Title : **Noise Control Plan**

Client : **City of Ottawa**

Project : **Trillium Line Extension Project**

Revised by : Cory van Hoof

Reviewed by : Cory van Hoof, P. Geo.

Approved by : Ignacio Sanz

Revision				Notes
Rev.	By	Appr.	Date	
00	NG	IS	April 9, 2019	Issued for City submission
01	CvH	IS	June 1, 2019	Address City comments

TABLE OF CONTENTS

LIST OF APPENDICES

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1.0 Introduction

Schedule 17 of the Project Agreement (PA), in regards with Environmental obligations, requires that a Noise and Vibration Control Plan (NVCP) is developed and submitted to the City Representative.

The present document forms part of this NVCP. It only deals with airborne noise. It is presented in two parts, the first concerning construction noise and the other concerning operational noise.

2.0 Noise during Construction Period

2.1 OBJECTIVE

The objectives of this part are to identify major airborne noise producing construction activities and identify a plan to minimize, monitor and mitigate noise levels to the extent reasonably possible and at least to meet the Applicable Noise Requirements, as defined in PA, Schedule 17, Part 8.

2.2 APPLICABLE NOISE REQUIREMENTS

2.2.1 Reference documents

In regards with noise produced during Construction period, the Project shall comply with the following documents.

- PA, Schedule 17, Part 8;
- City of Ottawa Noise By-Law No. 2017-255;
- City of Ottawa Specification S.P. No: F-1201 “Use of Explosives”.

2.2.2 Applicable Limits

In accordance with the City of Ottawa Noise By-Law, no construction vehicle or construction equipment shall be operated at night between 10 pm and 7 am on any day of the week, and before 9 am on any Sunday or statutory or public holiday, unless an exemption is granted by the Director of the By-Law Services.

According to PA, during permitted periods the applicable noise criterion related to construction activities is set to LAeq, 8h = 80 dBA during any 8-hour period comprised between 7 am and 11 pm, and LAeq, 8h = 70 dBA between 11 pm and 7 am. These limits apply at the nearest Sensitive Receiver.

2.3 MAJOR NOISE PRODUCING CONSTRUCTION ACTIVITIES

Some types of construction activities could be likely to generate noise at levels that may exceed the above mentioned applicable limits. Such activities usually imply the use of loud construction equipment, such as:

- Blasting;

- Concrete saw;
- Grapple (on backhoe);
- Impact pile driver;
- Mounted impact hammer;
- Jackhammer;
- Pavement scarifier;
- Pneumatic tools;
- Sand blasting;
- Shears (on backhoe);
- Vac-truck;
- Vibrating hopper;
- Vibratory pile driver;
- Etc.

This list is non-exhaustive but it presents the most common loud equipment which can be observed on construction sites. Construction activities which imply the use of such equipment are likely to generate high noise levels, but other factors can also contribute to the emission of high noise levels, such as:

- Distance of construction site to Sensitive Receiver;
- Duration of activity;
- Type and number of equipment.

A detailed assessment for each construction activity shall be conducted when construction methods will be precisely defined. The prediction procedure is defined in the next paragraph.

2.4 COMPLIANCE VERIFICATION

2.4.1 Prediction Procedure

The prediction procedure for airborne noise produced by construction activities consists in calculating the emitted sound level at a particular Sensitive Receiver, taking into account the following information:

- Number and type of construction equipment;
- Sound emission levels of construction equipment and their usage factor (percentage of use time);
- Operation hours of construction activity;
- Site location, and distance to the Sensitive Receiver;
- Presence of obstacles in sound propagation, such as screens, buildings, berms, etc.

The use of FHWA[1] software RCNM[2] or an equivalent calculation method is recommended.

The predicted LAeq, 8h shall be compared to the Applicable Limits defined in 2.2.2.

2.4.2 Instrumentation

The instrumentation used for noise measurements during the Construction Period will have the following specifications:

- Noise monitors will be Type 1 integrating sound level meters complying with IEC 651 or 61672:2002 Standards. They shall include a free field microphone equipped with a windscreen for outdoor measurements.
- Monitors will be calibrated prior to their use on the Project. Monitoring equipment will be calibrated by the manufacturer, or another authorized calibration services company, to the appropriate standard as set out in the manufacturer documentation of the equipment. Copies of the calibration certificates for all monitoring equipment will be available for consultation. The calibration certificates will be dated within twelve (12) months prior to the beginning of each collection of data.
- A portable noise calibrator will be used with the noise monitoring equipment as per the equipment manufacturer instructions. The monitoring equipment will be calibrated prior to the beginning of each data collection. The calibration must be within ± 0.5 dB of the calibration signal level to be considered acceptable. Data collection will not commence with monitoring equipment set beyond these tolerance rates.
- The noise monitoring equipment will be calibrated after each session of measurements. If the calibration is beyond the tolerance rates (± 0.5 dB) this will be noted in the report, including the extent that the calibration is out. Adjustments will be made to the equipment and/or will be replaced.

2.4.3 Monitoring Procedure

Noise measurements will be performed during the Construction Period of the project:

- At the closest Sensitive Receiver to a construction activity which is likely to generate noise at levels that may exceed the applicable limits.
- In such case, short duration (30min to 8h) noise measurements will be performed during normal construction activities. The duration of the sampling will be determined according to the stability and/or the audibility of the signal (contribution from the construction activities). Short duration samplings will be repeated as much as needed in order to verify that the construction activity is and would stay in compliance with the applicable limits;
- Short duration measurements will be under the constant supervision of a qualified technician;

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[1] Federal Highway Administration of United States.

[2] Roadway Construction Noise Model.

