Road Traffic Noise Impact Assessment

Mississauga Road Class Environmental Assessment
300 m North of Financial Drive to 300 m North of Queen Street West
Project # TP115085; Client Name: The Regional Municipality of Peel

Prepared for:

The Regional Municipality of Peel
10 Peel Centre Drive, Suite A and B, Brampton, ON L6T 4B9

May 5, 2017
revised
July 23, 2018

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited
3450 Harvester Road, Suite 100
Burlington, ON L7N 3W5 Canada
T: 905-335-2353
www.woodplc.com

July 23, 2018

Asha Saddi, BA(Hons), PMP
Technical Analyst, Infrastructure Planning & Studies
Transportation Division
The Regional Municipality of Peel
10 Peel Centre Drive, Suite A and B
Brampton, ON L6T 4B9

Dear Ms. Saddi,

Re: Road Traffic Noise Impact Assessment in Support of a Municipal Class Environmental Assessment for Mississauga Road from 300m North of Financial Drive to 300m North of Queen Street West

Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood), formerly Amec Foster Wheeler, is pleased to provide the attached Road Traffic Noise Impact Study to be used in support of a Municipal Class Environmental Assessment for the proposed improvements and widening of Mississauga Road from 300m north of Financial Drive to 300m north of Queen Street West.

Should you have any questions regarding the study or its findings, please do not hesitate to contact us.

Yours truly,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Buddy Ledger, P.Eng., M.A.Sc., INCE
Department Head & Senior Engineer
Acoustics & Vibration

'Wood' is a trading name for John Wood Group PLC and its subsidiaries

Road Traffic Noise Impact Assessment

Mississauga Road Class Environmental Assessment
Project # TP115085; Client Name: The Regional Municipality of Peel

Prepared for:

The Regional Municipality of Peel
10 Peel Centre Drive, Suite A and B, Brampton, ON L6T 4B9

Prepared by:

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited
3450 Harvester Road, Suite 100
Burlington, ON L7N 3W5 Canada
T: 905-335-2353

July 23, 2018

Copyright and non-disclosure notice

The contents and layout of this report are subject to copyright owned by Wood (© Wood Environment & Infrastructure Solutions a Division of Wood Canada Limited). save to the extent that copyright has been legally assigned by us to another party or is used by Wood under license. To the extent that we own the copyright in this report, it may not be copied or used without our prior written agreement for any purpose other than the purpose indicated in this report. The methodology (if any) contained in this report is provided to you in confidence and must not be disclosed or copied to third parties without the prior written agreement of Wood. Disclosure of that information may constitute an actionable breach of confidence or may otherwise prejudice our commercial interests. Any third party who obtains access to this report by any means will, in any event, be subject to the Third Party Disclaimer set out below.

Third-party disclaimer

Any disclosure of this report to a third party is subject to this disclaimer. The report was prepared by Wood at the instruction of, and for use by, our client named on the front of the report. It does not in any way constitute advice to any third party who is able to access it by any means. Wood excludes to the fullest extent lawfully permitted all liability whatsoever for any loss or damage howsoever arising from reliance on the contents of this report. We do not however exclude our liability (if any) for personal injury or death resulting from our negligence, for fraud or any other matter in relation to which we cannot legally exclude liability.

Executive Summary

Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood), formerly Amec Foster Wheeler, was retained by The Regional Municipality of Peel (Peel Region) to complete a Road Traffic Noise Impact Study (Noise Impact Study) for improvements and widening of Mississauga Road from 300m North of Financial Drive to 300m North of Queen Street West. The Noise Impact Study was completed in support of a Municipal Class Environmental Assessment (EA) for the proposed improvements along Mississauga Road in the City of Brampton, Ontario.

The noise guidelines applicable are the MOEE/MTO joint protocol, the Region of Peel corporate policy W30-04, and the City of Brampton document "Noise Attenuation – Retrofit Policy and Road Widenings". The project was assessed using the limits provided by these sources.

The existing posted speed limit from 300m north of Queen Street West to 300m north of Financial Drive is 60 kph. This noise impact assessment has been completed using a future posted speed limit of 60 kph from 300m north of Queen Street West to 300m north of Financial Drive.

The results of the noise impact study indicated that the noise impacts along Mississauga Road are predicted to be less than 5 dB when comparing the Future "build" 2031 and Future "no-build" 2031 scenarios. Therefore, in accordance with the MOEE/MTO protocol consideration of noise mitigation is not required. Further the predicted change in noise levels would result in a 'noticeable' (see Table 1) change between the Future "no-build" and Future "build" scenarios.

However, the predicted Future "build" 2031 levels are above the 60 dBA criterion at seven reverse frontage or side exposure locations (R01, R03 to R07 and R09). Therefore, these locations were assessed for possible mitigation in accordance with the Peel Region and City of Brampton Noise Attenuation Policies.

The barrier investigation concluded that Barriers 2 through 5 provided sufficient attenuation as to be warranted and these were recommended for implementation. Figures showing the recommended barrier extents and locations are provided in Appendix G. All recommended noise barriers are 4.0 metres in height above existing grade.

Construction noise impacts are temporary and largely unavoidable. However, the contract documents should identify the contractor's responsibilities with respect to controlling noise as well as recording, investigating and if possible addressing complaints. The contract documents should also explicitly state that compliance with all applicable law is an expectation of the contract including adherence to the Brampton Noise By-Law 93-84.

Table of Contents

List of Tables

List of Appendices

1.0 Introduction

Wood Environment & Infrastructure Solutions, a Division of Wood Canada Limited (Wood), formerly Amec Foster Wheeler, was retained by The Regional Municipality of Peel (Peel Region) to complete a Road Traffic Noise Impact Study (Noise Impact Study) for improvements and widening of Mississauga Road from 300m North of Financial Drive to 300m North of Queen Street West. The Noise Impact Study was completed in support of a Municipal Class Environmental Assessment (EA) for the proposed improvements along Mississauga Road in the City of Brampton, Ontario.

Rowan Williams Davies & Irwin Inc. (RWDI) has completed an "Environmental Noise Impact Assessment" in 2006 for Mississauga Road between Bovaird Drive and Queen Street *(RWDI, November 14, 2006)*. This study supersedes the 2006 work for the segment between Adamsville Road and Queen Street West as it reflects more recent speed, traffic, lane configuration and alignment data.

1.1 Definition of Study Area

The study area was comprised of approximately 2 kilometers of Mississauga Road. The northern limit of the study area is 300m north of Queen Street West and the southern limit of the study area is 300m north of Financial Drive. The study area is presented in Appendix A.

1.2 Description of Scenarios

Three scenarios were considered as part of this noise impact study:

1. Existing (2017);
2. Future "no-build" (2031);
3. Future "build" (2031) without Barriers;
4. Future "build" (2031) Barrier Investigation; and,
5. Future "build" (2031) Recommended Barriers.

