# 2935 & 2955 MISSISSAUGA ROAD

FUNCTIONAL SERVICING REPORT APRIL 28, 2021 PROJECT 20-697



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## TABLE OF CONTENTS

1.0	IN	TRODUCTION	1
1.1	Ва	CKGROUND	1
1.	1.1	SITE LOCATION AND DESCRIPTION	1
1.	1.2	SOIL CONDITIONS	2
1.	1.3	FLOOD AND EROSION HAZARDS, AND ECOLOGICAL CONSIDERATIONS	3
2.0	P	ROPOSED DEVELOPMENT	5
3.0	Sı	TE GRADING	5
4.0	R	OAD ACCESS	6
5.0	W	ATER SERVICING	6
5.	1.1	DOMESTIC WATER DEMANDS	7
5.	1.2	FIRE FLOW DEMANDS	8
5.	1.3	TOTAL WATER DEMAND	9
6.0	S	ANITARY SERVICING	9
6.	1.1	SANITARY DESIGN PARAMETERS	10
6.	1.2	SANITARY DEVELOPMENT DEMANDS	11
7.0	D	RAINAGE	11
7.1	Ex	ISTING DRAINAGE	11
7.	1.1	External Drainage Area	14
7.2	PR	OPOSED DRAINAGE	14
7.	2.1	External Drainage	18
7.	2.2	PRE AND POST DEVELOPMENT FLOW COMPARISON	18
7.	2.3	DRIVEWAY CULVERT	19
8.0	S	FORMWATER MANAGEMENT	20
8.1	WA	TER QUALITY	20
8.2	WA	TER QUANTITY	22
8.3	ER	OSION CONTROL	22
8.4	WA	ATER BALANCE	23
9.0		ROSION AND SEDIMENT CONTROL	
10.0	C	ONCLUSIONS	26
11.0	R	FFFRENCES	26

### LIST OF APPENDICES

#### APPENDIX A

SITE PLAN AND TOPOGRAPHIC SURVEY

APPENDIX B

**GEOTECHNICAL INVESTIGATION** 

**APPENDIX C** 

EIS

APPENDIX D

REGION OF PEEL CORRESPONDENCE

APPENDIX E

WATERMAIN CALCULATIONS

APPENDIX F

SANITARY CALCULATIONS

**APPENDIX G** 

STORMWATER MANAGEMENT CALCULATIONS

APPENDIX H

**ENGINEERING DRAWINGS** 

# 2935 & 2955 MISSISSAUGA ROAD FUNCTIONAL SERVICING REPORT

#### 1.0 Introduction

Greck and Associates Limited has been retained by 590816 Ontario Inc. (The Client) to prepare a Functional Servicing Report (FSR) for 2935 & 2955 Mississauga Road in Mississauga, Ontario (Subject Property) in support of the proposed site plan application.

This report provides an overview of the current proposed development plan and examines their functional serviceability, including requirements and proposed conceptual design works related to:

- General site grading
- Water Supply
- Sanitary sewer servicing
- Stormwater management; and
- Construction erosion and sediment control

This functional servicing report has been prepared in accordance with accepted engineering practices and criteria from the governing approval agencies including the City of Mississauga (City), Region of Peel (Region), Credit Valley Conservation (CVC), and applicable provincial policy and guidelines. Following the submission and review of this document, detailed design plans, including supporting reports and drawings, will be prepared and submitted to the above noted agencies for review and approvals, as required.

#### 1.1 BACKGROUND

#### 1.1.1 SITE LOCATION AND DESCRIPTION

The subject property comprises of two properties, 2935 & 2955 Mississauga Road, and is located in the City of Mississauga, east of the Dundas Street West and Mississauga Road intersection, see **Figure 1**. The subject property is 2.13ha in size and consists of undeveloped/unimproved, vegetated land. The property is bound by Mississauga Road to the south, a residential estate lot to the east, Sawmill Creek to the west, and Credit River to the north. Two topographic surveys were conducted: the survey of the subject property was completed by Tarasick Mcmillan Kubicki Limited on December 10<sup>th</sup> 2019, and an additional survey of the sanitary trunk infrastructure and surrounding topography located east of Dundas Road and north of the Sawmill Creek outfall was completed by

Calder Engineering Limited on March 8<sup>th</sup> 2021. The information from both surveys have been combined into the topographic survey plan by Tarasick Mcmillan Kubicki Limited and provided in **Appendix A**. The existing property slopes southeast, with an average slope of 4.7%.

The historical alignment of Sawmill Creek was conveyed from the intersection of Dundas Street and Mississauga Road east across the subject property, then directed north to discharge into the Credit River. This alignment has now been altered so that Sawmill Creek is no longer conveyed through the subject property, and discharges into the Credit River near the north limit of the subject property via an extensive outfall. A ditch was also constructed during this time that runs parallel to Mississauga Road to service local drainage from the subject property and Mississauga Road. This ditch wraps around the south and east limits of the subject property and discharges into the Credit River near the east corner of the subject property.

#### 1.1.2 SOIL CONDITIONS

A geotechnical investigation report was completed by Terraprobe on September 4, 2008, and an addendum was completed on March 10, 2010. The work included drilling and sampling a total of four (4) boreholes near the north valley slope, and ten (10) boreholes near the east and south slopes. The soil conditions consist primarily of the following:

- A surficial topsoil layer varying in thickness from 150mm to 200mm, encountered at seven (7) boreholes.
- A surficial Earth Fill layer varying in thickness from 0.8m to 1m, encountered at five (5) boreholes.
- Native Soils was encountered at the surface at two (2) boreholes, and encountered beneath the Earth Fill or Topsoil layer for the other boreholes. The native soils consist of clayey to sandy silt, to sand and silt to silty sand till. This layer extended to the bottom of all boreholes at depths varying from about 1.2m to 3.0m below grade.

Groundwater levels were measured at all boreholes during their respective studies on August 28, 2008 and March 17, 2010. The groundwater measurements taken on August 28, 2008 were taken on site two weeks after the completion of drilling, and the measurements taken on March 17, 2010 were taken onsite immediately after the completion of drilling. A maximum groundwater elevation of 97.6m, was measured at a depth of 0.5m below surface, at Borehole 1603 located at the south limit of the site, and a minimum groundwater elevation of 96.0m, was measured at a depth of 6.1m below surface, at Borehole 1 located at the north limit of the site.

A test pit investigation was also conducted by Terraprobe on September 15, 2015 to determine soil percolation rates. Four (4) test pits were dug within the subject property, and the percolation rates determined ranged from 20 min/cm to 35 min/cm.

For more details, see **Appendix B** for the geotechnical investigation report, the addendum, and the test pit investigation memo prepared by Terraprobe.

#### 1.1.3 FLOOD AND EROSION HAZARDS, AND ECOLOGICAL CONSIDERATIONS

Several studies have been completed to determine the development limits pertaining to flood and erosion hazards, and natural habitat with respect to the requirements, guidelines and polices of CVC. The following studies have been completed to date and can be found in the Appendices:

- The geotechnical investigation report and the addendum were completed on August 28 2008 and March 17 2010, respectively, by Terraprobe, and is provided in **Appendix B**.
- The EIS was completed in January 2021 by Palmer, and is provided in Appendix
   C.

The valley feature and the woodland govern the development limits of the property. In accordance with the studies, a 10m setback is provided from the long-term stable top of slope (LTSTOS), which define the north and west development limits, and a variable buffer from the delineated woodland dripline is provided, ranging from 1.8m to 13.7m, which define the south and east development limits.

Considering all development setbacks, the total development area is 1.06ha, which was used for the purposes of watermain and sanitary servicing design for the proposed development.



#### 2.0 Proposed Development

The proposed development is a mixed-use residential complex consisting of a 12-storey condo building, ten 3-storey stack townhouses, and a driveway with a roundabout providing access to the buildings. The development area for the site has been subdivided into two areas: 0.51 ha is associated with the condo development, and 0.55ha associated with the townhouses, for a total development area of 1.06ha. A site plan, prepared by Caricari Lee Architects, of the proposed development can be found in **Appendix A** and the proposed development population statistics can be found in **Table 2-1**.

Type of Development	Population Density *	Area (ha)	Equivalent Population
Condo	187 units @ 2.7 persons per unit	0.51	505
Townhouses	175 persons/hectare	0.55	97

TABLE 2-1: PROPOSED DEVELOPMENT POPULATION BREAKDOWN

The proposed development will be serviced by extending and utilizing existing municipal sanitary and water services. Water services laterals will be provided by directly tapping into the existing 400mm watermain on Dundas Street. Sanitary servicing will be provided by tapping into the 1050mm diameter sanitary trunk sewer on the northwest side of the property which runs parallel to Dundas Street and crosses underneath the Credit River.

#### 3.0 SITE GRADING

In general, after review of the topographic survey, the proposed grading is to generally maintain positive drainage from the proposed building towards the existing and proposed ditches. The majority of the proposed development will drain to the existing ditch that wraps around the south and east limits of the property, while landscaping and grassed areas on the north and west side of the building will drain towards a swale that drains to the west limit of the property. Earthmoving is required, to varying degrees, in order to achieve the municipal design criteria and accommodate the development form. Given existing topography and the proposed development plan, an overall fill is required. Only minor earth works are proposed within the provided setback buffers.

A grading plan has been provided in **Drawing GP1**, see **Appendix H**. The plan will follow municipal design standards, as required considering the following key design factors:

- Provide positive drainage from above ground structures/buildings,
- Match external grades,

<sup>\*</sup> As per Region of Peel Sanitary Sewer Design Criteria, March 2017

- Meet minimum and maximum grades for landscape, roadways and swales,
- Achieve municipal lot grading criteria,
- Provide safe overland flow relief,
- Provide sufficient cover for underground infrastructure,
- Minimize requirements for retaining walls and
- Minimize grading and earthworks where necessary.

#### 4.0 ROAD ACCESS

Road access to the proposed condo and townhouses will be facilitated by a singular 15.5m wide private roadway via Mississauga Road. In accordance with the City of Mississauga Standard 2220.010, Pavement and Road Base Design Requirements, the minimum pavement structure for the proposed road will be as follows in **Table 4-1**:

**TABLE 4-1: PAVEMENT STRUCTURE** 

Material	Thickness (mm)
Asphalt	
Surface Course (HL3)	40
Basecourse (HL8)	85
Total Asphalt Depth	125
Base	
Granular A Base (OPSS 1010)	200
Granular B Type 1 Sub-Base (OPSS 1010)	235
Total Driveway Depth	560

The proposed road access will require the removal of an existing double inlet catchbasin on Mississauga Road. This will be replaced by two new double inlet catchbasins, DCB1 and DCB2, at both sides of the proposed driveway. Drainage collected by DCB1 and DCB2 will discharge uncontrolled into the ditch to the north via a 300mm diameter catchbasin outlet.

The details of the pavement structure is to be confirmed by the geotechnical consultant during detailed design, and detailed traffic planning will be provided by others as required.

#### 5.0 WATER SERVICING

This section serves to provide anticipated water demands and required fire flow calculations in support of functional servicing.

Email correspondence with the Region (provided in **Appendix D**) confirmed the following:

- As the development is classified as a high-density residential area, a minimum 300mm diameter watermain is required according to sizing standards from the Region of Peel;
- The development is not permitted to connect to the existing 150mm diameter watermain on Mississauga Road; and
- The Region of Peel has confirmed that the existing 400mm watermain on Dundas Street has sufficient capacity to service the proposed development.

To service the proposed development, the existing segment of the 150mm diameter watermain, from the subject property to the 400mm diameter watermain on Dundas Street connection, will be replaced by a new 300mm diameter watermain. A single 300mm diameter watermain will supply the proposed development for fire protection. A tee and secondary supply line branched at the property line will provide domestic water supply. Both lines will include valves located at the property. The water service will have a backflow preventer and meter located in the mechanical room within the building's basement level.

Hydrants shall be located within 90m horizontally of any portion of a building perimeter that is required to face a street. The fire department connection for an automatic sprinkler system shall be located so that the distance from the fire department connection to a hydrant is not more than 45m and located on the outside of a building adjacent to a street or an access route, not less than 300mm and not more than 900mm above ground level, and provided with two 65mm hose connections with female swivel hose couplings (as per Ontario Building Code Section 3.2.5.16).

The nearest existing hydrant is located on Mississauga Road, across the subject property approximately 270m southeast of the Mississauga Road and Dundas Street intersection. This hydrant is located further than 45m from the proposed building fire department connection as required by the Ontario Building Code Section 3.2.5.16. Therefore, a new private hydrant is proposed within the development near the driveway access, as per Region of Peel Standard Drawing 1-8-3. Please see **Drawing SP1** for the Servicing Plan provided in **Appendix H**, for the proposed watermain and hydrant layout.

A detailed fire protection plan for the building will be undertaken during detailed design and supplemented by the building's mechanical engineer or fire system design consultant.

#### 5.1.1 DOMESTIC WATER DEMANDS

The design criteria used to determine water demands were based on Region of Peel *Watermain Design Criteria* and the Fire Underwriters Survey, as required. The proposed development includes a mixed-use residential complex consisting of a 12-storey condo

building, ten 3-storey stack townhouses, and a driveway with a roundabout providing access to the building. The service area for the 12-storey condo was delineated as the development limits of 2955 Mississauga Road, which was measured to be 0.51ha, and the service area for the 3-storey stack townhouses was delineated as the development limits of 2935 Mississauga Road, which was measured to be 0.55ha. Average Day Demand (ADD), Maximum Day Demand (MDD) and Peak Hour Demand (PHD) factors were calculated using demand peaking factors and population values as per Table 2 in Section 2.3 of the Region of Peel *Watermain Design Criteria*.

Based on the 12-story condominium building consisting of 187 units, and ten 3-storey stack townhouses, the proposed development has a theoretical design population of 602.

The estimated domestic water system demands for the proposed development of the subject property is summarized in below in **Table 5-1**.

**Water Demand Rate** 280 L/capita/day 175 persons/hectare - Townhouses **Population Density** 187 Units @ 2.7 person per unit - Condo Theoretical Population 602 2.0 **Maximum Day Factor Peak Hour Factor** 3.0 117.06 L/min (1.95 L/s) Average Daily Demand (ADD) **Maximum Daily Demand (MDD)** 234.11 L/min (3.90 L/s) **Peak Hour Daily Demand (PHD)** 351.17 L/min (5.85 L/s)

TABLE 5-1: PROJECT DOMESTIC WATER DEMANDS

A detailed breakdown of the calculated demands can be found in **Appendix E**.

#### 5.1.2 FIRE FLOW DEMANDS

Fire demands have been calculated using the *Water Supply for Public Fire Protection* (1999) prepared by Fire Underwriters survey (FUS). Detailed fire flow calculations are provided in **Appendix E**, and the results are summarized below in **Table 5-2**.

TABLE 5-2: RECOMMENDED FIRE FLOW

Proposed Building	Recommended Fire Flow (L/s)
Residential	133.33

From the fire flow calculations, it was determined that the recommended fire flow of 133.33 L/s is required for the proposed development.

#### 5.1.3 TOTAL WATER DEMAND

Based on the total residential water demand and the fire flow requirements, the fire flow plus MDD is 137.24 L/s (133.33 L/s + 3.90 L/s).

#### 6.0 SANITARY SERVICING

This section serves to provide anticipated sanitary demands and an overview of the proposed sanitary servicing in support of functional servicing.

There is no existing sanitary sewer servicing Mississauga Road, therefore, sanitary servicing will be provided for the proposed development by connecting to existing sanitary infrastructure on Dundas Street, which consists of an 1050mm diameter sanitary trunk sewer that runs west to east along the north side of Sawmill Creek and underneath the Credit River.

The existing 1050mm diameter sanitary trunk runs along Sawmill Creek which runs south along Mississauga Road until the Mississauga Road and Dundas Road intersection, where the sanitary trunk sewer runs east along Dundas Road. The sanitary sewer then continues east underneath the Credit River.

Preliminary correspondence with the Region confirmed that the sanitary sewer on Dundas Street has sufficient capacity to service the development, and that only a gravity pipe connection would be permitted. See email correspondence with the Region is provided in **Appendix D**.

Providing a gravity connection would need to be non-conventional given the subject property is lower than Dundas Street and there is a non-conventional storm outfall outletting Sawmill Creek into the Credit River, which runs parallel to Dundas Street between the subject property and sanitary trunk sewer. Two options were considered for servicing the development and connecting to the Dundas Street trunk sanitary sewer.

The first option proposed a gravity sewer towards Dundas Street from the development, along the right-of-way, and directly connecting to existing manhole SA MH 3T. However, to connect at the lowest sewer obvert in manhole SA MH 3T required not only drilling through the outfall structure, but potentially exposing the sanitary sewer within the structure itself. To confirm this, a detailed topographic survey was completed of the outfall structure, see **Appendix A**.

For the second option, as recommended by the Region, the sanitary sewer is proposed to run deep underground beneath the outfall and the existing sanitary trunk sewer to a new proposed manhole (SA MH4A). From here, a new sanitary sewer is proposed to run parallel to the existing sanitary trunk sewer and Dundas Street, connecting to a second

proposed new manhole (SA MH5A). From this manhole, a sewer connection will be made between SA MH5A and the existing SA MH 2T manhole alongside the Credit River. As suspected, given the local topography and valley form, to accommodate the existing sanitary system, a significant drop is proposed in manhole SA MH5A before tying into existing manhole SA MH 2T. SA MH 2T features an extensive drop structure to allow the sanitary trunk sewer to cross the Credit River. The proposed 250mm diameter inlet pipe obvert will match the obvert of the existing 750mm diameter drop structure outlet pipe within SA MH 2T. This option ensures a reliable 1.7m clearance from the obvert of the proposed 250mm diameter sanitary sewer to the bottom of the outfall, and accommodates the external drop structure that was field verified in existing manhole SA MH 2T.

As such, the second option is preferred and proposed in the conceptual drawings provided. Directional drilling methods should be considered for construction if space and topography permit.

Detailed cross sections and profiles showing the proposed sanitary sewer connection from existing sanitary manhole SA MH 2T, underneath Sawmill Creek and the existing sanitary trunk sewer, to the proposed connection to the building are provided in **Drawing SP1**, see **Appendix H**.

#### 6.1.1 SANITARY DESIGN PARAMETERS

The sanitary design parameters, as outlined in **Table 6-1**, for the proposed development are based on the municipal design criteria from the Region of Peel *Sanitary Sewer Design Criteria*:

**TABLE 6-1: SANITARY DESIGN PARAMETERS** 

Population Densities	Townhouses -175 persons/hectare Condo – 187 Units @ 2.7 person per unit			
Area	Townhouses – 0.55ha Condo – 0.51ha			
Population	602			
Unit Domestic Sewage Flows	302.8 L/cap/day			
Infiltration Rate	0.0002 m3/s/ha			
Minimum Flow Velocity	0.75 m/s			
Maximum Flow Velocity	3.5 m/s			
Minimum Sewer Pipe	250 mm dia.			
Minimum Sewer Pipe Grade	0.5%			
Minimum Sewer Depth of Cover	2.75 m			

#### 6.1.2 SANITARY DEVELOPMENT DEMANDS

The sanitary demand has been calculated using the design parameters as described in **Section 6.1.1** and the results are summarized in **Table 6-2** below.

TABLE 6-2: PROPOSED RE-DEVELOPMENT SANITARY DEMAND SUMMARY

	rea ha)	Population (persons)	Average Daily Flow	Harmon Peaking	Peak Daily Flow*	Infiltration Rate	Total Design Flow
			(L/s)	Factor	(L/s)	(L/s)	(L/s)
1	.06	602	2.11	3.93	13.0	0.49	13.49

<sup>\*</sup>The Peak Daily Flow was calculated to be 8.29L/s. However, as per Region Standard Drawing 2-9-2, domestic sewage flow for less than 1000 persons should be 0.013m<sup>3</sup>/s

The proposed development will produce a total sanitary demand of 13.49 L/s. Detailed sanitary development calculations can be found in the sanitary sewer design sheet provided in **Appendix F**.

#### 7.0 Drainage

Provided in this section is an outline of the preliminary drainage strategy for the proposed site plan and areas affected by the development. The proposed design will be in accordance with the City, Region, CVC, and MOECP standards and guidelines.

#### 7.1 EXISTING DRAINAGE

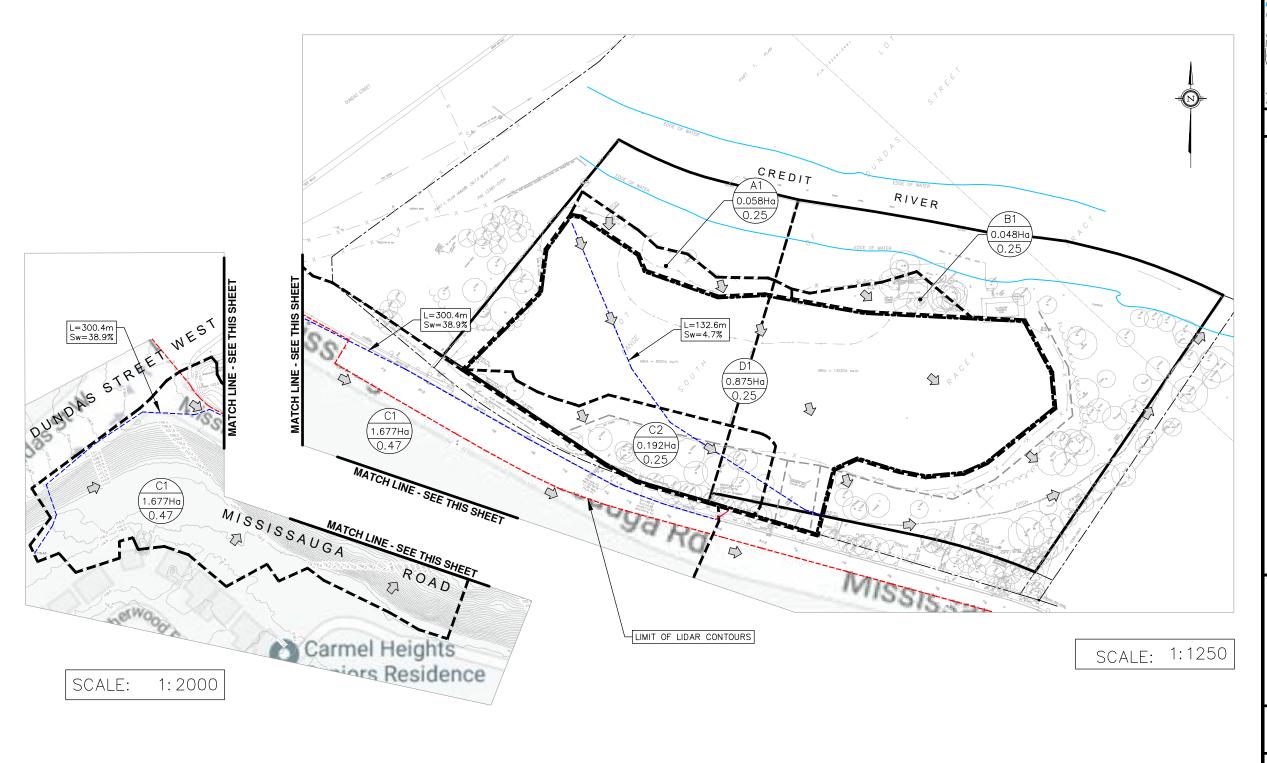
The existing drainage patterns is characterized by four (4) drainage areas: Area A1, B1, C2 and D1. Please see **Figure 2** below for the pre-development drainage area plan. Area D1 consists of the future development limits, while Area A1, B1, and C2 represents external drainage areas, that drains towards the proposed development. Area A1, B1, C2 and D1 is currently undeveloped/unimproved, vegetated land which currently drains in the southeast direction towards a ditch that wraps around the south and east limits of the property, ultimately directing runoff to the Credit River. Drainage area C1 represents a portion of external drainage via Mississauga Road draining towards the proposed access apron.

A summary of the pre-development land cover is provided below in **Table 7-1**.

TABLE 7-1: PRE-DEVELOPMENT LAND-USE SUMMARY

Surface	Runoff Coeff.	Area A1 (m²)	Area B1 (m²)	Area C2 (m²)	Area D1 (m²)	Coverage
Vegetated- Lawn	0.25	584	485	1921	8751	100%

The overall runoff coefficient of Area A1, B1, C2 and D1 was calculated to be 0.25 based on the City of Mississauga Development Requirements Manual, dated November 2020. For more details, please see **Appendix G**.



EXISTING CONDITIONS								
ROOF DRIVEWAY HARDSCAPE GRASSED TOTAL								
$(m^2)$ $(m^2)$ $(m^2)$ $(m^2)$ $(m^2)$								
AREA A1	0.00	0.00	0.00	583.77	583.77			
AREA B1	0.00	0.00	0.00	484.96	484.96			
AREA C1	0.00	0.00	5595.38	11179.60	16774.98			
AREA C2	0.00	0.00	0.00	1920.58	1920.58			
AREA D1	0.00	0.00	0.00	8750.49	8750.49			



N.T.S.

MAJOR OVERLAND FLOW DIRECTION MAJOR CONTOUR LABEL - EXISTING MINOR CONTOUR LABEL - EXISTING

STORM DRAINAGE BOUNDARY/LIMIT OF DEVELOPMENT

EDGE OF WATER PROPERTY LINE FUTURE PROPERTY LINE LOT LINE
LONGEST TRAVEL PATH

0.676Ha DENOTES AREA IN HECTARES

--- DENOTES PERCENT IMPERVIOUS

BENCHMARK: CITY OF MISSISSIAUAGA No. 58
ELEVATION = 108.293m
LOCATION: CITY OF MISSISSAUGA
DATED: DEC 10, 2019

COMPLETED BY: TARASICK McMILLAN KUBICKI LTD.
ONTARIO LAND SURVEYORS
4181 SLADVIEW CRESCENT, UNIT 42, MISSISSAUGA, ONTARIO L5L 2R2 (905) 569-8849



CLIENT NAME: 590816 ONTARIO INC. 2616 CYNARA ROAD MISSISSAUGA, ON L5B 2R7

PROJECT NAME:

2935 & 2955 MISSISSAUGA ROAD

MISSISSAUGA, ON

#### **EXISTING STORM DRAINAGE AREAS**

. FIG-2

DESIGNED BY:	E.P.	SCALES:	PROJECT No
CHECKED BY:	E.G.	HORIZONTAL: AS SHOWN	DRAWING No
DRAWN BY:	K.M.	VERTICAL: N/A	SHEET No.
DATE: APR 26	2021	SHEET SIZE: 11"x17"	SHEET NO.

#### 7.1.1 EXTERNAL DRAINAGE AREA

LiDAR topographic information titled LiDAR DTM GTA 2015 Package B was obtained from Land Information Ontario to conduct an external drainage assessment. The subject property receives external drainage from the southwest side of the subject property. The external drainage area is delineated as Area C1 as illustrated in the pre-development drainage area plan provided in **Figure 2.** Area C1 consists of forested areas and the Mississauga Road right of way. Mississauga Road is superelevated, directing runoff from the forested areas and the Mississauga Road right of way northeast towards catchbasins placed along the east side of Mississauga Road. The catchbasin leads discharge directly towards the ditch that wraps around the south and east limits of the subject property.

A summary of the external drainage area land cover is provided below in **Table 7-2**. External land-use areas were estimated using aerial topography via Google Earth.

Surface	Runoff Coeff.	Area C1 (m²)	Coverage	
Asphalt/Hardscape	0.90	5595	33%	
Vegetated-Lawn	0.25	11180	67%	
Total	0.30	16775	100%	

TABLE 7-2: EXTERNAL DRAINAGE AREA LAND-USE SUMMARY

#### 7.2 Proposed Drainage

Under proposed conditions, the subject site has been delineated into seven (7) drainage areas: Area A1, A2, B1, B2, C2, D1, and D2. Please see **Figure 3** below for the post-development drainage area plan.

Area D1 and D2 consists of the proposed development. Area D1 consists of a mixed-use residential complex consisting of a 12-storey condo building, ten 3-storey stack townhouses, and the majority of the driveway with a roundabout providing access to the building. Runoff from Area D1 is collected by roof drains and floor drains which will drain to the building's internal storm sewer system and connects to the external storm sewer system at the south side of the proposed condo building. Runoff from the storm sewers ultimately discharge overland onto a rip-rap apron spreader near the south limit of the site and sheet flows through vegetated areas towards the existing ditch that wraps around the south and east limits of the property. Area D2 consists of the remaining portion of the driveway which is serviced by catchbasins and outlets to the existing ditch that wraps around the south and east limits of the property.

Area A1 and B1 consists of the drainage area outside of the development limits, and Area A2 and B2 represents the drainage area located between the proposed development and the erosion or ecological hazard limits, designated as a "buffer" zone. The land cover for Area A1, A2, B1, and B2 consist of vegetated and landscaped areas which drain south towards the proposed development.

Runoff generated from Area A1 and A2 are intercepted by a proposed swale that runs along the north to west perimeter of the development, conveying drainage to the west towards an existing 1.1m diameter concrete culvert outlet at the west limit of the site, which discharges into the Sawmill Creek outfall. This increases flows directed to the concrete culvert outlet compared to existing conditions. However, the 100-year flow rate generated from Area A1 and A2 is 20.8L/s, which is minimal, and is considered to have a negligible impact to erosion and the conveyance capacity of the existing outlet. The slope from the swale outlet to the existing culvert outlet is 9%, therefore, to protect the steep valley slopes from erosion, a 0.3m deep, 150mm diameter rip-rap apron spreader is still proposed at the ditch outlet to mitigate erosion.

The Runoff from Area B1 and B2 is conveyed along the north to east limit of development, which naturally drains to the east towards the existing ditch that wraps around the south and east limits of the property, ultimately directing runoff to the Credit River.

Area C2 is to remain mostly unchanged under proposed conditions, with only minor grading proposed. Area C2 consists of forested area which drains southeast towards the culvert under the proposed driveway. The proposed culvert is sized to accommodate runoff from both drainage areas C1, C2, D1, and D2. For culvert sizing calculations please see **Section 7.2.3** below.

A summary of the post-development land cover is provided below in **Table 7-3**.