- To take advantage of the fact that the work is a progressive process, noise results will be used to predict potential exceedances, if any, to the next receiver exposed. The non-compliance protocol will be followed accordingly, if potential exceedances are expected;
- Short duration (30min to 8h) noise monitoring may be conducted to determine the effectiveness of mitigation measures, if implemented;
- In some cases, long term noise monitoring will be conducted at locations where the construction activities are expected to last for long periods (several weeks or months). In such cases, permanent monitoring equipment will be installed;
- Ideally, measurement location must be on Sensitive Receiver property, 1.5 m above ground, and at least 3 m away to any reflecting surface such as building, road, solid fence, etc.

2.5 MITIGATION MEASURES

2.5.1 Minimizing Noise Levels

Measures can be taken prior construction activities, at the planning stage, to minimize noise emissions from the site:

- Only broadband backup alarms are permitted, as per PA, Schedule 17, Part 8; and
- As far as practicable:
  - Select construction methods that requires the least amount of construction equipment;
  - Select the least noisy construction equipment possible;
  - Avoid the use of backup alarms by promoting forward movement rather than backward;
  - Maintain construction equipment in good working order;
  - Control the production of impact noise from the flapping of the rear panel of trucks during unloading;
  - Maintain access roads to avoid shocks from moving trucks, especially when empty.

2.5.2 Possible Mitigation Measures

The following are possible mitigation measures that could be implemented if needed:

- Substitution of construction equipment by quieter equipment;
- Change of construction method;
- Equipment sound enclosure;
- Temporary noise protection wall.

3.0 Noise during Operation Period

3.1 OBJECTIVE

The objective of this part is to identify the airborne noise prediction and measurement procedures, and methods to evaluate airborne noise from the operations and infrastructure of the Project.

3.2 APPLICABLE REQUIREMENTS

3.2.1 Reference Documents

In regards with noise produced during Operation period, the Project shall comply with the following documents.

- PA, Schedule 17, Part 8;
- City of Ottawa Environmental Noise Control Guidelines;
- MOE Publication NPC-300.

3.2.2 Applicable Limits

Depending on the noise source, the following limits apply:

Applicable Limits

Type of Noise/Source	Reference Document	Applicable Limit
Vehicle operations and road traffic noise	City of Ottawa Environmental Noise Guidelines, January 2016	LAeq, 16h (7 am – 11 pm) varying depending on Future Sound Level
Stationary noise sources	MOE NPC-300	LAeq, 1h varying depending on the existing background noise and the type of Class Area
LRT Station or Bus Facility Paging System	PA, Schedule 17, Part 8	Paging shall be lower than the ambient sound level
Emergency operations noise	PA, Schedule 17, Part 8	LAeq, 5min = 80 dBA inside station
	PA, Schedule 17, Part 8	SIL (500-4000Hz) = 78 dB in tunnel

Table 1: Applicable limits to noise during Operation period

3.3 PREDICTION PROCEDURE

3.3.1 Vehicle Operation

3.3.1.1 Sound Level Criterion

The City of Ottawa Environmental Noise Control Guidelines Part 2 (Environmental noise control guidelines for surface transportation projects) and Part 7 (Technical requirements: environmental noise control studies for surface transportation projects) define the sound level criteria as well as the assessment methodology to be applied to the Project.

The sound level criterion is based on the change above ambient sound level, corresponding to the difference between the expected future sound level and the expected ambient sound level at the commencement date of project construction. Table below presents this criterion.

Applicable Limits

Future sound level, LAeq, 16h (7am – 11pm), dBA	Change above Ambient, dBA	Impact rating	Mitigation
Greater than 55 dBA and less than or equal to 60 dBA	0-3	Not generally noticeable	None
	3-5	Generally noticeable	
	5-10	Significant	
	10+	Very significant	
Greater than 60 dBA	0-3	Not generally noticeable	Investigate noise control measures and mitigate to achieve retrofit criteria (minimum attenuation is 6 dBA)
	3-5	Generally noticeable	
	5-10	Significant	

10+	Very significant

Table 2: Applicable limits to noise during Operation period

3.3.1.2 Assessment Method

NPC-300 suggests that assessment of rail traffic noise impact should be conducted using the prediction method STEAM (Sound from Trains Environmental Analysis Method), or a computerized version such as STAMSON. Nevertheless NPC-300 also specifies that other traffic noise prediction models have been developed and may be adopted for some projects. Therefore, in the case of the TLE Project, the FTA[3] prediction method, implemented in SoundPLAN software will be used.

The descriptor used in the assessment is the 16-hour daytime equivalent sound level (LAeq, 16h), from 7 am to 11 pm.

Both the expected future sound level and the expected ambient sound level at the commencement date of project construction shall be assessed, and then compared to determine the need for mitigation measures according the applicable limits mentioned above in Table 2.

3.3.1.3 Possible Mitigation Measures

Mitigation measures which are generally observed in surface transportation projects include:

- Selection or alteration of a horizontal alignment;
- Depressed or elevated corridor profiles;
- Earth berms;
- A combination of earth berms plus acoustic barrier;
- Traffic management;
- Reduction or establishment of suitable vehicle speed limits;
- Acoustics barriers.

However, at this stage of advancement of the Project, it is highly probable that the most acceptable mitigation measures consist of acoustic barriers, such as berms, walls or a combination of both.

[3] Federal Transit Administration manual: « Transit Noise and Vibration Impact Assessment ».

3.3.2 Stationary Noise Sources

3.3.2.1 Sound Level Criteria

For stationary sources such as ventilation shafts, stations, bus transfer stations, MSF, substations, etc. the MOE Publication NPC-300 sound level criteria for outdoor receivers apply. These limits are reproduced in the table below.