Existing (2017): Consists of a 6-lane cross-section at Adamsville Road which transitions to a 4-lane cross-section at Queen Street West. A 4-lane cross-section continues from Queen Street West, past Embleton Drive, to the Lionhead Golf & Conference Centre (Lionhead GCC) entrance. Just south of the Lionhead GCC entrance the lane configuration transitions to a 6-lane cross-section. There are also existing additional turning lanes throughout the study area. Figures for this scenario are provided in Appendix C.

Future "no-build" (2031): Consists of the same lane configurations as Existing (2017) but with increased traffic volumes due to local population growth. Figures for this scenario are provided in Appendix D.

Future "build" (2031) without Barriers: Consists of a 6-lane cross-section throughout the study area with additional turning lanes. Figures for this scenario are provided in Appendix E.

Future "build" (2031) Barrier Investigation: Consists of a 6-lane cross-section throughout the study area with additional turning lanes. This scenario includes possible noise barrier locations put forward for evaluation. Figures for this scenario are provided in Appendix F.

Future "build" (2031) Recommended Barriers: Consists of a 6-lane cross-section throughout the study area with additional turning lanes. This scenario includes noise barriers which were found to be warranted based on the barrier investigation. Figures for this scenario are provided in Appendix G.

2.0 Environmental Noise Guidelines

Environmental noise is typically assessed based on noise or sound levels. The term "noise level" in this context typically refers to the equivalent continuous sound pressure level (L_{EQ}) expressed in A-weighted decibels (dBA referenced to 20µPa) having the same total sound energy as a time-varying sound pressure level over a specified time period. It is important to note that, although environmental noise is reported in A-weighted decibels (dBA), the difference between two A-weighted values is reported in decibels (dB).

Road traffic noise impact assessments for road widenings (under the Municipal Class EA process) typically consider outdoor noise levels only. This limitation is a result of the fact that the only practical noise mitigation measure under such circumstances are retrofit noise barriers as alterations to existing residential building envelopes is not considered practical or feasible. Therefore, this road traffic noise assessment is limited to the assessment of Outdoor Living Areas (OLA).

2.1 Perception of Increases in Sound Level

Increases in noise level can be ranked as shown in Table 1 below. This ranking information is based on general practice and is documented within the draft MOEE/GO Transit noise and vibration protocol *(MOEE/GO Transit, January 1995 (Draft #9))*.

Table 1. PERCEPTION OF CHANGES IN NOISE LEVEL

Change in Noise Level (dB)	Perception of Change
0 to less than 3	Insignificant
3 to less than 5	Noticeable
5 to less than 10	Significant
Over 10	Very Significant

2.2 Noise Guidelines which are Applicable to this Project

The following sections describe the noise guidelines which are both applicable within the projects geographical area and appropriate for a project of this type.

2.2.1 Provincial – MOEE/MTO Protocol

The Ontario Ministry of the Environment and Climate Change (MOECC), formerly the Ministry of Environment (MOE) and before that the Ministry of Environment and Energy (MOEE), does not have a specific noise guideline for the assessment of regional or municipal road improvements, widenings or expansions. However, the MOECC does have a protocol which was developed with the Ontario Ministry of Transportation (MTO) which relates to road traffic noise assessments of provincial highway improvements. Although not specifically intended for this purpose this guideline is typically adopted within Ontario to assess regional and municipal road improvement projects.

The MOEE/MTO joint protocol "A Protocol for Dealing with Noise Concerns during the Preparation, Review and Evaluation of Provincial Highway's Environmental Assessments" *(MTO/MOEE, 1986)* states that if the expected noise impact of implementing the roadway improvements is 5 dB or less, then noise mitigation need not be considered. Conversely if the noise impact is expected to be greater than 5 dB, an investigation into possible noise mitigation measures is required. Noise impact is defined as the difference between the future "build" noise level with the proposed improvements and the future "no-build" noise level without the proposed improvements. To be economically feasible (cost effective), the protocol states that noise control measures should achieve a minimum attenuation of 5 dB at the OLAs when averaged

over the first row of receivers. The objective noise level is stated to be 55 dBA and thus an impact of greater than 5 dB but resulting in an overall noise level of less than or equal to 55 dBA would not require consideration of noise mitigation since the objective level is already met. Therefore, if the noise impact is greater than 5 dB and the overall sound level is greater than 55 dBA, investigation of noise mitigation is required.

The MOEE/MTO protocol does not outline the detailed requirements of the noise assessment. However, the protocol does refer to the Ontario Ministry of Transportation and Communication (MTC) Directive A-1 *(Ontario Ministry of Transportation, February 1992)*, which does outline the specific requirements of noise assessment.

According to Directive A-1 the noise assessment should be based on the 24-hour L_{eq} noise level. This is appropriate for provincial highways since the day-time (07:00 to 23:00) traffic volume typically accounts for roughly 66 percent of the total daily traffic with the remainder of the traffic occurring during night-time (23:00 to 07:00). However, for regional and municipal roads the majority of the traffic occurs during day-time hours. Thus it is more appropriate to assess regional and municipal roads based on the day-time 16-hour L_{eq} (07:00 to 23:00).

2.2.2 Peel Region – Noise Attenuation Barriers

The Region of Peel corporate policy W30-04 *(The Regional Municipality of Peel, June 1996)* outlines the specific circumstances under which the Region will consider the construction of noise barriers for existing reverse frontage dwellings. According to this document, noise attenuation will be considered for OLAs for existing residential properties when the noise levels are predicted to be above 60 dBA (16-hour LEQ) and only if a reduction of 5 dB or more can be achieved for the 16 hour period between 07:00 and 23:00.

2.2.3 City of Brampton – Noise Attenuation Policy

The City of Brampton document "Noise Attenuation – Retrofit Policy and Road Widenings" *(The Corporation of the City of Brampton, October 2007)* specifically addresses the noise levels calculated from proposed road widening within the City. According to this document, noise attenuation will be considered for OLAs for existing residential properties when the noise levels are predicted to be above 60 dBA (16-hour L_{EQ}) and only if a reduction of 5 dB or more can be achieved for the 16 hour period between 07:00 and 23:00.

In the event that a noise wall is proposed to attenuate traffic noise levels at the residential properties adjacent to the road widening, the funding would be provided as part of the Capital Road project (per the City's six-lane widening policy).

2.3 Noise Guidelines which are Not Applicable to this Project

The following sections describe the noise guidelines which are applicable within the projects geographical area but which are not appropriate for a project of this type. These are discussed here to acknowledge their existence, briefly describe them and ultimately provide a rational for their exclusion from consideration in the context of this project. This section should not be regarded as exhaustive or complete but instead only discusses the most commonly known guidance sources applicable to this geography but which are not applicable to this project.

