Daily	Vehicles Daily	Train Max Speed (mph)	Road Speed (km/h)	Lanes	Tracks	IsUrban
15797	22816	CP	ONT	ON	Public	F	98.73	Havelock - CP			10Th Concession Rd	44.3939	-77.9658	Asphodel-Norwood (ON)	Active - FLB	0	0	0	1	200	10	50	2	1	Y

Appendix C

Road Traffic Information

Highway	Location Description	Dist. (KM)	Year	Pattern Type	AADT	SADT	SAWDT	WADT	AR
			2015	CTR	4,950	6,050	6,100	4,200	N/A
			2016	CTR	4,900	6,000	6,050	4,200	N/A
7	HAVELOCK E LT C8-9-MARY ST - START OF NA	1.8							
7	RAILWAY CROSSING - END OF NA	9.1	1988	IR	6,750	8,700	6,800	5,400	0.4
			1989	IR	7,000	9,000	7,700	5,700	0.6
			1990	IR	7,650	9,700	8,400	6,200	0.5
			1991	IR	7,900	9,900	8,700	6,500	0.4
			1992	IR	7,400	9,100	8,100	6,200	0.7
			1993	IR	7,400	9,300	8,200	5,900	0.6
			1994	IR	5,850	7,300	6,450	4,750	0.7
			1995	IR	5,500	6,950	6,150	4,450	0.8
			1996	IR	5,950	8,750	8,350	4,150	0.6
			1997	IR	6,100	8,950	8,550	4,250	0.3
			1998	IR	6,200	9,000	8,600	4,350	0.5
			1999	IR	6,300	9,150	8,750	4,350	0.4
			2000	IR	6,450	9,350	8,950	4,500	0.7
			2001	IR	6,700	9,800	9,300	4,600	0.7
			2002	IR	6,700	9,750	9,300	4,650	0.6
			2003	IR	7,000	10,200	9,750	4,850	0.4
			2004	IR	7,100	10,200	9,700	4,950	0.5
			2005	IR	7,400	9,200	8,250	6,000	0.7
			2006	IR	7,450	9,000	8,150	6,350	0.4
			2007	IR	7,600	9,200	9,200	6,450	0.7
			2008	IR	7,750	9,400	9,200	6,600	0.6
			2009	IR	7,900	9,300	8,300	6,950	0.5
			2010	IR	8,050	9,450	8,450	7,050	0.5
			2011	IR	8,200	9,750	9,600	6,950	N/A
			2012	IR	8,350	9,950	9,700	7,200	N/A
			2013	IR	8,500	10,100	10,900	7,250	N/A
			2014	IR	8,650	10,300	10,300	7,350	N/A
			2015	IR	8,800	10,500	10,500	7,500	N/A
			2016	IR	8,950	10,700	10,700	7,600	N/A
7	PETERBOROUGH RD 45	9.8	1988	CTR	6,550	8,500	6,600	5,200	0.7

Highway	Location Description	Dist. (KM)	Year	Pattern Type	AADT	SADT	SAWDT	WADT	AR
			1989	CTR	7,000	9,000	7,700	5,700	0.9
			1990	CTR	7,450	9,400	8,200	6,100	0.8
			1991	CTR	7,700	9,700	8,500	6,300	0.8
			1992	CTR	7,200	8,800	7,900	6,100	0.7
			1993	CTR	6,800	7,500	8,200	6,000	0.4
			1994	CTR	7,000	7,300	8,050	6,450	0.7
			1995	CTR	7,200	7,550	8,350	6,350	0.9
			1996	CTR	7,400	10,900	10,400	5,200	0.8
			1997	CTR	7,950	11,700	11,100	5,550	0.3
			1998	CTR	8,150	11,800	11,300	5,700	0.4
			1999	CTR	7,600	11,000	10,500	5,250	0.8
			2000	CTR	7,700	11,200	10,700	5,350	0.5
			2001	CTR	7,700	11,200	10,700	5,300	0.4
			2002	CTR	7,750	11,300	10,700	5,350	0.6
			2003	CTR	7,750	11,300	10,800	5,350	0.2
			2004	CTR	7,900	11,300	10,800	5,500	1.0
			2005	CTR	7,800	8,650	8,750	6,900	0.6
			2006	CTR	8,050	8,950	9,050	7,150	0.3
			2007	CTR	8,100	9,000	9,300	7,150	0.5
			2008	CTR	8,150	9,850	9,800	6,850	0.7
			2009	CTR	8,200	9,850	9,500	6,950	0.5
			2010	CTR	8,250	9,900	9,550	7,000	0.3
			2011	CTR	8,300	9,700	9,800	7,400	N/A
			2012	CTR	9,700	11,600	11,400	8,250	N/A
			2013	CTR	10,000	12,000	12,300	8,500	N/A
			2014	CTR	10,000	12,200	12,300	8,500	N/A
			2015	CTR	9,300	11,300	11,400	7,900	N/A
			2016	CTR	9,400	11,500	11,600	8,000	N/A
7	PETERBOROUGH RD 38 - (TO WARSAW)	5.5	1988	CTR	7,300	9,400	8,700	6,000	0.5
			1989	CTR	8,000	10,200	9,500	6,700	0.5
			1990	CTR	8,600	10,600	9,800	7,700	0.4
			1991	CTR	8,850	10,800	10,100	7,900	0.3
			1992	CTR	8,700	10,700	9,900	7,800	0.6