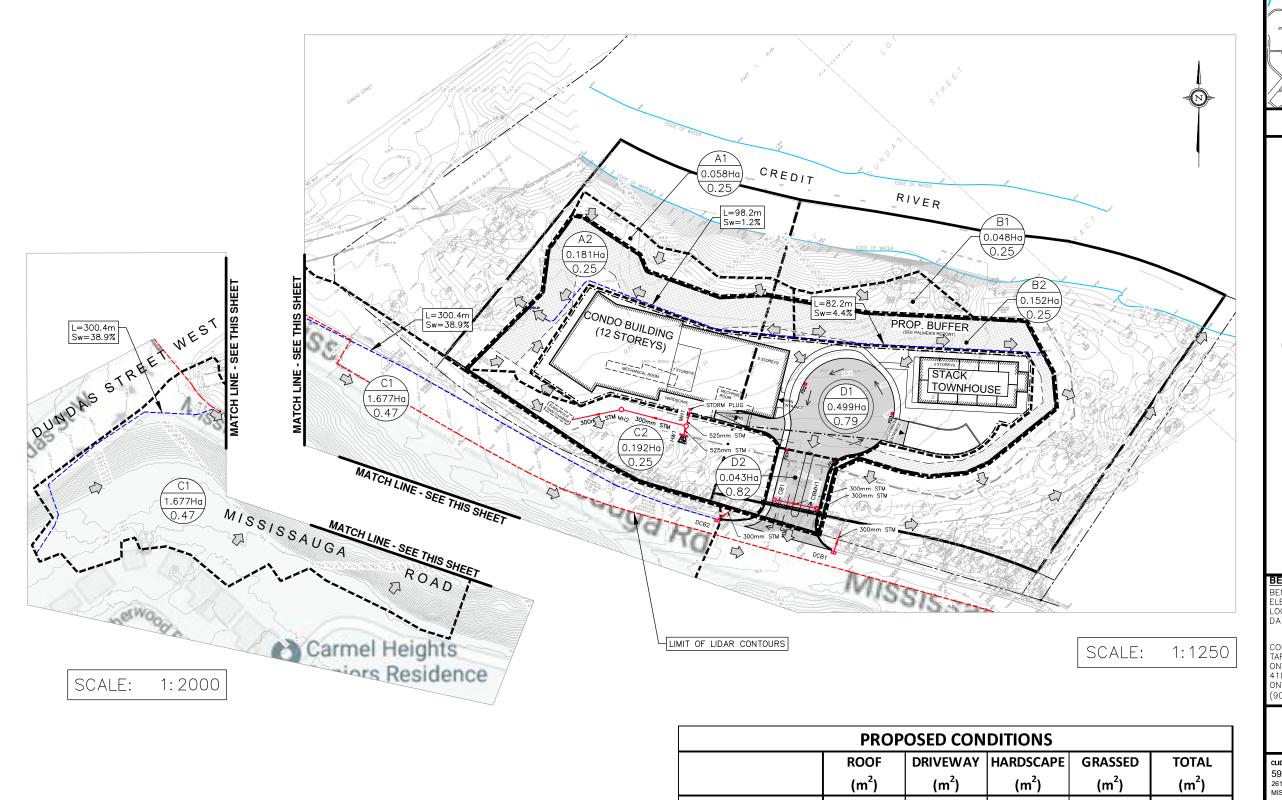
Surface Runoff **A1 A2 B1** B2 C2 **D1** D2 Coverage Coeff. (m<sup>2</sup>) (m<sup>2</sup>) (m<sup>2</sup>)(m<sup>2</sup>) (m<sup>2</sup>) (m<sup>2</sup>) (m<sup>2</sup>)Roof 0.90 0 0 0 2484 21% 0 0 0 0 0 979 379 **Asphalt** 0.90 11% 0.90 0 0 659 Hardscape 0 0 0 0 6% Vegetated-0.25 584 1808 485 1518 1921 869 54 62% Lawn **Total** 0.50 584 1808 485 1518 1921 4991 433 100%

TABLE 7-3: POST-DEVELOPMENT LAND-USE SUMMARY

The overall runoff coefficient of the proposed site was calculated to be 0.50 based on the City of Mississauga Development Requirements Manual dated November 2020. For more details please see **Appendix G**.

The proposed storm sewer is sized for the 100-year event, the storm sewer design sheet is provided in **Appendix G**.

The proposed storm sewer outfall servicing all impervious development area is to be protected with 0.5m thick, 150mm diameter rip-rap apron which has been sized for the 100-year runoff generated from Area D1. For more rip-rap sizing details please see **Appendix G**.



PROPOSED CONDITIONS								
	ROOF DRIVEWAY HARDSCAPE GRASSED TOTAL							
	(m²)	(m²)	(m²)	(m²)	(m²)			
AREA A1	0.00	0.00	0.00	583.77	583.77			
AREA A2	0.00	0.00	0.00	1808.42	1808.42			
AREA B1	0.00	0.00	0.00	484.96	484.96			
AREA B2	0.00	0.00	0.00	1518.40	1518.40			
AREA C1	0.00	0.00	5595.38	11179.60	16774.98			
AREA C2	0.00	0.00	0.00	1920.58	1920.58			
AREA D1	2484.18	978.56	659.09	869.26	4991.09			
AREA D2	0.00	378.53	0.00	54.05	432.76			



N.T.S.

MAJOR OVERLAND FLOW
DIRECTION

MAJOR CONTOUR LABEL — EXISTING

MINOR CONTOUR LABEL — EXISTING

STORM DRAINAGE BOUNDARY/LIMIT OF DEVELOPMENT
LIMIT OF RIGHT-OF-WAY
EDGE OF WATER
PROPERTY LINE
FUTURE PROPERTY LINE

LOT LINE
LONGEST TRAVEL PATH
PROP. CONCRETE RETAINING WALL
PARKING GARAGE / CONCRETE WALL
FOREST DRIP LINE
EXISTING DITCH

STORM MANHOLE
FLOOR DRAIN
SINGLE CATCHBASIN
DOUBLE CATCHBASIN

0.676Ha DENOTES AREA NUMBER

DENOTES AREA IN HECTARES

DENOTES PERCENT IMPERVIOUS

#### BENCHMAR

BENCHMARK: CITY OF MISSISSIAUAGA No. 58 ELEVATION = 108.293m LOCATION: CITY OF MISSISSAUGA DATED: DEC 10, 2019

COMPLETED BY:
TARASICK McMILLAN KUBICKI LTD.
ONTARIO LAND SURVEYORS
4181 SLADVIEW CRESCENT, UNIT 42, MISSISSAUGA,
ONTARIO L5L 2R2
(905) 569-8849



5770 Highway 7, Woodbridge, Ontario, L4L 1T8 www.greck

CLIENT NAME: 590816 ONTARIO INC. 2616 CYNARA ROAD MISSISSAUGA, ON L5B 2R7

PROJECT NAME:

2935 & 2955 MISSISSAUGA ROAD

MISSISSAUGA, ON

#### PROPOSED STORM DRAINAGE AREAS

ESIGNE	D BY:		E.P.	SCALES:		PROJECT No.	20-697
HECKE	D BY:		E.G.	HORIZONTAL:	1:1000	DRAWING No.	FIG-3
RAWN	BY:		K.M.	VERTICAL:	N/A	SHEET No.	
ATE.	ΔPR	26	2021	CUEET CIZE	44"47"	SHEET NO.	2

| SHEEL SIZE: |

Date Plotted: Apr 26. 2021 - 4:48

#### 7.2.1 EXTERNAL DRAINAGE

The land cover and drainage path of external drainage Area C1 remains unchanged under post-development conditions. The external drainage area is delineated as Area C1 as illustrated in the post-development drainage area plan provided in **Figure 3**. The runoff generated from Area C1 is collected by the proposed double ditch inlet catchbasin (DCB2) located on Mississauga Road at the west side of the new driveway. The catchbasin lead discharges directly to the existing ditch, towards Area C2. Drainage from Area C1 and C2 is then conveyed underneath the new driveway via a proposed 600mm diameter CSP culvert. For culvert sizing calculations please see **Section 7.2.3** below.

#### 7.2.2 Pre and Post Development Flow Comparison

In accordance with the City of Mississauga Design Requirements, runoff flows are to be calculated using the Rational Method. The equation is as follows: Q = 0.0028 C I A. The rational method equation is based on the runoff coefficient (C), drainage area in hectares (A), and rainfall intensity in mm/hr (I).

IDF values were used from the City of Mississauga Development Requirements to generate the rainfall intensity for the 2-year and 100-year storm event. These IDF curves are a function of the time of concentration, therefore, in order to determine rainfall intensity, the time of concentration is required to be calculated. Depending on the runoff coefficient of the drainage area, Bransby or the Airport method is used to calculate the time of concentration. Detailed calculations are provided in **Appendix G**.

Calculated pre-development and post-development flows are summarized below in **Table 7-4**.

Existing		Proposed			
Drainage Area	2- year (L/s)	100-year (L/s)	Drainage Area	2- year (L/s)	100-year (L/s)
			A1 + A2	7.1	20.8
A1+B1+D1	35.2	103.5	B2 + B2	8.2	24.1
			D1 + D2	71.2	209.2
C1 + C2	198.4	578.7	C1 + C2	198.4	578.7
Total	233.6	682.2	Total	284.9	832.7

TABLE 7-4: PRE-DEVELOPMENT AND POST-DEVELOPMENT FLOW COMPARISON

**Table 7-4** shows that there is a net increase in peak runoff due to the increase in impervious area (building area).

Capacity calculations were completed to ensure all proposed swales can convey the 100year flow generated from their respective drainage areas. See **Appendix G** for capacity calculations.

#### 7.2.3 DRIVEWAY CULVERT

A driveway is proposed to provide access to the proposed development from Mississauga Road. Fill works are required in the existing ditch to accommodate the proposed driveway. To provide safe conveyance of flows underneath the driveway, a culvert was sized to convey the 100-year flow from Area C1, C2, D1, and D2. The 100-year flow was calculated using the Modified Rational Method, and a hydraulic assessment was conducted on PCSWMM to determine an appropriate culvert size. The above analyses assume that the entirety of runoff from 100-year storm event is conveyed towards the proposed culvert. This is conservative, as discharge from Drainage Area C1 would be conveyed via major overland flow in a south east direction down Mississauga Road. See **Appendix G** for the proposed driveway culvert sizing calculations.

The summary of the culvert sizing assessment is provided in **Table 7-5** below, and the PCSWMM modelling can be provided upon request.

TABLE 7-5: DRIVEWAY CULVERT SIZING SUMMARY

Drainage Area (ha)	100-year flow (L/s)	Freeboard Provided (m)
2.4	787.9	0.50

The proposed culvert is a 21m long 600mm CSP pipe with a slope of 5.2%, an upstream invert elevation of 98.16m, and a downstream invert elevation of 97.08m. The 100-year flow will be contained within the existing ditch and provide a 0.5m freeboard from the proposed driveway crown.

#### 8.0 STORMWATER MANAGEMENT

The following SWM criteria is to be addressed in accordance with regulatory policy:

- Water quality
- Water quantity
- Erosion control
- Water balance

The proposed SWM strategy includes considerations for water quality control, erosion control, and water balance for the site. The proposed SWM strategy includes a treatment train approach featuring the following SWM controls:

- OGS unit
- Underground stormwater chambers
- Rip-rap flow spreader, and a vegetated filter strip

Runoff generated from the building, and the driveway will be collected by the building's internal storm sewer system where runoff is treated by a proposed Oil and Grit Separator (OGS) unit, then conveyed to the external storm sewer system connection at the south side of the building, which drains to underground infiltration chambers. When the chambers are at capacity, the stormwater is redirected to the storm sewer outlet, where runoff discharges overland onto a rip-rap apron spreader and sheet flows through vegetated areas towards the existing ditch that wraps around the south and east limits of the property, which ultimately discharges into Credit River. This process is discussed in greater detail in the following sections below.

#### 8.1 WATER QUALITY

The required suspended solids removal treatment is MOE Enhanced Protection Level (Level 1). This corresponds to a long-term average removal of 80% of total suspended solids (TSS). Water quality volumes (WQV) were determined from Table 3.2 of the Ministry of Environment Stormwater Management Planning and Design Manual. The required WQV is a function of percent imperviousness of the drainage area, see **Table 8-1**.

Stormwater from the development will be characterized by runoff from roofs, hardscape areas, landscape areas, and the driveway. The main contaminants of concern being:

- Suspended sediments
- Phosphorous
- Other (oil, grease, gas, temperature)

44.2m<sup>3</sup>/ha

 $4.3m^{3}$ 

Roof drainage and other hardscape areas other than a driveway or roadway are considered clean and therefore, require no quality controls. Runoff from the driveway and areas with vehicular traffic contribute the most contaminants including oils and grit. Most notably during a rainfall's first flush. As such, water quality controls are only required for the driveway areas within Area D1 and D2.

Drainage Area (Driveway Area in Area D1) 979m²
Imperviousness 100%
Unitary Volume

TABLE 8-1: WATER QUALITY VOLUME SUMMARY

A treatment train approach is proposed for capturing and treating contaminated runoff from Area D1:

(to achieve 80% TSS removal)

**Required Water Quality Volume** 

- First, driveway runoff is captured by floor drains which is conveyed to the building's internal storm sewer system and treated by a Stormceptor EF4 OGS unit (or approved equivalent) proposed within the building, which will provide stormwater treatment by trapping free oils and floatable solids and settling any captured sediment, prior to discharge towards the external storm sewer system. The OGS has been sized to provide 60% TSS removal based on the CA ETV Size Distribution. To be conservative, it is assumed that the OGS will only provide 50% TSS removal.
- Secondly, the CULTEC Recharger 330XLHD underground infiltration chambers (or approved equivalent) will capture and retain stormwater, from the internal building storm sewer system for infiltration. The infiltration chambers have been designed with a sump such that the WQV is retained and infiltrated. A total volume of 19.5m³ is infiltrated within 48 hours, exceeding the WQV requirement of 4.3m³. Once the infiltration chamber is at capacity, stormwater is redirected towards the storm sewer outlet. More details on the infiltration chambers are provided in Section 8.3.
- Thirdly, the storm sewer system discharges into the existing ditch that wraps around the south and east limits of the property via a rip-rap flow spreader. The existing ditch is vegetated, which acts as vegetated filter strip which will provide a tertiary opportunity for sediment capture and deposition before discharging into the Credit River.

The OGS, infiltration chamber, and vegetated filter strip will provide a total of 95% TSS removal for Area D1, which exceeds the required 80% TSS removal.

Runoff generated from Area D2, will be collected by catchbasins, and outlet into the existing ditch that wraps around the south and east limits of the property. A debris/sediment trap is proposed in CB1 and CB2 to prevent suspended solids from entering the outlet pipe and allow it to settle within the sump of the catchbasin. A 600mm deep sump is proposed at CB1 and CB2 to allow for the settling of debris and sediment. If maintained, sediment traps and catchbasin filters can provide an additional 50% TSS removal.

Specific details regarding the OGS sizing report, infiltration chambers, and water quality calculations are provided in **Appendix G** and the drawings located in **Appendix H**.

#### 8.2 WATER QUANTITY

As per the Credit Valley Conservation Stormwater Management Criteria dated August 2012, the subject property ultimately drains to a segment of the Credit River, where quantity controls are not required, and therefore is not proposed on site.

#### 8.3 Erosion Control

The CVC Erosion Control Criteria requires that 5mm of on-site retention be provided. Based on a total development area of 8750m<sup>2</sup> (Proposed Drainage Area A2, B2, D1, and D2), this equates to a required retention volume of 43.8m<sup>3</sup>. Erosion controls will be provided for D1 by the proposed infiltration chambers. No erosion controls are proposed for Area A2 and B2, as these areas only consist of grassed areas as per existing conditions. No erosion controls are proposed for Area D2, however, to compensate for this, the proposed infiltration chambers are oversized.

See **Table 8-2** below for a summary of erosion control volume requirements and the storage provided by the infiltration chambers during the 5mm storm event.

 Area
 Area (m²)
 Required Volume (m³)
 Provided Volume (m³)

 Area A2, B2, D1, D2
 8750
 43.8
 44.7

TABLE 8-2: EROSION CONTROL VOLUME SUMMARY

During the 5mm event, the depression storage from the grassed, hardscaped and driveway areas will provide 25.3m³ of erosion control storage, and the proposed infiltration chambers will provide a total of 19.5m³ of subsurface storage. In total, 44.7m³

of erosion control storage is provided on site. This is greater than the required retention volume of 43.8m<sup>3</sup>.

8 units of the CULTEC Recharger 330XLHD chambers (or approved equivalent) occupying an area of 32.7m<sup>2</sup>, is proposed on the southwest corner of the development, which provides 19.5m<sup>3</sup> of subsurface storage. Erosion control and infiltration chamber sizing calculations are provided in **Appendix G**.

Based on the test pit investigation conducted by Terraprobe on September 15, 2015, the percolation rates determined on site ranged from 20 min/cm to 35 min/cm. To be conservative, a 35 min/cm (17mm/hr) percolation rate was used for drawdown calculations. The underground infiltration chambers will infiltrate the 19.5m<sup>3</sup> in 48 hours which meets the maximum drawdown time of 48 hours required by CVC. Drawdown time calculations are provided in **Appendix G**.

#### 8.4 WATER BALANCE

Urbanization increases impervious cover which, if left unmitigated, results in a decrease in infiltration. This infiltration reduces groundwater recharge and soil moisture replenishment. It also reduces stream baseflow needed for sustaining aquatic life. Therefore, it is important to maintain the natural hydrologic cycle. Groundwater recharge helps maintain aquifer water levels and supports significant watershed features that are necessary components to the maintenance of a healthy watershed. As a result, a water balance analysis is required to estimate the pre-development and post-development infiltration and runoff.

The subject property is located within an Environmentally Sensitive Area as classified by the City, and CVC. Therefore, according to CVC SWM Water Balance criteria, the predevelopment groundwater recharge rates are to be maintained. As such, a site-specific water balance assessment is required.

A site-specific water balance was completed for the development area delineated by Area A2, B2, D1, and D2, using the MOE's "Stormwater Management Planning and Design Manual", March 2003. This approach uses the method developed by Thornthwaite and Mather.

A summary of the pervious and impervious areas is provided below in Table 8-3

TABLE 8-3: EXISTING AND PROPOSED LAND COVER

Area	Existing (m²)	Proposed (m <sup>2</sup> )
Pervious	8751	4250
Impervious	0	4500

The parameters used for the water balance analysis are provided in **Table 8-4**.

TABLE 8-4: MOE WATER BALANCE INFILTRATION PARAMETERS

	Comment	Factor
Topography	Hilly Land	0.1
Soils	Open Sandy Loam	0.2
Cover	Cultivated Land	0.1

A total deficit volume of 362.6m³/year will not be infiltrated into the ground given the proposed development plan and resulting change in pervious cover. A such, this annual volume must be balanced and infiltrated back into the ground under proposed conditions.

The water balance target of 362.6m<sup>3</sup>/year will be provided through the subsurface infiltration chambers throughout the property.

The infiltration chambers have been sized to capture 5mm of rainfall to meet erosion control requirements, which represents approximately 55% of all rainfall events in a given year (City of Toronto Wet Weather Flow Management Guidelines Figure 1b, November 2006).

An impervious annual surplus of 726mm was applied due to the lack of evapotranspiration on impervious areas such as roofs or driveways, however, it is assumed 10% of the precipitation is evaporated.

Based on an annual impervious surplus factor of 726mm per year, the annual infiltration volume towards the infiltration chambers equates to 1742m³ per year with a total site-wide infiltration of 2085m³. However, a factor of safety of 1.5 was applied to the total infiltrated chamber volume, in the event that infiltration does not occur as efficiently, due to soil saturation, partially full chambers from previous rainfall events, or unexpected insitu soil conditions. This equates to an annual chamber infiltration volume of 1161m³ for a total site-wide infiltration of 1504m³, therefore exceeding pre-development conditions.

A summary of the infiltration volumes is provided in **Figure 8.1**.

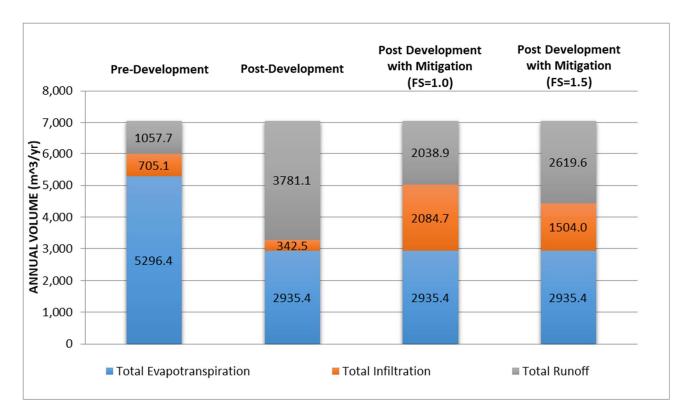


FIGURE 8.1: WATER BALANCE SUMMARY

As such, the application of the infiltration chambers achieves a net increase in overall infiltration, which meets CVC's criteria of maintaining pre-development infiltration levels. For water balance calculations, please see **Appendix G**.

#### 9.0 EROSION AND SEDIMENT CONTROL

Erosion and sediment controls (ESC) will be implemented for all construction activities, including topsoil striping, material stockpiling, pavement construction, and grading operations. Design details will include a phased approach to minimize disturbance including considerations for restoration. Significant site excavation is anticipated during construction due to the 2 levels of proposed underground parking. During this time, a combination of sediment traps and pumping to silt sacks are proposed to dewater the site accounting for clean groundwater seepage and rainfall. Considering the size of the building footprint, during building construction, heavy duty silt fencing and local dewatering will be the main controls for sediment control as exposed earth will be minimal, if not contained within the excavation pit. The groundwater seepage rate and the required pumping rate will be determined in detailed design by consulting with the hydrogeological engineer.

An Erosion and Sediment Control Plan will be provided during detailed design.

Greck and Associates limited Page 25

#### 10.0 CONCLUSIONS

As presented in this report, the proposed development will meet the following municipal and provincial standards and regulations specified for:

- General site grading;
- Water distribution
- Sanitary sewer servicing;
- Utilities
- Stormwater management; and
- Construction erosion and sediment controls

In summary, it has been determined that the development can be serviced with existing and proposed infrastructure that is in accordance with policies and guidelines required by the City of Mississauga and other regulating agencies.

#### 11.0 REFERENCES

City of Mississauga – Development Requirements Manual – November 2020

Credit Valley Conservation – Stormwater Management Criteria- August 2012

Fire Underwriters Survey – Water Supply for Public Fire Protection - 1999

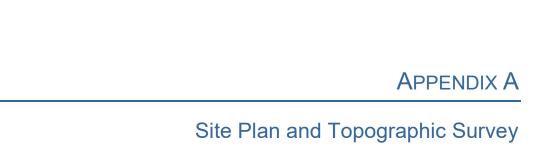
Ministry of the Environment – Stormwater Management Planning and Design Manual – March 2003

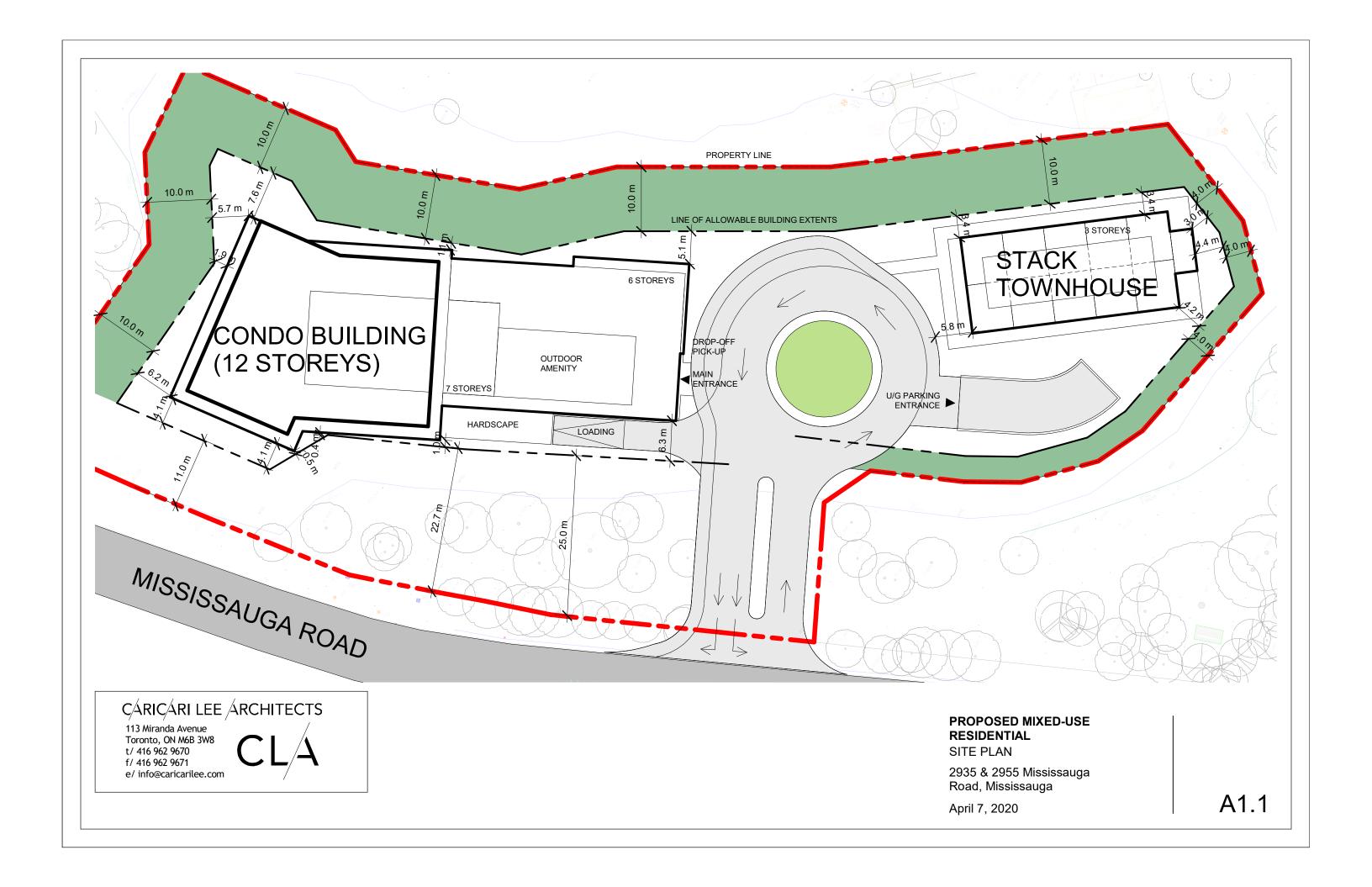
Ministry of the Environment – Design Guidelines for Drinking Water Systems – 2008

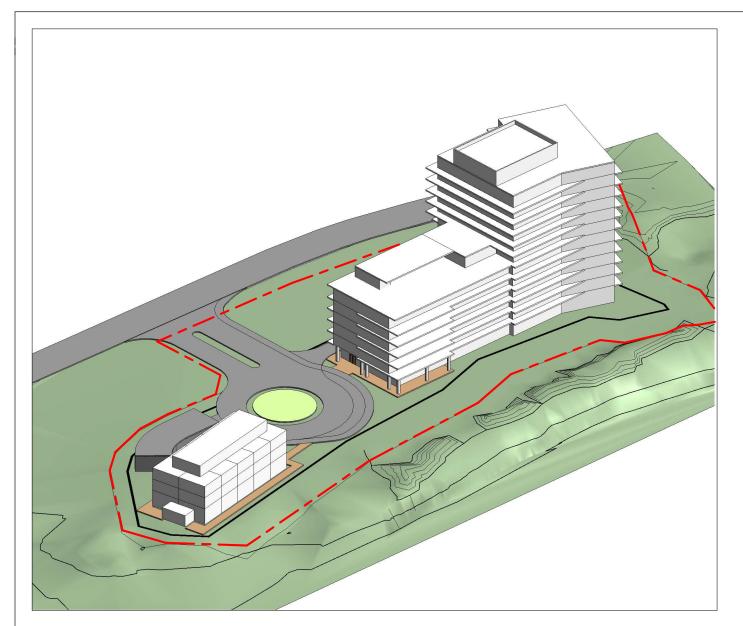
Ministry of the Environment – Design Guidelines for Sewage Works – 2008