2.3.1 Provincial – MTO Environmental Noise Guide

The Ontario Ministry of Transportation (MTO) "Environmental Noise Guide" *(Ontario Ministry of Transporation, October 2006 (Version 1.1 updated July 2008))* (MTO Noise Guide) states that it was developed to provide guidance for MTO personnel and consultants in the analysis of highway noise and

its effects. The MTO noise guide establishes that if predicted noise impact is less than 5 dB and the overall sound level is less than 65 dBA, then noise mitigation need not be considered. Conversely if the noise impact is found to be greater than or equal to 5 dB or the overall sound level is greater than or equal to 65 dBA, then noise mitigation must be considered. Noise impact is defined as the difference between the future noise level with and without the proposed roadway improvements. To be economically feasible (cost effective), the guide states that noise control measures should achieve a minimum attenuation of 5 dB when averaged over the first row of receivers.

The MTO Noise Guide applies only to provincial highways and freeways under MTO jurisdiction and therefore does not apply to this project.

2.3.2 Provincial – NPC-300

The MOECC publication NPC-300 "Environmental Noise Guideline: Stationary and Transportation Sources – Approval and Planning" (Ontario Ministry of the Environment and Climate Change, 2013) Part C "Land Use Planning" provides guidelines and criteria for the assessment of road traffic noise in the context of the municipal land use planning process. The acceptable noise level for an OLA as defined in this document is 55 dBA (day-time, 16-hour L_{eq}), which is consistent with the goal of the MOEE/MTO joint protocol (MTO/MOEE, 1986). The MOECC guidelines allow an exceedance of up to 5 dB without any mitigation required provided that prospective purchasers or tenants are informed via an appropriate title warning clause. When the OLA sound levels exceed 60 dBA (day-time, 16-hour L_{eq}), physical mitigation is required to reduce the sound levels. There are no night-time sound level criteria for the OLA, as the MOECC considers the OLA to be used during the daytime only.

NPC-300 Part C is intended to provide guidance with respect to the municipal land-use planning process and is relevant when assessing proposed developments adjacent to existing roadways. It is not applicable to Municipal Class Environmental Assessments of new or upgraded road transportation infrastructure and thus is not applicable to this project.

2.3.3 Peel Region – Guidelines for Acoustical Reports

The Region of Peel "Guidelines for Acoustical Reports" *(The Regional Municiapality or Peel, December 2002)* (Peel Guideline) specifies a sound level limit at OLA between the hours of 07:00 and 23:00 (16-hour L_{eq}) of 55 dBA. The sound level limit may be exceeded by up to 5 dB as noise mitigation costs for reductions less than 5 dB are not considered economically feasible. However, when designing noise barrier walls, the design criteria is 55 dBA and the design should provide the maximum amount of attenuation that is aesthetically, technically, administratively and economically practical.

The Peel Guideline is intended to provide guidance with respect to the municipal land-use planning process and is relevant when assessing proposed developments adjacent to existing roadways. It is not applicable to Municipal Class Environmental Assessments of new or upgraded road transportation infrastructure and thus is not applicable to this project.

3.0 Project Noise Criteria

This section outlines the specific noise criteria drawn from the documents discussed in Section 2.2 which apply to this project. Table 2 provides a summary of the criteria consideration of noise mitigation which are applicable to this project.

Table 2. PROJECT NOISE CRITERIA

Daytime $L_{eq\text{-}16hr}$ (dBA)	Noise Impact (dB)	Mitigation Effort Required
> 55 dBA	> 5 dB	• Mitigation in accordance with the MOEE/MTO Noise Protocol; • Investigate noise mitigation measures within the Right-of-Way; • Noise mitigation measures, where introduced, should achieve a minimum of 5 dB attenuation, over first row receivers.
> 60 dBA	-	• If reverse frontage investigate mitigation in accordance with the Region of Peel and City of Brampton retrofit policies; • Noise mitigation measures, where introduced, should achieve a minimum of 5 dB attenuation, over first row receivers; • The Region of Peel and City of Brampton policies have further non-technical, including financial, requirements which must be met to warrant mitigation effort.
All other cases		• None.

4.0 Noise Impact Assessment Methodology

This section outlines the noise impact methodology which was applied to the assessment of this project.

4.1 Road Traffic Data

A detailed "Transportation and Traffic Analysis Report" was completed for the project by Paradigm Transportation Solutions Limited *(Paradigm Transportation Solutions Limited, February 2017)* (Traffic Study). The Traffic Study provided figures showing the AM peak hour and PM peak hour traffic volumes. Three scenarios were provided Balanced Existing (2017), Future (2031) Traffic Growth and Future (2031) Total Traffic these scenarios correspond to Existing, Future "no-build" and Future "build" scenarios respectively. The southbound Annual Average Daily Traffic (AADT) value was estimated by assuming that the AM peak hour volume represented 10% of the daily southbound traffic. Whereas the northbound AADT value was estimated by assuming that the PM peak hour volume represented 10% of the daily northbound traffic. This was consistent with the predominant traffic flow trend consisting of heavy morning southbound traffic and heavy evening northbound traffic.

The day night traffic splits and percentages of heavy and medium trucks were not provided in the Traffic Study. Therefore, these values were taken from the 2006 Class EA noise assessment for the section of Mississauga Road from Bovaird Drive to Queen Street West *(RWDI, November 14, 2006)*. The day night split was therefore assumed to be 89% day-time and 11% night-time which is within the typical range for non-highway roads. Heavy and medium trucks were assumed to be 8% and 2%, respectively, of total traffic volume. The existing posted speed limit from 300m north of Queen Street West to 300m north of Financial Drive is 60 kph. This noise impact assessment has been completed using a future posted speed limit of 60 kph from 300m north of Queen Street West to 300m north of Financial Drive.

A summary of the traffic data used for the Noise Impact Study is provided in Appendix B.

4.2 Noise Modelling

STAMSON V5.04 (2000) is a computerized implementation of the road and rail traffic noise prediction methods described in ORNAMENT *(Ontario Ministry of the Environment and Climate Change, October 1989)* (Ontario Road Noise Analysis Method for Environment and Transportation) and STEAM *(Ontario Ministry of the Environment and Climate Change, July 1990)* (Sound from Trains Environmental Analysis Method). Older modelling software and models such as STAMSON/ORNAMENT are limited to assessing idealized two dimensional vertical slices. This limitation is primarily due to the limited computer resources available at the time of their development 1993 and 1989 for STAMSON and ORNAMENT, respectively (Although STAMSON V5.04 was released in 2000 the original STAMSON program was released in 1993). The use and application of STAMSON is further limited by the fact that it is a 16-bit DOS program and thus will not run on modern computers without the aid of specialist virtualization as modern computer processors no longer include native 16-bit instructions sets.

To take advantage of modern computing capabilities the road traffic noise levels for this project were calculated using the CadnaA implementation of TNM 2.5. Cadna/A is a modern noise prediction and modelling software suite which implements many internationally recognized calculation models and standards for noise propagation and prediction from industrial, rail and road traffic sources. CadnaA was selected for its ability to utilize the available CAD and GIS data to model complex terrain and barrier configurations to account for the various resulting vantage points, in three dimensions, from sources to points of reception which occur in the natural and built physical environments. The TNM 2.5 noise model is published by the United States Federal Highway Administration and represents the most recently acquired and standardized database of North American vehicle fleet noise emissions.