Stationary Source Sound Limit

Time of Day	Class 1 Area	Class 2 Area	Class 3 Area	Class 4 Area
7 a.m.–7 p.m.	50	50	45	55
7 p.m.-11 p.m.	50	45	40	55

Table 3 : Stationary source sound limit, $L_{Aeq, 1h}$ (dBA), for outdoor receivers

Area classes are defined in NPC-300. More precisions on sound limits are also given in NPC-300.

3.3.2.2 Assessment Method

The impact assessment of noise produced by stationary sources is done by prediction. The noise impact assessment descriptor is the one-hour equivalent sound level (LAeq, 1h), and the noise impact is evaluated at representative points of reception.

The assessment of noise impact should be conducted using the ISO 9613-2 model, implemented in software such as SoundPLAN.

3.3.2.3 Possible Mitigation Measures

Possible mitigation measures for stationary sources which are generally observed in surface transportation projects include:

- Selection of quiet equipment (such as ventilation equipment, generators, transformers, etc.)
- Silencers and/or louvers to reduce ventilation noise;
- Earth berms, acoustic barrier, or a combination of both.

3.3.3 Paging System

PA requires that the LRT station or bus facility paging system produces a sound level that shall be lower than the ambient sound level, applicable at the nearest Sensitive Receiver exterior.

The sound descriptor used will be the LAeq, 1h, evaluated within Sensitive Receiver property limits.

3.3.4 Emergency Operations

3.3.4.1 Inside Station

PA requires that the sound level produced inside stations by emergency ventilation system shall not exceed LAeq, 5min = 80 dBA, evaluated on the station platform.

3.3.4.2 In Tunnel

PA requires that the sound level produced inside tunnels by emergency ventilation system shall not exceed SIL[4] = 78 dB, evaluated at 5 ft above the tunnel walkway.

4.0 Representative Sensitive Receivers and Baseline

4.1 OBJECTIVE

A survey of the Lands and the vicinity of the planned alignment of the Expanded Trillium Line must be conducted to identify Representative Sensitive Receivers (RSR) which would be under the influence of airborne noise impact from the planned Project.

RSR must be selected such that they are:

- Exposed to the worst case effects of airborne noise compared to all the Sensitive Receivers that the RSR is intended to represent;
- Distributed across areas with differing characteristics affecting noise levels along the corridor, such as setback from the alignment, grade elevation, traffic volume, alignment, track configuration, shielding from alignment, etc.

Once the RSR are identified, baseline noise measurements shall be performed at them.

4.2 BASELINE MEASUREMENT PROCEDURE

According to PA, measurements shall consist of at least 48 hours unattended outdoor noise monitoring at each RSR, provided that the weather conditions are suitable for measurement, as per MOECC publication NPC-103.

Indoor noise measurements are not of interest for airborne noise. They will not be performed under the scope of airborne noise studies.

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[4] Speech Interference Level: defined as the unweighted arithmetic average of the octave-band sound pressure levels at 500, 1000, 2000 and 4000 Hz mid-frequencies, expressed in dB.

4.2.1 Instrumentation

Type 1 integrating sound level meters complying with IEC 651 or 61672:2002 Standards shall be used. They shall include a free field microphone equipped with a windscreen for outdoor measurements.

A Type 1 acoustics calibrator shall be used to confirm the integrating sound level meter is calibrated before and after each measurement period.

A measurement shall not be reported if the integrating sound level meter calibration after the measurement period is more than 0.5 dB different from that before the measurement commencement.

4.2.2 Measurement Location

For outdoor airborne sound, the measurement location shall be a location out-of-doors where a person may be exposed to the sound.

The microphone shall be located not less than 1 m above the ground (recommended height is 1.5 m), and not less than 1 m from any sound reflective surface (recommended distance is at least 3 m).

The microphone shall also be located out of the influence of any local sound source which would not be representative of all the sensitive receivers, such as a heat pump, a condenser, a pool pump, etc.

4.2.3 Weather Conditions

For outdoor measurements, the following weather conditions shall be met:

- Wind-induced sound level is more than 10 dB below the measured levels (ref. Table 102-3 of Publication NPC-102);
- Relative humidity is not above the maximum for which the meter specification is guaranteed by the manufacturer (normally 90%);
- No precipitation;
- Air temperature is not outside the range for which the specification of the instrument is guaranteed by the manufacturer (normally higher than -10°C).

4.2.4 Reporting

The following information shall be reported:

- Location and description of sound sources;
- Dimensioned sketch including photographs of sound sources and point of reception;
- Physical and topographical description;
- Meteorological conditions;
- Type, model and serial number of all instrumentation;

- Location of the microphone;
- Continuous time period of observation;
- Integrating sound level meter readings (LAeq, 1h and other relevant sound descriptor).

Appendix A

List of Sensitive Receivers

Trillium Extension Line Project
SNC-Lavalin Inc
***1145** Hunt Club Road, 2nd Floor*
Ottawa, Ontario, Canada,
K1V 0Y3

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Memorandum

TO:	Mr. Robert Timlin	DATE:	March 8, 2019
C.C.:		REF.:	660373-0000-003-4GEN-0001_00
FROM:	Jacques Savard		
SUBJECT:	Noise monitoring locations for baseline		

Mr. Timlin,

Schedule 17 of the Trillium Line Extension (TLE) Project Agreement (PA), in regards with Environmental obligations, requires that baseline noise be measured at the representative sensitive receivers.

This current document deals solely with airborne noise.

Noise Monitoring locations

Eleven noise monitoring locations were identified in the RFP; they can be found in Table 1 below. Nine additional noise monitoring areas have been identified since then; they can be found in Table 2.