Region of Peel – Sanitary Sewer Design Criteria – March 2017

Region of Peel – Watermain Design Criteria – June 2010









CARICARI LEE ARCHITECTS

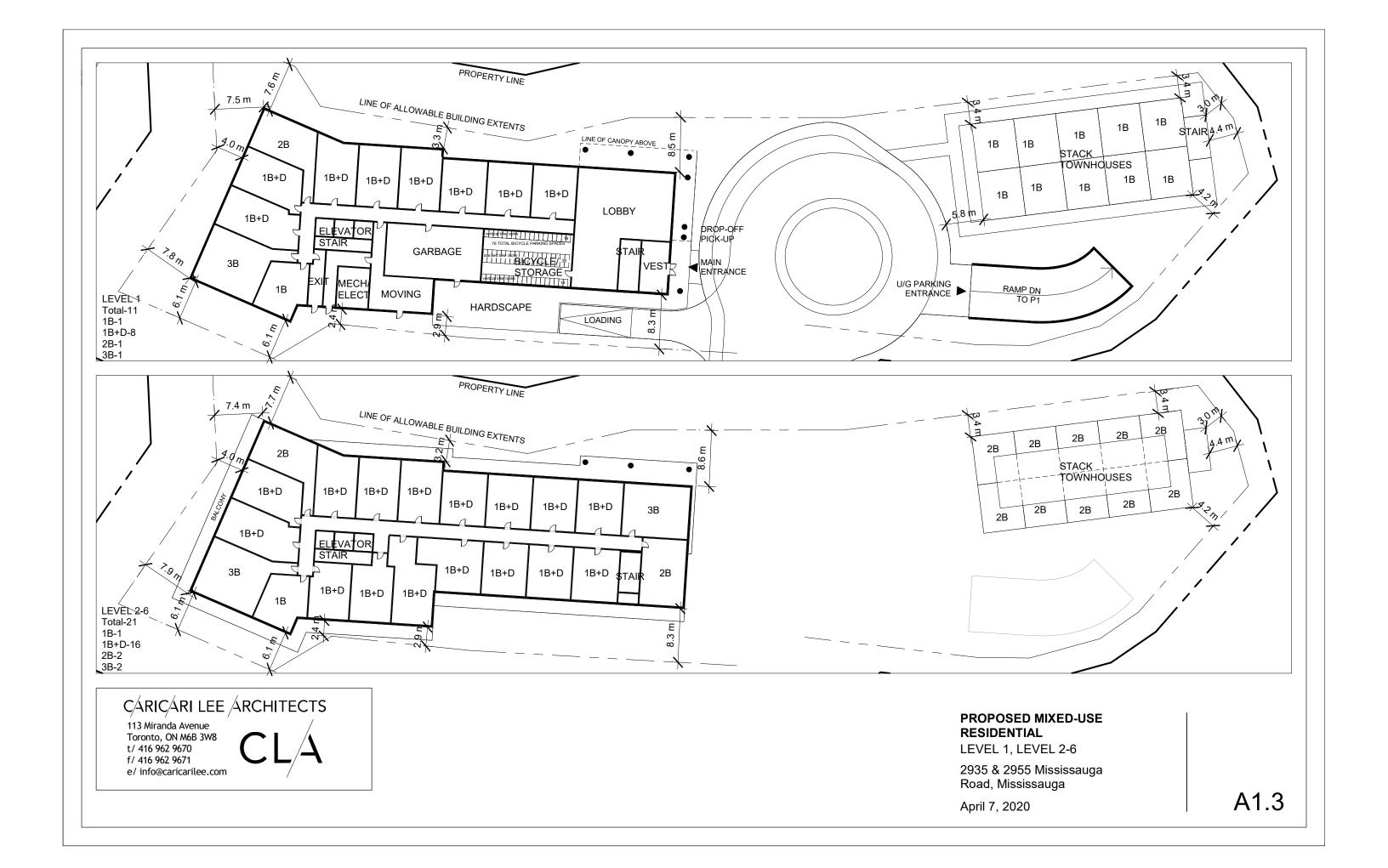
113 Miranda Avenue
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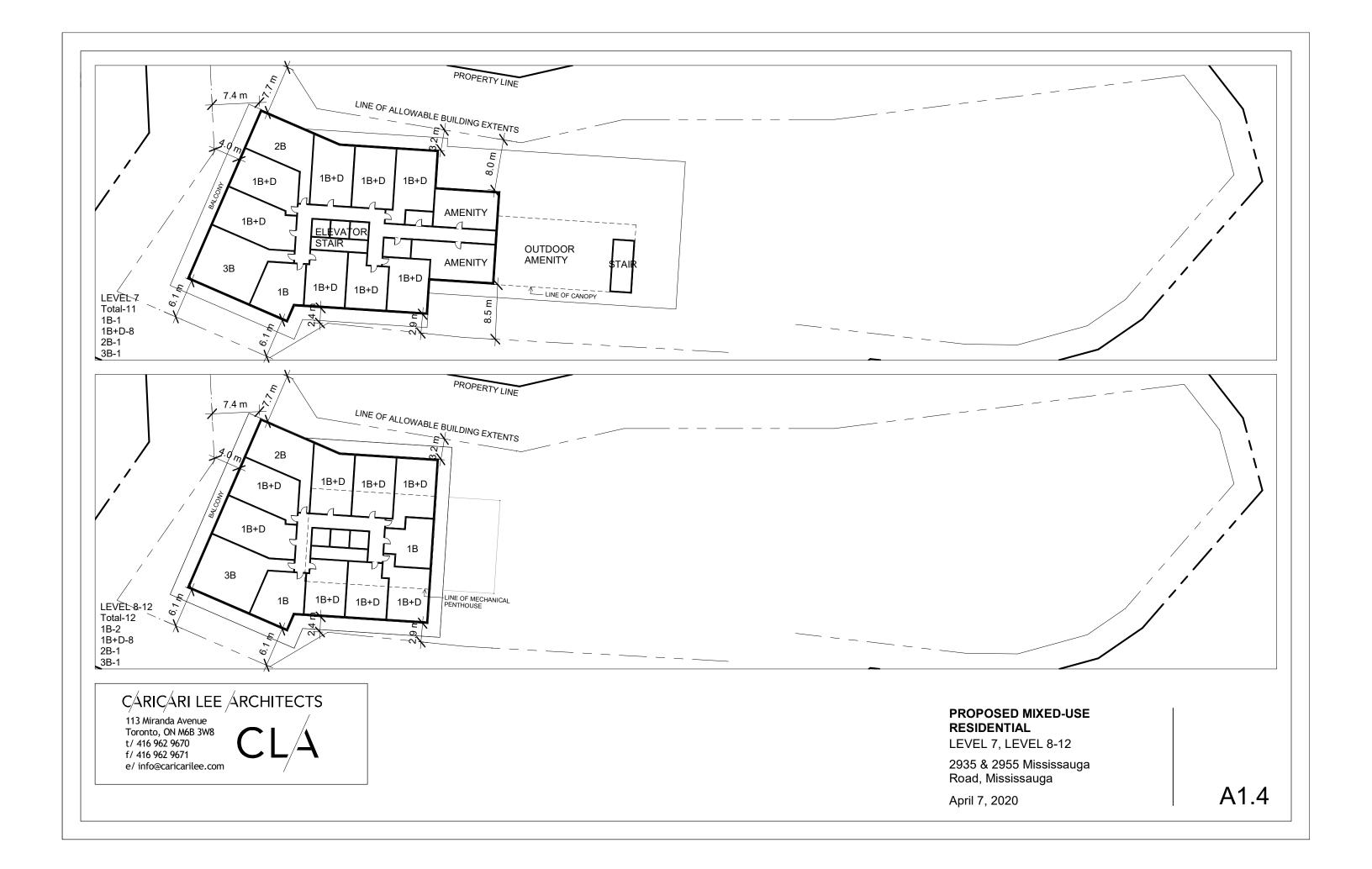
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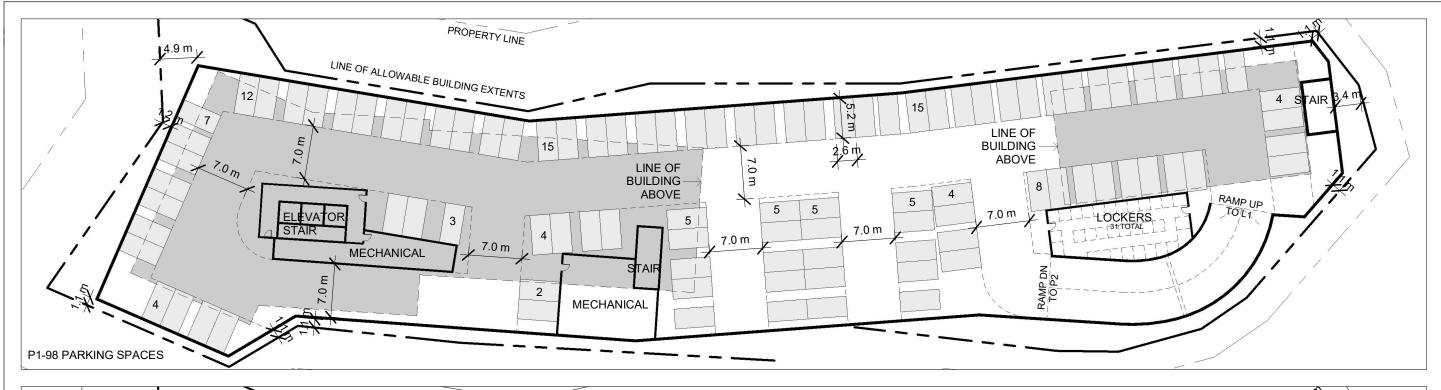
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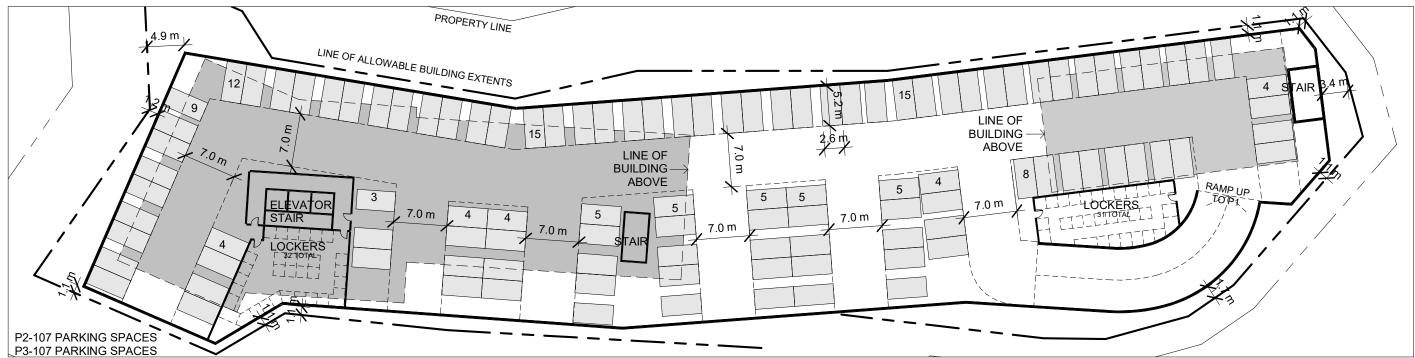
2935 & 2955 Mississauga Road, Mississauga

April 7, 2020









# CARICARI LEE ARCHITECTS

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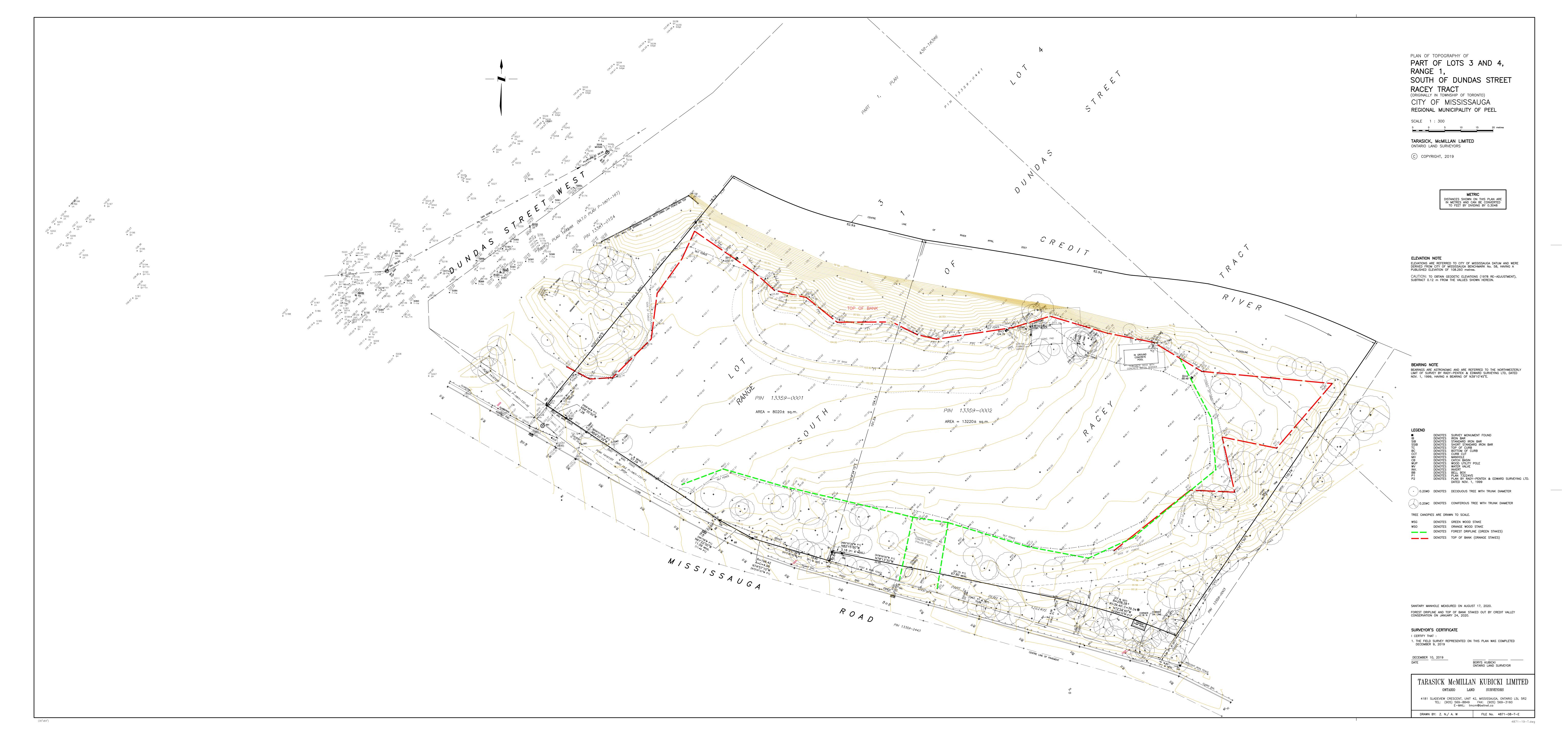
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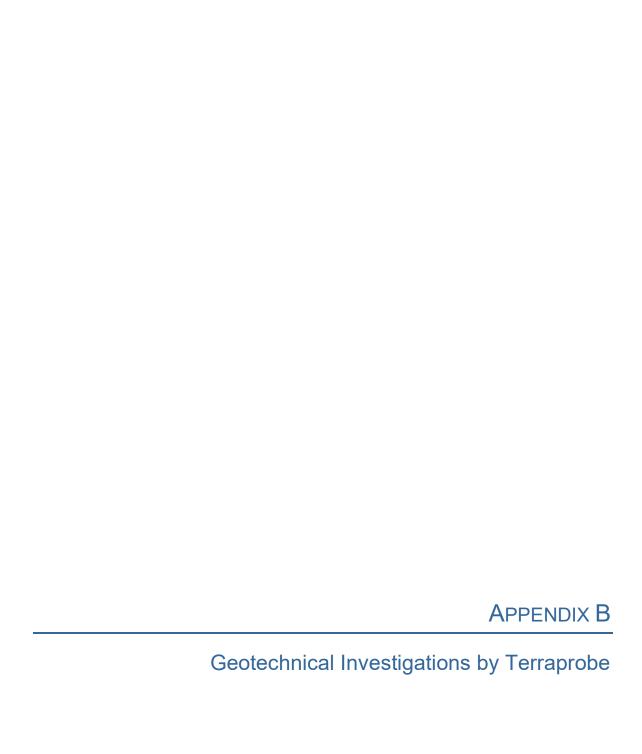
PARKING P1, P2/P3

2935 & 2955 Mississauga Road, Mississauga

April 7, 2020

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# GEOTECHNICAL INVESTIGATION SLOPE STABILITY AND STREAMBANK EROSION ANALYSIS 2935 & 2955 MISSISSAUGA ROAD MISSISSAUGA, ONTARIO

**Prepared for:** G. Merulla Inc.

c/o Beacon Planning Services 3464 Semenyk Court, Unit 213

Mississauga, Ontario

L5C 4P8

**Attention**: Mr. Dirk Blyleven

File No. 1-08-3220 September 4, 2008 © **Terraprobe Limited** 

### **Distribution**:

8 Copies - Beacon Planning Services 1 Copy - Terraprobe Limited, Brampton

### 1. INTRODUCTION

Terraprobe Limited was retained by G. Merulla Inc. c/o Beacon Planning Services to conduct a slope stability and streambank erosion study for a property located in the southeast quadrant of the intersection of Mississauga Road and Dundas Street West, in the City of Mississauga, Ontario.

The subject property is bounded by Mississauga Road on the west and Credit River on the east side. There is a drainage channel located on the north side of the property followed by Dundas Street West. The west and south portions of the property are densely vegetated and includes a drainage ditch located approximately along the west and south property boundary. It is understood that the study area consists of two adjoining land parcels (2935 - 2955 Mississauga Road). The subject site currently consists of a relatively flat tableland surrounded by vegetated/forested areas located along the north, south and west property boundaries, and the Credit River valley slope located along the east property boundary. The property is currently vacant, however, includes remnants of previous development (abandoned swimming pool, concrete pad and a portion of the concrete foundation of a former dwelling) located on the south parcel (2935 Mississauga Road).

This report includes the results of a detailed slope stability and streambank erosion study based on a site specific borehole investigation, which was conducted to assess the long-term stability and erosion risks of the valley slope located within the study area. The study provides geotechnical engineering recommendations with respect to the long-term stability of the site slope including applicable stability and erosion setbacks.

### 2. SITE AND PROJECT DESCRIPTION

The site is located at a short distance south of the intersection of Mississauga Road and Dundas Street West, in the City of Mississauga, Ontario. The property fronts on Mississauga Road and extends east to Credit River which is located at the toe of the valley slope along the east property boundary. The municipal address of the property is 2935 - 2955 Mississauga Road, Mississauga, Ontario. The legal description of the property is "Part of Lots 3 and 4, Range 1, South of Dundas Street Racey Tract, City of Mississauga, Regional Municipality of Peel". The general location of the property is shown on Figure 1. An aerial view of the site (2006 Aerial Photograph, Source City of Mississauga) is enclosed as Figure 2. For the purpose of site discussion, the orientation of Mississauga Road is assumed to be aligned in a north-south direction.

The subject property is roughly rectangular in shape and consists of two adjoining land parcels fronting on Mississauga Road. Portions of the property located along the west, north and south property boundaries currently consists of densely vegetated/forested areas. The property includes a relatively flat tableland surrounded by these vegetated/forested areas and the Credit River valley slope located along the east property boundary. The property is currently vacant except for the remnants of a previous development located on

the south parcel. The current site topography consists of a relatively flat to gently sloping ground except for the easterly portion of the property which consists of a relatively steep slope associated with Credit River watershed.

The prominent feature of the site, pertaining to the slope stability and erosion risks, consists of a relatively high and steep valley slope located within the easterly portion of the site adjoining Credit River. This slope distinctively extends from the north property boundary to almost to the two-third length of the property along Credit River. The northerly portion of this slope (close to Borehole 1 and Section 1) is about 6 m to 8 m in height. The slope becomes progressively higher as it extends further south, becoming as high as about 11m for the remaining portion of the slope (in the area of Boreholes 2 & 3 and Sections 2 & 3), except for the southerly portion (south of Section 3 to the existing swimming pool) where it decreases in height to about 6 m to 3 m close to the southerly edge of the swimming pool. The watercourse (Credit River) is located at the toe of the slope in this area. The proximity of the river to the slope has resulted in active toe erosion and over-steepening of the lower portion of the slope which consists of shale (Bedrock of Geogian Bay Formation). The slope located further south of the swimming pool, within the study area, gradually diminishes as the ground becomes relatively flat and the river gradually meanders away.

It is noted that the rear (west) portion of the high (middle) slope, behind the top of bank, extending from about Section 1 to approximately to the middle of Sections 2 and 3, has been disturbed and re-graded. The area to the rear (west) of the top of bank currently consists of a relatively narrow and level plateau (about 1 m to 3 m) wide, followed by a drop of about 2 m to 3 m. It appears that the ground behind the top of bank, in this area, has been lowered and re-graded.

There are densely vegetated/forested areas located along the north, west and south property boundaries. The topography of these areas generally varies from relatively flat to gently sloping. The majority of the vegetated area along the west property boundary (Mississauga Road) is generally flat to gently sloping and includes a relatively small ditch. The ditch continues along the south property boundary located within the southerly vegetated area. This area extends across the width of the property to Credit River. The topography of this southerly vegetated area is also relatively flat to gently sloping except for a couple of localized relatively steep areas (Sections 4 and 5). The northerly vegetated area also consists of gently sloping ground and includes dense vegetation.

The remainder of the property, surrounded by these vegetated areas and the relatively steep slope along Credit River on the east, currently includes a relatively flat and clear area which was cultivated and reportedly supports a barley crop.

### 3. FIELD PROCEDURE

The field investigation of the site was conducted on August 14, 2008, and consisted of drilling and sampling a total of four (4) exploratory boreholes extending to depths of about 7.4 m (Boreholes 2 and 4) to 9.2 m (Boreholes 1 and 3) below existing ground surface.

The borehole locations were established and finalized in the presence of the client and a representative of Beacon Planning Services. The boreholes were staked out in the field by Terraprobe Limited. Various public utility agencies were contacted to clear borehole locations of possible underground plants. The ground surface elevations at the borehole locations were measured by Tarasick McMillan Kubicki Limited, OLS, and are referenced to the geodetic datum. The approximate locations of the boreholes are presented on Figure 3.

The borings were made using a continuous flight power auger machine (track-mounted) equipped with conventional soil sampling and testing tools. The drilling was observed and recorded by a member of our field engineering staff on a full time basis, who also logged the boring and examined the samples. The results of the borehole are recorded in detail on the accompanying borehole logs.

Representative disturbed samples of the strata penetrated were obtained from the boreholes using a split-barrel sampler advanced by a 63.5 kg hammer dropping approximately 760 mm. The results of the Penetration Tests are reported as "N" values on the borehole logs at the corresponding sampling depths.

Samples obtained from the boreholes were inspected in the field immediately upon retrieval for type, texture, colour and odour. The samples obtained were then sealed in clean plastic containers and transferred to the Terraprobe laboratory where the samples were examined by a geotechnical engineer to verify the accuracy of the initial soil descriptions, and to select appropriate samples for laboratory testing. Laboratory testing consisted of water content determination on all samples, while a sieve and hydrometer analysis was carried out on selected samples (Borehole 1, Sample 4; Borehole 2, Sample 6; Borehole 3, Sample 3; Borehole 3, Sample 6; and Borehole 4, Sample 2). Atterberg Limits tests were also conducted on four selected samples (Borehole 1, Sample 4; Borehole 2, Sample 6; Borehole 3, Sample 6; and Borehole 4, Sample 2). The measured natural water content for individual samples are plotted on the corresponding borehole logs at respective sampling depths, and the results of the grain size analysis are appended.

Water levels were monitored in the open boreholes upon completion of drilling. Standpipe type piezometer consisting a PVC tubing were installed in Boreholes 1, 3 and 4 to facilitate shallow ground water monitoring. The PVC tubing was saw slotted near its base and fitted with a bentonite clay seal as shown on the

accompanying borehole logs. The results of ground water monitoring are summarized in a subsequent section of this report.

### 4. SUBSURFACE CONDITIONS

The results of the borehole are summarized below and recorded on the accompanying Borehole Logs. This summary is intended to correlate this data to assist in the interpretation of the subsurface conditions encountered at the site.

It should be noted that the soil conditions are confirmed at the borehole locations only and may vary between and beyond the borehole locations. The stratigraphic boundaries as shown on the logs and sections represent an inferred transition between the various strata, rather than a precise plane of geologic change.

In summary, the borehole encountered an overburden predominantly comprising undisturbed glacial till deposit underlain by shale bedrock of Georgian Bay Formation. A layer of topsoil was encountered in Borehole 4 at the ground surface.

### 4.1 Topsoil

A topsoil layer (about 200 m thick) was encountered at the ground surface in Borehole 4. The topsoil was dark brown to black in colour and predominantly consisted of a clayey silt matrix. A distinct layer of topsoil was not encountered at other borehole locations.

It must be noted that the topsoil thickness is confirmed at the borehole location only, and may vary beyond the borehole location. This information is not considered to be sufficient for estimating topsoil quantities and associated costs.

### 4.2 Earth Fill

A relatively thin layer of earth fill materials (about 0.8 m thick) was encountered at the ground surface in Borehole 3. The earth fill materials consisted of clayey silt with trace amounts of sand and gravel. The earth fill materials also included trace amounts of organic.

The Standard Penetration Test result ('N' Value) obtained from the earth fill layer was 10 blows per 300 mm of penetration, suggesting a stiff consistency. Measured moisture content of the earth fill sample was 13 percent by weight, indicating a moist condition.

### 4.3 Native Soils

Native glacial till deposit was encountered at the ground surface in Boreholes 1 and 2, and beneath the earth fill and topsoil layers at Boreholes 3 and 4 respectively. The native soils predominantly consisted of silt to clayey silt till deposit with embedded sand and gravel. This deposit was underlain by bedrock of Georgian Bay Formation which extended to the full depth of investigation at every borehole location. At Borehole 2, a silt and sand layer was penetrated at a depth of 3.0 m below grade, embedded within the silt/clayey silt till deposit. Similarly, a sand and silt to silty sand layer was encountered overlying the silt/clayey silt till deposit (underlying the surficial earth fill layer) at Borehole 3 extending to a depth of about 2.3 m below grade.

The Standard Penetration Test results ('N' Values) obtained from the silt/clayey silt till deposit generally varied from 21 blows to 78 blows per 300 mm of penetration and 50 blows per 50 mm to 150 mm of penetration, suggesting a very stiff to hard consistency (typically hard). Measured moisture contents of the samples of these soils typically ranged between 4 percent to 14 percent by weight, indicating a damp to moist condition.

The Standard Penetration Test results ('N' Values) obtained from the silt and sand to silty sand layers varied from 17 blows per 300 mm of penetration and 50 blows per 100 mm to 150 mm of penetration, suggesting a compact to very dense relative density (typically very dense). Measured moisture contents of these soil samples typically ranged between 6 percent to 13 percent by weight, indicating a moist to very moist condition.

### 4.4 Geotechnical Laboratory Test Results

The geotechnical laboratory testing consisted of water content determination on all samples, while a sieve and hydrometer analysis was carried out on selected native soil samples (Borehole 1, Sample 4; Borehole 2, Sample 6; Borehole 3, Sample 3; Borehole 3, Sample 6; and Borehole 4, Sample 2). Atterberg Limits test was also conducted on four selected native soil samples (Borehole 1, Sample 4; Borehole 2, Sample 6; Borehole 3, Sample 6; and Borehole 4, Sample 2). The measured natural water content for individual samples are plotted on the borehole logs at respective sampling depths, while the results of the sieve and hydrometer analysis as well as Atterberg Limits are appended and summarized below.

Borehole No.	Sample No.	Depth	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
1	4	2.3 m BG	19	17	45	19
2	6	4.5 m BG	6	26	49	19
3	3	1.5 m BG	13	45	35	7
3	6	4.5 m BG	10	8	63	19

Borehole No.	Sample No.	Depth	Gravel (%)	Sand (%)	Silt (%)	Clay (%)
4	2	0.8 m BG	8	11	54	27

BG = Below Grade

The results of the Atterberg Limits tests were plotted on A-Line Graph (refer to enclosed figures, Atterberg Limits Test Results). The following table presents a summary of Atterberg Limit tests:

Borehole No., Sample No.	Depth	Liquid Limit (WL)	Plastic Limit (WP)	Plasticity Index (IP)	Natural Water Content (WN)	Compressibility	Plasticity
BH 1, Sa 4	2.5 m BG	25.8	15.9	9.9	6	Slight or Low	Slightly Plastic
BH 2, Sa 6	4.6 m BG	22.4	14.7	7.7	8	Slight or Low	Slightly Plastic
BH 3, Sa 6	4.7 m BG	21.9	13.8	8.1	9	Slight or Low	Slightly Plastic
BH 4, Sa 2	1.0 m BG	34.2	20.7	13.4	10	Moderate or Intermediate	Slightly Plastic

The results of the Atterberg Limits Tests classify the soil samples analyzed as an inorganic clay of slight plasticity with a slight or low compressibility except for Borehole 4, Sample 2 which has a moderate or intermediate compressibility.

### 4.5 Bedrock

The glacial till overburden is underlain by bedrock of the Georgian Bay Formation. The interpreted elevations at which the inferred bedrock surface was identified, are tabulated below:

	BH 1	BH 2	ВН 3	BH 4
Inferred Bedrock Surface Elevation (m)	97.6	98.7	97.2	96.2

The bedrock of the Georgian Bay Formation is a deposit predominantly comprising thin to medium bedded grey shale of Ordivcian age. The shale contains interbeds of grey calcareous shale, limestone and calcareous sandstone which are discontinuous and nominally 50 to 300 mm thick. Experience from other previous investigations conducted in the general area indicated that there may be thicker limestone layers present in the formation.

There is typically a zone of weathering at the contact between the rock of the Georgian Bay Formation and the glacial soil overburden. In the Ontario Ministry of Transportation and Communications document RR229, *Evaluation of Shales for Construction Projects*, there is reproduced from Skempton, Davis and

Chandler, a *typical weathering profile of a low durability shale*, that characterizes the shale surface into three grades of weathering and four zones described as follows:

	Zone	Description	Notes
Fully Weathered	IVb	soil like matrix only	indistinguishable from glacial drift deposits, slightly clayey, may be fissured
Partially Weathered	IVa	soil like matrix with occasional pellets of shale less than 3 mm dia.	little or no trace of rock structure, although matrix may contain relic fissures
	III	soil like matrix with frequent angular shale particles up to 25 mm dia.	moisture content of matrix greater than the shale particles
	II	angular blocks of unweathered shale with virtually no matrix separated by weaker chemically weathered but intact shale	spheroidal chemical weathering of shale pieces emanating from relic joints and fissures, and bedding planes
Unweathered (Sound)	I	shale	regular fissuring

The surface of the rock having been scoured and involved by the base of glacial ice, Shale Zone III and IV are not present in an identifiable form. At the base of the Glacial Till deposit there is sometimes found a zone of silt and fragmented shale that can be interpreted as the lowest portion of the till or as partially weathered rock of Zone III. The distinction is subjective and depends on the investigator. The differences between the partially weathered classes of rock is not profound.

### 4.6 Ground Water

The depth of ground water seepage was measured in open boreholes upon completion of drilling. Water levels were also measured on August 28, 2008 in the standpipe piezometer installed in Boreholes 1, 3 and 4. The water level measurements in the open boreholes and standpipe piezometers are summarized below:

Borehole No.	Depth of Boring	Depth to Cave	Unstabilized Water Level Depth / Elevation at the time of drilling	Water Level Depth/ Elevation on August 28, 2008
1	9.2 m BG	open	dry	6.1 m / 96.0 m
2	7.4 m BG	open	dry	NP
3	9.2 m BG	open	dry	7.5 m / 97.3 m
4	7.4 m BG	open	dry	2.2 m / 96.3 m

BG = Below Grade NP = Piezometer not installed



It should be noted that the ground water levels indicated above may fluctuate seasonally depending on the amount of precipitation and surface runoff.

### 4.7 Visual Slope Inspection

A visual inspection was conducted of the subject slope area on August 28, 2008. General information pertinent to the existing slope features such as slope profile, slope drainage, watercourse features, vegetation cover, structures in the vicinity of the slope, erosion and slope slide features, was obtained during this inspection. A brief summary of the results of the visual inspection is presented below.

A topographic survey of the property was provided by Tarasick McMillan Kubicki Limited and is enclosed (Figure 3). A total of six (6) cross sections were derived from the topographic information provided to prepare slope models for the long-term slope stability analysis. The cross-sections were selected on the basis of the slope height and inclination to represent the critical slope conditions present within the study area. The sections included a portion of the tableland and extended across the slope down to the slope toe and watercourse if applicable. The locations of the selected slope cross-sections are presented on Figure 3, and the details of the slope profile are presented on Figures 4A and 4B.

The subject property includes a relatively flat tableland surrounded by densely vegetated/forested areas located along the west, east and south property boundaries, and the Credit River valley slope located along the east property boundary. The current site topography consists of a relatively flat to gently sloping ground except for the easterly portion of the property which consists of a relatively steep slope associated with Credit River.

The prominent valley feature present within the study area consists of a relatively high and steep valley slope located within the easterly portion of the site adjoining Credit River. This slope extends from the north property boundary to almost to the two-third length of the property along Credit River. The slope height increases as it extends south and then gradually decreases after the high point (ridge). The slope becomes relatively gentle and gradually diminishes as it extends further south of the highest slope area, and towards the south property boundary (refer to Figure 3). The overall slope height within the northerly portion (close to Borehole 1 and Section 1) is about 6 m to 8 m. As noted before, the slope becomes higher as it extends further south becoming as high as about 11 m (in the area of Boreholes 2 & 3 and Sections 2 & 3). The slope height gradually decreases as it extends further south of the highest slope area (southerly portion, south of Section 3 to the existing swimming pool) where it decreases in height to about 6 m to 3 m close to the southerly edge of the swimming pool. The slope further south of the swimming pool, within the study area, gradually diminishes as the ground becomes relatively flat.

The valley slope located along the east property boundary (Credit River) is among the steepest and highest within the study area. The lower portion of the slope comprises shale bedrock which underlies the overburden. The inclination of the lower shale portion of the slope is relatively steep and near vertical at locations. It generally varies from about 0.3 to 0.8 (horz.) to 1 (vert.) or locally steeper. The upper (overburden) potion of the slope is relatively less steep compared to the lower shale portion. The overall average inclinations of the overburden portion of the slope vary from about 1.1 (horz.) to 1 (vert.) at Section 3 to about 1.6 (horz.) to 1 (vert.) at Section 1. The overburden slope, close to Borehole 3, is also at locally near vertical inclination and appeared to be unstable. Please refer to enclosed sections (Figures 3, 4A and 4B) and photographs for details.

The slope surface (including the lower shale and upper overburden portion) is generally bare with only minor patchy vegetation consisting of grass, weed and bush growth (refer to photographs). There are a few trees located at the slope crest in the area of the near vertical ridge, close to Borehole 3. As noted before, shale bedrock is exposed at the lower portion of the slope surface. Credit River is located at the slope toe and there is no floodplain separating the watercourse and the slope toe in this area. The water flow against the slope, the existing river contact with the slope, and stream bank conditions suggests 'active toe erosion' condition. The intermittent relatively harder limestone layers are visible in the bank erosion areas and are protruding out, at locations, from the slope surface. In general, the slope in this area appears to be over-steepened and unstable.

The slope located further south of the swimming pool, within the study area, gradually diminishes as the ground becomes relatively flat. The river meanders away from the slope in this area. The slope becomes relatively gentle and its height decreases significantly as it extends further south towards the south property boundary. The slope and the adjoining area are densely vegetated with grass, weed, brush and tree growth. There were no obvious slope instability and significant erosion issues identified in this area; and the area, in general, appeared to be stable.

It is noted that the rear (west) portion of the high (middle) slope area, behind the top of bank, extending from about Section 1 to approximately to the middle of Sections 2 and 3, has been disturbed and re-graded. The area to the rear (west) of the top of bank currently consists of a relatively narrow and level plateau (about 1 m to 3 m) wide, followed by a drop of about 2 m to 3 m. It appears that the ground behind the top of bank in this area has been lowered and re-graded.

As noted before, there are densely vegetated/forested areas located along the north, west and south property boundaries. The topography of these areas generally varies from relatively flat to gently sloping. The majority of the vegetated area along the west property boundary (Mississauga Road) is generally flat to

gently sloping (with inclinations 3 to 5 horz. to 1 vert., or flatter) and includes a relatively small ditch. There are a few culverts located along Mississauga Road which drain into this ditch. The ditch continues along the south property boundary located within the southerly vegetated area. This area extends across the width of the property to Credit River. The topography of this southerly vegetated area is also relatively flat to gently sloping (typically 3 to 5 horz. to 1 vert., or flatter) except for a couple of localized relatively steep areas (Sections 4 and 5) with locally steeper inclinations approaching about 1.4 horz. to 1 vert. The overall elevation drop to the ditch level within the west and south vegetated areas vary from about 2 m to 4 m. These areas are densely vegetated with grass, weed, bush and a variety of young to mature trees. Only a few trees were noted to be leaning, while, the majority of the tree trunk growth was straight and upright (refer to enclosed photographs). The ditch was noted to be dry at the time of our site visit. These areas (except for the localized steep area at Sections 4 and 5) are relatively flat to gently sloping, and there were no obvious signs of any instability or erosion, and generally appeared to be stable. The area at Section 4 and 5 is locally relatively steep with inclination approaching about 1.4 horz. to 1 vert. However, the slope in this area is only about 3 m to 4 m high and there were no obvious signs of slope instability (i.e., tension cracks, slope slide, scarp, slump) and active erosion.