Based on the traffic data, daytime noise levels were calculated at the OLAs. The OLA location was selected in the rear yard in accordance with the guideline requirements. Reverse frontage and side-frontage exposures to Mississauga Road were assessed. Existing noise barriers along Mississauga Road were included in the noise predictions. The digital terrain model of the area was obtained from the City of Brampton and this was used to model the terrain within the study area.

Mississauga Road was the dominant source of noise considered in the traffic noise impact study. The noise level contributions from roads crossing Mississauga Road were neglected. This is a conservative approach as these secondary noise sources would reduce the significance of noise level changes (impact) due to the widening of Mississauga Road. Mississauga Road has the greatest future traffic volume and traffic speed when compared to the roads which cross it. As a further justification of this approach note that since the Mississauga Road crossings are at grade, traffic can only flow at speed on one of the crossing roadways at any given time.

4.3 Location of Noise Sensitive Areas

The focus of this assessment was to predict the noise levels at properties that back onto or side onto Mississauga Road between Adamsville Road and Financial Drive.

Thirteen representative receptors were selected to predict the future noise levels as a result of the proposed Mississauga Road widening. These locations are expected to be the most affected by the noise associated with the roadway improvements. Predicted noise levels were assessed in the OLA of each receptor location. The OLA locations were modelled at 1.5 metres (m) high and 3 m horizontally from the rear wall of the residence. Other residences with similar setback and orientation to the noise source will receive similar sound exposure and noise impacts. Table 3 summarizes the receptor numbers and their locations and illustrations of their locations are provided in Appendix C.

Table 3. RECEPTOR LOCATIONS AND ELEVATIONS

Location	Coordinates[1] (m)		Elevations[2] (m)	
	Northing	Easting	Receptor	Ground
R01	596232.80	4833574.40	212.80	211.30
R02	596447.20	4833562.00	208.50	207.00
R03	596669.20	4833397.20	206.00	204.50
R04	596675.90	4833359.10	199.70	198.20
R05	596635.80	4833283.10	191.90	190.40
R06	596673.20	4833214.90	185.90	184.40
R07	596819.00	4833077.20	186.50	185.00
R08	596936.00	4833064.40	184.20	182.70
R09	596842.20	4833029.40	185.90	184.40
R10	597001.30	4832866.70	184.50	183.00
R11	597343.50	4832704.80	204.20	202.70
R12	597273.10	4832591.80	205.50	204.00
R13	597475.70	4832381.00	205.50	204.00

Notes:

1. Northing and Easting coordinates are provided in the UTM coordinate projection using datum NAD83 zone 17N.

2. The receptor and ground elevations provided are the elevations above sea level. All receptors were modeled at a relative elevation of 1.5 m above ground.

5.0 Results

The following sections describe the noise prediction results, noise impact assessment results and the resulting noise mitigation recommendations.

5.1 Noise Modelling Results

The predicted average sound levels for the Existing 2017 (Appendix C), Future "no-build" 2031 (Appendix D) and Future "build" 2031 (Appendix E) scenarios are summarized in Table 4.

Table 4. NOISE LEVEL PREDICTIONS

Location	Existing Daytime (16-hr) L_{eq} (dBA) (Appendix D)	Future "no-build" Daytime (16-hr) L_{eq} (dBA) (Appendix E)	Future "build" Daytime (16-hr) L_{eq} (dBA) Without Barriers (Appendix G)	Noise Impact[1] (dB)	5 dB or Greater Impact? (Yes/No)	Future "build" > 60 dBA Criterion?[2] (Yes/No)
R01	63.1	65.1	67.0	2	No	Yes
R02	56.3	58.3	60.2	2	No	No
R03	61.4	63.5	65.0	1	No	Yes
R04	64.2	66.3	67.8	2	No	Yes
R05	63.5	65.6	66.6	1	No	Yes
R06	58.7	60.8	61.7	1	No	Yes
R07	67.2	69.2	70.0	1	No	Yes
R08	61.6	63.7	65.3	2	No	Yes
R09	63.2	65.3	66.7	1	No	Yes
R10	60.3	62.4	63.9	2	No	Yes
R11	56.7	58.8	60.4	2	No	No
R12	56.6	58.7	59.3	1	No	No
R13	55.4	57.5	58.6	1	No	No

Notes:

1. The noise impact is defined as the Future "build" noise level minus the Future "no-build" noise level. A positive value indicates an increased impact and a negative value indicates a decreased impact. Noise Impact values have been rounded to the nearest whole decibel.
2. Future "build" value greater than 60 dBA when rounded to nearest whole number (Yes/No).

The maximum predicted noise impact from Table 4, when rounded to the nearest whole number is 2 dB. Therefore, in accordance with the MOEE/MTO protocol consideration of noise mitigation is not required under that guideline.

The predicted Future "build" levels are predicted to be above the 60 dBA criterion, when rounded to the nearest whole decibel, at nine locations (R01 and R03 to R10). Locations R08 and R10 are frontage lots

and therefore the Peel Region and City of Brampton Noise Attenuation Policies do not apply. However, locations R01, R03 to R07 and R09 are either reverse frontage or side exposure lots. Therefore, a barrier investigation is warranted for these locations.

5.2 Barrier Investigation

Based on the noise modelling results presented in Table 4 consideration for noise mitigation is a requirement for the project. Table 5 presents the results of a noise barrier investigation which compares the results of the Future "build" 2031 without barriers (Appendix E) scenario to the Future "build" 2031 Barrier Investigation (Appendix F) scenario. In order to be warranted the barrier must achieve a minimum 5 dB reduction at a targeted receptor but not necessarily at all targeted receptors. Table 5 Indicates that Barrier 1 achieves no reduction in sound levels while Barriers 2 to 5 achieve an average reduction of 5 dB or greater. Barrier 1 is ineffective because the Mississauga Road right-of-way is approximately 6 meters lower than the subject receptor (R01) elevation. Therefore, only Barriers 2 through 5 are feasible and recommended for implementation.

Table 5. NOISE BARRIER INVESTIGATION

Barrier Segment	Barrier Height (m) Above Grade	Receptor Location	Future "build" Daytime (16-hr) L_{eq} (dBA) Without Barriers (Appendix E)	Future "build" Daytime (16-hr) L_{eq} (dBA) Barrier Investigation (Appendix F)	Barrier Reduction (dB)	Barrier Reduction ≥ 5 dB
Barrier 1	4	R01	67.0	67.0	0	No
Barrier 2	4	R03	65.0	57.3	8	Yes
		R04	67.8	63.5	4	No
Barrier 3	4	R05	66.6	58.8	8	Yes
		R06	61.7	58.5	3	No
Barrier 4	4	R07	70.0	65.0	5	Yes
Barrier 5	4	R09	66.7	61.4	5	Yes

Notes:

1. Barrier reductions have been rounded to the nearest whole decibel.
2. Future "build" value greater than 60 dBA when rounded to nearest whole number (Yes/No).