Table 1 Noise monitoring locations from RFP

Receiver	Location
1	10 Breezehill Avenue
2	930 Gladstone Avenue
3	37 George Street West
4	116 Beech Street
5	130 Pamilla Street
6	2517 Flannery Drive
7	104 Sawmill Private
8	1073 Cromwell Drive
9	231 Westvalley Private
10	122 Bartlett Private
11	2877 Millstream Way

Table 2 Additional noise monitoring locations

Receiver	Location
12	Traverse Dr & Yarmouth Cr
13	Ledbury Ave & Banff Ave
14	Johnston Rd
15	Albion Rd
16	Macoun Cir
17	Plante Dr
18	Quinn Rd
19	Earl Armstrong Rd
20	Carlton University residences (Campus Ave)

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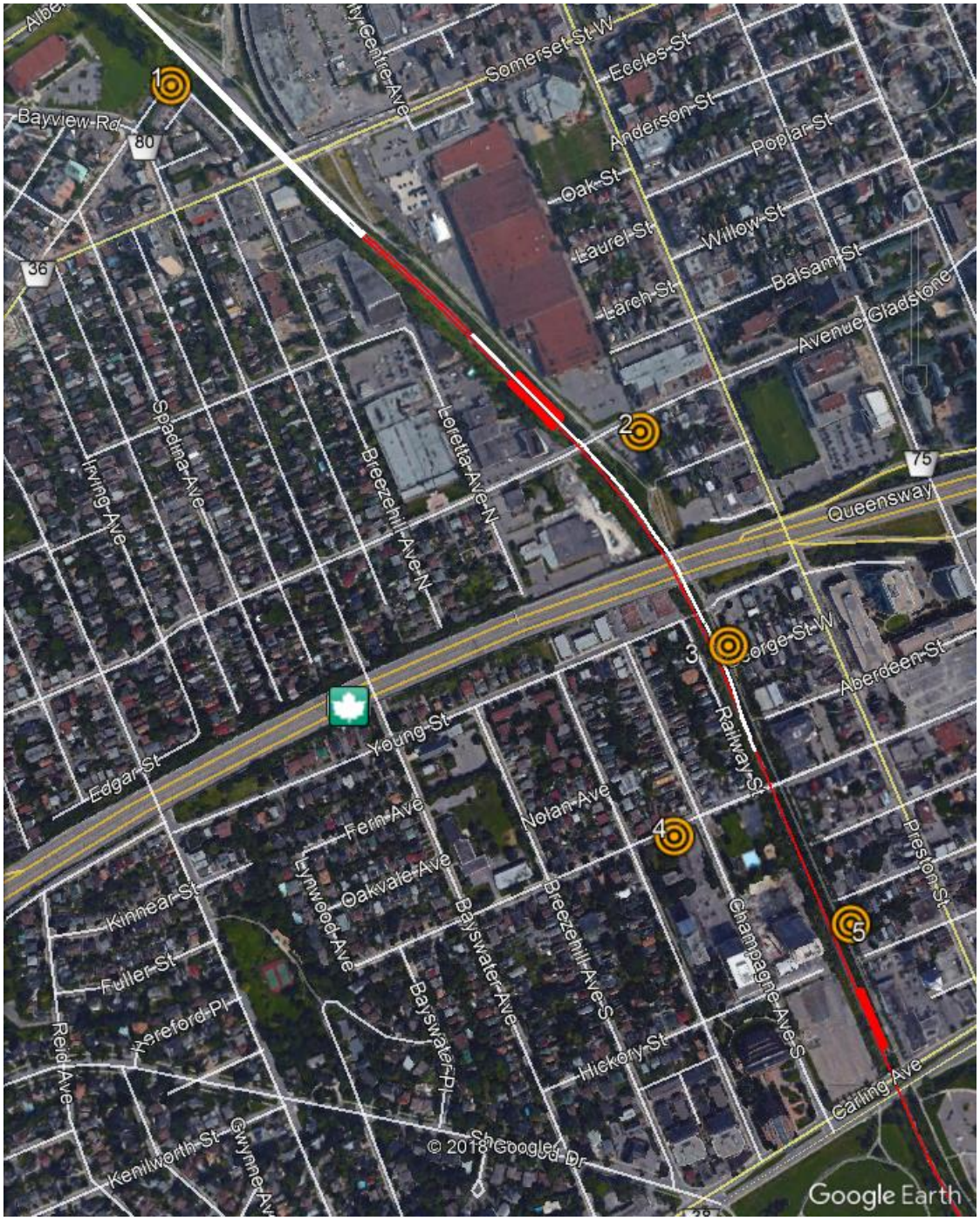
Maps