The northerly vegetated area (Section 6) also consists of gently sloping ground (typical inclination of a about 3 horz. to 1 vert.) with an overall drop of about 3 m to 4 m, and includes dense vegetation comprising grass, weed and tree growth. The tree trunk growth was noted to be generally straight and upright (refer to enclosed photographs). There were no obvious slope instability and erosion issues identified in this area; and the area, in general, appeared to be stable.

### 5. DISCUSSION AND RECOMMENDATIONS

The following discussion and recommendations are based on the factual data obtained from this investigation and are intended for use of the owner and the design engineer. Contractors bidding or providing services on this project should review the factual data and determine their own conclusions regarding construction methods and scheduling.

This report is provided on the basis of these terms of reference and on the assumption that the design features relevant to the geotechnical analyses will be in accordance with applicable codes, standards and guidelines of practice. If there are any changes to the site development features or any additional information relevant to the interpretations made of the subsurface information with respect to the geotechnical analyses or other recommendations, then Terraprobe should be retained to review the implications of these changes with respect to the contents of this report.

### 5.1 Slope Stability Analysis

A total of four boreholes were advanced along the east slope crest. The native soils (overburden) encountered in these boreholes predominantly consisted of hard/very dense native soils underlain by shale bedrock of Georgian Bay Formation.

A detailed engineering analysis of slope stability was carried out for selected slope cross-sections utilizing computer software (SLOPE/W, Geostudio 2004) and several standard methods of limit equilibrium analysis (Bishop's, Janbu, and Spencer). These methods of analysis allow the calculation of Factors of Safety for hypothetical or assumed failure surfaces through the slope. The analysis method is used to assess potential for movements of large masses of soil over a specific failure surface which is often curved or circular. The analysis involves dividing the sliding mass into thin slices and calculating the forces on each slice. The normal and shear forces acting on the sides and base of each slice are calculated. It is an iterative process that converges on to a solution.

For a specific failure surface, the Factor of Safety is defined as the ratio of the available soil strength resisting movement, divided by the gravitational forces tending to cause movement. The Factor of Safety of 1.0 represents a "limiting equilibrium" condition where the slope is at a point of pending failure since the soil resistance is equal to forces tending to cause movement. It is usual to require a Factor of Safety greater than one (1) to ensure stability of the slope. The typical Factor of Safety used for engineering design of slopes for stability, ranges from about 1.3 to 1.5 for developments situated close to the slope crest. The most common design guidelines are based on a 1.5 minimum Factor of Safety.

Credit Valley Conservation (CVC) Policy Guidelines require a 1.5 minimum F.S. for slope stability for land development and planning. The guidelines stipulate that the slopes be provided with stability and erosion setbacks determined on the basis of various parameters, including height of slope, proximity of the slope toe to the watercourse, type of soils comprising slope, groundwater conditions, slope geometry, condition of vegetation etc. The CVC Policy Guidelines provide a generalized stability setback criteria based on the slope height and type of soil(s) comprising slope. In addition, it also stipulates a provision of a detailed investigation consisting of site specific boreholes and a slope stability analysis to refine/determine the safe stability setback distance.

The analysis was carried out by preparing a model of the slope geometry and subsurface conditions, and analyzing numerous different failure surfaces through the slope in search of the minimum or critical Factor of Safety for specific slope conditions. The pertinent data obtained from topographic mapping, slope profiles, slope mapping and the borehole information, were input for the slope stability analysis. Many calculations were carried out to examine the Factor of Safety for varying depths of potential failure surfaces. Based on the borehole results, the following average soil properties were utilized for the soil strata in the slope stability analysis:

Stratum	Unit Weight (kN/cu.m)	Angle of internal friction	Cohesion (kPa)
Silt to Clayey Silt (typically hard)	21	30°	6
Silt and Sand/Silty Sand (typically very dense)	21.5	36°	0

The above soil strength parameters are based on effective stress analysis for long-term slope stability. It is noted that these soil properties are relatively conservative, and the site soils are actually stronger. The ground water levels as measured in the standpipe piezometer in Boreholes 1, 3 and 4 were incorporated in the analysis.

The analysis was conducted for existing slope conditions for Sections 1, 2 and 3. These sections were selected based on the critical slope conditions present within the study area. The results of the slope stability analysis are presented on the enclosed figures, and are summarized as follow:

Section	Minimum Factor of Safety for Potential Slope Slides	Type of Slope Slide
Section 1	1.32	Overall Overburden Slope Slide
Section 2	1.28	Overall Overburden Slope Slide
Section 3	0.99	Overall Overburden Slope Slide

For residential developments, the MNR Policy Guidelines allow a minimum Factor of Safety of 1.3 to 1.5 for slope stability, as follows:

TYPE	LAND-USES	DESIGN MINIMUM FACTOR OF SAFETY
А	PASSIVE: no buildings near slope; farm field, bush, forest, timberland, woods, wasteland, badlands, tundra	1.1
В	LIGHT: no habitable structures near slope; recreational parks, golf courses, buried small utilities, tile beds, barns, garages, swimming pools, sheds, satellite dishes, dog houses	1.20 to 1.30
С	ACTIVE: habitable or occupied structures near slopes; residential, commercial, and industrial buildings, retaining walls, storage/warehousing of non-hazardous substances	1.30 to 1.50
D	INFRASTRUCTURE and PUBLIC USE: public use structures and buildings (i.e. hospitals, schools, stadiums), cemeteries, bridges, high voltage power transmission lines, towers, storage/warehousing of hazardous materials, waste management areas	1.40 to 1.50

Credit Valley Conservation Policy Guidelines require a 1.5 minimum F.S. for slope stability for land development and planning. The computed minimum factors of safety for Section 1, 2 and 3 for existing slope and ground water conditions, were 1.32, 1.28 and 0.99, respectively. These factors of safety are lower than the minimum required factor of safety of 1.5, and suggest that the east slope (along Credit River), in its current condition, is not stable in the long-term. The factor of safety obtained for Section 3 was 0.99 which indicates that the slope at this location is at pending failure and is likely deriving its current marginal stability from the vegetation root reinforcement which has not been taken into consideration in the slope stability analysis.

Therefore, additional slope stability analysis was carried out to determine the stable slope inclination for the subject slope. In order to establish the stable slope inclination, the most critical section (Section 3) with the least factor of safety (F.S. = 0.99) was selected and a number of representative trial profiles of the overburden

slope with flatter inclinations but similar slope height and subsurface conditions as that of Section 3 were analyzed to obtain a minimum factor of safety of 1.5, in conformance to the policy guidelines.

As noted before, the borehole remained open and dry upon completion. Water levels in the standpipe piezometers (measured after about two weeks following the drilling) installed in Boreholes 1, 3 and 4 varied from about 2.2 m to 7.5 m below grade, located generally at or below the bedrock level. These water levels were incorporated in the slope stability analysis noted above. The site slope predominantly comprises glacial till overburden of relatively low permeability, underlain by shale bedrock. The formation of relatively high pore pressure in the overburden soil is not likely due to its composition and the slope configuration. However, conservatively, the potential effect of pore pressure on the long-term stability of the site slope was assessed to establish the long-term stable slope inclination, by incorporating an assumed elevated ground water level (within 1 to 2 m of the ground surface) to simulate short-term, temporary and infrequent elevated groundwater level condition due to the potential seasonal fluctuation in the groundwater table.

The results of the slope stability analysis conducted for a hypothetical slope profile with a flatter inclination of 1.8 horizontal to 1 vertical for the overburden soil with similar sub-surface conditions as that of Section 3, for both normal and elevated ground water conditions, are presented on the enclosed figures, and are summarized below:

0	Assumed Overburden Minimum Factor of Safety for Potential Slope Slides			Type of	
Section	Slope Inclination	Normal Ground Water (Normal Condition)	Elevated Ground Water (Temporary Condition)	Slope Slide	
Section 3	1.8 H : 1V	1.53	1.31	Overburden Slope Slide	

The above minimum computed factors of safety of 1.53 for the long-term (normal groundwater condition) and 1.31 for the short-term, temporary and infrequent condition (elevated groundwater level) are considered satisfactory and adequate. The remaining sections (Sections 1 and 2) were also re-analyzed with this flatter slope inclination of 1.8 to 1 (horizontal to vertical) to determine factors of safety against potential slope slides. The minimum factors of safety obtained for Sections 1 and 2 with a flatter inclination of 1.8 horizontal to 1 vertical for the overburden soil and with similar sub-surface conditions as that of the individual sections, were 1.67 and 1.71, which are considered to be satisfactory and adequate (refer to enclosed Slope Stability Analysis Figures).

Therefore, a slope inclination of 1.8 to 1 (horizontal to vertical) or flatter is required for the long-term stability of the overburden slope at this site. Based on the results of previous studies, and in conformance

to CVC Policy Guidelines, a long term stable slope inclination of 1.4 horz. to 1 vert. is recommended for the slope portion comprising shale bedrock. Figure 3 and Figures 5A and 5B present the estimated location of the Long-term Stable Slope Crest in plan and sections. These figures delineate the location of the Long-term Stable Slope Crest where it is located behind the Physical Top of Bank (inland, towards the tableland) including both east and south slopes. In other areas, existing slope is considered to be stable in the long-term. Figure 6 presents the stable slope crest model to determine the long-term stable slope crest location based on applicable setbacks.

### 5.2 Toe Erosion Allowance

In addition to a stability set-back, a toe erosion allowance/setback is also recommended in areas where the watercourse position is within 15 m of the slope toe. A guideline table (MNR) recommended for estimating the toe erosion allowance is presented as follow:

### **Guideline Table**

MINIMUM TOE EROSION ALLOWANCE - River within 15 m of Slope Toe *				
Type of Material	Evidence of Active Erosion** or	No evidence o	f Active Erosion**	or
	Bankfull Flow Velocity > Competent Flow Velocity***	Flow Velocity < Velocity***	< Competent Flo	ow
Native Soil Structure			Bankfull Width	
		< 5 m	5 - 30 m	> 30 m
1. Hard Rock (granite)	0 - 2 m	0 m	0 m	1 m
Soft Rock (shale, limestone)     Cobbles, Boulders	2 - 5 m	0 m	1 m	2 m
Stiff/Hard Cohesive Soil     (clays, clayey silt)     Coarse Granular (gravels)     Tills	5 - 8 m	1 m	2 m	4 m
4. Soft/Firm Cohesive Soil Fine Granular (sand, silt) Fill	8 - 15 m	1 - 2 m	5 m	7 m

- \* If a valley floor is > 15m width, still may require study or inclusion of a toe erosion allowance.
- Active Erosion is defined as: bank material is bare and exposed directly to stream flow under normal or flood flow conditions and, where undercutting, over steepening, slumping of a bank or high down stream sediment loading is occurring. An area may be exposed to river flow but may not display "active erosion" (i.e. is not bare or undercut) either as a result of well rooted vegetation or as a result of shifting of the channel or because flows are relatively low velocity. The toe erosion allowances presented in the right half of Table 2 are suggested for sites with this condition.
- \*\*\* Competent Flow velocity; the flow velocity that the bed material in the stream can support without resulting in erosion or scour.Consideration must also be given to potential future meandering of the watercourse channel.

Source: Ontario Ministry of Natural Resources (2002), "Technical Guide River & Stream Systems: Erosion Hazard Limit, pp38

The MNR Guidelines "Geotechnical Principles for Stable Slopes" recommend an erosion setback where the watercourse is located within 15 m of the slope toe. The Guideline Table recommends different ranges of erosion setbacks based on the material comprising the slope toe, degree of erosion and watercourse characteristics.

The watercourse (Credit River) is located at the toe of the east slope, and there is no floodplain separating the slope toe and the watercourse. The proximity of the watercourse to the slope is resulting in active toe erosion at this location. The borehole data suggests that the subject slope predominantly comprises

competent glacial till overburden underlain by bedrock of Georgian Bay Formation, and the slope toe in this area consists of shale bedrock. The MNR Guideline Table recommends a toe erosion allowance of 2 m to 5 m for these conditions.

However, the toe erosion setback for the subject site must be determined in accordance with the Credit Valley Conservation Authority document *Watercourse and Valleyland Protection Policies 1992*, which requires a 5 m toe erosion allowance in this case.

The relatively steep slope portion located within the southerly forested area (Sections 4 and 5) is located within 15 m of a ditch. This ditch was noted to be dry at the time of our inspection, and is understood to have only intermittent flow, generally originating from the discharge emanating from the existing culverts located along Mississauga Road. There was obvious evidence of active toe erosion at this location. According to the CVC Policy Guidelines, a toe erosion setback of 4 m was applied (based on cohesive clayey silt till soil composition comprising the slope toe, and a non-active erosion condition) at this location, to determine the location of the Long-Term Stable Slope Crest, in addition to the applicable stability setback.

The Long-term Stable Slope Crest location was calculated based on the applicable erosion and stability setbacks (stable slope inclination) in accordance with the CVC guidelines, as shown on the enclosed Long-Term Stable Slope Crest Model (Figure 6). As noted before, Figure 3 and Figures 5A and 5B present the estimated location of the Long-term Stable Slope Crest in plan and sections. These figures delineate the location of the Long-term Stable Slope Crest where it is located behind the Physical Top of Bank (inland, towards the tableland), including both east and south slopes. In other areas, existing slope is considered to be stable in the long-term. For planning purposes the long-term refers to a 100 year planning horizon.

### 5.3 Development Setback/Erosion Access Allowance

It should be noted that MNR and various Conservation Authority Policy Guidelines require that developments, dwellings, buildings, swimming pools or other structures should be further setback from the estimated long-term stable slope crest position. The development setback requirement varies for different authorities, and is also based on the development specifics. Typically, the CVC Guidelines stipulate a 5 m development setback.

### 6. SUMMARY

The borehole data indicates that the undisturbed native soils (overburden) comprising the subject slope consist of competent (typically hard/very dense) glacial till deposit. The glacial till overburden is underlain by shale bedrock which extended to the full depth of investigation.

Based on the results of the slope stability analysis, an inclination of 1.8 to 1 (horizontal to vertical) or flatter is required for the long-term stability of the overburden portion of the slope. A long term stable slope inclination of 1.4 horz. to 1 vert. is recommended for the underlying shale bedrock.

The watercourse (Credit River) is located at the toe of the east slope and the exposed bank conditions suggest 'active toe erosion' in this area. The lower portion of the slope (slope toe) in this area consists of shale bedrock, therefore a toe erosion allowance/setback of 5 m is recommended in conformance to CVC policy guidelines. A toe erosion allowance of 4 m is recommended at the localized steep slope portion situated within the southerly forested area (Section 4 and 5), located in a relative proximity of a ditch with intermittent flow.

Figure 3 and Figures 5A and 5B present the estimated location of the Long-term Stable Slope Crest in plan and sections. These figures delineate the location of the Long-term Stable Slope Crest where it is located behind the Physical Top of Bank (inland, towards the tableland), including both east and south slopes. In other areas, existing slope is considered to be stable in the long-term.

The following general constraints relating to the slope and erosion risks are recommended:

- a) the site activities should be conducted in a manner which do not result in surface erosion of the slope. In particular, site grading and drainage should not be altered to result in a direct concentrated or channelized surface runoff from flowing directly over the slope, but a minor sheet flow may be acceptable,
- b) the extent of the existing bare slope areas should be reduced by planting vegetation (where possible) using native non-invasive species. The vegetation growth will help reduce the surface erosion, particularly at the east slope, and
- c) the configuration of the Credit River slope as well as other slopes located within the north, south and west vegetated/forested areas should not be altered without prior consultation with a geotechnical engineer and approval from concerned authorities. In particular, the slope

should not be steepened and fill materials should not be placed on the slope or within 5 m of the slope crest.

It is recommended that any changes to site grading should only be carried out if approved by concerned authorities and a geotechnical engineer.

We trust the foregoing information is sufficient for your present requirements. If you have any questions, or if we can be of further assistance, please do not hesitate to contact us.

Yours truly,

### Terraprobe Limited

B. Singh, M.A.Sc., P. Eng. Associate

Michael Tanos, P. Eng. Principal

### **TABLE OF CONTENTS**

1.	INTR	RODUCTION
2.	SITE	AND PROJECT DESCRIPTION
3.	FIEL	D PROCEDURE
4.	SUB	SURFACE CONDITIONS
	4.1	Topsoil
	4.2	Earth Fill
	4.3	Native Soils 5
	4.4	Geotechnical Laboratory Test Results
	4.5	Bedrock
	4.6	Ground Water
	4.7	Visual Slope Inspection
5.	DISC	CUSSION AND RECOMMENDATIONS
	5.1	Slope Stability Analysis
	5.2	Toe Erosion Allowance
	5.3	Development Setback/Erosion Access Allowance
6.	SUM	MARY 18

### **APPENDIX**

Abbreviations, Terminology and General Information

Borehole Logs

Sieve and Hydrometer Analysis

**Atterberg Limits Test Results** 

Figure 1 - Site Location Plan

Figure 2 - Aerial Photograph (2006)

Figure 3 - Topographic Plan

Figures 4A & 4B - Existing Cross-Sections

Figures 5A & 5B - Long-term Stable Slope Crest

Figure 6 - Long-term Stable Slope Crest Model

Slope Stability Analysis Results

PHOTOGRAPHS



### Terraprobe

Consulting Geotechnical & Environmental Engineering
Construction Materials Inspection & Testing

September 22, 2015

File No. 1-15-0441
Brampton Office

590816 Ontario limited c/o G. Merulla Inc. 2616 Cynara Road Mississauga, Ontario L5B 2R7

Attention:

Mr. Frank Merulla

RF:

**TEST PIT INVESTIGATION** 

PERCOLATION RATE (T-TIME) ANALYSIS

PROPOSED SEPTIC BED

2935 & 2955 MISSISSAUGA ROAD

**MISSISSAUGA** 

Dear Mr. Merulla:

Terraprobe Inc. was retained by 590816 Ontario Limited c/o G. Merulla to conduct a test pit investigation at the above noted site located in the southeast quadrant of the intersection of Mississauga Road and Dundas Street West, in the City of Mississauga, Ontario (Figure 1). The municipal addresses of the properties are 2935 and 2955 Mississauga Road, Mississauga. The objective of the investigation was to obtain subsurface soil samples from the test pit locations to determine Soil Percolation Rate ('T-Time') for the future septic beds (one septic bed for each property).

Terraprobe previously completed a geotechnical investigation and slope stability and stream bank erosion analysis for the property which consisted of advancing a total of four (4) boreholes extending to depths varying from about 7.5 to 9.0 m below existing grade. The results of this investigation were presented in our Geotechnical Investigation Report (File No. 1-08-3220, dated September 4, 2008).

The test pit investigation was conducted on July 22 and 27, 2015 comprising a total of four (4) test pits (Test Pits 1 to 4), excavated to depths varying from 2.3 to 2.9 m below existing grade.

Test Pits 1 and 2 were excavated in the general area of the proposed septic bed footprint at 2935 Mississauga Road, while Test Pits 3 and 4 were excavated within the proposed septic bed area at 2955 Mississauga Road. The test pit locations were finalized and established by Terraprobe in consultation with the client. The locations of test pits are provided on Figure 2.

Test pits were excavated using a rubber tire backhoe by an excavation contractor retained by the client. The field investigation was conducted under the full time supervision of a member of our field engineering staff who logged the test pits and examined the soil samples as obtained. All test pits remained open and dry upon completion of the excavation. Soil samples were obtained from the test pits and sealed in clean plastic bags and transported to our geotechnical laboratory for Sieve and Hydrometer (grain size) analysis. A Sieve and Hydrometer analysis was carried on four (4) selected soil samples (Test Pit 1, Sample 3; Test Pit 2, Sample 4, Test Pit 3, Sample 3 and Test Pit 4, Sample 4) to estimate percolation rates (T-Time') for each soil sample. Based on the soil gradation curve, percolation rates were estimated. The results of the analysis and percolation rates (T-Time') are appended and summarized below:

	S	ample	Soil Descrip	Estimated		
Test Pit No.	No.	Depth below Grade	MIT	Unified Soil Classification System	classification ("T-time")	Estimated Permeability
1	3	1.2 m	SILT AND SAND, some clay, trace gravel	ML (Inorganic silt and very fine sand)	30 min/cm	10 <sup>-7</sup> cm/sec or less
2	4	1.7 m	SANDY SILT, some clay, some gravel	ML (Inorganic silt and very fine sand)	35 min/cm	10 <sup>-7</sup> cm/sec or less
3	3	1.7 m	SANDY SILT, some clay, some gravel	ML (Inorganic silt and very fine sand)	35 min/cm	10 <sup>-7</sup> cm/sec or less
4	4	2.3 m	SILTY SAND, gravelly, some clay	SM (silty sand, sand silt mixtures)	20 min/cm	10 <sup>-5</sup> cm/sec

Based on the soil gradation curves test results for the samples analyzed, the soil composition varied from sandy silt to silt and sand to silty sand with trace gravel to gravelly and some clay. Under the Unified Soil Classification System, three (3) soil samples (Test Pit 1, Sample 3; Test Pit 2, Sample 4 and Test Pit 3, Sample 3) are classified as ML (inorganic silt and very fine sand with slight plasticity), and one (1) sample (Test Pit 4, Sample 4) as SM (silty sand, sand silt mixtures). The Supplementary Standards to the Ontario

Building Code 2006 document *Percolation Time and Soil Descriptions (SB-6)* assigns percolation rates of 20-50 min/cm for ML soils and 8-20 min/cm for SM soils. Based on the percentage of fines and the range of relative density of the materials, percolation rates of 30 min/cm (Test Pit 1, Sample 3); 35min/cm (Test Pit 2, Sample 4 and Test Pit 3, Sample 3) and 20 min/cm (Test Pit 4, Sample 4) are considered appropriate.

It should be noted that the percolation rates as noted above are estimated values based on the composition of the soil samples tested. It should be noted that the soil conditions may vary between and beyond the test pits locations. Terraprobe Inc. does not present the estimated percolation rate given in this report as a warranty of performance for the soils tested. The client or any third party using this information as a basis for the septic field design assumes all risk associated with their evaluation of this report and all other pertinent criteria used in the design of such structure.

Terraprobe Inc. assumes no responsibility for the application of the above-noted percolation rates ("T"-Time) for use in the intended septic field design. The design of the septic bed must be conducted by a qualified professional with due regard to site-specific conditions and other design considerations. Further, Terraprobe Inc. does not present the estimated percolation rates and soil permeability values given in this report as a warranty of performance for the soils tested.

We trust that the foregoing is sufficient for your present requirements. If you have any questions or if we can be of further assistance, please do not hesitate to contact us.

Yours truly

Terraprobe Inc.

Abdus Sobahan, M. Eng., P. Eng. Geotechnical Engineer

nical Engineer

B. Singh, M.A.Sc., P. Eng. Principal

encl.: Abbreviations, Terminology and General Information

"T-Time" Analysis Test Reports

Figure 1 - Site Location Plan

Figure 2 - Test Pit Location Plan

## **ENCLOSURES**

TERRAPROBE INC.





### **Terraprobe**

### ABBREVIATIONS AND TERMINOLOGY

### SAMPLING METHODS

#### AS auger sample CORE cored sample DP direct push FV field vane GS grab sample SS split spoon ST shelby tube WS wash sample

### PENETRATION RESISTANCE

Standard Penetration Test (SPT) resistance ('N' values) is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a standard 50 mm (2 in.) diameter split spoon sampler for a distance of 0.3 m (12 in.).

**Dynamic Cone Test (DCT)** resistance is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a conical steel point of 50 mm (2 in.) diameter and with 60° sides on 'A' size drill rods for a distance of 0.3 m (12 in.)."

COHESIONLE	SS SOILS	COHESIVE S	OILS	,	COMPOSITION		
Compactness	pactness 'N' value		'N' value	Undrained Shear Strength (kPa)	Term (e.g)	% by weight	
very loose loose compact dense very dense	< 4 4 - 10 10 - 30 30 - 50 > 50	very soft soft firm stiff very stiff hard	< 2 2 - 4 4 - 8 8 - 15 15 - 30 > 30	< 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	trace silt some silt silty sand and silt	< 10 10 – 20 20 – 35 > 35	

### **TESTS AND SYMBOLS**

МН	mechanical sieve and hydrometer analysis	Ā	Unstabilized water level	
w, w <sub>c</sub>	water content	$oxed{\Psi}$	1 <sup>st</sup> water level measurement	
$w_L$ , $LL$	liquid limit	. <u>Ā</u>	2 <sup>nd</sup> water level measurement	
w <sub>P</sub> , PL	plastic limit	$\blacksquare$	Most recent water level measurement	
$I_P$ , $PI$	plasticity index	-		
k	coefficient of permeability	3.0+	Undrained shear strength from field vane (with sensitivity)	
Υ	soil unit weight, bulk	Cc	compression index	
Gs	specific gravity	C <sub>v</sub>	coefficient of consolidation	
φ'	internal friction angle	m <sub>v</sub>	coefficient of compressibility	
c'	effective cohesion	е	void ratio	
Cu	undrained shear strength			

### FIELD MOISTURE DESCRIPTIONS

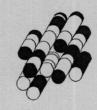
Damp refers to a soil sample that does not exhibit any observable pore water from field/hand inspection.

Moist refers to a soil sample that exhibits evidence of existing pore water (e.g. sample feels cool, cohesive soil is at plastic limit) but does not have visible pore water

minity but abes not have visible pore water

Wet refers to a soil sample that has visible pore water

TERRAPROBE INC.





PROJECT: Estimation of Soil Percolation Rate LOCATION: 2935 Mississauga Rd., Mississauga , ON

CLIENT: 580816 Ontario Inc

TEST PIT NUMBER: TP1
SAMPLE NUMBER: 3
SAMPLE DEPTH: 1.2 m

MIT DESCRIPTION: SILT AND SAND, some clay, trace gravel

USC SYMBOL: ML

FILE NO.: 1-15-0441-01 LAB NO.: 1152C

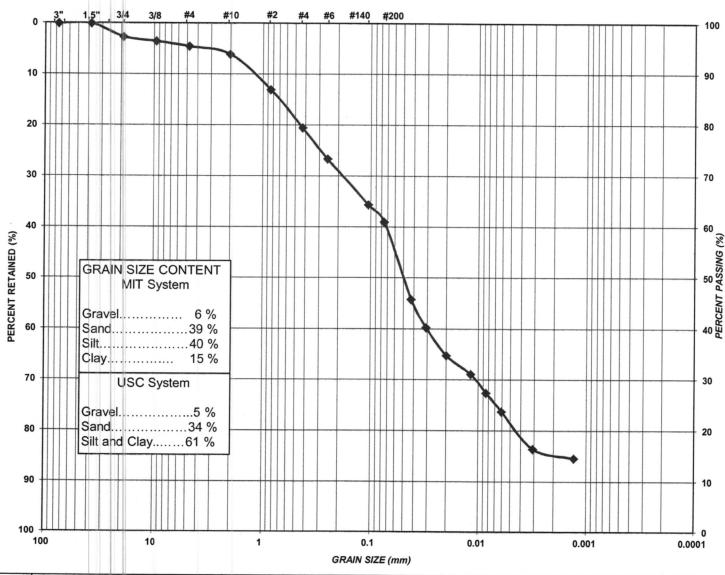
SAMPLE DATE: July 22 & 27, 2015

SAMPLED BY: S.M.

\* To be read in conjunction with cover letter only \*
Estimated rate of Percolation = 30 min/cm

### **GRAIN SIZE DISTRIBUTION**

### U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL				COARSE	SAND	FINE	SILT	CLAY
UNIFIED	COARSE		FINE	COARSE	MEDIUM	F	FINE		
SYSTEM	GRAVEL				SAND			SILT AND	CLAY



PROJECT: Estimation of Soil Percolation Rate LOCATION: 2935 Mississauga Rd., Mississauga , ON

CLIENT: 590946 Ontario Inc

CLIENT: 580816 Ontario Inc

TEST PIT NUMBER: TP2
SAMPLE NUMBER: 4
SAMPLE DEPTH: 1.70m

MIT DESCRIPTION: SANDY SILT, some clay, some gravel

USC SYMBOL: ML

FILE NO.: **1-15-0441-01** LAB NO.: **1152D** 

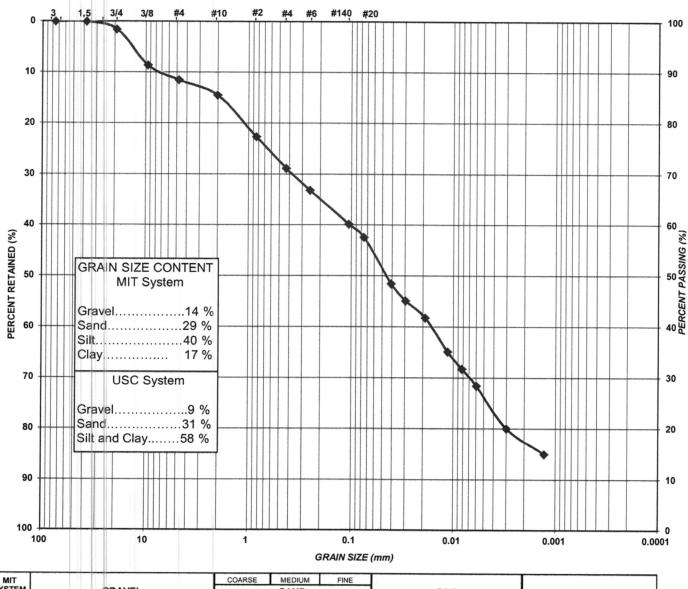
SAMPLE DATE: July 22 & 27, 2015

SAMPLED BY: S.M.

\* To be read in conjunction with cover letter only \*
Estimated rate of Percolation = 35 min/cm

#### **GRAIN SIZE DISTRIBUTION**

#### U.S. STANDARD SIEVE SIZES





PROJECT: Estimation of Soil Percolation Rate LOCATION: 2955 Mississauga Rd., Mississauga , ON

CLIENT: 580816 Ontario Inc

TEST PIT NUMBER: TP3
SAMPLE NUMBER: 3
SAMPLE DEPTH: 1.7m

MIT DESCRIPTION: SANDY SILT, some clay, some gravel

USC SYMBOL: ML

FILE NO.: **1-15-0441-01** LAB NO.: **1152A** 

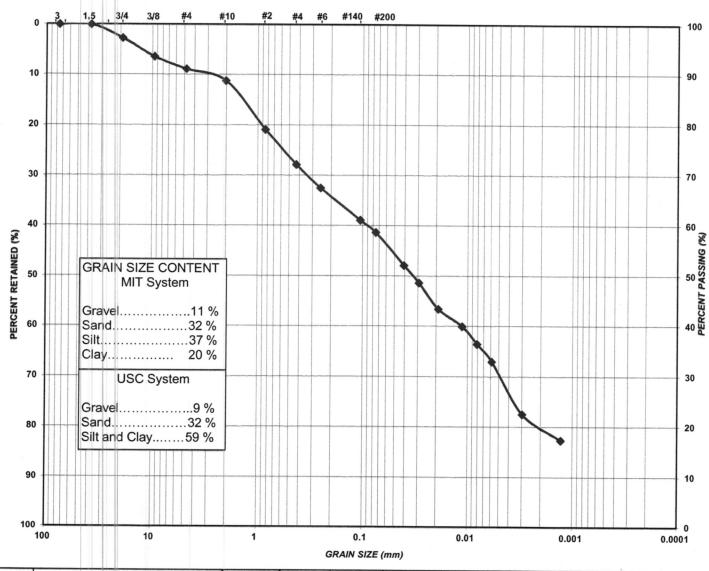
SAMPLE DATE: July 27, 2015

SAMPLED BY: S.M.