5.3 Noise Modelling Results with Recommended Mitigation

The predicted average sound levels for the Future "no-build" 2031 (Appendix D), Future "build" 2031 without Barriers (Appendix E) and Future "build" 2031 with Recommended Barriers (Appendix G) scenarios are summarized in Table 6. Appendix G includes figures showing the proposed locations and extents of the recommended noise barriers.

Table 6. NOISE LEVEL PREDICTIONS WITH MITIGATION

Location	Future "no-build" Daytime (16-hr) L_{eq} (dBA) (Appendix D)	Future "build" Daytime (16-hr) L_{eq} (dBA) Without Barriers (Appendix E)	Noise Impact[1] (dB)	Future "build" Daytime (16-hr) L_{eq} (dBA) Recommended Barriers (Appendix G)	Barrier Warranted (Yes/No)	Barrier Reduction (dB)
R01	65.1	67.0	1.9	67.0	No	-
R02	58.3	60.2	1.9	60.2	No	-
R03	63.5	65.0	1.4	57.3	Yes	8
R04	66.3	67.8	1.5	63.5	Yes	4
R05	65.6	66.6	1.0	58.9	Yes	8
R06	60.8	61.7	0.9	58.7	Yes	3
R07	69.2	70.0	0.8	65.0	Yes	5
R08	63.7	65.3	1.7	65.3	No	-
R09	65.3	66.7	1.4	61.4	Yes	5
R10	62.4	63.9	1.5	63.8	No	-
R11	58.8	60.4	1.6	60.4	No	-
R12	58.7	59.3	0.6	59.3	No	-
R13	57.5	58.6	1.1	58.6	No	-

Notes:

1. The noise impact is defined as the Future "build" noise level minus the Future "no-build" without barriers noise level. A positive value indicates an increased impact and a negative value indicates a decreased impact. Noise Impact values have been rounded to the nearest whole decibel.
2. Barrier reductions have been rounded to the nearest whole decibel.

6.0 Construction Noise

The following sections describe policies to consider with respect to the generation and mitigation of construction noise related to the project.

6.1 Local By-Laws

The Brampton Noise By-Law 93-84 *(The Corporation of the City of Brampton, April 25, 1984)* of the Corporation of the City of Brampton states that any sound arising from road work and road improvements undertaken by or on behalf of the Ministry of Transportation (Ontario) or the Region of Peel are specifically permitted and the presence of these sounds and noises is not to be considered a contravention of the By-Law.

6.2 MOECC Sound Emission Standards

MOECC Publication NPC-115 provides sound emission standards for various types of construction equipment. Due to the temporary and unavoidable nature of construction, these MOECC guidelines stipulate limits on individual pieces of equipment instead of a site limit. Table 7 illustrates maximum noise emission levels which should be adhered to for typical construction equipment per NPC-115.

Table 7. NPC-115 NOISE EMISSION LIMITS FOR CONSTRUCTION EQUIPMENT

Type of Equipment	Maximum Sound Level (dBA)(1)	Power Rating (kW)
Excavation equipment, bulldozers, loaders, backhoes or other equipment	83	Less than 75
	85	75 and greater
Pneumatic Pavement Breakers	85	-
Portable Air Compressors	70	-

(1) Maximum Sound Level (dBA) as determined using Publication NPC – 103 – Procedures, Section 6

6.3 Contract Documentation

The construction contract should include provisions relating to the adequate control of noise, compliance with related laws, establishment of a complaints process and outline the responsibilities with respect to investigations of noise up to and including remedial measures.

7.0 Conclusions and Recommendations

The results of the noise impact study indicated that the noise impacts along Mississauga Road are predicted be less than 5 dB when comparing the Future "build" 2031 and Future "no-build" 2031 scenarios. Therefore, in accordance with the MOEE/MTO protocol consideration of noise mitigation is not required. Further the predicted change in noise levels would result in a 'noticeable' (see Table 1) change between the Future "no-build" and Future "build" scenarios.

However, the predicted Future "build" 2031 levels are above the 60 dBA criterion at seven reverse frontage or side exposure locations (R01, R03 to R07 and R09). Therefore, these locations were assessed for possible mitigation in accordance with the Peel Region and City of Brampton Noise Attenuation Policies.

The barrier investigation concluded that Barriers 2 through 5 provided sufficient attenuation as to be warranted and these are recommended for implementation. Figures showing the recommended barrier extents and locations are provided in Appendix G. All recommended noise barriers are 4.0 metres in height above existing grade. The following is a listing of the recommended barriers and the corresponding adjacent residential properties:

Barrier 2:

- 1957 Queen Street West
- 8951 Mississauga Road

Barrier 3:

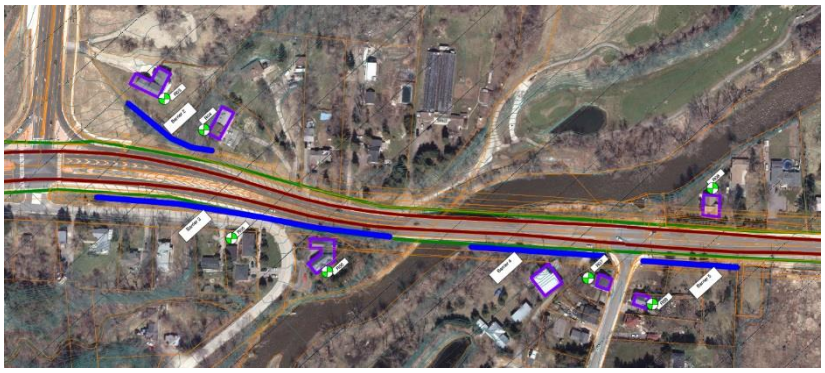
- 22 River Road
- 21 River Road

Barrier 4:

- 2014 Embleton Road

Barrier 5:

- 2015 Embleton Road



Construction noise impacts are temporary and largely unavoidable. However, the contract documents should identify the contractor's responsibilities with respect to controlling noise, as well as recording, investigating and if possible addressing complaints. The contract documents should also explicitly state that compliance with all applicable law is an expectation of the contract including adherence to the Brampton Noise By-Law 93-84.