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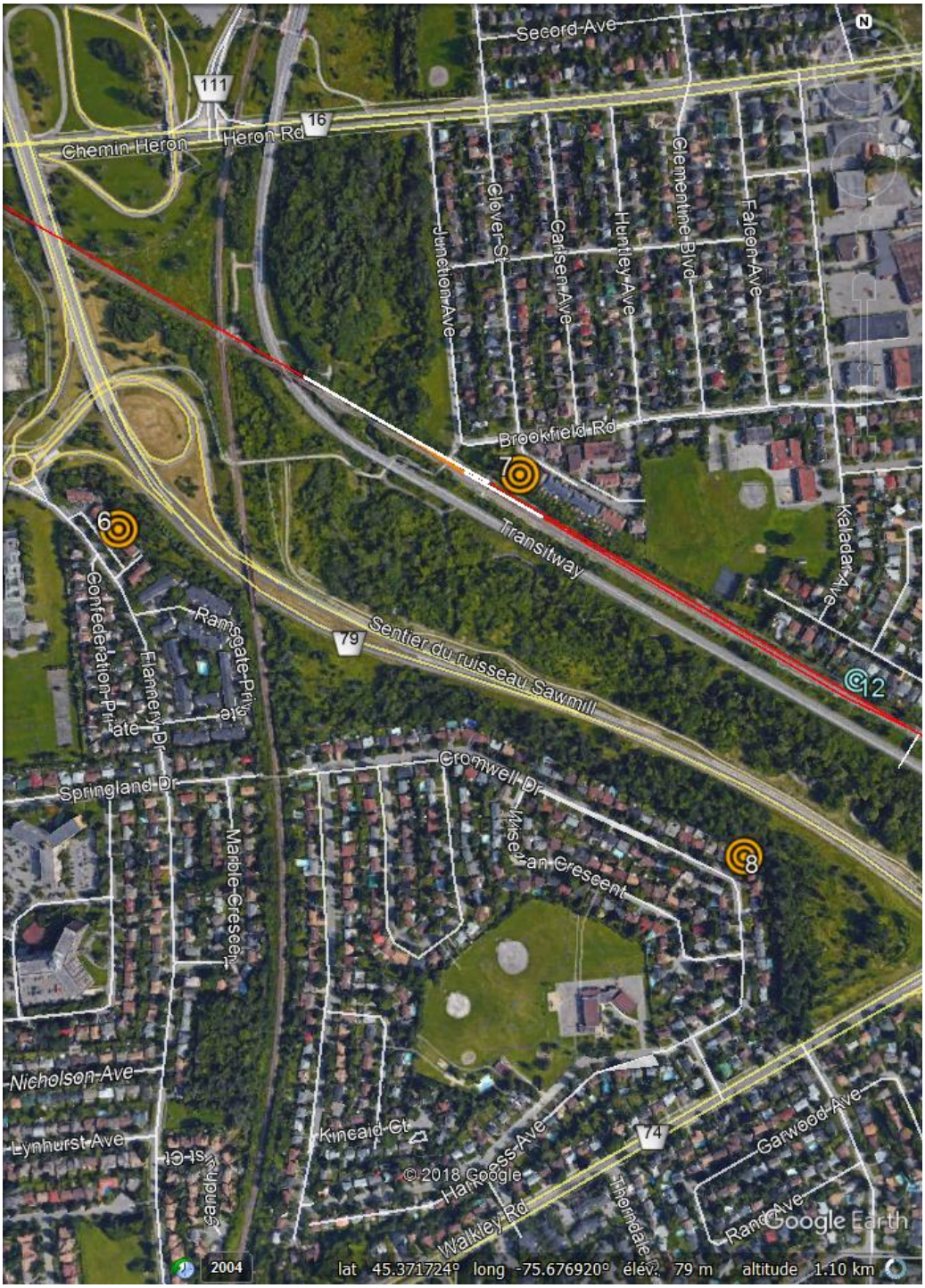

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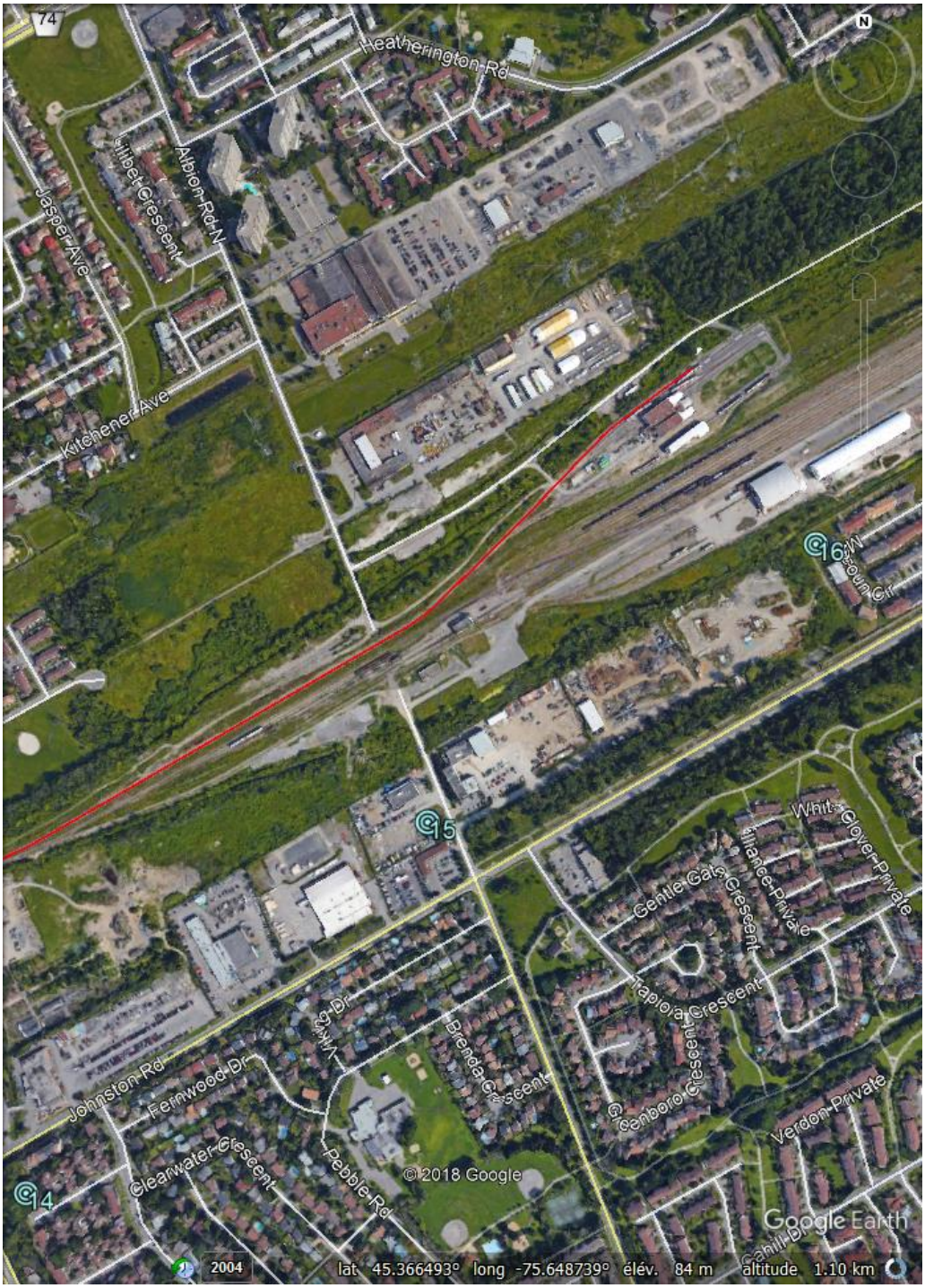