Appendix B

Sample STAMSON 5.04 Output

STAMSON 5.0 NORMAL REPORT Date: 29-03-2023 16:29:42
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: a.te Time Period: Day/Night 16/8 hours
Description: Pred. Loc. [A], low density dwelling backing rail

Rail data, segment # 1: Havelock (day/night)

Train Type	Trains (Left)	Trains (Right)	Speed (km/h)	# loc /Train	# Cars /Train	Eng type	Cont weld
1.	0.6/0.6	0.6/0.6	16.0	2.0	200.0	Diesel	No

Data for Segment # 1: Havelock (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 : 40.00 / 40.00 m
Receiver height : 7.50 / 7.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Whistle Angle : 80 deg Track 1
Reference angle : 0.00

Results segment # 1: Havelock (day)

LOCOMOTIVE (0.00 + 60.45 + 0.00) = 60.45 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.41	67.42	-5.98	-0.99	0.00	0.00	0.00	60.45

WHEEL (0.00 + 42.99 + 0.00) = 42.99 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.51	50.61	-6.43	-1.19	0.00	0.00	0.00	42.99

LEFT WHISTLE (0.00 + 60.16 + 0.00) = 60.16 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-77	80	0.41	67.40	-5.98	-1.26	0.00	0.00	0.00	60.16

RIGHT WHISTLE (0.00 + 43.10 + 0.00) = 43.10 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
80	86	0.41	67.40	-5.98	-18.31	0.00	0.00	0.00	43.10

Segment Leq : 63.40 dBA

Total Leq All Segments: 63.40 dBA

Results segment # 1: Havelock (night)

LOCOMOTIVE (0.00 + 63.80 + 0.00) = 63.80 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.41	70.78	-5.98	-0.99	0.00	0.00	0.00	63.80

WHEEL (0.00 + 46.34 + 0.00) = 46.34 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.51	53.97	-6.43	-1.19	0.00	0.00	0.00	46.34

LEFT WHISTLE (0.00 + 63.51 + 0.00) = 63.51 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-77	80	0.41	70.76	-5.98	-1.26	0.00	0.00	0.00	63.51

RIGHT WHISTLE (0.00 + 46.46 + 0.00) = 46.46 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
80	86	0.41	70.76	-5.98	-18.31	0.00	0.00	0.00	46.46

Segment Leq : 66.75 dBA

Total Leq All Segments: 66.75 dBA

Road data, segment # 1: Hwy 7 (day/night)

Car traffic volume : 12940/2284 veh/TimePeriod *
Medium truck volume : 744/131 veh/TimePeriod *
Heavy truck volume : 1190/210 veh/TimePeriod *
Posted speed limit : 70 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

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

24 hr Traffic Volume (AADT or SADT): 11500
Percentage of Annual Growth : 2.50
Number of Years of Growth : 17.00
Medium Truck % of Total Volume : 5.00
Heavy Truck % of Total Volume : 8.00

Day (16 hrs) % of Total Volume : 85.00

Data for Segment # 1: Hwy 7 (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 : 350.00 / 350.00 m
Receiver height : 7.50 / 7.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Hwy 7 (day)

Source height = 1.68 m

ROAD (0.00 + 51.30 + 0.00) = 51.30 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.47	72.60	0.00	-20.17	-1.13	0.00	0.00	0.00	51.30

Segment Leq : 51.30 dBA

Total Leq All Segments: 51.30 dBA

Results segment # 1: Hwy 7 (night)

Source height = 1.68 m

ROAD (0.00 + 46.78 + 0.00) = 46.78 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.47	68.07	0.00	-20.17	-1.13	0.00	0.00	0.00	46.78

Segment Leq : 46.78 dBA

Total Leq All Segments: 46.78 dBA

TOTAL Leq FROM ALL SOURCES (DAY): 63.66
(NIGHT): 66.79

STAMSON 5.0 NORMAL REPORT Date: 29-03-2023 16:30:32
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: aola.te Time Period: 16 hours
Description: OLA of Pred. Loc. [A], unmitigated

Rail data, segment # 1: Havelock

Train ! Trains ! Speed !# loc !# Cars! Eng !Cont
Type ! !(km/h) !/Train!/Train! type !weld
---
1. ! 1.3/0.4 ! 16.0 ! 2.0 !200.0 !Diesel! No

Data for Segment # 1: Havelock

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 35.00 m
Receiver height : 1.50 m
Topography : 2 (Flat/gentle slope; with barrier)
No Whistle
Barrier angle1 : -90.00 deg Angle2 : 90.00 deg
Barrier height : 0.00 m
Barrier receiver distance : 10.00 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Havelock

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)

4.00 ! 1.50 ! 2.21 ! 2.21
0.50 ! 1.50 ! 1.21 ! 1.21

LOCOMOTIVE (0.00 + 60.61 + 0.00) = 60.61 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 90 0.58 67.77 -5.83 -1.33 0.00 0.00 -0.25 60.36*
-90 90 0.58 67.77 -5.83 -1.33 0.00 0.00 0.00 60.61
---

* Bright Zone !