8.0 Closure

This road traffic noise impact study was completed by Wood for the sole benefit of the Region of Peel, and is based on information available at the time of this study. We have relied on information provided to us by others and therefore are not liable or responsible for incomplete, incorrect and inadequate information. The material in it reflects Wood's judgment in light of the information available to us at the time of preparation

Yours truly,

Wood Environment & Infrastructure Solutions
a Division of Wood Canada Limited

Written by: Buddy Ledger, P.Eng., M.A.Sc., INCE
Department Head & Senior Engineer
Acoustics & Vibration

Signature: _____ Date: July 23, 2018

Reviewed by: Alfredo Rodrigues, EngSci.
Senior Specialist
Acoustics & Vibration

Signature: _____ Date: July 23, 2018

9.0 References

[1] RWDI, "Environmental Noise Impact Assessment Mississauga Road, Brampton, Ontario," November 14, 2006.

[2] MOEE/GO Transit, "Noise and Vibration Protocol," January 1995 (Draft #9).

[3] MTO/MOEE, "A Protocol for Dealing with Noise Concerns during the Preparation, Review and Evaluation of Provincial Highways Environmental Assessments," The Queen's Printer for Ontario, 1986.

[4] Ontario Ministry of Transportation, "Directive A-1: Noise Policy and Acoustic Standards Provincial Highways," February 1992.

[5] The Regional Municipality of Peel, "Noise Attenuation Barriers. Policy No.:W30-04," June 1996.

[6] The Corporation of the City of Brampton, "Noise Attenuation - Retrofit Policy and Road Widenings," October 2007.

[7] Ontario Ministry of Transporation, "Environmental Guide for Noise," October 2006 (Version 1.1 updated July 2008).

[8] Ontario Ministry of the Environment and Climate Change, *Environmental Noise Guideline NPC-300,* (updated final version #22) ed., Ontario: © Queen's Printer for Ontario, 2013, 2013, p. 65.

[9] The Regional Municiapality or Peel, "General Guidelines for the Preparation of Acoustical Reports in the Region of Peel," December 2002.

[10] Paradigm Transportation Solutions Limited, "Mississauga Road Class EA Study - Transportation and Traffic Analysis Report," February 2017.

[11] Ontario Ministry of the Environment and Climate Change, "Ontario Road Noise Analysis Method for Environment and Transportation, ORNAMENT.," October 1989.

[12] Ontario Ministry of the Environment and Climate Change, "Sound from Trains Environment Analysis Method, STEAM," July 1990.

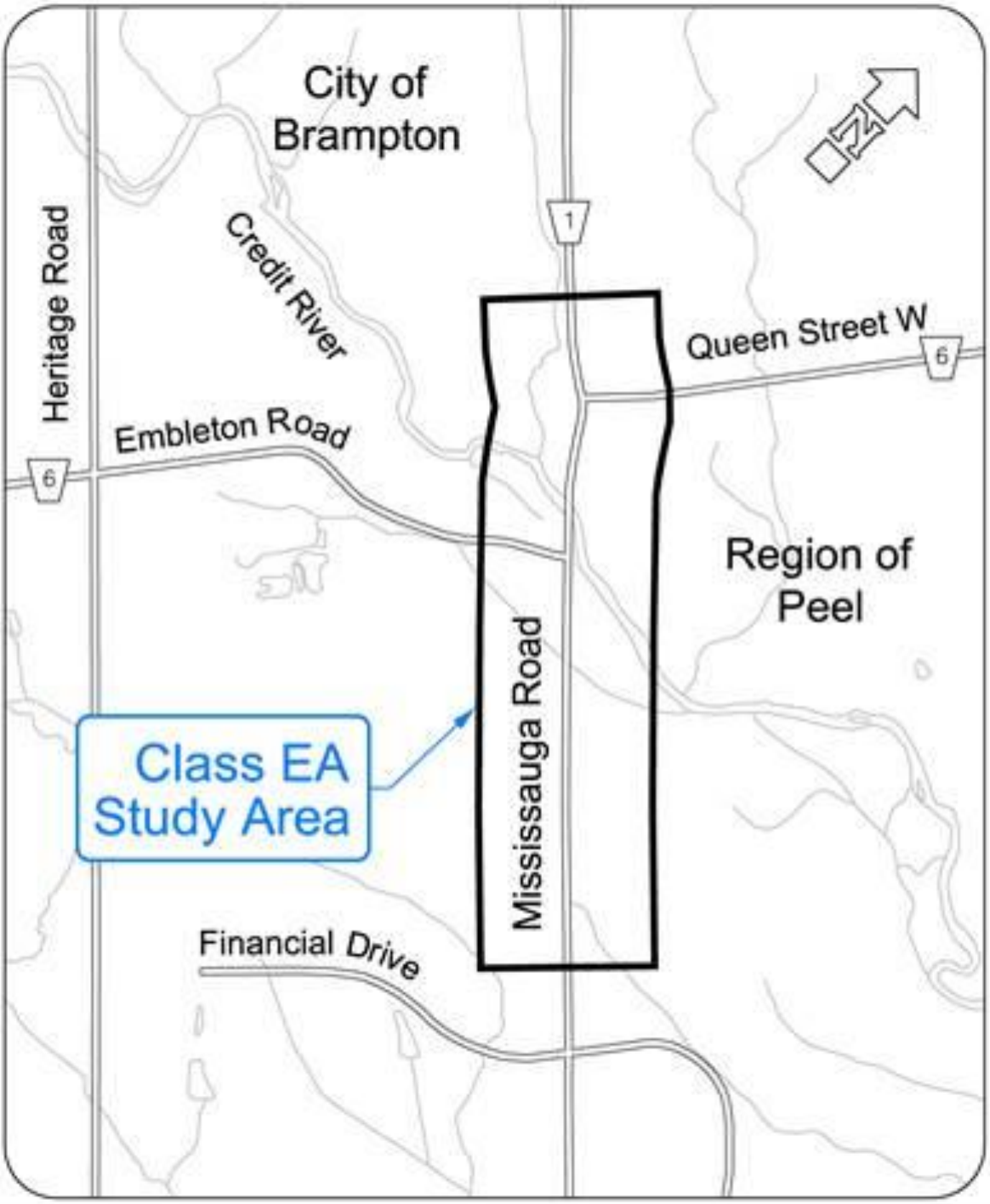
[13] The Corporation of the City of Brampton, "Noise By-Law 93-84," April 25, 1984.

[14] Valcoustics Canada Limited, "Environmental Noise Feasibility Study Bluegrass Valley," February 13, 2014.

[15] Jade Acoustics, "Detailed Environmental Noise Report Four X Developments," April 16, 2015.