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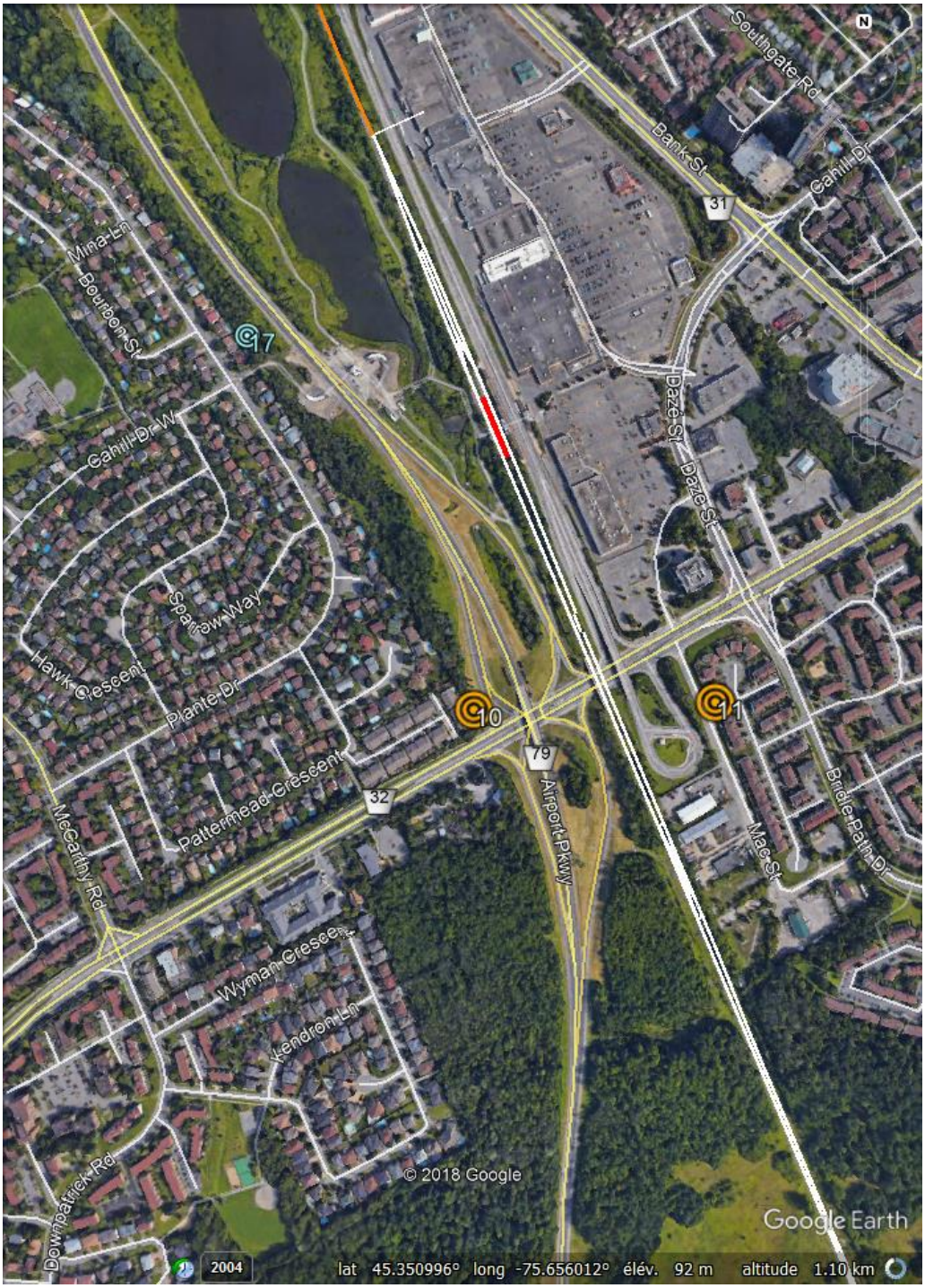