\* To be read in conjunction with cover letter only \*
Estimated rate of Percolation = 35 min/cm

### **GRAIN SIZE DISTRIBUTION**

### U.S. STANDARD SIEVE SIZES



MIT SYSTEM	GRAVEL			COARSE	SAND	FINE	SILT	CLAY	
UNIFIED	COARSE	FINE	COARSE	MEDIUM	F	INE			
SYSTEM GRAVEL				SAN	ND		SILT AND CLAY		



PROJECT: Estimation of Soil Percolation Rate

LOCATION: 2955 Mississauga Rd., Mississauga, ON

CLIENT: 580816 Ontario Inc

TEST PIT NUMBER: TP4 SAMPLE NUMBER: 4 SAMPLE DEPTH: 2.30m

MIT DESCRIPTION: SILTY SAND, gravelly, some clay

USC SYMBOL: SM

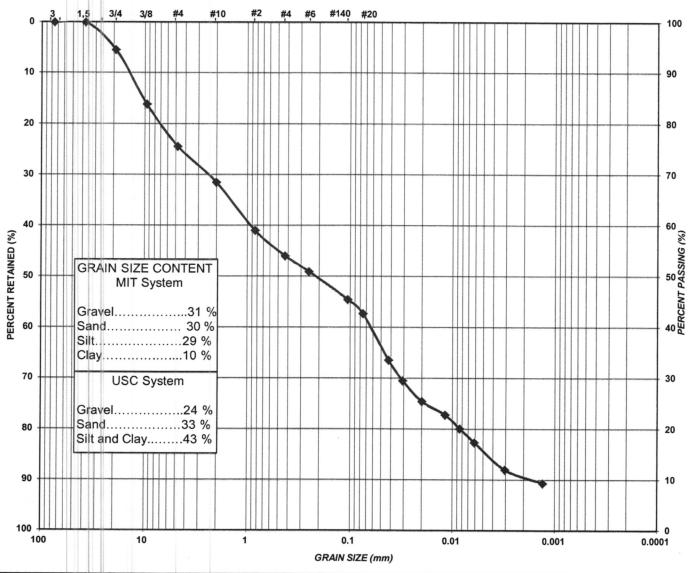
FILE NO.: 1-15-0441-01 LAB NO.: 1152B SAMPLE DATE: July 27, 2015

SAMPLED BY: S.M.

\* To be read in conjunction with cover letter only \* Estimated rate of Percolation = 20 min/cm

### **GRAIN SIZE DISTRIBUTION**

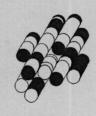
#### U.S. STANDARD SIEVE SIZES

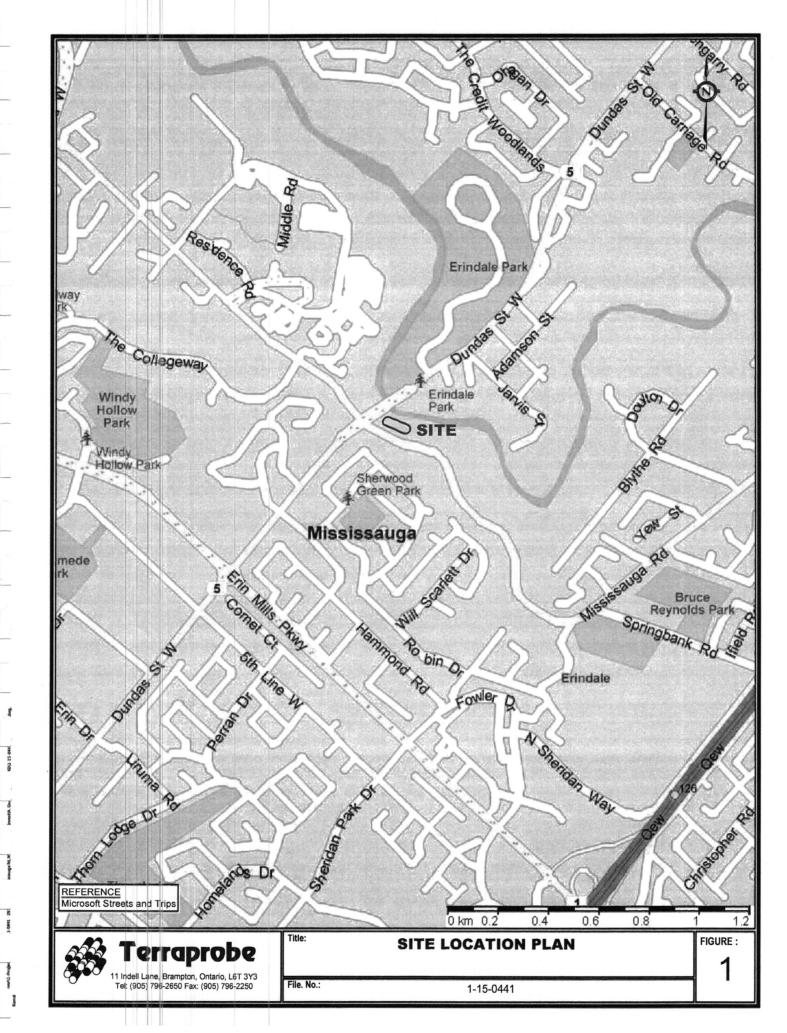


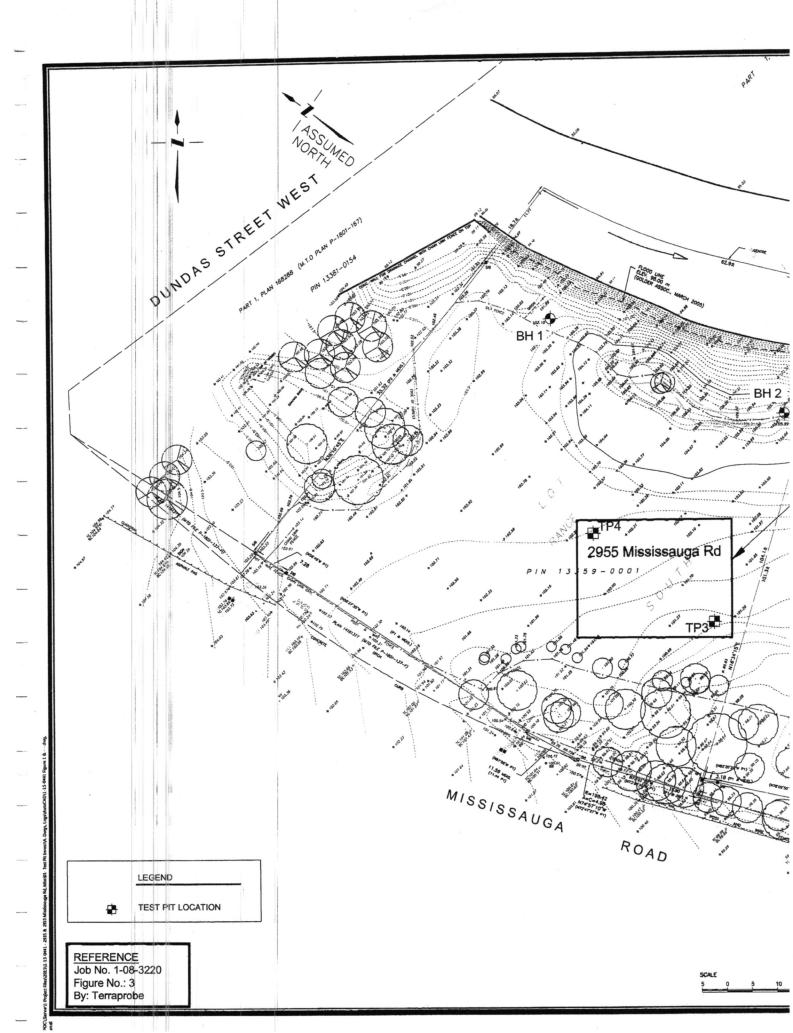
MIT SYSTEM	GRAVEL		COARSE	MEDIUM	FINE	SILT	CLAY			
UNIFIED	COARSE	Ħ	FINE	COARSE	MEDIUM		FINE			
SYSTEM		3RA1	VEL		SA	ND		SILT CLAY  SILT AND CLAY		

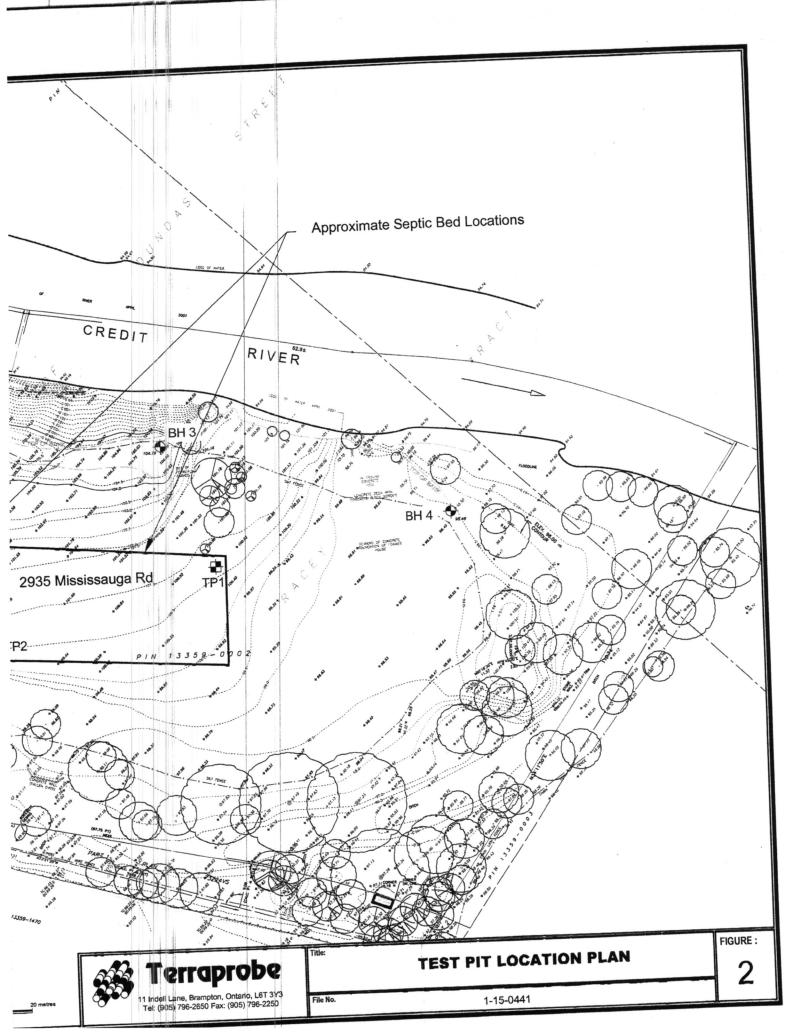
# **FIGURES**

TERRAPROBE INC.











March 30, 2010 File No. 1-08-3220 Brampton Office

G. Merulla Inc. c/o Beacon Planning Services 3464 Semenyk Court, Unit 213 Mississauga, Ontario L5C 4P8

Attention: Mr. Dirk Blyleven

**RE: ADDENDUM-**

GEOTECHNICAL INVESTIGATION 2935 & 2955 MISSISSAUGA ROAD MISSISSAUGA, ONTARIO

Dear Mr. Blyleven:

This addendum letter summarizes the additional work/investigation carried out for the above noted property subsequent to the completion of our original Slope Stability and Streambank Erosion study in 2008.

#### **BACKGROUND**

Terraprobe Limited was retained by G. Merulla Inc. c/o Beacon Planning Services in 2008 to conduct a detailed slope stability and streambank erosion study for the subject property located in the southeast quadrant of the intersection of Mississauga Road and Dundas Street West, in the City of Mississauga, Ontario (Figure 1). The property consists of two adjoining land parcels (2935 - 2955 Mississauga Road). The property is currently vacant, however, includes remnants of previous development (abandoned swimming pool, concrete pad and a portion of the concrete foundation of a former dwelling) located on the south parcel (2935 Mississauga Road).

stoneycreek@terraprobe.ca

The field investigation for the original study (2008) was conducted on August 14, 2008, and consisted of drilling and sampling a total of four (4) exploratory boreholes extending to depths varying from about 7.4 m (Boreholes 2 and 4) to 9.2 m (Boreholes 1 and 3) below existing ground surface. A detailed slope stability and streambank erosion analysis was carried out utilizing site specific subsurface information obtained from these borehole and topographic survey information prepared by an Ontario Land Surveyor (Tarasick MacMillan Kubicki Limited, File No. 4871-08-T).

The location of the long-term stable slope crest was determinated and delineated based on the applicable stability and toe erosion setbacks in accordance with Credit Valley Conservation Policy Guidelines. The results of the investigation were presented in our report (Geotechnical Investigation, Slope Stability and Streambank Erosion Analysis, 2935 & 2955 Mississauga Road, Mississauga, Ontario, dated September 4, 2008). Figure 3 and Figures 5A and 5B of this report presented the location of the Long-term Stable Slope Crest in plan and sections. These figures delineated the location of the Long-term Stable Slope Crest where it was located beyond/behind the Physical Top of Bank (inland, towards the tableland), including for both east and south slopes. In other areas (including slope along north property boundary), it was concluded that the existing slope (Section 6, slope inclination 3 horz. to 1 vert.) is stable in the long-term, and the physical Top of Bank location in this area is considered to be the long-term stable slope crest location.

Subsequently, additional survey was carried out for the property by Tarasick MacMillan Kubicki (November 17, 2009) and the Topography Plan was updated. The updated plan included the Regional Flood Line (Elev. 98.0 m) staked at the south/southwest portion of the property (in areas where there is no significant and well defined slope present), as well as the surveyed Top of Bank for the sloping ground located at the north property boundary.

Terraprobe was contacted to conduct additional work/investigation for the property which included advancing additional shallow boreholes staked out by Tarasick MacMillan Kubicki along the surveyed 98.0m Elevation line located on the east/north side of the drainage ditch situated primarily within the southwest portion of the property, and a visual inspection of the site.

#### FIELD PROCEDURE

The number and locations of the boreholes were finalized by the client, as noted on Figure 3A. The boreholes were advanced to depths varying from about 1.2 to 2.1 m depth below grade. This supplementary subsurface soil investigation was conducted on March 17, 2010. The borehole ground surface elevations were provided by the surveyor. It should be noted that the borehole surface elevations are for the purpose of relating borehole soil stratigraphy and should not be used or relied on for other purposes.

The test holes were advanced by a specialist subcontractor with continuous soil sampling using a portable manual equipment. The in-situ penetration resistance testing was conducted manually by advancing a 51 mm diameter O. D. split spoon sampler with a 31.8 kg hammer, dropping a height of 762 mm. It should be noted that the weight of hammer utilized for advancing the split spoon sampler was half the weight of the normal drop hammer used in the Standard Penetration Test (ASTM D 1586) to measure the "N" values (blows/305mm of sampling spoon penetration), and therefore, the field "N" values were corrected accordingly.

Representative soil samples from the test holes were collected using the split spoon sampler during the performance of in-situ penetration tests. The field work (drilling, sampling, testing) was observed and recorded by a member of our engineering staff, who also transported the samples to our geotechnical testing laboratory.

The soil samples were visually examined, sealed into plastic jars, and transported to our laboratory where the samples were re-examined (tactile) in detail, and classified according to visual and index properties. Laboratory testing consisted of water content determination on all samples; and sieve and hydrometer analysis on selected soil samples (Borehole 1603, Sample 2; Borehole 1605, Sample 2; Borehole 1607, Sample 2; Borehole 1608, Sample 2; and Borehole 1611, Sample 1). Atterberg Limits tests were also conducted on selected soil samples (Borehole 1603, Sample 2; Borehole 1605, Sample 2; Borehole 1607, Sample 2; and Borehole 1611, Sample 1). The measured natural water content of the individual samples are plotted on the enclosed borehole logs at respective sampling depths, and the results of the sieve and hydrometer analysis as well as Atterberg Limits tests are appended.

Ground water levels were monitored in open boreholes upon completion of drilling and are recorded on the borehole logs.

#### SUBSURFACE CONDITIONS

The results of the individual boreholes are summarized below and recorded on the accompanying Borehole Logs. This summary is intended to correlate this data to assist in the interpretation of the subsurface conditions. Please refer to enclosed borehole logs for borehole and stratigraphic details.

It should be noted that the soil conditions are confirmed at the borehole locations only and may vary between and beyond the boreholes. The stratigraphic boundaries as shown on the logs represent an inferred transition between various strata, rather than a precise plane of geologic change.

#### **Topsoil**

A topsoil layer, varying in thickness from about 150 mm (Borehole 1608) to 200 mm (Borehole 1604) was encountered at the ground surface in Boreholes 1603, 1604, 1605, 1606, 1607 and 1608. A distinct topsoil layer was not encountered at the ground surface at the remaining boreholes (Boreholes 1609, 1610, 1611 and 1612) except for a presence of minor surficial organics/rootlets. However, presence of topsoil/organics (about 300 mm thick zone) was noted in these boreholes (Boreholes 1609, 1610, 1611 and 1612) at a depth of about 1 m below ground surface. The topsoil was dark brown to black in colour and predominantly consisted of a silt matrix. It must be noted that the topsoil thickness is estimated from the boreholes, and may vary between and beyond the boreholes.

#### **Earth Fill**

A layer of earth fill materials (about 1.0 m thick) was encountered at the ground surface in Boreholes 1609, 1610, 1611 and 1612. The earth fill materials predominantly consisted of clayey to sandy silt, silty sand, with trace to some gravel, and trace amounts of organics as well as rock/shale fragments. As noted above, the earth fill materials at these boreholes were underlain by topsoil/organic (about 300 mm thick) zone.

The Standard Penetration Test result ('N' Value) obtained from the earth fill generally varied from 3 to 11 blows per 300 mm of penetration, indicating typically a very loose to loose relative density (cohesionless soils) and firm consistency (cohesive soils). Measured moisture content of the earth fill samples varied from 12 to 21 percent by weight, indicating a typically moist condition.

#### **Native Soils**

Native soils were encountered beneath the surficial topsoil layer in Boreholes 1603, 1604, 1605, 1606, 1607 and 1608, and beneath the earth fill and embedded topsoil/organic layer at Boreholes 1609, 1610, 1611 and 1612. The native soils predominantly consisted of clayey to sandy silt, to sand and silt to silty sand till, with trace to some gravel to gravelly, and included sporadic presence of shale fragments in some boreholes. Weathered shale was encountered in Boreholes 1603, 1604, 1607 and 1612 beneath the native soil deposit at depths varying from about 1.2 to 2.0 m below grade.

The Standard Penetration Test results ('N' Values) obtained from the native soils generally varied from 5 to 16 blows per 300 mm of penetration, indicating a loose to compact relative density (cohesive soils) and firm to very stiff consistency (cohesive soils). Measured moisture contents of the native soil samples typically varied from 13 to 24 percent by weight, indicating a moist to very moist/locally wet condition.

#### **Ground Water**

Observations pertaining to the depth of water level and borehole caving were made in the open boreholes immediately after completion of drilling, and are noted on the enclosed borehole logs. A summary of these measurements is provided below.

Borehole No.	Test Hole Depth	Depth to Cave	Unstabilized Water Level Depth
1603	1.3 m BG	0.6 m BG	0.5 m BG
1604	1.2 m BG	1.1 m BG	0.9 m BG
1605	1.2 m BG	minor caving	1.0 m BG
1606	1.2 m BG	open	1.0 m BG
1607	1.8 m BG	1.2 m BG	1.1 m BG
1608	1.2 m BG	open	dry
1609	1.8 m BG	open	dry
1610	1.8 m BG	open	dry
1611	1.8 m BG	open	dry
1612	2.1 m BG	1.5 m BG	dry

BG = Below Grade

It should be noted that the ground water levels indicated above may fluctuate seasonally depending on the amount of precipitation and surface runoff.

#### SITE INSPECTION AND REVIEW

The site was visited on March 25, 2010 to conduct a visual inspection to assess general physical site conditions. Our original site investigation and study was carried out in 2008, therefore, the visual site inspection was carried out to establish if there has been any significant changes (regrading) of the site areas which may have an implication of our previous findings and recommendations.

As noted before, an updated topographic plan was provided (prepared by Tarasick MacMillan Kubicki) which included location of the Regional Flood Line (Elev. 98.0 m) staked at the south/southwest portion of the property (in areas where there is no significant and well defined slope present), as well as the surveyed Top of Bank for the sloping ground located at the north property boundary.

A review of the updated plan and site inspection indicated that there has been no significant changes to the general physical condition of the site particularly with respect to site grades. There was no conspicuous indication of any further cut/fill of the site or significant grade alterations which may have implications on our previous (2008) findings and recommendations.

Similar to the conditions noted during our previous site investigation in 2008, the majority of the grade alteration ('relatively recent' cut and fill) was limited to the area located approximately within the northerly two-third portion of the site and was contained within the silt fenced area. The southerly one-third portion of the site (located approximately to the south of the northerly line of the remnant of the in-ground concrete pool and circumferenced by the silt fence) does not appear to have experienced any 'recent' grade alterations (cut/fill), which is also evident from the presence of patchy surficial vegetation in this area which is not present in the northerly two-third ('recent cut/fill') portion of the site (Photos A, B and C).

As previously indicated, the updated plan includes the location of the Regional Flood Line (Elev. 98.0 m) staked at the south/southwest portion of the property (in areas where there is no significant and well defined slope present). Our slope and erosion study (2008) delineated the location of the Long-term Stable Slope Crest (LTSSC) where it was located beyond/behind the Physical Top of Bank (inland, towards the tableland), including for both east and south slopes as noted in Figure 3 of our original report. There is currently, a generally wooded area, located to the south and between the southerly end of our LTSSC line (close to Borehole 4) established for the east slope (along Credit River) and the easterly extremity of the LTSSC line drawn for the southerly ridge (Sections 5 and 6), which does not include a well defined slope. Although there is no well defined slope located in this area and the ground inclination is relatively very gentle (about 4 to 6 horz. to 1 vert., or flatter), we recommend that the LTSSC line for this area be established by joining the previously established southerly end of the LTSSC line for the easterly slope, and the easterly extremity of the LTSSC line drawn for the southerly ridge area. Although, a very conservative approach, the LTSSC line obtained in this manner, for this areas, will ensure that it is located well above the Regional Flood Line elevation as well as it is located outside of any slope/valley feature(s) which may be present in this area. The location of the Long-Term Stable Slope Crest for all site slopes is presented on Figure 3A.

We trust the foregoing information is sufficient for your present requirements. If you have any questions, or if we can be of further assistance, please do not hesitate to contact us.

Yours truly,

## Terraprobe Limited

B. Singh, M.A Associate

Michael Tanos, P. Eng.

Principal

encl. Abore vations, Terminology and General Information

Borehole Logs

Sieve and Hydrometer Analysis Atterberg Limits Test Results

Figure 1

Site Location Plan

Figure 2

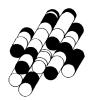
Aerial Photograph (2006)

Figure 3A

Topographic Plan (Revised March 2010)

**PHOTOGRAPHS** 

# **ENCLOSURES**



TERRAPROBE INC.



## ABBREVIATIONS, TERMINOLOGY, GENERAL INFORMATION

#### **BOREHOLE LOGS**

SAMP	LING METHOD	PENETRATION RESISTANCE
SS ST AS WS RC	split spoon Shelby tube auger sample wash sample rock core	<b>Standard Penetration Test</b> (SPT) resistance ('N' values) is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a standard 50 mm (2 in.) diameter split spoon sampler for a distance of 0.3 m (12 in.).
WH PH	weight of hammer pressure, hydraulic	<b>Dynamic Cone Test</b> (DCT) resistance is defined as the number of blows by a hammer weighing 63.6 kg (140 lb.) falling freely for a distance of 0.76 m (30 in.) required to advance a conical steel point of 50 mm (2 in.) diameter and with 60° sides on 'A' size drill rods for a distance of 0.3 m (12 in.).

SOIL DESCRIPTION - COHE	SIONLESS SOILS	SOIL DESCRI	PTION - COHESIVE	SOILS
Relative Density very loose	'N' value	Consistency	Undrained Shear Strength, kPa	'N' value
loose compact dense very dense	4 - 10 10 - 30 30 - 50 > 50	very soft soft firm stiff very stiff hard	< 12 12 - 25 25 - 50 50 - 100 100 - 200 > 200	< 2 2 - 4 4 - 8 8 - 15 15 - 30 > 30
SOIL COMPOSITION		TESTS, SYMB	OLS	
'trace' (e.g. trace silt) 'some' (e.g. some gravel) adjective (e.g. sandy) 'and' (e.g. sand and gravel)	% by weight < 10 10 - 20 20 - 35 35 - 50	$\begin{array}{ccc} w,w_c & \text{water } \alpha \\ w_l & \text{liquid } l \\ w_p & \text{plastic} \\ l_p & \text{plastic} \\ k & \text{coeffic} \\ \gamma & \text{soil un} \\ \varphi' & \text{angle } \alpha \\ c' & \text{cohesi} \end{array}$		meter analysis

#### **GENERAL INFORMATION, LIMITATIONS**

The conclusions and recommendations provided in this report are based on the factual information obtained from the boreholes and/or test pits. Subsurface conditions between the test holes may vary.

The engineering interpretation and report recommendations are given only for the specific project detailed within, and only for the original client. Any third party decision, reliance, or use of this report is the sole and exclusive responsibility of such third party. The number and siting of boreholes and/or test pits may not be sufficient to determine all factors required for different purposes.

It is recommended Terraprobe be retained to review the project final design and to provide construction inspection and testing.

# BOREHOLE LOGS



## **LOG OF BOREHOLE 1603**

PROJECT: 2935 & 2955 Mississauga Roa	DATE:	March	17, 2010		
LOCATION: Mississauga, Ontario	EQUIPM	MENT: Manua	I SPT		
CLIENT: Mr. Merulla	ELEVA	TION DATUM:	Geodetic	FILE:	1-08-322

	SOIL PROFILE			SAMP	LES	Щ	PENE RESIS	TRATIO	N PLOT	_			NAT	UDAL		0 ~	STANDOIGE
ELEV DEPTH	DESCRIPTION  Ground Surface	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEA O U	20 4 AR STI NCONF OCKET	IO 6 RENGT INED	0 8 H kPa + ×	30 1 FIELD LAB V	₩ <sub>P</sub> WA1	TER CO	w OMTEN	LIQUID LIMIT V. T (%)	G ORGANIC 3 VAPOUR	STANDPIPE INSTALLATION OR REMARKS
0.0		7. 7. V		<del> </del>		98		-	H						Ĩ		
97,9 0.2			1	ss	3		\							۰			Ā
	SAND AND SILT TO SILTY SAND gravelly, some clay (slightly plastic), trace shale fragments, compact/stiff, greyish brown, very moist to wet (TILL)		2	ss	15	97		GR.SA 24.32.					٥ŀ				
96.9											_						1
1.2 96.8 1.3	(Georgian Bay Formation)		3	SS	50/5cm								0				
												1	Í				100
																-	
																***************************************	- programma
							;										
NOT	ES:	<u> </u>	i					L:		;	L	 		L			

Borehole was caving at 0.6m (Elev. 97.5m) and unstabilized water level at 0.5m (Elev. 97.6m) upon completion of drilling.



CLIENT: Mr. Merulla

## **LOG OF BOREHOLE 1604**

FILE: 1-08-3220

ELEVATION DATUM: Geodetic

PROJECT: _	2935 & 2955 Mississauga Road	DATE:	March 17, 2010
OCATION:	Mississauga, Ontario	EQUIPMENT:	Manual SPT

Γ	SOIL PROFILE	,		SAMP	l E¢	111	PENE	TRATIC	N				I					1-00-0220
	OOR FINITE	Τ.	$\vdash$		l .	ELEVATION SCALE	l .					00	PLAST LIMBT	IC MAT MOIS CON	URAL STURE	LIQUID UMIT	ORGANIC	STANDPIPE INSTALLATION
		P.O.	Ä	<u> </u>	.UES	N S		20 4 AR STE				00	wp	CON	W W	w <sub>L</sub>	APC	OR
ELEV DEPTH	DESCRIPTION	STRAT PLOT	NUMBER	TYPE	"N" VALUES	VATE	οu	NCONF	INED	+	FIELD		;		o			REMARKS
00.4	Ground Surface	STF.	Z		<u> </u>	ELE		OCKET			LAB V	ANE 00			ONTEN 20 3	T (%) 10	(ppm)	
0.0		7115.7	1	-		98				Î	Ĩ	Ĭ		Ě		Ĕ		,
97.9		17.31																
0.2	trace organic/rootlets in upper ± 0.2m		1	ss	3		Ι.				ĺ							
	soft													۰	1			
			<u> </u>												1			
	CLAYEY TO SANDY SILT		1															
	gravelly, trace shale fragments, stiff, greyish brown, very moist to wet		_		٠,													互
	(TILL)		2	SS	12							İ		٥				포
96.9						97		<b></b>										
1.2		- <del>  \</del>				<u> </u>					<del> </del>	†	<b> </b>		<del> </del>	$\vdash$		
96.9 1.2																		
	End of Borehole									1								
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NOT			Щ.			L					Щ.	<u>.                                    </u>						

NOTES:

Borehole was caving at 1.1m (Elev. 97.0m) and unstabilized water level at 0.9m (Elev. 97.2m) upon completion of drilling.

## **LOG OF BOREHOLE 1605**

 PROJECT:
 2935 & 2955 Mississauga Road
 DATE:
 March 17, 2010

 LOCATION:
 Mississauga, Ontario
 EQUIPMENT:
 Manual SPT

CLIENT: Mr. Merulla ELEVATION DATUM: Geodetic FILE: 1-08-3220

SOIL PROPRIE  SOIL PROPRIE  SOIL PROPRIE  DESCRIPTION  SOIL PROPRIE  SOIL PROPRIE  DESCRIPTION  SOIL PROPRIE  SOIL PRO		SOIL PROFILE			SAMP	LES	Щ	PENE	TRATIC	ON E PLOT					NAT	I IRAI		υ~	STANDPIPE
180mm TOPSOIL 98  1 soft CLAYEY TO SANDY SILT some gravel, firm, brown, very moist to wet  96.9  (TILL)			1		TYPE	"N" VALUES	ELEVATION SCA	SHEA O U	AR STI	RENGT INED PEN.	0 6 H kPa + ×	BO 11 FIELD LAB V	VANE ANE	w <sub>₽</sub> ⊢ WAT	TER CO	ONTEN	₩ <sub>L</sub> T (%)	Ì	INSTALLATION OR
0.2 trace organic/rootlets in upper ± 0.2m  soft  CLAYEY TO SANDY SILT some gravel, firm, brown, very moist to wet  2 SS 5  GF, SA.SI.CL 18.30.34.18	0.0		74.7				98												
CLAYEY TO SANDY SILT some gravel, firm, brown, very moist to wet 2 SS 5 GR.SA.SI.CL 18 30.34.18 O 1—1  96.9 (TILL)		soft			ss	2									0	***************************************			
96.9 (TILL)		CLAYEY TO SANDY SILT some gravel,		2	ss	5		18					:		0 }				又
1.2 End of Borehole	96.9	(TILL)	K/K				97							<u> </u>					
	_	End of Borehole																	

NOTES:

Borehole was caving at 1.2m (Elev. 96.9m) and unstabilized water level at 1.0m (Elev. 97.1m) upon completion of drilling.