APPENDIX A:

STUDY AREA FIGURE


City of Brampton
Heritage Road
Credit River
1
Queen Street W
6
Embleton Road
6
Region of Peel
Mississauga Road
Class EA Study Area
Financial Drive

APPENDIX B:

SUMMARY OF TRAFFIC DATA

Summary Traffic Data Table

Road Segment	AADT Existing (2017)		AADT Future "no-build" (2031)		AADT Future "build" (2031)		Traffic Split[3]		Truck Percentages[3]		Posted Speed Limits (kph)[4]
	SB[1]	NB[2]	SB[1]	NB[2]	SB[1]	NB[2]	Day	Night	Heavy	Medium	
Adamsville Road to Queen Street West	16,120	16,460	25,870	26,410	39,450	41,530	89%	11%	8%	2%	80
Queen Street West to Embleton Road	21,470	21,300	34,450	34,180	45,990	47,420	89%	11%	8%	2%	60
Embleton Road to Lionhead GCC	20,430	17,940	32,780	28,790	44,680	43,220	89%	11%	8%	2%	60
Lionhead GCC to Financial Drive	20,420	17,890	32,750	28,680	44,670	43,130	89%	11%	8%	2%	60

Notes:

1. SB denotes Southbound and these volumes were estimated by assuming that the AM peak hour volume represents 10% of the total daily southbound traffic.
2. NB denotes Northbound and these volumes were estimated by assuming that the PM peak hour volume represents 10% of the total daily northbound traffic.
3. The traffic splits and truck percentages were taken from the 2006 noise study conducted by RWDI for Mississauga Road between Bovaird Drive and Adamsville Road (RWDI, November 14, 2006).

APPENDIX C:

EXISTING 2017

596000 596050 596100 596150 596200 596250 596300 596350 596400 596450 596500 596550 596600 596650 596700 596750

4833750 4833700 4833650 4833600 4833550 4833500 4833450 4833400 4833350 4833300

EXIST

R01 R02 R03 R04 R05

Existing 2017

Map 1

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

596000 596050 596100 596150 596200 596250 596300 596350 596400 596450 596500 596550 596600 596650 596700 596750

596400 596450 596500 596550 596600 596650 596700 596750 596800 596850 596900 596950 597000 597050 597100 597150

4833350
4833300
4833250
4833200
4833150
4833100
4833050
4833000
4832950

R03 R04 R05 R06 R07 R08 R09 R10

Existing 2017

Map 2

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

596400 596450 596500 596550 596600 596650 596700 596750 596800 596850 596900 596950 597000 597050 597100 597150

596900 596950 597000 597050 597100 597150 597200 597250 597300 597350 597400 597450 597500 597550 597600 597650

4832900 4832850 4832800 4832750 4832700 4832650 4832600 4832550 4832500

R11 R10 R12 R13

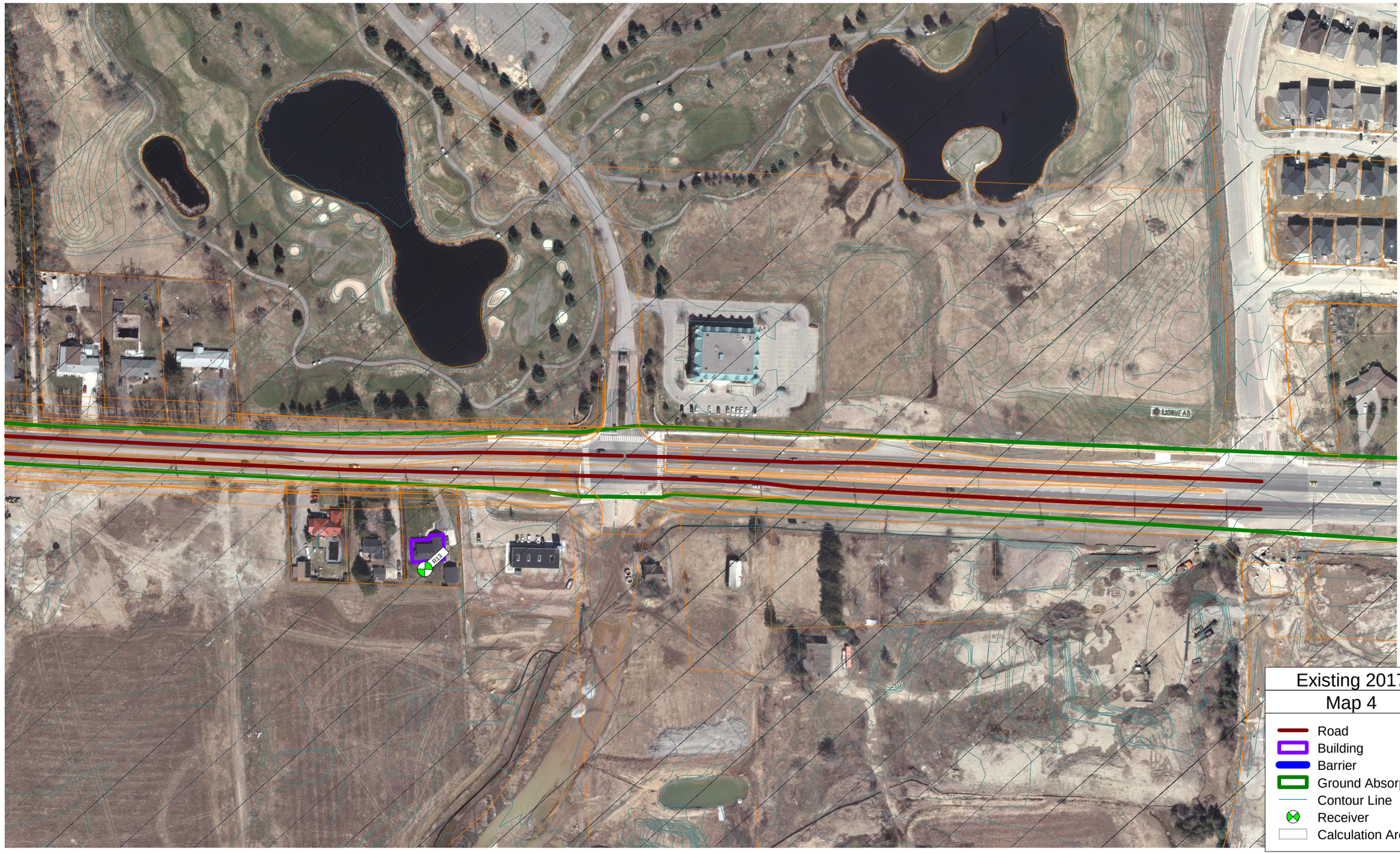
Existing 2017

Map 3

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

597300 597350 597400 597450 597500 597550 597600 597650 597700 597750 597800 597850 597900 597950 598000 598050

4832550 4832500 4832450 4832400 4832350 4832300 4832250 4832200 4832150 4832100



Existing 2017

Map 4

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

597300 597350 597400 597450 597500 597550 597600 597650 597700 597750 597800 597850 597900 597950 598000 598050

APPENDIX D:

FUTURE "NO-BUILD" 2031

596000 596050 596100 596150 596200 596250 596300 596350 596400 596450 596500 596550 596600 596650 596700 596750

4833750 4833700 4833650 4833600 4833550 4833500 4833450 4833400 4833350 4833300

EXIST

R01 R02 R03 R04 R05

Future "No-Build" 2031

Map 1

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

596000 596050 596100 596150 596200 596250 596300 596350 596400 596450 596500 596550 596600 596650 596700 596750