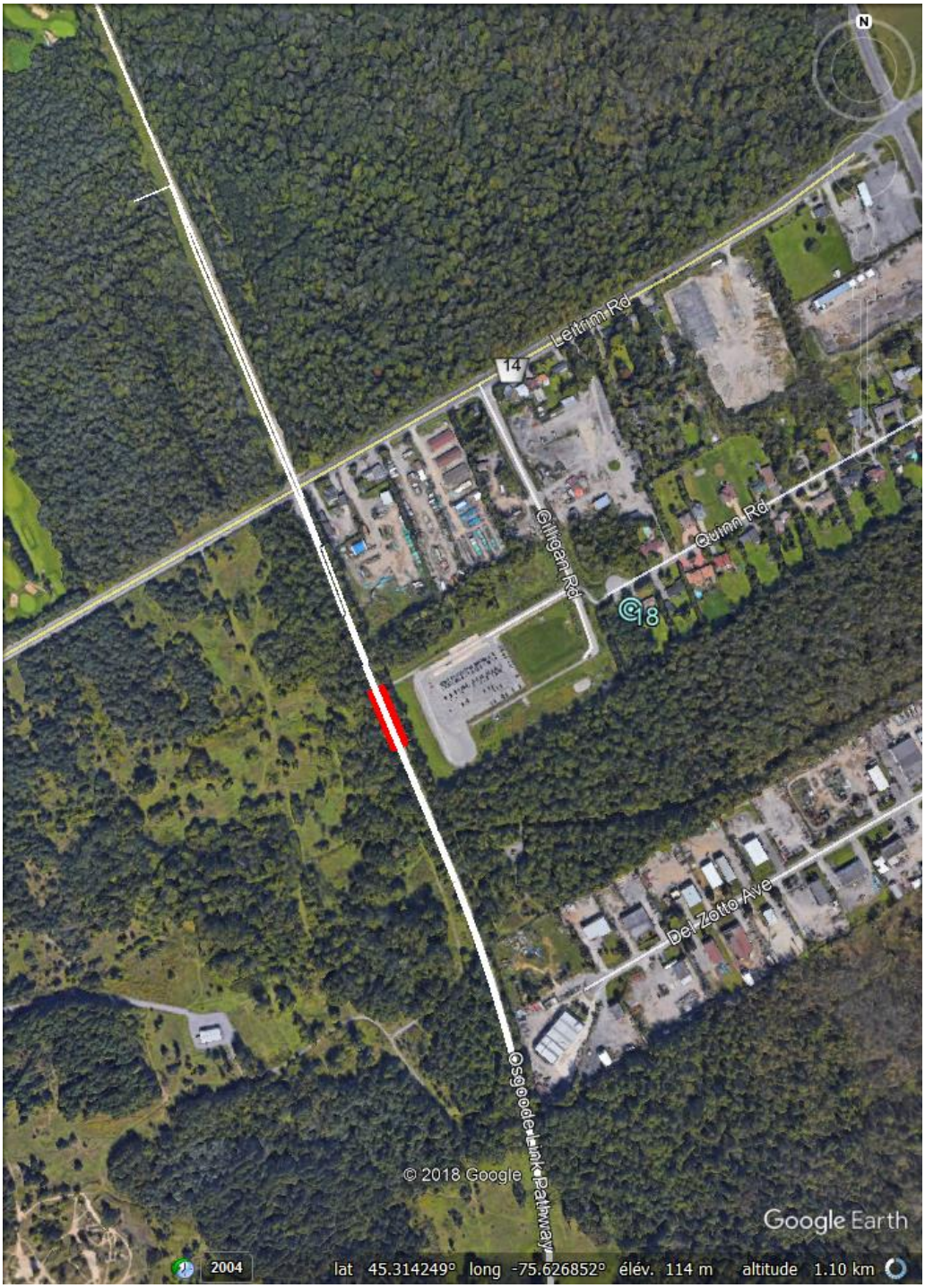
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Gilligan Rd
Quinn Rd
18
Del Zotto Ave
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© 2018 Google
Google Earth
2004
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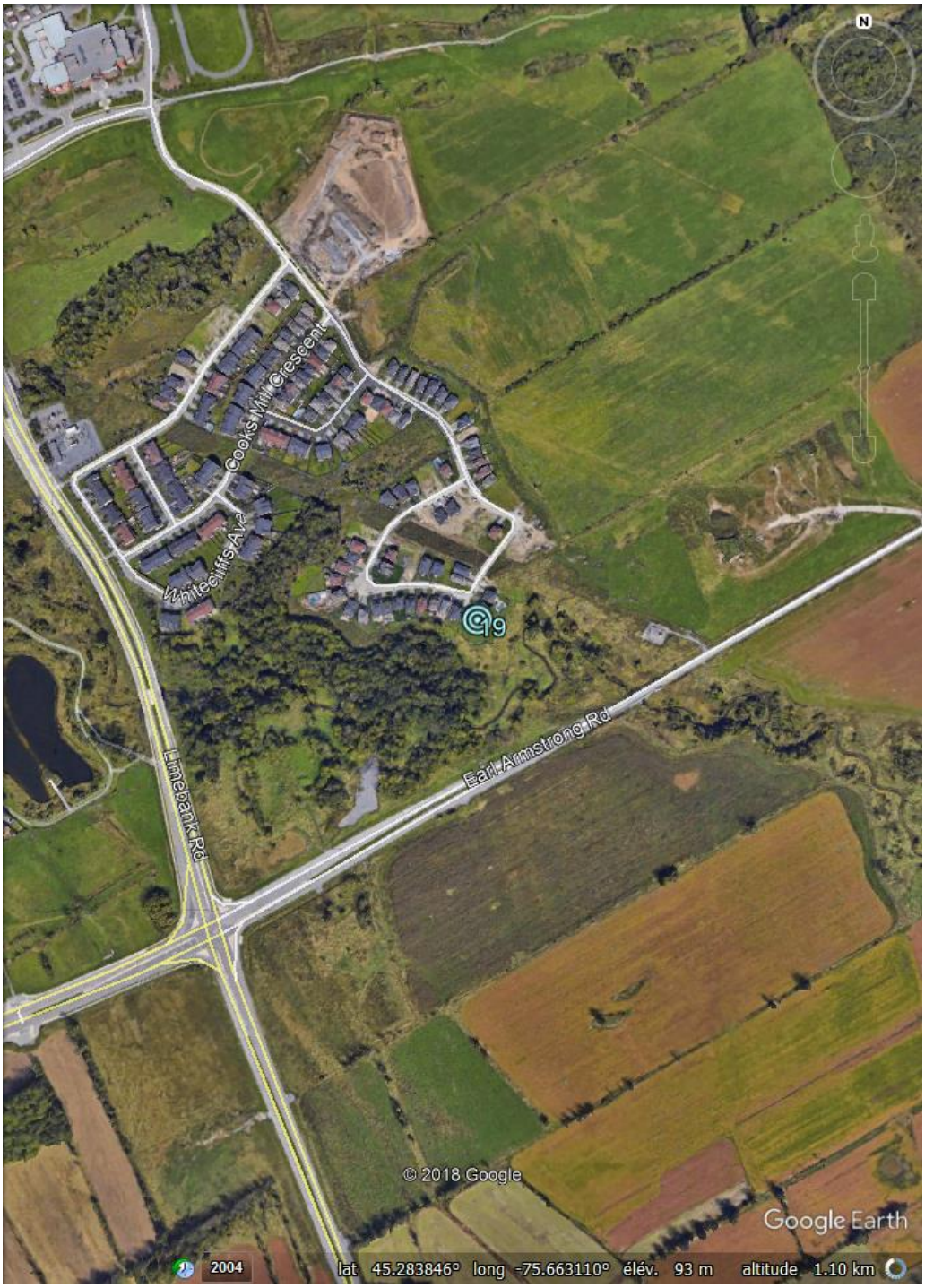