WHEEL (0.00 + 43.39 + 0.00) = 43.39 dBA

Angle1	Angle2	Alpha	RefLeq	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.66	50.96	-6.11	-1.46	0.00	0.00	-0.92	42.47*
-90	90	0.66	50.96	-6.11	-1.46	0.00	0.00	0.00	43.39

* Bright Zone !

Segment Leq : 60.69 dBA

Total Leq All Segments: 60.69 dBA

Road data, segment # 1: Hwy 7

Car traffic volume : 12625 veh/TimePeriod *
Medium truck volume : 726 veh/TimePeriod *
Heavy truck volume : 1161 veh/TimePeriod *
Posted speed limit : 70 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Hwy 7

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 1
House density : 60 %
Surface : 1 (Absorptive ground surface)
Receiver source distance : 350.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Hwy 7

Source height = 1.68 m

ROAD (0.00 + 45.30 + 0.00) = 45.30 dBA

Angle1	Angle2	Alpha	RefLeq	P.Adj	D.Adj	F.Adj	W.Adj	H.Adj	B.Adj	SubLeq
-90	90	0.65	72.49	0.00	-22.63	-1.45	0.00	-3.11	0.00	45.30

Segment Leq : 45.30 dBA

Total Leq All Segments: 45.30 dBA

TOTAL Leq FROM ALL SOURCES: 60.81

STAMSON 5.0 NORMAL REPORT Date: 29-03-2023 16:31:08
MINISTRY OF ENVIRONMENT AND ENERGY / NOISE ASSESSMENT

Filename: aola_m.te Time Period: 16 hours
Description: OLA of Pred. Loc. [A], mitigated

Rail data, segment # 1: Havelock

Train ! Trains ! Speed !# loc !# Cars! Eng !Cont
Type ! !(km/h) !/Train!/Train! type !weld
---
1. ! 1.3/0.4 ! 16.0 ! 2.0 !200.0 !Diesel! No

Data for Segment # 1: Havelock

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 0
Surface : 1 (Absorptive ground surface)
Receiver source distance : 35.00 m
Receiver height : 1.50 m
Topography : 2 (Flat/gentle slope; with barrier)
No Whistle
Barrier angle1 : -30.00 deg Angle2 : 90.00 deg
Barrier height : 5.50 m
Barrier receiver distance : 10.00 m
Source elevation : 0.00 m
Receiver elevation : 0.00 m
Barrier elevation : 0.00 m
Reference angle : 0.00

Results segment # 1: Havelock

Barrier height for grazing incidence

Source ! Receiver ! Barrier ! Elevation of
Height (m) ! Height (m) ! Height (m) ! Barrier Top (m)

4.00 ! 1.50 ! 2.21 ! 2.21
0.50 ! 1.50 ! 1.21 ! 1.21

LOCOMOTIVE (55.07 + 47.71 + 0.00) = 55.81 dBA
Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 -30 0.58 67.77 -5.83 -6.86 0.00 0.00 0.00 55.07

-30 90 0.25 67.77 -4.62 -2.27 0.00 0.00 -13.18 47.71

WHEEL (37.77 + 28.49 + 0.00) = 38.25 dBA

Angle1 Angle2 Alpha RefLeq D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 -30 0.66 50.96 -6.11 -7.08 0.00 0.00 0.00 37.77

-30 90 0.36 50.96 -5.00 -2.44 0.00 0.00 -15.03 28.49

Segment Leq : 55.89 dBA

Total Leq All Segments: 55.89 dBA

Road data, segment # 1: Hwy 7

Car traffic volume : 12940 veh/TimePeriod *
Medium truck volume : 744 veh/TimePeriod *
Heavy truck volume : 1190 veh/TimePeriod *
Posted speed limit : 70 km/h
Road gradient : 0 %
Road pavement : 1 (Typical asphalt or concrete)

Data for Segment # 1: Hwy 7

Angle1 Angle2 : -90.00 deg 90.00 deg
Wood depth : 0 (No woods.)
No of house rows : 1
House density : 60 %
Surface : 1 (Absorptive ground surface)
Receiver source distance : 350.00 m
Receiver height : 1.50 m
Topography : 1 (Flat/gentle slope; no barrier)
Reference angle : 0.00

Results segment # 1: Hwy 7

Source height = 1.68 m

ROAD (0.00 + 45.41 + 0.00) = 45.41 dBA
Angle1 Angle2 Alpha RefLeq P.Adj D.Adj F.Adj W.Adj H.Adj B.Adj SubLeq
---
-90 90 0.65 72.60 0.00 -22.63 -1.45 0.00 -3.11 0.00 45.41

Segment Leq : 45.41 dBA

Total Leq All Segments: 45.41 dBA

TOTAL Leq FROM ALL SOURCES: 56.26