## **LOG OF BOREHOLE 1606**

PROJECT: 2935 & 2955 Mississauga Road DATE: \_\_ March 17, 2010 LOCATION: Mississauga, Ontario EQUIPMENT: Manual SPT

CLIENT: Mr. Merulla ELEVATION DATUM: Geodetic \_ FILE: <u>1-08-3220</u>

SOIL PROPILE		SOIL PROFILE SAMPLES				LES	ij	PENE	TRATIC	N E PLOT	>				NAT	URA		U n	STANDPIPE
90.0   180mm TOPSOIL   1   SS   3   Soft   CLAYEY TO SANDY SILT   trace to some gravel, firm, brown, very moist to wet   2   SS   5   (TILL)   96.9   97			STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCA	SHEA O U	AR STE NCONF	O 6 RENGT INED PEN.	0 8 TH kPa + ×	30 1 I FIELD LAB V	VANE ANE	₩ <sub>P</sub> WA1	ŒR CO	W ONTEN	—" T (%)		INSTALLATION OR
2 trace organic/rootlets in upper ± 0.2m  soft CLAYEY TO SANDY SILT trace to some gravel, firm, brown, very moist to wet  2 SS 5  (TILL)	0.0	180mm TOPSOII	717.7				98					ļ			<u> </u>				1711111
trace to some gravel, firm, brown, very moist to wet  2 SS 5  (TILL)		trace organic/rootlets in upper ± 0.2m		1	SS	3										0			
96.9		trace to some gravel, firm, brown, very moist to wet		2	SS	5	07									o			Ā
1.2 End of Borehole		3	MM				97												
NOTES:																			

Borehole was open and unstabilized water level at 1.0m (Elev. 97.1m) upon completion of drilling.

## **LOG OF BOREHOLE 1607**

PROJECT: 2935 & 2955 Mississauga Road DATE: \_ March 17, 2010 LOCATION: Mississauga, Ontario EQUIPMENT: Manual SPT

<b>-</b> -	CLIENT: Mr. Merulla							ELEV	ATIO	_	TUM:			ic			FILE:	1-08-3220
	SOIL PROFILE			SAMP	LES	SCALE	PENE RESIS	TRATIO	ON E PLOT	2	-		PLAST	IC NAT	URAL	LIQUID	일 또	STANDPIPE
ELEV DEPTH 98.0		STRAT PLOT	NUMBER	ТҮРЕ	"N" VALUES	ELEVATION	SHEA O U	AR STI NCONE OCKET	RENG INED PEN.	TH kP + ×	a FIELD LAB V	_	W <sub>P</sub> WA¹		W O ONTEN	LIMIT W L	G ORGANIC 3 VAPOUR	INSTALLATION OR REMARKS
0.0 97.9	180mm TOPSOIL	17 34				98					-							
0.2	trace organic/rootlets in upper ± 0.2m soft		1	ss	3													
	SAND AND SILT TO SILTY SAND some clay, trace to some gravel (slightly plastic), loose/firm, brown, very moist to wet		2	SS	6	97		53.31,	1					<b>d</b> -				立
	(TILL) Clayey Silt with shale fragments, very stiff, moist		3	SS	16		\		1 m 1 m 2 m	District.				c				
96.3	∖WEATHERED SHALE Γ							_			<del>                                     </del>		<u> </u>	0				····
96.2 1.8	(Georgian Bay Formation)  End of Borehole																	
			The state of the s								Tr specialists							

NOTES:

Borehole was caving at 1.2m (Elev. 96.8m) and unstabilized water level at 1.1m (Elev. 96.9m) upon completion of drilling.

## **LOG OF BOREHOLE 1608**

PROJECT: 2935 & 2955 Mississauga Road DATE: March 17, 2010

LOCATION: Mississauga, Ontario EQUIPMENT: Manual SPT

CLIENT: Mr. Merulla ELEVATION DATUM: Geodetic FILE: 1-08-322

	CLIENT: Mr. Merulla					TAPILUS .	_ [	ELEV	ATIO		ΓUM:		eodet	ic	****		FILE:	1-08-3220
4	SOIL PROFILE			SAMP	LES	J.E	PENE	TRATIC	N PLOT	_			DI ACT	, NAT	URAL	LIGUED	۷ د	STANDPIPE
ELEV DEPTH 97.9	DESCRIPTION  Ground Surface	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEA O UI	R STE	RENGT INED PEN.	ξΟ ε TH kPa + ×	FIELD LAB V		W <sub>P</sub> WA <sup>-</sup>	TER CO	ONTEN	LIQUID LIMIT *L T (%)	G ORGANIC S VAPOUR	INSTALLATION OR REMARKS
97.8	150mm TORSOIL	7, ×. 7														· · · · ·		1711-
0.2	*****		1	ss	6									٥				
96.7	(slightly plastic), trace shale fragments, loose/firm, brown, moist (TILL)		2	ss	6	97		.SA.SI .51.25.	I			17.00		•				
1.2		2/////										<u> </u>						
T THE THE THE THE THE THE THE THE THE TH	End of Borehole		To the transfer of the transfe															

NOTES:
Borehole was open and dry upon completion of drilling.



CLIENT: Mr. Merulla

## **LOG OF BOREHOLE 1609**

\_\_ FILE: <u>1-08-3220</u>

ELEVATION DATUM: Geodetic

PROJECT: _	2935 & 2955 Mississauga Road	DATE:	March 17, 2010
LOCATION:	Mississauga, Ontario	EQUIPMENT:	Manual SPT

	\$OIL PROFILE			SAMP	LES	J.	PENE	TRATIC	N PLOT	_				NAT	URAL		0 ~	STANDPIPE
ELEV DEPTH	DESCRIPTION  Ground Surface	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEA O UI	R STE NCONF	0 6 RENGT INED	0 8 H kPa + ×	FIELD LAB V	VANE	WP WAT	TER CO	W O ONTEN	LIQUID LIMIT VL T(%)	G ORGANIC S VAPOUR	INSTALLATION OR REMARKS
0.0	Surficial organic/rootlets presence FILL - Sandy Silt, some gravel, trace clay, with rock/shale fragments, topsoil/organic inclusions, loose, brown/grey, moist		1	SS	4	98								0				
97.1	TOPSOIL		2	SS	4	97								0	<b></b>			
96.8 1.3 96.3	CLAYEY TO SANDY SILT trace to some gravel, firm, brown, moist to very moist		3	ss	5										0			
1.8	End of Borehole																	
NO	TES:		I			L	L			L	1	ł	L		<u></u>	Щ		

NOTES:

Borehole was open and dry upon completion of drilling.

Sheet 1 of 1



## **LOG OF BOREHOLE 1610**

PROJECT: _	2935 & 2955 Mississauga Road	DATE:	March 1	17, 2010		
LOCATION:	Mississauga, Ontario	EQUIPMENT:	Manual	SPT		
CLIENT:	Mr. Merulla	ELEVATION DA	TUM:	Geodetic	FILE:	1-08-3220

	SOIL PROFILE			SAMP	LES	щ	PENE	TRATIC	N PLOT									
ELEV DEPTH 98.0	DESCRIPTION	STRAT PLOT	NUMBER	түрЕ	"N" VALUES	ELEVATION SCALE	SHEA O UI	R STE NCONF	0 6 RENGT INED PEN.	0 8 H kPa + ×	80 10	VANE ANE	w <sub>P</sub> ⊢ WAT	ER CC	NTEN	LIQUID LIMIT V.L T (%)	G ORGANIC 3 VAPOUR	STANDPIPE INSTALLATION OR REMARKS
0.0	Surficial organic/rootlets presence FILL - Clayey Silt, some sand to sandy, some gravel, with rock/shale fragments, topsoil/organic inclusions, firm, brown, moist		1	ss	6	98							erit.	o				
97.1 0.9 96.8 1.2	TOPSOIL decayed wood/rootlet inclusions, dark brown to black		2	SS	4	97									0			
96.2 1.8	trace to some gravel, firm, brown, moist to very moist (TILL)		3	SS	5										0			
	TES:																	

Borehole was open and dry upon completion of drilling.

Sheet 1 of 1

## **LOG OF BOREHOLE 1611**

PROJECT: _	2935 & 2955 Mississauga Road	DATE:	March 17, 2010
LOCATION:	Mississauga, Ontario	EQUIPMENT:	Manual SPT

	CLIENT: Mr. Meruila											G	eodet	ic			FILE:	1-08-3220
	SOIL PROFILE	<u> </u>		SAMP	Γ	CALE	RESIS	TRATIO	E PLOT			00	PLAST LIMIT	TIC NAT	URAL STURE	LIQUID LIMIT	INIC	STANDPIPE INSTALLATION
ELEV DEPTH 98.1	DESCRIPTION  Ground Surface	STRAT PLOT	NUMBER	TYPE	"N" VALUES	ELEVATION SCALE	SHEA O U	AR STI NCONF OCKET	RENG INED PEN.	TH kPa + ×	FIELD LAB V	VANE ANE 00	W <sub>P</sub>	TER CO		₩L	G ORGANIC 3 VAPOUR	OR REMARKS
0.0	Surficial organic/rootlets presence FILL - Sandy Silt to Silty Sand, some gravel to gravelly, some clay, trace rock/shale fragments, topsoil/organic inclusions, loose, brown/grey, moist		1	ss	4	98	GF	3.SA.SI				Service Control of the	0 1	1	Proposition and the second			
97.1 1.0 96.8	decayed wood/rootlet inclusions,		2	ss	7	97			- Appropriate Action						0			
96.3	CLAYEY TO SANDY SILT trace to some gravel, firm, brown, moist (TILL)		3	ss	7									0				
1.8	End of Borehole																	

Borehole was open and dry upon completion of drilling.



## **LOG OF BOREHOLE 1612**

 PROJECT:
 2935 & 2955 Mississauga Road
 DATE:
 March 17, 2010

 LOCATION:
 Mississauga, Ontario
 EQUIPMENT:
 Manual SPT

CLIENT: Mr. Merulla ELEVATION DATUM: Geodetic FiLE: 1-08-3220

PLASTIC MOISTURE LIQUID  STORY	SOIL PROFILE			SAMP	LES	щ	PENE	TRATIC	N		····							
Surficial organic foctories presence FILL - Clayey to Sandy Silt, some gravel, with rock/shale fragments, topsoil/organic inclusions, obstruction at 0.8m, very loose, brown, moist  compact  2 SS 11  96.9  1.1 TOPSOIL decayed wood/rootlet inclusions, dark brown to black  1.4 CLAYEY TO SANDY SILT trace to some gravel, stiff, brown, moist to very moist  (TILL)  4 SS 12 96  0 O	98.0	DESCRIPTION E	SINAI PLOI				ELEVATION SCAL	SHEA O UI	R STF NCONF	0 6 RENGT INED PEN.	0 8 H kPa + ×	FIELD V	VANE NE	W <sub>P</sub> WAT	ER CC	NTEN	₩ <sub>L</sub> Γ(%)	STANDPIPE INSTALLATION OR REMARKS
compact  2 SS 11  96.9  1.1 TOPSOIL decayed wood/rootlet inclusions, 96.5 dark brown to black  1.4 CLAYEY TO SANDY SILT trace to some gravel, stiff, brown, moist to very moist  (TILL)  4 SS 12 96  2 SS 11  97  4 SS 12  96  0 0	0.0	FILL - Clayey to Sandy Silt, some gravel, with rock/shale fragments, topsoil/organic inclusions, obstruction		1	ss	3									0			
decayed wood/rootlet inclusions, dark brown to black  1.4 CLAYEY TO SANDY SILT trace to some gravel, stiff, brown, moist to very moist  (TILL)  2.1 WEATHERED SHALE (Georgian Bay Formation)		 compact		2	SS	11	97				······································					<b>&gt;</b>		
99.9 WEATHERED SHALE 96.9 (Georgian Bay Formation)	96.5	decayed wood/rootlet inclusions, dark brown to black  CLAYEY TO SANDY SILT trace to some gravel,	; ; ; ; ; ;	3	SS	8									0	0		
95.9 (Georgian Bay Formation)				4	SS	12	96	_\										
NOTES:	95.9	(Georgian Bay Formation)  End of Borehole																

Borehole was caving at 1.5m (Elev. 96.5m) and dry upon completion of drilling.

# SIEVE AND HYDROMETER ANALYSIS





PROJECT: 2935 & 2955 Mississauga Road

LOCATION: Mississauga, Ontario

CLIENT: Mr. Merulla

BOREHOLE NUMBER: 1603 SAMPLE NUMBER: 2

SAMPLE DEPTH: 0.6 - 1.2 m

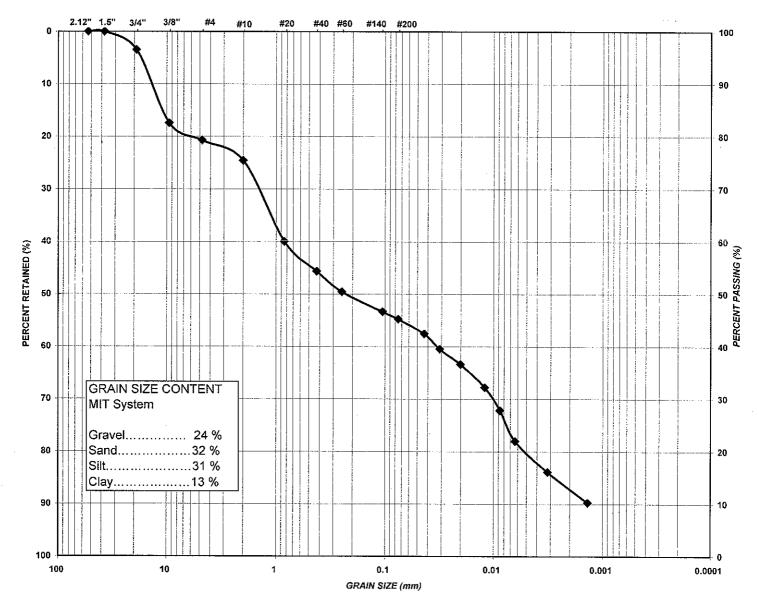
SAMPLE DESCRIPTION: SAND AND SILT, gravelly, some clay (TILL)

FILE NO.: **1-08-3220** LAB NO.: **1049A** 

SAMPLE DATE: March 17, 2010

SAMPLED BY: AW / JS

#### **GRAIN SIZE DISTRIBUTION**



MIT SYSTEM		GRAVEL			SAND	FINE	SILT	CLAY
UNIFIED	COARSE	FINE	COARSE	MEDIUM		FINE		
SYSTEM	GR.	AVEL		SANE	5		SILT AND	CLAY



PROJECT: 2935 & 2955 Mississauga Road

LOCATION: Mississauga, Ontario

CLIENT: Mr. Merulla

BOREHOLE NUMBER: 1605 SAMPLE NUMBER: 2

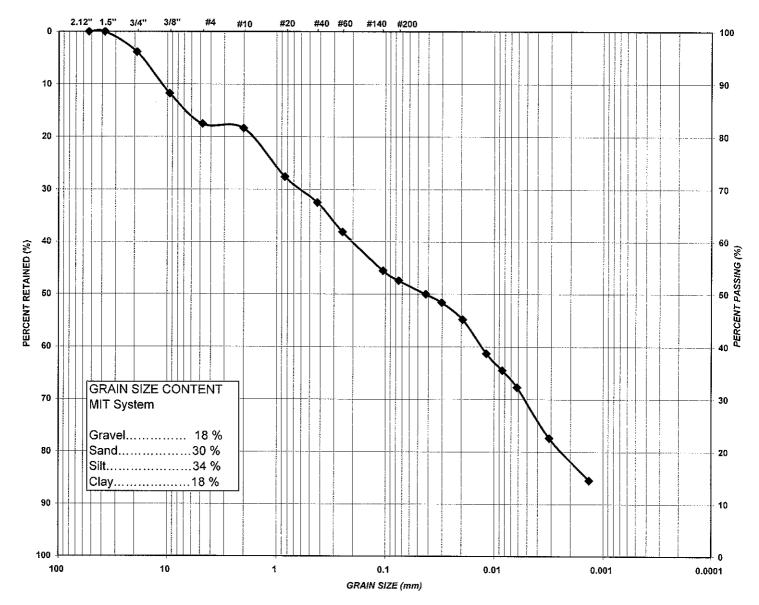
SAMPLE DEPTH: 0.6 - 1.2 m

SAMPLE DESCRIPTION: SANDY SILT, some clay, some gravel ( TILL )

FILE NO.: **1-08-3220** LAB NO.: **1049B** 

SAMPLE DATE: March 17, 2010 SAMPLED BY: AW / JS

#### **GRAIN SIZE DISTRIBUTION**



MIT				COARSE	MEDIUM FINE		
SYSTEM		GRAVEL			SAND	SILT	CLAY
UNIFIED	COARSE	FINE	COARSE	MEDIUM	FINE		
SYSTEM		AVEL		SANI	5	SILT AND	CLAY



PROJECT: 2935 & 2955 Mississauga Road

LOCATION: Mississauga, Ontario

CLIENT: Mr. Merulla

BOREHOLE NUMBER: 1607 SAMPLE NUMBER: 2

SAMPLE DEPTH: 0.6 - 1.2 m

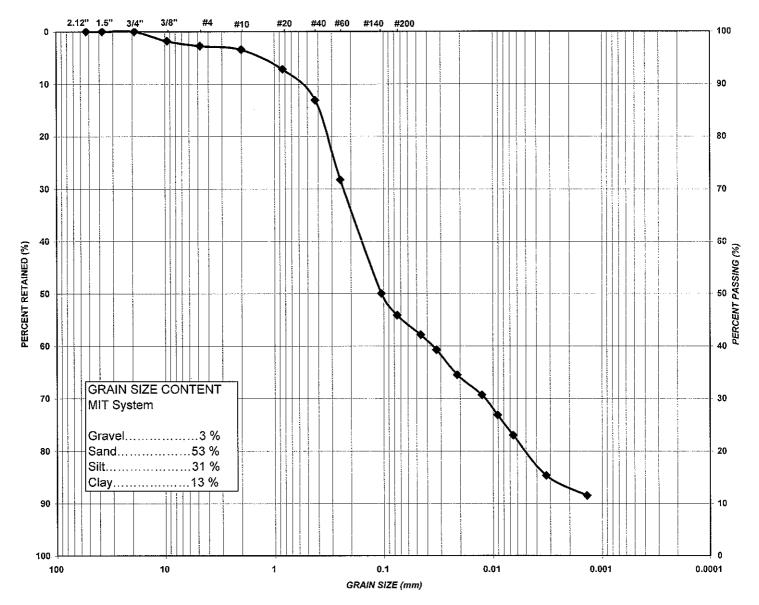
SAMPLE DESCRIPTION: SILTY SAND, some clay, trace gravel (TILL)

FILE NO.: **1-08-3220** LAB NO.: **1049C** 

SAMPLE DATE: March 17, 2010

SAMPLED BY: AW / JS

#### **GRAIN SIZE DISTRIBUTION**



MIT SYSTEM		GRAVEL			SAND	SILT	CLAY
UNIFIED SYSTEM	COARSE	FINE AVEL	COARSE	MEDIUM SAND	FINE	SILT AND	CLAY
01012	- OIN	MVLL.	<u> </u>		1		



PROJECT: 2935 & 2955 Mississauga Road

LOCATION: Mississauga, Ontario

CLIENT: Mr. Merulla

BOREHOLE NUMBER: 1608 SAMPLE NUMBER: 2

SAMPLE DEPTH: 0.6 - 1.2 m

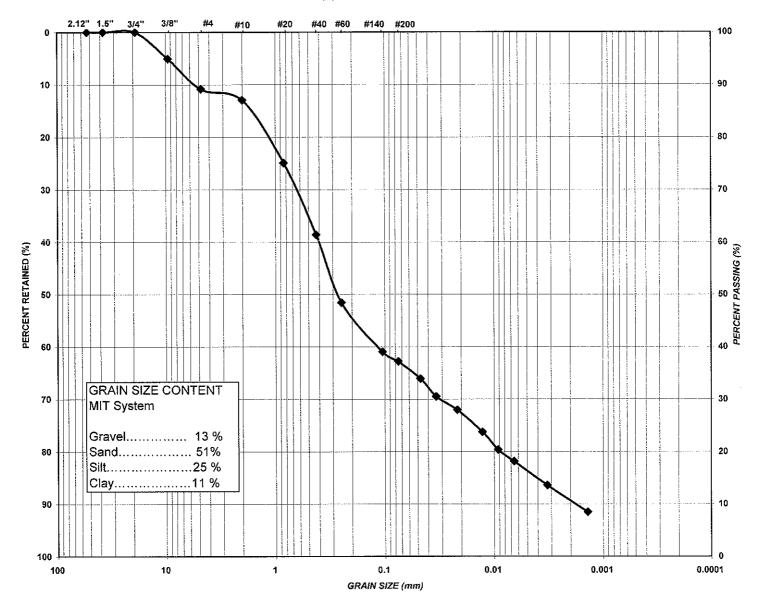
SAMPLE DESCRIPTION: SILTY SAND, some gravel, some clay ( TILL )

FILE NO.: **1-08-3220** LAB NO.: **1049D** 

SAMPLE DATE: March 17, 2010

SAMPLED BY: AW / JS

#### **GRAIN SIZE DISTRIBUTION**



MIT				COARSE	MEDIUM	FINE		
SYSTEM	;	GRAVEL			SAND		SILT	CLAY
UNIFIED	COARSE	FINE	COARSE	MEDIUM		FINE		
SYSTEM	GR	AVEL		SAN	-		SILT AND	···



PROJECT: 2935 & 2955 Mississauga Road

LOCATION: Mississauga, Ontario

CLIENT: Mr. Merulla

BOREHOLE NUMBER: 1611 SAMPLE NUMBER: 1

SAMPLE DEPTH: 0.0 - 0.6 m

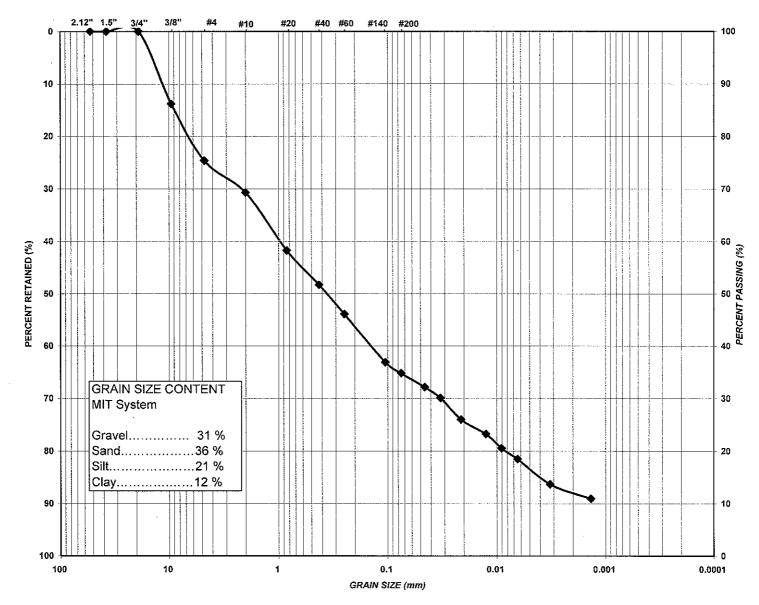
SAMPLE DESCRIPTION: GRAVELLY SAND, silty, some clay

FILE NO.: **1-08-3220** LAB NO.: **1049E** 

SAMPLE DATE: March 17, 2010

SAMPLED BY: AW / JS

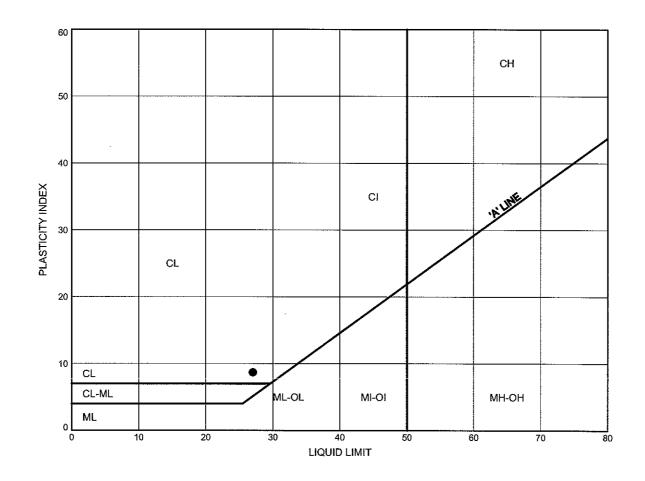
#### **GRAIN SIZE DISTRIBUTION**



MIT				COARSE	MEDIUM	FINE		
SYSTEM		GRAVEL			SAND		ŞILT	CLAY
UNIFIED	COARSE	FINE	COARSE	MEDIUM	'	FINE		
SYSTEM	GR	AVEL		SAND			SILT AND	CLAY

TERRAPROBE INC.





SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
•	1603	0.9	97.2

Liguid Limit (WL) = 27.0
Plastic Limit (WP) = 18.3
Plasticity Index (IP) = 8.7
Natural Water Content (WN) = 16

Soil Classification: Slightly plastic, slight or low compressibility

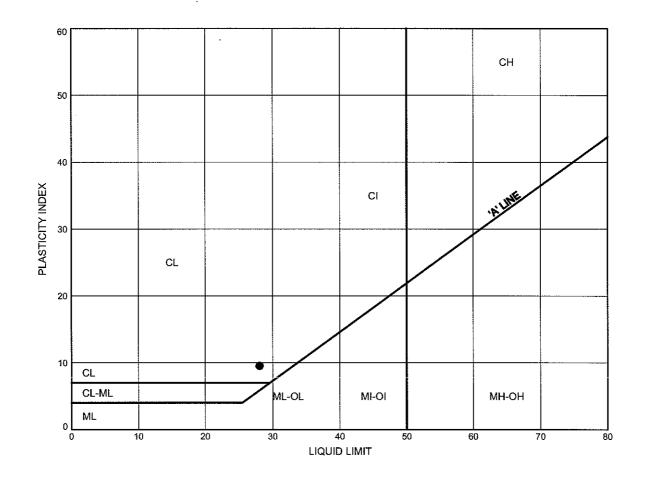
Date March 2010

Project 1-08-3220



Prep'd J.S.
Chkd. B.S.

ALTR 1-08-3220 MISSISSAUGA RD.GPJ 3/26/10



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
•	1605	0.9	97.2

Liguid Limit (WL) = 28.0
Plastic Limit (WP) = 18.5
Plasticity Index (IP) = 9.5
Natural Water Content (WN) = 16

Soil Classification: Slightly plastic, slight or low compressibility

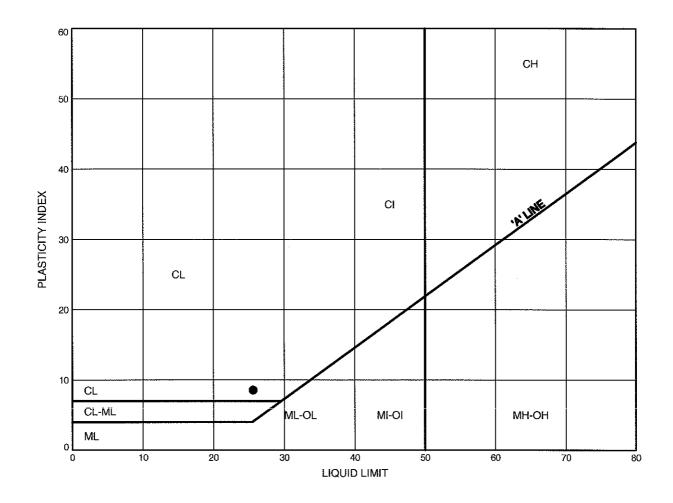
Date March 2010

Project 1-08-3220....



Prep'd J.S. Chkd B.S.

ALTR 1-08-3220 MISSISSAUGA RD.GPJ 3/26/10



SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
•	1607	0.9	97.1

Liguid Limit (WL) = 25.6Plastic Limit (WP) = 17.1Plasticity Index (IP) = 8.5Natural Water Content (WN) = 16

Soil Classification: Slightly plastic, slight or low compressibility

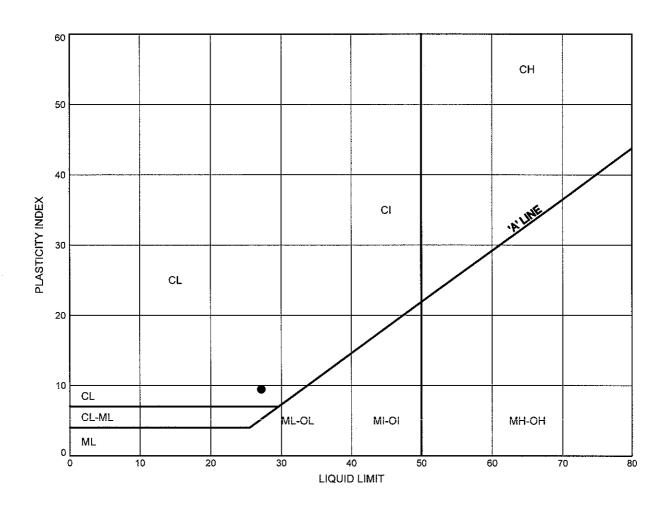
Date March 2010

Project .1-08-3220....



Prep'd J.S.
Chkd. B.S.

ALTR 1-08-3220 MISSISSAUGA RD.GPJ 3/26/10

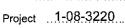


SYMBOL	BOREHOLE	DEPTH (m)	ELEVATION (m)
•	1611	0.3	97.8

Liguid Limit (WL) = 27.1 Plastic Limit (WP) = 17.7 Plasticity Index (IP) = 9.4 Natural Water Content (WN) = 13

Soil Classification: Slightly plastic, slight or low compressibility

Date March 2010

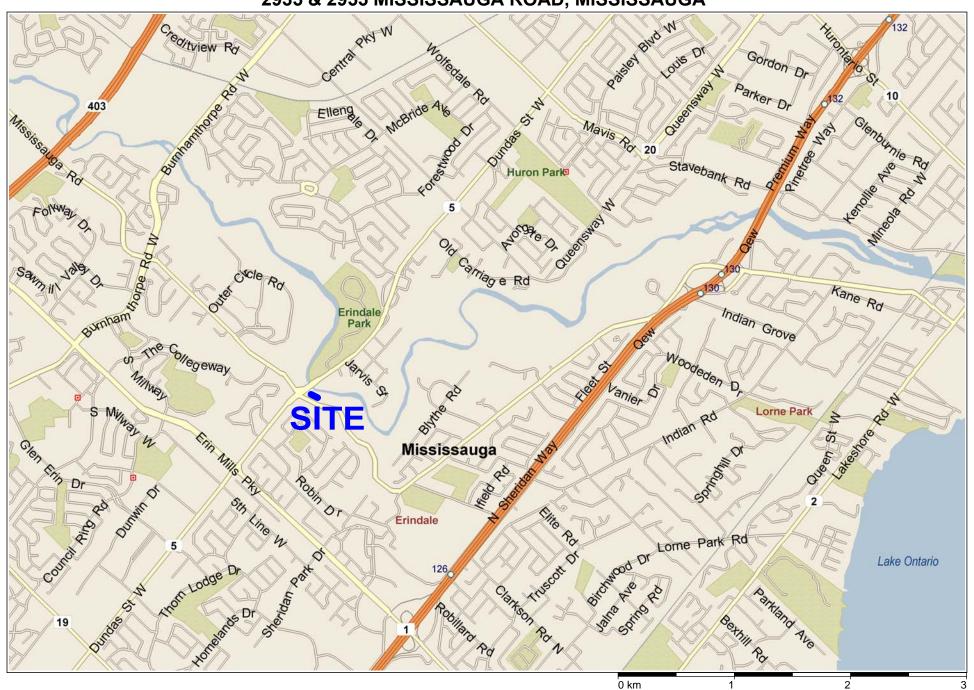




# **FIGURES**



#### 2935 & 2955 MISSISSAUGA ROAD, MISSISSAUGA



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# **PHOTOGRAPHS**

TERRAPROBE INC.