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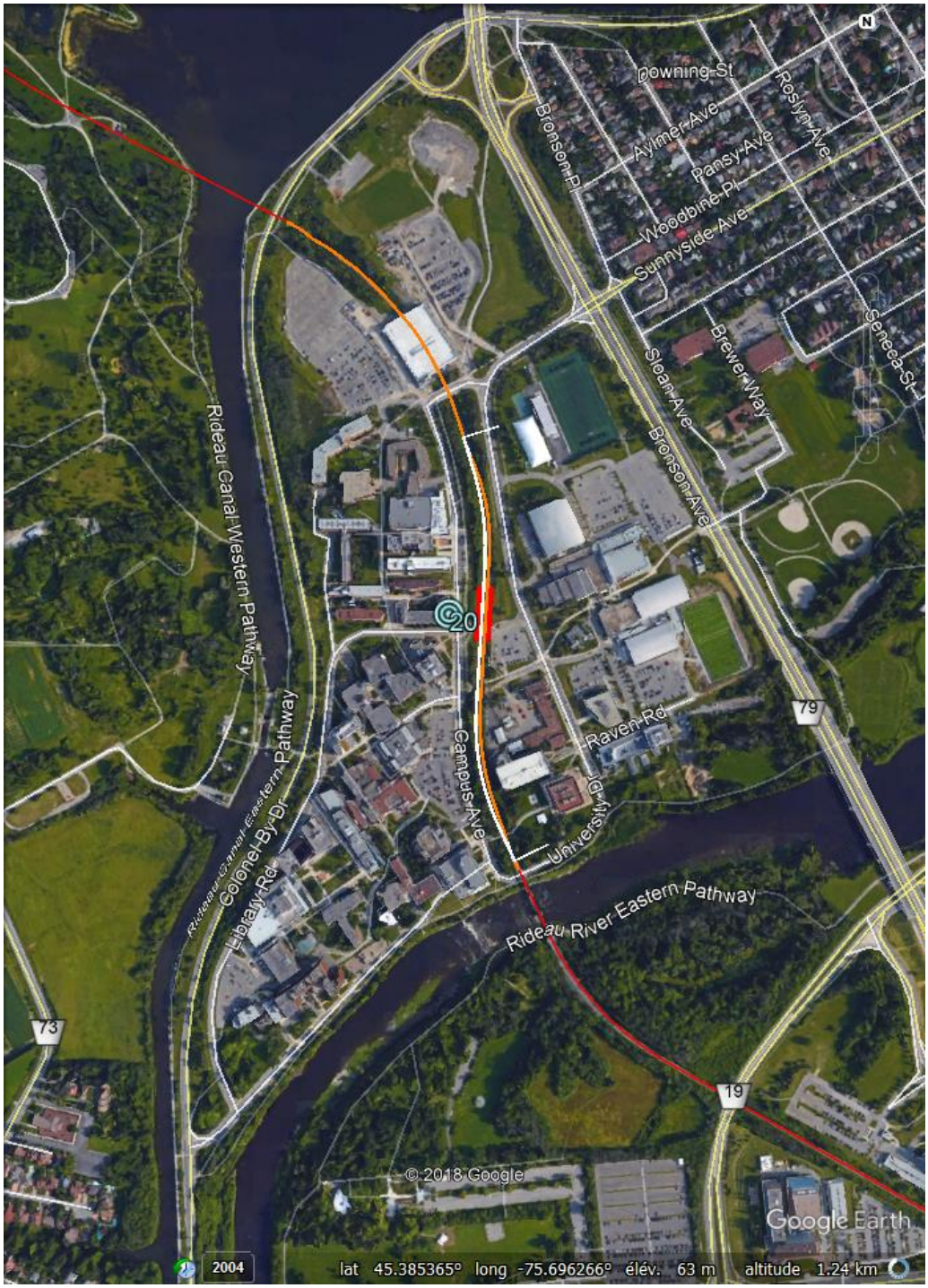

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Memorandum

Should you require any clarification regarding this technical note, please do not hesitate to contact the undersigned.

Sincerely,

SNC♦LAVALIN INC.

Prepared by:

Jacques Savard, M.Sc.
Deputy Director, Acoustics and vibrations

Verified by:

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