596400 596450 596500 596550 596600 596650 596700 596750 596800 596850 596900 596950 597000 597050 597100 597150

4833350
4833300
4833250
4833200
4833150
4833100
4833050
4833000
4832950

R03 R04 R05 R06 R07 R08 R09 R10

Future "No-Build" 2031

Map 2

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

596400 596450 596500 596550 596600 596650 596700 596750 596800 596850 596900 596950 597000 597050 597100 597150

596900 596950 597000 597050 597100 597150 597200 597250 597300 597350 597400 597450 597500 597550 597600 597650

4832900 4832850 4832800 4832750 4832700 4832650 4832600 4832550 4832500

R11 R10 R12 R13

Future "No-Build" 2031

Map 3

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

597300 597350 597400 597450 597500 597550 597600 597650 597700 597750 597800 597850 597900 597950 598000 598050

4832550 4832500 4832450 4832400 4832350 4832300 4832250 4832200 4832150 4832100

R13

EXONHEAD

Future "No-Build" 2031

Map 4

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

597300 597350 597400 597450 597500 597550 597600 597650 597700 597750 597800 597850 597900 597950 598000 598050

APPENDIX E:

FUTURE "BUILD" 2031 WITHOUT BARRIERS

596000 596050 596100 596150 596200 596250 596300 596350 596400 596450 596500 596550 596600 596650 596700 596750

4833750 4833700 4833650 4833600 4833550 4833500 4833450 4833400 4833350 4833300

EXIST

R01 R02 R03 R04 R05

Future "Build" 2031 without Barriers

Map 1

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

596000 596050 596100 596150 596200 596250 596300 596350 596400 596450 596500 596550 596600 596650 596700 596750

596400 596450 596500 596550 596600 596650 596700 596750 596800 596850 596900 596950 597000 597050 597100 597150

4833350
4833300
4833250
4833200
4833150
4833100
4833050
4833000
4832950

R03 R04 R05 R06 R07 R08 R09 R10

Future "Build" 2031 without Barriers

Map 2

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

596400 596450 596500 596550 596600 596650 596700 596750 596800 596850 596900 596950 597000 597050 597100 597150

596900 596950 597000 597050 597100 597150 597200 597250 597300 597350 597400 597450 597500 597550 597600 597650

4832900
4832850
4832800
4832750
4832700
4832650
4832600
4832550
4832500

R11
R10
R12
R13

Future "Build" 2031 without Barriers

Map 3

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

597300 597350 597400 597450 597500 597550 597600 597650 597700 597750 597800 597850 597900 597950 598000 598050

4832550 4832500 4832450 4832400 4832350 4832300 4832250 4832200 4832150 4832100

R1B

EXONHEAD

Future "Build" 2031 without Barriers

Map 4

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

597300 597350 597400 597450 597500 597550 597600 597650 597700 597750 597800 597850 597900 597950 598000 598050

APPENDIX F:

FUTURE "BUILD" 2031 BARRIER INVESTIGATION

596000 596050 596100 596150 596200 596250 596300 596350 596400 596450 596500 596550 596600 596650 596700 596750

4833750 4833700 4833650 4833600 4833550 4833500 4833450 4833400 4833350 4833300

EXIST

4.0

R02

R03

Barrier 2

R04

Barrier 3

R05

Barrier 1

R01

Future "Build" 2031 Barrier Investigation

Map 1

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

596000 596050 596100 596150 596200 596250 596300 596350 596400 596450 596500 596550 596600 596650 596700 596750

596400 596450 596500 596550 596600 596650 596700 596750 596800 596850 596900 596950 597000 597050 597100 597150

4833350 4833300 4833250 4833200 4833150 4833100 4833050 4833000 4832950

R03 Barrier 2 R04 R05 Barrier 3 R06 Barrier 4 R07 R08 Barrier 5 R09 R10

Future "Build" 2031 Barrier Investigation

Map 2

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

596400 596450 596500 596550 596600 596650 596700 596750 596800 596850 596900 596950 597000 597050 597100 597150

596900 596950 597000 597050 597100 597150 597200 597250 597300 597350 597400 597450 597500 597550 597600 597650

4832900
4832850
4832800
4832750
4832700
4832650
4832600
4832550
4832500

R11
R10
R12
R13

Future "Build" 2031 Barrier Investigation

Map 3

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

596900 596950 597000 597050 597100 597150 597200 597250 597300 597350 597400 597450 597500 597550 597600 597650

597300 597350 597400 597450 597500 597550 597600 597650 597700 597750 597800 597850 597900 597950 598000 598050

4832550 4832500 4832450 4832400 4832350 4832300 4832250 4832200 4832150 4832100

R1B

EXONHEAD

Future "Build" 2031 Barrier Investigation

Map 4

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

597300 597350 597400 597450 597500 597550 597600 597650 597700 597750 597800 597850 597900 597950 598000 598050

APPENDIX G:

FUTURE "BUILD" 2031 RECOMMENDED BARRIERS

596000 596050 596100 596150 596200 596250 596300 596350 596400 596450 596500 596550 596600 596650 596700 596750

4833750 4833700 4833650 4833600 4833550 4833500 4833450 4833400 4833350 4833300

EXIST

R02

R03

Barrier 2

R04

Barrier 3

R05

R01

Future "Build" 2031 Recommended Barriers

Map 1

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

596000 596050 596100 596150 596200 596250 596300 596350 596400 596450 596500 596550 596600 596650 596700 596750

596400 596450 596500 596550 596600 596650 596700 596750 596800 596850 596900 596950 597000 597050 597100 597150

4833350 4833300 4833250 4833200 4833150 4833100 4833050 4833000 4832950

R03 R04 R05 R06 R07 R08 R09 R10

Barrier 2 Barrier 3 Barrier 4 Barrier 5

Future "Build" 2031 Recommended Barriers

Map 2

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

596400 596450 596500 596550 596600 596650 596700 596750 596800 596850 596900 596950 597000 597050 597100 597150

596900 596950 597000 597050 597100 597150 597200 597250 597300 597350 597400 597450 597500 597550 597600 597650

4832900 4832850 4832800 4832750 4832700 4832650 4832600 4832550 4832500

R11 R10 R12 R13

Future "Build" 2031 Recommended Barriers

Map 3

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

596900 596950 597000 597050 597100 597150 597200 597250 597300 597350 597400 597450 597500 597550 597600 597650

597300 597350 597400 597450 597500 597550 597600 597650 597700 597750 597800 597850 597900 597950 598000 598050

4832550 4832500 4832450 4832400 4832350 4832300 4832250 4832200 4832150 4832100

R13

Future "Build" 2031 Recommended Barriers

Map 4

- Road
- Building
- Barrier
- Ground Absorption
- Contour Line
- Receiver
- Calculation Area

597300 597350 597400 597450 597500 597550 597600 597650 597700 597750 597800 597850 597900 597950 598000 598050