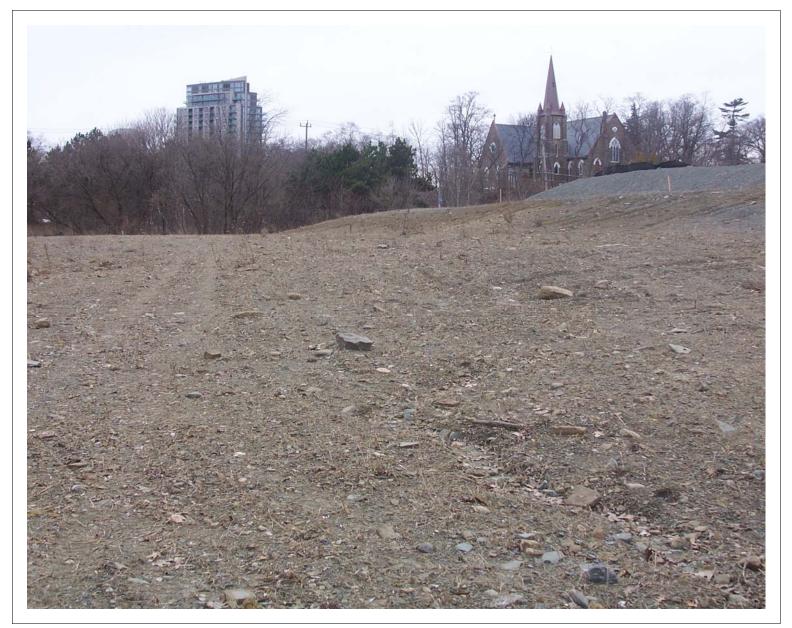
# 2935 - 2955 Mississauga Road, Mississauga, Ontario



Photograph A: Looking from west side of the fence towards the site. Relatively 'recent' graded fill located on the east side of the fence.

TERRAPROBE INC. File No. 1-08-3220

# 2935 - 2955 Mississauga Road, Mississauga, Ontario



Photograph B: Another view (looking north) of the relatively 'recent' fill area, no significant vegetation cover / growth.

TERRAPROBE INC. File No. 1-08-3220

# 2935 - 2955 Mississauga Road, Mississauga, Ontario



Photograph C: A view of southern portion of the site (inside the silt fence). This area includes patchy vegetation growth, and does not appear to include 'recent' fill.

TERRAPROBE INC. File No. 1-08-3220

APPENDIX C

EIS by Palmer



74 Berkeley Street, Toronto, ON M5A 2W7 Tel: 647-795-8153 | www.pecg.ca

# Updated Environmental Impact Study for 2935 & 2955 Mississauga Road, City of Mississauga

**Project #** 1903701

**Prepared For** 590816 Ontario Inc.

May 6, 2021



74 Berkeley Street, Toronto, ON M5A 2W7 Tel: 647-795-8153 | www.pecg.ca

May 6, 2021

Frank Merulla 2616 Cynara Road Mississauga, ON, L5B 2R7

Dear Frank Merulla:

Re: Updated Environmental Impact Study (EIS) for 2935 & 2955 Mississauga Road, City of

Mississauga

Project #: 1903701

Palmer is pleased to submit the following Updated Environmental Impact Study (EIS) for 2935 & 2955 Mississauga Road in the City of Mississauga.

The findings of our study are the result of a background review, initial field investigation and an analysis of data using the current scientific understanding of the ecology of the area, as well as the current natural heritage policy requirements. Based on the EIS prepared by Dougan and Associates in 2017 and on Palmer's background review and recent field observation, we have identified the environmental sensitivities, constraints and development opportunities of the project site. Based on the findings and recommendations of this study, it is our professional opinion that with the implementation of the mitigation measures as provided in this report, the proposed development plan is environmentally feasible.

Please let us know if you have question or comments on this submission

Yours truly,



Dirk Janas, B.Sc. Principal, Ecologist



# **Table of Contents**

#### Letter

1.	Intr	oduction	3	
2.	Environmental Policy			
	2.1	Migratory Birds Convention Act (1994)		
	2.2	Endangered Species Act (2007)		
	2.3	Provincial Policy Statement (2020)		
	2.4	Growth Plan for the Greater Golden Horseshoe (2019)		
	2.5	Greenbelt Plan (2017)		
	2.6	Peel Region Official Plan (2018)	7	
	2.7	City of Mississauga Official Plan (2019)	88	
	2.8	Credit Valley Conservation Policies and Regulations	88	
3.	Stu	Study Approach		
	3.1	Planning Context	9	
	3.2	Natural Heritage Information		
	3.3	Agency Consultation		
	3.4	Field Investigations		
4.	Existing Conditions			
	4.1	Site Description	11	
	4.2	Physiography, Geography, and Hydrology		
	4.3	Environmental Designations		
	4.4	Vegetation Communities	12	
	4.5	Flora	16	
	4.6	Breeding Birds	16	
	4.7	Breeding Amphibians	16	
	4.8	Incidental Wildlife Observations	16	
	4.9	Aquatic Assessment	17	
<b>5</b> .	Assessment of Significance			
	5.1	Significant Woodland	17	
	5.2	Significant Valleyland	17	
	5.3	Species at Risk Screening	18	
	5.4	Significant Wildlife Habitat	19	
6.	Pro	posed Development	20	
7.	Con	nstraints and Opportunities	20	



	7.1 7.2	Natural Features Regional Floodplain		
8.	Impa	ct Assessment and Mitigation Measures	22	
	8.1	Woodland Connectivity with the Reinstated Site Access		
	8.2	Minor Vegetation Removal		
	8.3	Turtle Habitat Removal	23	
9.	Polic	y Conformity	23	
10.	. Conclusions		24	
11.	. Signatures 2			
12.	2. References			
List	of Fig	jures		
Figure	1. Pr	oject Site	4	
•		ng Conditionsraints and Opportunities		
i igaic i	o. 001100	Tallito dila Opportantias	2 1	
List	of Ta	bles		
Table 1	. Field Iı	nvestigations	10	
	Table 2. Vegetation Community Descriptions1			
	Table 3: Species at Risk Habitat Screening			
Table 4	. Policy	Conformity	24	
List	of Ap	pendices		
Append Append		Agency Comments to the Terms of Reference Flora List		
Append		Breeding Birds		
1-1				



### 1. Introduction

Palmer was retained to complete this updated Environmental Impact Study (EIS) for 2935 & 2955 Mississauga Road, City of Mississauga, Regional Municipality of Peel (**Figure 1**). This updated EIS is based on a previous EIS Report prepared by Dougan and Associates' (Dougan) in 2017 (Dougan, 2017).

The Project Site is composed of two properties (2935 and 2955 Mississauga Road) adjacent to each other that combined are 2.13 hectares (ha). The Project Site comprises a largely open meadow central area and is surrounded by naturalized treed areas to the east, south and west. The northern limit of the Project Site is directly adjacent to the Credit River. No structures, with the exception of an abandoned swimming pool, exist on the property. The proposed development consists of a multi-story apartment building and a group of mid-density stacked townhouses.

The objectives of this EIS are to update the EIS prepared by Dougan in 2017 by evaluating the existing natural heritage features and ecological functions associated with the site, identifying development constraints and restoration opportunities, assessing the impacts of the proposed development, and recommending suitable mitigation measures.

# 2. Environmental Policy

#### 2.1 Migratory Birds Convention Act (1994)

The *Migratory Birds Convention Act*, MBCA (1994) and Migratory Birds Regulations, MBR (2014) protect most species of migratory birds and their nests and eggs anywhere they are found in Canada. General prohibitions under the MBCA and MBR protect migratory birds, their nests and eggs and prohibit the deposit of harmful substances in waters / areas frequented by them. The MBR includes an additional prohibition against incidental take, which is the inadvertent harming or destruction of birds, nests or eggs.

Compliance with the MBCA and MBR is best achieved through a due diligence approach, which identifies potential risk, based on a site-specific analysis in consideration of the Avoidance Guidelines and Best Management Practices information on the Environment Canada website.

#### 2.2 Endangered Species Act (2007)

Species designated as *Endangered* or *Threatened* by the Committee on the Status of Species at Risk in Ontario (COSSARO) are listed as Species at Risk in Ontario (SARO). These species at risk (SAR) and their habitats (e.g. areas essential for breeding, rearing, feeding, hibernation and migration) are afforded legal protection under the *Endangered Species Act* (ESA) (Government of Ontario, 2007).

The protection provisions for species and their habitat within the ESA apply only to those species listed as *Endangered* or *Threatened* on the SARO list, being Ontario Regulation 230/08 of the ESA. Species listed as *Special Concern* may be afforded protection through policy instruments respecting significant wildlife habitat (e.g. the Provincial Policy Statement) as defined by the Province or other relevant authority, or other protections contained in Official Plan policies.





#### 2.3 Provincial Policy Statement (2020)

The Provincial Policy Statement (PPS) provides direction to regional and local municipalities regarding planning policies for the protection and management of natural heritage features and resources (MMAH, 2020). Section 2.1 of the PPS defines ten natural heritage features (NHF) and adjacent lands and provides planning policies for each. Of these NHF, development is not permitted in:

- Significant Coastal Wetlands;
- Significant Wetlands in Ecoregions 5E, 6E and 7E;
- Fish Habitat, except in accordance with provincial and federal requirements; or
- Habitat of species designated as Endangered and Threatened, except in accordance with provincial and federal requirements.

Additionally, unless it can be demonstrated through an EIS that there will be no negative impacts on the natural features or their ecological functions, development and site alteration are also not permitted in:

- Significant Wetlands in the Canadian Shield north of Ecoregions 5E, 6E and 7E;
- Significant Woodlands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Mary's River);
- Significant Valleylands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Mary's River);
- Significant Wildlife Habitat;
- Significant Areas of Natural and Scientific Interest;
- Other Coastal Wetlands in Ecoregions 5E, 6E and 7E; and
- Lands defined as Adjacent Lands to all the above natural heritage features.

Each of these natural heritage features is afforded varying levels of protection subject to guidelines, and in some cases, regulations. The Project Site is located in Ecoregion 7E (Crins *et al.*, 2009).

#### 2.4 Growth Plan for the Greater Golden Horseshoe (2019)

The Growth Plan for the Greater Golden Horseshoe (GGH) directs growth and the development to ensure economic prosperity, environmental protection and community support. This is intended to direct municipalities towards the establishment of appropriate policies to maintain, restore, or enhance biodiversity and connectivity of the system and long-term ecological function (MMAH, 2019). The Project Site is outside of the designated Natural Heritage System for the GGH.

The Growth Plan for the GGH was developed as a supplement to the PPS, and "builds upon the policy foundation provided by the PPS and provides additional and more specific land use planning policies to address issues facing specific geographic areas in Ontario. This Plan is to be read in conjunction with the PPS. The policies of this Plan take precedence over the policies of the PPS to the extent of any conflict, except where the relevant legislation provides otherwise."

Schedule 2 of the Growth Plan depicts the Project Site as located within the "Built-up Area – Conceptual", outside of the "Greenbelt Area". The Growth Plan has been adopted by the Peel Region's Official Plan (OP), which was updated in 2018.



#### 2.5 Greenbelt Plan (2017)

The Greenbelt Plan was prepared and approved under the *Greenbelt Act*, 2005 and took effect in December 2004. The Greenbelt Plan builds on the PPS to identify where urbanization should not occur in order to provide permanent protection to the agricultural land base and the ecological and hydrological features, areas and functions occurring on the landscape of the Greater Golden Horseshoe (MMAH, 2017).

The Project Site is within the Greenbelt's Urban River Valley System (**Map A**). The Urban River Valley designation applies to lands within the main corridors of river valleys connecting the rest of the Greenbelt to the Great Lakes and inland lakes (section 6.1). The goals for areas designated as Urban River Valley are to promote the following (section 1.2.3):

- Protection of natural and open space lands along river valleys in urban areas which will assist in ecologically connecting the rest of the Greenbelt Area to the Great Lakes and other inland lakes;
- Protection of natural heritage and hydrologic features and functions along urban river valleys, including coastal wetlands;
- Conservation of cultural heritage resources;
- Provision of a gateway to the rural landscape of the Greenbelt; and
- Provision of a range of natural settings on publicly owned lands for recreational, cultural and tourism uses, including parkland, open space land and trails.

The following policies apply to lands within the Urban River Valley designation (Greenbelt Plan Section 6.2):

- 1. Only public owned lands are subject to the policies of the Urban River Valley designation. Any privately-owned lands within the boundary of the Urban River Valley area are not subject to the policies of this designation. For the purposes of this section, publicly owned lands mean lands in the ownership of the Province, a municipality or a local board, including a conservation authority.
- 2. The lands are governed by the applicable official plan policies provided they have regard to the objectives of the Greenbelt Plan.
- 3. All existing, expanded or new infrastructure which is subject to and approved under the Environmental Assessment Act, or which receives a similar approval, is permitted provided it supports the needs of adjacent settlement areas or serves the significant growth and economic development expected in southern Ontario and supports the goals and objectives of the Greenbelt Plan
- 4. The Protected Countryside policies do not apply except for:
  - a. The policies of section 3.2.6; and
  - b. The policies of section 3.3.

Section 3.2.6 (1.b.) states that municipalities, conservation authorities, other agencies and stakeholders should promote and undertake appropriate planning and design to ensure that external connections and Urban River Valley areas are maintained and/or enhanced. Section 3.3 is not applicable to this Project Site as it refers to parkland, open space, and trails.





Map A. Greenbelt (dark green outline) with Urban River Valley (blue shading) (MNRF, 2020).

#### 2.6 Peel Region Official Plan (2018)

The Peel Region Official Plan (OP) was adopted by the Regional Council on July 11, 1996. The in-effect OP underwent office consolidation in 2018. Natural heritage features in Peel Region are protected by its Greenlands System, which consists of Core Areas, Natural Areas and Corridors, and Potential Natural Areas and Corridors. Core Areas are designated on Schedule A (Core Areas of the Greenlands System of Peel) of the Official Plan and are intended to represent the most important natural features in Peel, providing the best uninterrupted natural systems and highest biodiversity as identified through the OP.

Natural Areas and Corridors and Potential Natural Areas and Corridors are to be identified and protected in lower tier municipal official plans in accordance with the policies outlined in the Peel Official Plan (Region of Peel, 2018).

The Project Site is identified as part of the Region's Greenlands System (**Map B**). Per Section 2.3.2.6, development and site alteration are prohibited within Core Areas, however, "the area municipalities are directed to adopt appropriate policies to allow the exceptions subject to it being demonstrated that there is no reasonable alternative location outside of the Core Area and the use, development or site alteration is direction away from the Core Area feature to the greatest extent possible; and the impact to Core Area features is minimized and any impact to the feature or its functions that cannot be avoided is mitigated through restoration or enhancement to the greatest extent possible". (Region of Peel, 2018).



Map B. Core Area in green present within and adjacent to the Project Site (Peel Region OP, Schedule A).

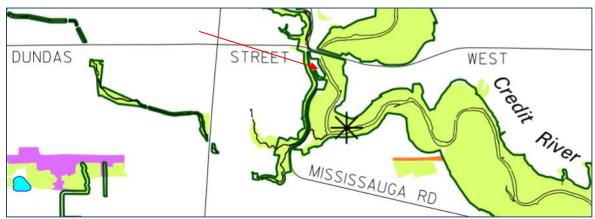


#### 2.7 City of Mississauga Official Plan (2019)

The office consolidation of the City of Mississauga Official Plan has recently been updated which includes Ontario Municipal Board decisions and City Council approved Official Plan Amendments. As there are still outstanding appeals, the 2003 Mississauga OP remains partially in effect

The City's Green System makes up about 23% of the land area of Mississauga and is comprised of the Natural Heritage System (NHS), Urban Forest, Natural Hazard Lands, and Parks and Open Spaces. The Official Plan, Section 6.3.8 states that: Buffers will be determined on a site-specific basis as part of an Environmental Impact Study or other similar study to the satisfaction of the City and appropriate conservation authority. Section 6.3.12 (f) provides criteria for the identification of Significant Woodland. Section 6.3.47 and 6.3.48 provides study requirements for development adjacent to Valleylands.

The Project Site is within the Green System. It is surrounded by Significant Natural Areas and Natural Green Spaces and by Natural Hazards (**Map C**). Per Section 6.3.27, development and site alteration as permitted in accordance with the Greenlands designation within or adjacent to a Significant Natural Area will not be permitted unless all reasonable alternatives have been considered and any negative impacts minimized (City of Mississauga, 2019).



Map C. Significant Natural Areas and Natural Green Spaces (light green shading) and Natural Hazards (dark green outline) (City of Mississauga OP, Schedule 3).

#### 2.8 Credit Valley Conservation Policies and Regulations

The Project Site is located within the jurisdiction of the Credit Valley Conservation Authority (CVC). Relevant CVC regulations and policies include the following:

- Ontario Regulation 160/06 Development, Interference with Wetlands and Alterations to Shorelines and Watercourses. Through this regulation, the CVC regulates activities in natural and hazardous areas (e.g., areas in and near rivers, streams, floodplains, wetlands, and slopes and shorelines).
- Watershed Planning and Regulation Policies (April 2010). This document presents the CVC's planning and permit review practices and technical guidelines. Relevant policies will be discussed in applicable sections of this EIS (CVC, 2010).



# 3. Study Approach

#### 3.1 Planning Context

A Planning Justification and Rational Report has been prepared by Beacon Planning Services as part of the proposed development approval process (Beacon, 2020). The planning report provides a detailed summary of the site history, natural features and natural hazards, and environmental planning management considerations. It also describes the proposed development and includes a policy conformity assessment. This report provides supplementary information to this EIS report.

#### 3.2 Natural Heritage Information

Palmer has reviewed relevant background material to provide a focus on field investigation and ensure compliance with applicable regulations and policy. Background information collection is guided by the *Natural Heritage Information Request Guide (MNRF*, 2018). Current direction from the Ministry of Natural Resources and Forestry (MNRF) and the Ministry of Environment, Conservation and Parks (MECP) is to gather natural heritage information and species occurrence records from available sources; the Natural Heritage Information Centre (NHIC) Make-a-Map application being the main source of information and records from the Ministry itself (MNRF, 2020). Information gathered is recommended to be balanced and supplemented by a professional ecological review of potential habitats and characteristics of a project site.

Background review for the Project Site included the collection and review of relevant mapping and reports, including regulations and policies, Official Plans, and zoning by-laws; and the NHIC Make-a-Map application for species occurrences and designated area mapping. In addition to these sources, the following data sources were reviewed for the project:

- Natural Area Inventory (NAS): The NAS provides factsheets for the Natural Areas in the City of Mississauga (City of Mississauga, 2017).
- **Fisheries and Oceans Canada (DFO):** The DFO maintains mapping of aquatic SAR habitats, including the critical habitat, occupied, and contributing habitat ranges of SAR and *Special* Concern species (DFO, 2020).

Following the *Information Request Guide* (MNRF, 2018), MECP advice and direction should be solicited once SAR interactions or potential interactions are identified via field investigation and analysis.

#### 3.3 Agency Consultation

A Terms of Reference was circulated to the CVC and the City of Mississauga on June 14, 2019. Comments were received from both agencies on November 26, 2019. The agency comments have been reviewed and taken into account in the preparation of this EIS (**Appendix A**).

A preliminary site meeting was conducted on September 17, 2019 with Palmer, CVC, and City staff. A second site meeting was conducted on January 24, 2020 to verify the top-of-slope limit and woodland limit pre-staked by Beacon Planning Services. The top-of-slope limit was accepted and confirmed by CVC during the site meeting. The woodland limit was not approved by CVC, however CVC and the City recommended



minor revisions to the dripline. Minor differences between the two woodland delineations are portrayed on Figure 2. The minor revisions to the woodland limit are reflected in this report to represent the woodland limit in a manner that is satisfactory to the review agencies.

#### 3.4 Field Investigations

Field investigations were conducted to collect existing conditions data on flora, fauna, natural features and ecological functions. Fieldwork was conducted by Dougan from 2013 to 2017 and by Palmer in 2019 (**Table 1**). Survey methodology for Palmer's 2019 fieldwork is described below.

Table 1. Field Investigations

Ecological Survey	Dougan's Fieldwork (2013-2017)	Palmer's Fieldwork (2019)
Vegetation surveys	October 2013, June 2014, May 2017	June 27, 2019
Breeding bird surveys	May and June 2014	June 14, 2019
Nocturnal amphibian surveys	April and May 2014	June 27, 2019 *
Snapping Turtle and Eastern Milksnake search	May and June 2014	No specific survey *

<sup>\*</sup>Incidental observations were recorded when on site with an emphasis on the area with the abandoned pool.

Dougan completed Snapping Turtle (*Chelydra serpentina*) and Eastern Milksnake (*Lampropeltis Triangulum*) searches. Four Snapping Turtle surveys were conducted in 2014 during mornings under fair weather conditions. The entire site was searched for any activity. Four surveys for Eastern Milksnake were conducted in 2014 following the MNRF Guelph District Milksnake Survey Protocol (MNRF, 2013).

#### **Vegetation Communities and Flora**

Vegetation community boundaries were delineated on field maps through the interpretation of recent aerial photographs and refined in the field based in Ecological Land Classification (ELC) System for Southern Ontario (Lee *et al.*, 1998). Information collected during ELC surveys includes dominant species cover, community structure, as well as level of disturbance, presence of indicator species, and other notable features.

Botanical surveys were completed by traversing the site and recording species observed in each vegetation community. Local plant rarity status for Mississauga is based on CVC/Peel species ranks (CVC, 2002). Provincial plant status was based on the NHIC species list (MNRF, 2020a) and the SARO list (MNRF, 2020b).

#### **Breeding Bird Survey**

A breeding bird survey was conducted following the principles of the *Ontario Breeding Bird Atlas Guide for Participants* (Bird Studies Canada, 2001). One breeding bird survey was conducted on the Project Site on June 14, 2019 to document the bird communities on the Project Site along with flyovers and adjacent areas. Surveys were carried out between 07:00 and 09:00 h. Weather conditions during the survey were 80% overcast, with moderate breezes, no precipitation, and 12°C. The surveyor recorded all bird species seen and heard within and flying over the survey area. The number, breeding evidence, and approximate location of each bird or bird group was recorded on the site map.



#### **Breeding Amphibians**

An amphibian breeding survey was completed following the Environment Canada's Marsh Monitoring Program protocol (Bird Studies Canada, 2008) and was conducted on June 27, 2019. Species, calling locations and approximate numbers of calling individuals are recorded and mapped when present. A list of Area Sensitive species was referenced to determine habitat and species sensitivities (OMNR, 2000). The survey method provides an indication of amphibian abundance during the breeding season. The air temperature at the time of the survey was 25°C, with light winds and clear skies. The survey location was focused on the swimming pool for breeding amphibians and snapping turtles.

#### **Incidental Wildlife Observations**

Incidental observations of wildlife were recorded during all visits to the Project Site. Recorded wildlife observations included direct and indirect evidence. Direct evidence included visual or auditory observations of species. Evidence considered "indirect" included observation of tracks, scat, and browse.

# 4. Existing Conditions

#### 4.1 Site Description

The Project Site is composed of two adjacent properties that combined are 2.13 ha (**Figure 2**). The Project Site consists of a large open central area which is surrounded by treed vegetation communities to the east, south and west. The property at 2935 Mississauga Road historically supported a residential dwelling. No structures are currently present on the Project Site except for remnants of the concrete bridge abutments for the small bridge that spanned over Sawmill Creek as part of the driveway that provided access to dwelling from Mississauga Rd. Several elements of the former dwelling also remain, including a concrete swimming pool, sections of foundation footings, the cement floor and the partial back wall of the garage (Dougan, 2017).

The northern limit of the Project Site is directly adjacent to the Credit River. A channelized segment of Sawmill Creek at the confluence with the Credit River runs parallel to Dundas Street West, directly west of the Project Site. This segment of Sawmill Creek underwent major changes in the 1970s when the creek was relocated and constructed into a concrete spillway. An ephemeral naturalized drainage channel is present along the part of the southern site boundary and bends along the eastern site boundary towards the Credit River. This feature is remnant of the diversion channel for Sawmill Creek created in the 1970s. The ephemeral naturalized drainage channel supports water flowing from the ravine lands located on the south side of Mississauga Road through culverts and seepage.

#### 4.2 Physiography, Geography, and Hydrology

The Project Site is located within the Iroquois Plain physiographic region. The slightly sloping plain is mostly covered with stratified sands of varying depths (Chapman and Putman, 1984). The Project Site comprises undulating tableland and a steep ravine with bluffs associated with the Credit River watercourse valley system on the north side of the properties (Dougan, 2017). A portion of the Project Site drains towards Mississauga Road where runoff is captured in an ephemeral naturalized drainage swale (not a natural watercourse as it is a remnant of the historical diversion channel created for Sawmill Creek) which runs along the bottom part of the southern portion of the site and then along the eastern edge of the Project Site



before flowing into the Credit River (**Figure 2**). This naturalized swale captures runoff from a very limited catchment area; the Project Site and three culverts coming from the ravine on the opposite side of Mississauga Road, and as a result has minimal flow (Parish Aquatic Service, 2016).

#### 4.3 Environmental Designations

The Project Site does not include provincially designated features such as significant woodland, wetlands, Area of Natural and Scientific Interest (ANSIs) or Environmentally Significant/Sensitive Areas (ESAs). The natural area located adjacent to the site is identified as a Significant Natural Area (CRR7) as part of the NAS (City of Mississauga, 2017) (**Map E**) and partly within the Greenbelt's Urban River Valley.



Map E. Significant Natural Area (CRR7) (City of Mississauga, 2017)

#### 4.4 Vegetation Communities

The previous EIS identified six (6) ELC vegetation communities on the Project Site, including Anthropogenic (ANTH), Dry-Moist Old Field Meadow (CUM1-1), Mineral Cultural Woodland (CUW1), Fresh-moist Sugar Maple — Lowland Ash Deciduous Forest (FOD6-1), Fresh-moist Willow Lowland Deciduous Forest (FOD7-3), and Open Clay Bluff (BLO1-1) (**Table 2**; **Figure 2**). During the 2019 field surveys, the ELC communities were found to have remained large unchanged but have been updated based on current site conditions.



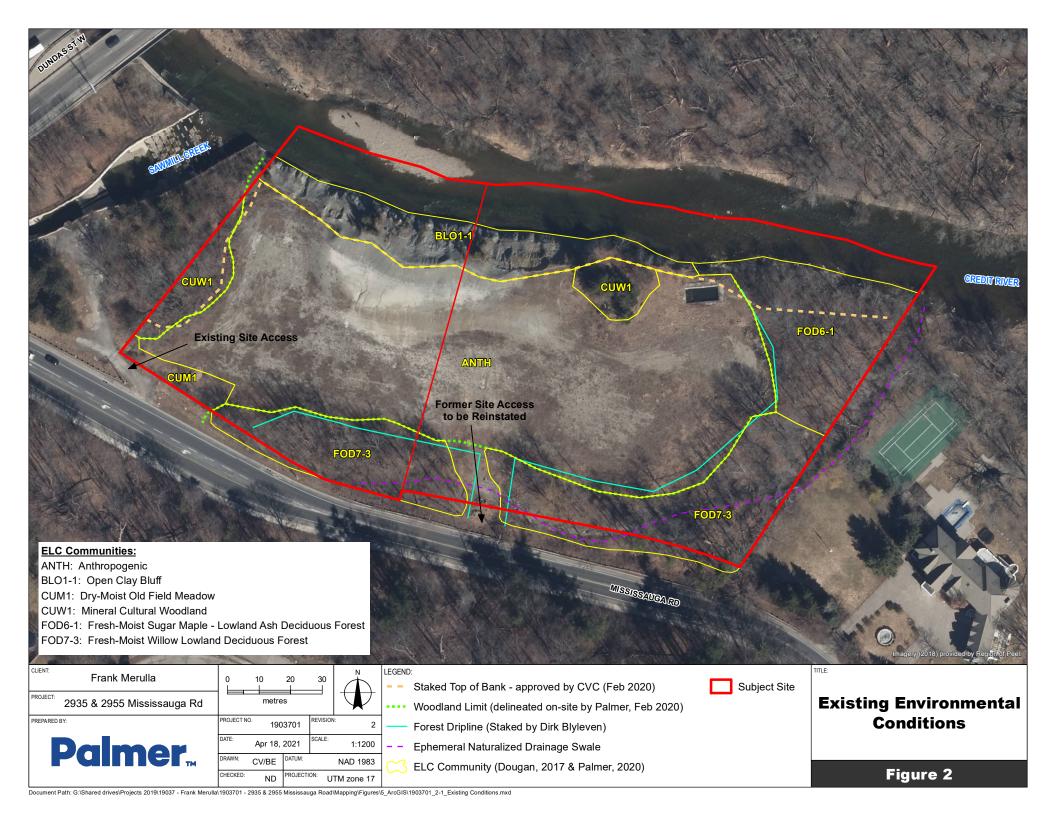
Table 2. Vegetation Community Descriptions

Vegetation Community	Descriptions
Mineral Cultural Woodland (CUW1)	The western community adjacent to the channelized Saw Mill Creek has a canopy consisting of White Ash ( <i>Fraxinus americana</i> ), Norway Maple ( <i>Acer platanoides</i> ), American Elm ( <i>Ulmus americana</i> ), and Sweet Cherry ( <i>Prunus avium</i> ), providing approximately 50% cover. The understory layer is mostly comprised of invasive shrubs such as Tartarian Honeysuckle ( <i>Lonicera tatarica</i> ) and European Buckthorn ( <i>Rhamnus cathartica</i> ) along with Staghorn Sumac ( <i>Rhus typhina</i> ) and Black Raspberry ( <i>Rubus occidentalis</i> ). The ground layer is dominated by Garlic Mustard ( <i>Alliaria petiolaris</i> ). Evidence of past soil and debris dumping was noted (Dougan, 2017).
	The small northern community adjacent to the bluffs and the abandoned swimming pool has a higher diversity of native plants. The canopy comprises Black Oak ( <i>Quercus velutina</i> ) and Red Oak ( <i>Quercus rubra</i> ) along with Bur Oak ( <i>Quercus macrocarpa</i> ), White Oak ( <i>Quercus alba</i> ), Sugar Maple ( <i>Acer saccharum</i> ), Black Cherry ( <i>Prunus serotina</i> ), Sweet Cherry ( <i>Prunus avium</i> ), Green Ash, Eastern Hophornbeam ( <i>Ostrya virginiana</i> ), Trembling Aspen ( <i>Populus tremuloides</i> ), American Basswood ( <i>Tilia americana</i> ), Scots Pine ( <i>Pinus sylvestris</i> ), and Norway Spruce ( <i>Picea abies</i> ). The understorey layer consists of Roundleaf Dogwood ( <i>Cornus rugosa</i> ), Juneberries ( <i>Amelanchier arborea</i> and <i>A. spicata</i> ), Chokecherry ( <i>Prunus virginiana</i> ), Red-osier Dogwood ( <i>Cornus sericea</i> ) alongside the invasive Tatarian Honeysuckle. The ground layer includes Canada Goldenrod ( <i>Solidago canadensis</i> ), Yarrow ( <i>Achillea millifolium</i> ), Spreading Dogbane ( <i>Apocynum androsaemifolium</i> ), Rough Cinquefoil ( <i>Potentilla recta</i> ), Canada Bluegrass ( <i>Poa compressa</i> ), King Devil ( <i>Hieracium praealtum</i> ), Field Goldenrod ( <i>Solidago nemoralis</i> ), Heart-leaf Aster ( <i>Symphyotrichum cordifolium</i> ), Ditch-stonecrop ( <i>Penthorum sedoides</i> ) and Pussytoes ( <i>Antennaria</i> sp.) (Dougan, 2017).
Anthropogenic (ANTH)	The Project Site is mostly occupied by this anthropogenic area which has been cleared, graded, and tilled in the past. Herbaceous vegetation present mostly comprises White Sweet Clover ( <i>Melilotus albus</i> ), Canada Goldenrod ( <i>Solidago canadensis</i> ), Birds-foot Trefoil ( <i>Lotus corniculatus</i> ), Yarrow, Chickory ( <i>Cichorium intybus</i> ), Canada Thistle ( <i>Cirsium arvense</i> ), Wild Carrot ( <i>Daucus carota</i> ), and Fuller's Teasel ( <i>Dipsacus follunum</i> ). Many patches of bare soil are present throughout (Dougan, 2017).
Fresh-Moist Sugar Maple – Lowland Ash Deciduous Forest (FOD6- 1)	This community located in the northeastern portion of the Project Site has a canopy comprised of Sugar Maple and Green Ash ( <i>Fraxinus pennsylvanica</i> ) with Paper Birch ( <i>Betula papyrifera</i> ), Black Cherry, American Elm, Eastern Hophornbeam, Eastern Cottonwood ( <i>Populus deltoides</i> ), Black Maple ( <i>Acer nigrum</i> ), and Manitoba Maple ( <i>Acer negundo</i> ) along the bank of the valleyland. The understorey comprises various native and introduced shrubs including Chokecherry, Gray Dogwood ( <i>Cornus racemosa</i> ), Rose ( <i>Rosa</i> sp.), Tartarian Honeysuckle, Raspberries ( <i>Rubus</i> sp.) and Japanese Barberry ( <i>Berberis thunbergii</i> ). The very sparse ground layer includes such species as Yellow Avens ( <i>Geum aleppicum</i> ), Rough Avens ( <i>Geum laciniatum</i> ), Tall Butter-cup ( <i>Ranunculus acris</i> ), Garlic Mustard, Broad-leaved Goldenrod ( <i>Solidago flexicaulis</i> ), and Poison Ivy ( <i>Toxicodendron radicans</i> ) (Dougan, 2017).
Fresh-Moist Willow Lowland	This linear deciduous forest fragment runs parallel to Mississauga Road. The narrowness of the woodland results in the dominance of edge habitat. The canopy consists of Willows ( <i>Salix</i> spp.) with Green Ash, American Basswood, American Elm, native and non-native Maples ( <i>Acer</i> spp.) and

**May 6, 2021** 



Vegetation Community	Descriptions
Deciduous Forest (FOD7- 3)	Eastern White Pine ( <i>Pinus strobus</i> ). The understorey layer includes Common Buckthorn, Roundleaf Dogwood, Common Red Raspberry ( <i>Rubus idaeus</i> ), Purple Flowering Raspberry ( <i>Rubus odoratus</i> ), Riverbank Grape ( <i>Vitis riparia</i> ) and Japanese Barberry. A relatively rich spring flora was observed including Jack-in-the-Pulpit ( <i>Arisaema triphyllum</i> ), Yellow Trout-lily ( <i>Erythronium americanum</i> ), Wood Anemone ( <i>Anemone quinquefolia</i> ), Narrow-leaved Spring Beauty ( <i>Claytonia virginica</i> ) Wild Geranium ( <i>Geranium maculatum</i> ), Yellow Avens, Large-leaved Avens ( <i>Geum macrophyllum</i> ), John's Cabbage ( <i>Hydrophyllum virginianum</i> ), Cut-leaved Toothwort ( <i>Dentaria laciniata</i> ), False Solomon's Seal ( <i>Maianthemum racemosum</i> ), May Apple ( <i>Podophyllum peltatum</i> ), Bloodroot ( <i>Sanguinaria canadensis</i> ), Broad-leaved Goldenrod, Tall Meadow Rue ( <i>Thalictrum polygamum</i> ), and Violets ( <i>Viola sororia</i> , and others). Invasive plants including Garlic Mustard, Goutweed ( <i>Aegopodium podagraria</i> ), Creeping Euonymus ( <i>Euonymus fortunei</i> ), Scilla ( <i>Silla siberica</i> ) and Lily-of-the-Valley ( <i>Convallaria majalis</i> ) were also observed (Dougan, 2017).
Dry-Moist Old Field Meadow (CUM1)	The small patch of cultural meadow located beside the laneway entrance along Mississauga Road has a mix of early-successional, disturbance-tolerant forbs and grasses. These include Canada Goldenrod, White Sweet Clover, Birds-foot Trefoil, Orchard Grass ( <i>Dactylis glomerata</i> ), Kentucky Bluegrass ( <i>Poa pratensis</i> ), Creeping Wild-rye ( <i>Elymus repens</i> ) and Wild Carrot. A few woody species have begun to emerge including Tartarian Honeysuckle, Norway Maple, Sugar Maple and Trembling Aspen (Dougan, 2017).
Open Clay Bluff (BLO1-1)	This polygon is a steep clay and shale face which is largely open and eroding, with sparse cover of trees and shrubs, including Eastern White Cedar ( <i>Thuja occidentalis</i> ), Blasam Poplar ( <i>Populus balsamifera</i> ), Hop Hornbeam, and White Birch trees, and several severely leaning/hanging Eastern Hemlock ( <i>Tsuga canadensis</i> ) trees affected by steep grades and erosion. Understorey shrubs include Juneberries and Round-leaved Dogwood. The ground layer is sparsely covered by White Sweet Clover and Goldenrod ( <i>Solidago</i> sp.). Towards the west end, there is growth of Scots Pine, Gray Dogwood, European Buckthorn, and Goldenrod ( <i>Solidago</i> sp.) (Dougan, 2017).





#### 4.5 Flora

A total of 176 flora species were recorded within and directly adjacent to the Project Site (**Appendix B**). Of the species identified, 15 species were recorded to the genus only. The majority of plants recorded are native to the Peel Region and CVC's watershed. As many as13 native species of regional / local significance were recorded of which all were found within the deciduous forest/woodland, and open bluff habitats on the property, except for Canada Honewort (*Cryptotaenia canadensis*) located in the Mineral Cultural Meadow (CUM1) in the southwest corner of the Project Site (Dougan, 2017). No flora species provincial significance was recorded on the properties.

#### 4.6 Breeding Birds

The previous EIS documented 30 bird species, of which 25 were likely breeding on-site or in the local area (Dougan, 2017). In 2019, 14 bird species were documented, including two species that were newly recorded within the Project Site (**Appendix C**).

One area-sensitive species, White-breasted Nuthatch (*Sitta carolinensis*) was found within the Project Site. Area-sensitive species require large areas of continuous habitat for breeding and foraging. One species, Bank Swallow (*Riparia riparia*) is designated as *Threatened* on the SARO list. As many as six Bank Swallows were observed foraging and flying over the Credit River during the 2014 and 2019 breeding bird surveys. Bank Swallow are believed to be nesting on the buffs at the northern limit of the Project Site.

#### 4.7 Breeding Amphibians

No amphibians were detected during the 2014 or 2019 formal breeding amphibian surveys. However, a few frogs have been incidentally observed during other field surveys. All observations were within the abandoned swimming pool, including a Green Frog (*Lithobates clamitans*; adult and tadpole) and adult American Toads (*Anaxyrus americanus*; adult) observed in 2014 as well as two unidentified frogs observed in 2019. Given the small size of the swimming pool, as well as the urban context, it is likely only very small numbers of the more tolerant amphibians would be supported; thus, no significant level of breeding is expected.

#### 4.8 Incidental Wildlife Observations

A raptor nest was observed in the Fresh-moist Willow Lowland Deciduous Forest (FOD7-3) in the southeast corner of the Project Site.

No Snapping Turtle was observed during species surveys, but an individual was incidentally observed in 2014 in the abandoned swimming pool. This is a species of *Special Concern*. No Eastern Milksnake was observed during 2014 surveys and 2019 field visits.

The previous EIS included the finding of four mammal species during their 2014 field investigation; including Gray Squirrel (*Sciurus carolinensis*), Coyote (*Canis latrans*), Raccoon (*Procyon lotor*) and White-tailed Deer (*Odocoileus virginianus*). An Eastern Gartersnake (*Thamnophis sirtalis sirtalis*) was also observed. All of these species are considered common and widespread in southern Ontario and the local region.



#### 4.9 Aquatic Assessment

The Credit River directly adjacent to the northern limit of the Project Site is approximately 23 to 28 metres (m) wide with low to moderately sloped shallow riffles and runs, and shallow pools (Dougan, 2017). Instream habitat is fairly diverse with gravelly portions and variable velocities. The upstream cobble and gravel bar potentially provide spawning habitat for suckers and migratory salmonids (Dougan, 2017). A moderate variety of substrates with interstitial spaces and variable depths and velocities may provide habitat for migratory American Eel (*Anguilla rostrata*) (Dougan, 2017).

There is an ephemeral naturalized drainage swale, also referred to as the old Sawmill Creek channel along the eastern property limit. The presence of downstream-oriented small woody debris and a conspicuous absence of vegetation and organic litter along the centre of the channel suggest the channel periodically conveys minor flow. Periodic flow could be a result of stormwater from the small upstream catchment or the falling limb of floods from the Credit River that inundate the lower section of the old channel. Along the periphery of the over-widened channel, deciduous trees are present suggesting flows rarely inundate the entire channel bed. A naturally formed levee and rafted woody debris block the mouth of the old Sawmill Creek channel at the confluence with Credit River. This feature is not hydrologically connected to an upstream watercourse. Fish passage from the Credit River is not possible due to the steep drop in grades. Therefore, this feature is not believed to provide fish habitat.

# 5. Assessment of Significance

#### 5.1 Significant Woodland

The Fresh-Moist Sugar Maple – Lowland Ash Deciduous Forest (FOD6-1) and Fresh-Moist Willow Lowland Deciduous Forest (FOD7-3) are identified as a Core Area of the Region's Greenlands System. These forest communities are also identified as part of the City's Significant Natural Areas and Natural Green Spaces.

Based on the City's Significant Woodland criteria provided in section 6.3.12.f of the OP, the woodland is considered significant. On a landscape level assessment, the woodland extends south and east of the Project Site. The woodland is greater than 0.5 ha and is located within 30 m of a watercourse. The City's OP states that woodland buffers are to be determined on a site-specific basis.

Based on the urban nature of the area, the historical use of the site, and the features and functions of the woodland, it is believed that a 10 m in width along the southern and eastern portions of the Project Site would provide a suitable buffer between the existing woodland edge and the future medium density development. A 10 m buffer is consistent with CVC's regulatory requirements.

#### 5.2 Significant Valleyland

The Project Site is occupied by a valleyland feature associated with the Credit River where the valley slope is characterized as an Open Clay Bluff (BLO1-1) vegetation community along the northern boundary of the site. The area is identified as Natural Hazards in the City's OP. The top of bank was staked in 2019 and approved by CVC staff in 2020. CVC's regulations require a 10 m setback for the stable top of slope. A geotechnical slope stability assessment was completed by Terraprobe in 2008 and an addendum report



was issued in 2010 (Terraprobe, 2008; Terraprobe, 2010). Terraprobe's study determined the Long Term Stable Slope (**Figure 4**). Based on the City's policies (section 6.3.48), any development adjacent to valleyland and watercourse features may be required to be supported by a detailed slope stability and stream erosion studies. Palmer has prepared a Stream Stability/Erosion Assessment review provided under a separate cover (Palmer, 2020). A 10 m setback from the Long Term Stable Slope, as instructed in CVC's Regulation, is considered suitable.

#### 5.3 Species at Risk Screening

Screening for potential SAR habitat was completed based on the background information review and data collected during field investigations. According to the Make-a-Map online resource (MNRF, 2020), Barn Swallow (*Hirundo rustica*) and American Eel have been recorded in the general vicinity. Historical records for Henslow's Sparrow (*Ammodramus henslowii*) and Lake Sturgeon (*Acipenser fulvescens*) have been excluded from this screening assessment. Furthermore, a correspondence letter between Dougan and the MNRF Aurora District in 2013 identified nearby records for Butternut (*Juglans cinerea*), Snapping Turtle (*Chelydra serpentina*) and American Eel (Dougan, 2017). Habitat screening for SAR on the Project Site was assessed by comparing habitat preferences of species deemed to have potential to occur against current site conditions, as well as previously recorded evidence of Bank Swallow and Snapping Turtle (Dougan, 2017) (**Table 3**).

Table 3: Species at Risk Habitat Screening

Species	Habitat Requirement Overview	Habitat Suitability
Barn Swallow (Threatened)	Barn Swallows largely to nesting in and on artificial structures, including barns and other outbuildings, garages, houses, bridges, and road culverts. Barn Swallows prefer various types of open habitats for foraging, including grassy fields, pastures, various kinds of agricultural crops, lake and river shorelines, cleared rights-of-way, cottage areas and farmyards, islands, wetlands, and subarctic tundra.	Absent (no observed and no suitable nesting habitat)
American Eel (Endangered)	The American Eel preferred habitat can be found in lakes and rivers including all waters extending from the high-water mark down to at least a 10 m depth. Eelgrass, rock outcrops and other benthic features offering hiding places are important to American Eel as cover, particularly during daylight hours	Potential (likely to migrate through the Credit River curing their life cycle [Dougan, 2017])
Bank Swallow (Threatened)	The Bank Swallow readily breeds in a wide variety of low-elevation (< 900 m), natural and anthropogenic habitats, including: lake and ocean bluffs; stream and river banks; sand and gravel pits; roadcuts; and piles of sand, topsoil, sawdust, coal ash, and other materials. Nest burrows are nearly always in a vertical or near-vertical bank (range: 76-105° slope).	Present (observed in 2014 and 2019)
Snapping Turtle (Special Concern)	Snapping turtles spend most of their lives in water. They prefer shallow waters so they can hide under the soft mud and leaf litter, with only their noses exposed to the surface to breathe. Snapping turtles often take advantage of man-made structures for nest sites, including roads (especially gravel shoulders), dams and aggregate pits.	Present (observed in 2014)



Species	Habitat Requirement Overview	Habitat Suitability
Butternut	Found in mixed deciduous forests, with openings giving access to partial to	Absent
(Endangered)	full sun conditions.	(not observed)
Eastern Small-	Maternity Roosts: primarily under loose rocks on exposed rock outcrops,	Potential (suitable
footed Bat	crevices and cliffs, and occasionally in buildings, under bridges and	habitat observed)
(Endangered)	highway overpasses and under tree bark (MNRF, 2019b).	
Little Brown	Maternal Roosts: Often associated with buildings (attics, barns etc.).	Potential (suitable
Myotis	Occasionally found in trees (25-44 cm in diameter at breast height [DBH])	habitat observed)
(Endangered)	(MNRF, 2019c).	
Northern Myotis	Maternity Roosts: Often associated with cavities of large diameter trees	Potential (suitable
(Endangered)	(25-44 cm DBH). Occasionally found in structures (attics, barns etc.)	habitat observed)
	(MNRF, 2019d).	
Tri-coloured Bat	Maternity Roosts: Can be in trees or dead clusters of leaves or arboreal	Potential (suitable
(Endangered)	lichens on trees. May also use barns or similar structures (MNRF, 2019e).	habitat observed)

Based on the SAR habitat screening, Endangered Bat species may be roosting in the deciduous forests; Snapping Turtle is known to be using the abandoned pool as habitat; Bank Swallow is known to be nesting on the steep bluff; and American Eel is potentially present in the Credit River.

Endangered Bats may be present within the deciduous forest (FOD) vegetation communities. Generally, trees greater than 25 centimeters in diameter at breast height, with attributes such as crevices, cavities, and and peeling bark, that are present within these forest communities may provide suitable bat maternity roosting habitat.

Snapping Turtle is a Species of *Special Concern*, which is not afforded species or habitat protection under the ESA. The abandoned pool is proposed to be removed.

Bank Swallow is designated as *Threatened*, and is afforded species and habitat protection under the ESA. The bluff habitat for this species will be retained and protected.

American Eel is an *Endangered* species and is afforded species and habitat protection. The aquatic habitat for this species will be retained and protected.

#### 5.4 Significant Wildlife Habitat

Significant Wildlife Habitat (SWH) is addressed in Provincial, Regional, and Municipal policies. It is defined by the MNRF in the *Significant Wildlife Habitat Technical Guide* (OMNR, 2000), and includes the following broad categories:

- seasonal concentration areas:
- rare vegetation communities or specialised habitats for wildlife;
- habitats of species of conservation concern, excluding the habitats of endangered and threatened species; and
- animal movement corridors.



Criteria for the identification of these features are provided in the Significant Wildlife Habitat Criteria Schedules for Ecoregion 7E (OMNRF, 2015). The dated Peel-Caledon Significant Woodlands and Significant Wildlife Habitat Study (North-South Environmental *et al.*, 2009) was reviewed but no additional information was deemed relevant. As indicated in Dougan's 2017 SWH screening, no SWH was identified within the Project Site (**Appendix D**).

# 6. Proposed Development

The proposed development includes a high-rise building consisting of a six-storey podium and a 12-storey tower, a stacked townhouse complex, and three levels of underground parking.

The proposed site access is deemed to be a necessary and reasonable alternative to the existing site access because the existing site access at 2955 Mississauga Rd is deemed unsafe not functional because it is too close to the intersection with Dundas Street and because the proposed site access was formally an access to the 2935 Mississauga Rd remains as an opening in the forest canopy cover. The site access is proposed to be wider than the former site access to allow for two-way traffic (**Figure 3**).

# 7. Constraints and Opportunities

The development limit was determined based on several environmental constraints associated with the Project Site; woodland, Significant Woodland, Significant Valleyland, and Regional Floodplain (**Figure 3**). Given the complicated history associated with past land use and occupancy of the site, the proponent has directed that the development limit be established based on the current site conditions.

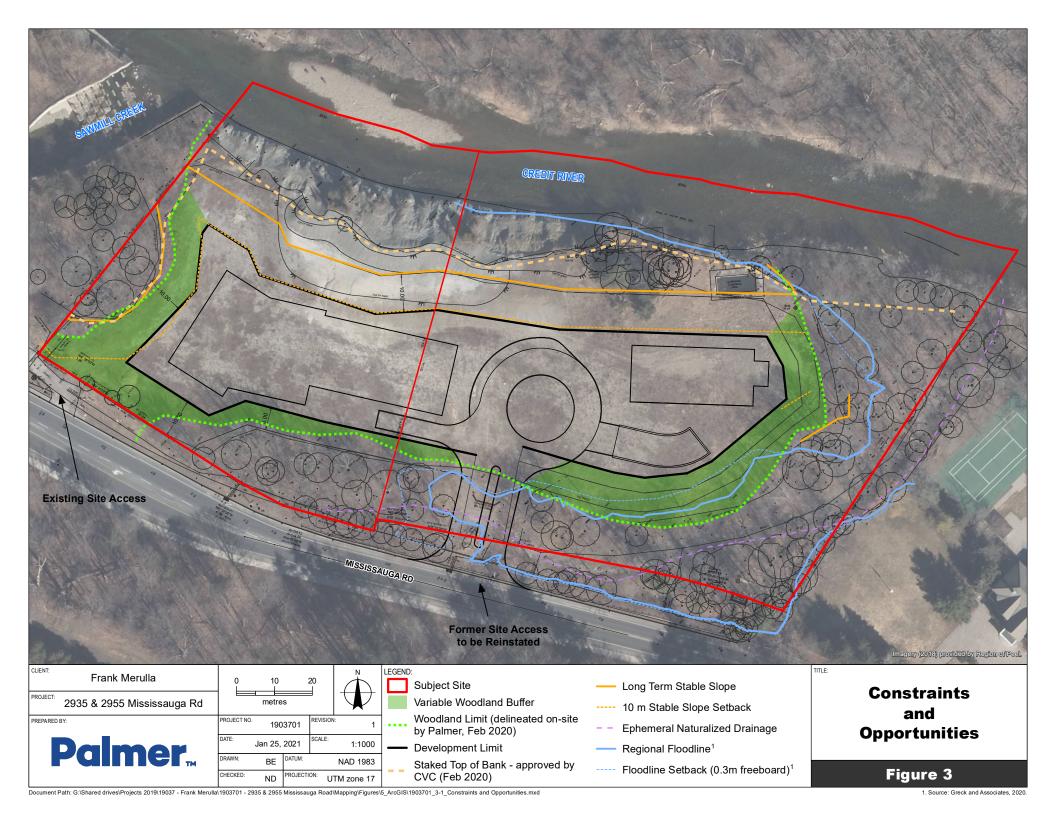
#### 7.1 Natural Features

The Significant Valleyland is proposed to be protected with a 10 m setback (Beacon, 2020) and the woodland located on the western property limit is proposed to be protected with a 10 m buffer.

The Significant Woodland along the southern and eastern property limits are proposed to be protected with a variable buffer ranging from 1.8 to 13.7 m wide. This buffer is proposed to be a combination of landscaping and pedestrian amenities with naturalized plantings throughout, as proposed by the proponent (Beacon, 2020). The narrowness of portions of FOD7-3 along Mississauga Road means that the woodland functions as edge habitat, thus smaller buffers would be achievable due to the limited sensitivity of the woodland.



## Figure 3. Constraints and Opportunities





#### 7.2 Regional Floodplain

Greck and Associate (Greck) has been engaged as part of the project team to review the hazard assessment associated with the regional floodplain. The following regional floodplain analysis was prepared by Greck:

Historical site alterations have significantly reduced contributing flows to the channel which is now described as an ephemeral naturalized drainage swale, and as such the floodline through the property is conservatively based on flood elevations originating from the Credit River which back up into the historical channel outlet. Greck have delineated the 2005 Golder floodline on the December 10, 2019 topographic mapping from the local land surveyor Tarasick McMillan Kubisick Limited. Greck has paired the floodplain with a 0.3m freeboard line based on hydraulic modelling from the Credit River (**Figure 3**). The regulatory flood elevation is delineated through the subject property on 2019 topographic mapping prepared by TMK. The flood elevation is derived from CVC approved floodplain mapping for this section of the Credit River, which was prepared by Golder Associates, 2005.

In accordance with provincial policy, all proposed development should be located outside of the 0.3m freeboard line. Given the flood elevations associated with the historical channel are based on backwater from the Credit River, any proposed fill should be compensated with an equivalent cut. However, it should be recognized that any fill impacts would have an insignificant impact on the main Credit River as this particular channel can be considered an ineffective flow area after its truncation years ago.

Therefore, the Regional flood limit associated with the ephemeral naturalized drainage channel is proposed to be protected with 0.3 m freeboard setback as determined by Greck.

# 8. Impact Assessment and Mitigation Measures

The proposed development will not require any vegetation clearing within the Project Site, except for the reinstatement of the site access at the location of the former driveway to Mississauga Road (**Figure 3**). The existing site access at 2955 Mississauga Road is proposed to be decommissioned and proposed to be naturalized with woodland plantings (**Figure 3**).

The following impact assessment and mitigation measures have been prepared based on the proposed site plan. Further potential impacts are to be assessed in greater detailed once the grading plan and stormwater management plan are prepared.

#### 8.1 Woodland Connectivity with the Reinstated Site Access

The narrow portion of the woodland feature adjacent to the north side of Mississauga Rd is considered a low functioning linear treed area. The woodland vegetation community is currently bisected by the anthropogenic opening where the former site access was located (Beacon, 2020). The proposed



reinstatement of the site access is not expected to result in changes to the woodland feature or its functions. Reinstating this access is expected to slightly encroach into existing woodland edge. Nevertheless, the woodland units of the FOD7-3 community are expected to remain connected from a functional perspective given the narrowness of the proposed site access. The reinstated site access is proposed to be approximately 15 m wide and woodland connectivity is considered to be maintained where canopy gaps are less than 20 m wide, per general guidance from Provincial technical documents such as the Oak Ridges Moraine Conservation Plan (ORMCP) *Technical Paper 7 - Identification and Protection of Significant* Woodlands (OMNR, 2007). The proposed reinstated site access is proposed to be constructed in a manner that will maintain and/or improve the Ephemeral Naturalized Drainage Swale. Thus, no negative impact is expected as a result of the reinstated site access.

Native buffer plantings are proposed to be implemented to protect the woodland feature from the proposed development with a variable buffer approach. Narrow buffer plantings are expected to adequately protect the feature from the proposed adjacent land uses (**Figure 3**).

#### 8.2 Minor Vegetation Removal

The removal of some forest edge vegetation is proposed to re-instate the former site access. This proposed works will involve the removal of common trees and shrubs that were present at the edge of the old access lane or that have regenerated into the clearing over time.

The proposed vegetation removal for the re-creation of the site access should be completed outside of the migratory bird period from early April to later August.

Consultation with the MECP should be undertaken to ensure conformity with the ESA regarding Endangered Bats before the removal of potential bat maternity roost trees. In general, tree removal should be conducted outside of the bat maternity roosting period from April 1 to September 30.

#### 8.3 Turtle Habitat Removal

The existing pool is considered to potentially result in the loss of wildlife. Although turtles have been observed in the pool, they may become trapped when water levels lower because the cement sides are too steep to climb out. Therefore, the existing pool is proposed to be removed to avoid detrimental wildlife use and safety precautions.

The removal of the pool should be completed during fall or winter months to avoid the active amphibian and reptile period that spans from early April to late September.

# 9. Policy Conformity

A summary of applicable natural heritage policies and the manner in which the proposed development plan meets their requirements is provided in **Table 4** below.



Table 4. Policy Conformity

Policy Document	Policy Intent/Objective	Implications and Policy Conformity
Migratory Birds Convention Act	Protect most species of migratory birds and their nests and eggs anywhere they are found in Canada.	Vegetation removal should be completed between early September and late March of any given year. Biologist to screen for nest for any proposed vegetation removal outside of this period.
Endangered Species Act	Species and the habitat of species designated as Endangered or Threatened are afforded legal protection.	SAR and SAR habitat this is known to be within or directly adjacent to the Project Site are proposed to be retained and protected. Consultation with MECP may be required regarding the removal of potential bat maternity roost trees.
Provincial Policy Statement	Direction to regional and local municipalities regarding planning policies for the protection and management of natural heritage features.	No development or site alteration is proposed within the existing, defined natural heritage features and the ecological functions will be maintained.
Growth Plan for the Greater Golden Horseshoe	Directs growth and the development to ensure economic prosperity, environmental protection and community support.	The Project Site is within the City's Settlement Area; the Growth Plan's natural feature protection buffer do not apply.
Region of Peel Official Plan	Core Areas: Development is generally prohibited within Core Areas.	No development is proposed in the existing limits of the woodland designated as Core area with the exception for a re-instated site access. The proposed site access is deemed to be a necessary and reasonable alternative to the existing site access.
City of Mississauga Official Plan	The City's Green System is comprised of the NHS, Urban Forest, Natural Hazard Lands, and Parks and Open Spaces. Buffers are determined on a site-specific basis as part of the EIS.	A 10 m buffer to the existing limits of the Significant Woodland and a 10 m setback to the Significant Valleyland are being proposed. The Project Site will be enhanced with native plantings following the completion of nearby grading works.
O. Reg. 160/06	CVC regulates activities in and adjacent to water, natural areas, and hazardous areas.	CVC's policies for buffers and setbacks are proposed to be implemented, including 10 m buffer to a Significant Woodland and 10 m setback to a Significant Valleyland.

# 10. Conclusions

The findings of this updated EIS are the result of a background review, field investigations, compilation of data from the 2017 Dougan and Associates EIS, and an analysis of data using current scientific understanding of the ecology of the area, as well as current natural heritage policy.



We have identified natural environmental sensitivities, constraints and development opportunities for the Project Site based on the current site conditions. The environmental constraints consist of various natural heritage features and respective buffers or setbacks in accordance with planning and regulatory policies and guidelines.

# 11. Signatures

This report was prepared, reviewed and approved by the undersigned:

	NDu
Prepared By:	
,	Natalie Dunn, B.Sc., PG[ER] Ecologist
Reviewed By:	Austin adams
,	Austin Adams, M.Sc., EP
	Senior Ecologist
Approved By:	Dir Janae
	Dirk Janas, B.Sc.

Principal, Senior Ecologist



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# **Appendix A**

Agency Comments to the Terms of Reference



#### Natalie Dunn <natalie.dunn@pecg.ca>

### RE: Proposed TOR for 2935&2955 Mississauga Road

1 message

Ashlee Rivet <Ashlee.Rivet@mississauga.ca>

Tue, Nov 26, 2019 at 2:14 PM

To: Natalie Dunn <natalie@pecg.ca>

Cc: "Maricris.Marinas@cvc.ca" <Maricris.Marinas@cvc.ca>, Michael Hynes <Michael.Hynes@mississauga.ca>

Hi Natalie,

The original email with the draft TOR was sent by Angela. If I remember correctly, this is now your file.

Attached are CVC's comments on the TOR. Community Services comments include:

- Please ensure that the City of Mississauga's Natural Areas Survey factsheet for the site is referenced in the background review section and that the site is discussed in the context of Mississauga's Natural Heritage System.
- Can you also ensure that the applicant has received Mississauga's EIS terms of reference checklist (attached)?

Any specific questions regarding these comments should be directed to the reviewer directly and copy me.

Thanks,



#### Ashlee Rivet-Boyle BES, MCIP, RPP

Planner, Development South

T 905-615-3200 ext.5751

ashlee.rivet@mississauga.ca

City of Mississauga | Planning and Building Department

**Development and Design Division** 

Please consider the environment before printing.

From: Angela Wallace [mailto:angela@pecg.ca]

**Sent:** Friday, June 14, 2019 1:51 PM

To: Maricris.Marinas@cvc.ca

Cc: Dirk Janas; Ashlee Rivet; Frank Merulla; planning@cvc.ca; Robin McKillop; Eric Greck

Subject: Proposed TOR for 2935&2955 Mississauga Road

Hi Maricris,

Attached, please find a proposed Environmental Impact Study Terms of Reference (TOR) for 2935 & 2955 Mississauga Road.

Please review this TOR and provide us with any comments or clarifications.

Please contact me at 647-795-8153 ext. 159 or angela@pecg.ca if you have any questions.

Thank you for your time.

Angela

Angela Wallace Senior Aquatic Ecologist

#### Palmer Environmental Consulting Group Inc.

74 Berkeley Street, Toronto, ON M5A 2W7 **t** 647 795 8153 ext 159 **c** 647 242 7207 **e** angela@pecg.ca www.pecg.ca

----- Forwarded message ------

From: "Marinas, Maricris" < Maricris.Marinas@cvc.ca>
To: Ashlee Rivet < Ashlee.Rivet@mississauga.ca>
Cc:

Bcc:

Date: Thu, 14 Nov 2019 15:55:27 +0000

Subject: 2935-2955 Miss Rd., EIS TOR Comments

Hi Ashlee,

As you are aware, there is a long history on these subject lands and throughout CVC has consistently provided guidance that the appropriateness and extent of any proposed development requires achieving regulatory and policy requirements including the restoration and rehabilitation of (unauthorized) disturbed portions of the site.

It is with this understanding that CVC staff provide the following comments with regards to the EIS TOR (attached):

#### **COMMENTS**

1. The subject property is entirely within the City of Mississauga's designated Green System (Natural Heritage System - significant natural area and natural green space, and Natural Hazards) and Core Area (environmentally significant area, significant woodlands, significant valleyland and fish habitat) of the Region of Peel's Greenlands System.

Please include a Policy Review section in the background review to identify all relevant planning policies and regulations; all municipal, regional and provincial designations; significant natural features; and, appropriate setbacks to these features. Both the City of Mississauga and Region of Peel's official Plans contain policies restricting development within, and adjacent to, these areas. Replacement and rehabilitation of ecological features and functions is required by the Region of Peel's Official Plan (2.3.2.7) where those have been damaged or destroyed.

- 2. Please refer to Region of Peel's Core Greenlands System mapping and related Official Plan policies to ensure the site and any proposed development is assessed and discussed in context with these.
- 3. Please include the review of historic aerial photography to identify the extent and ecological composition of pre-disturbance conditions on the subject property to inform the development of a site restoration plan.
- 4. Please provide a site restoration plan that will outline the extent of site restoration and the measures that will be taken to restore soil conditions, natural site gradients, and natural heritage features within the restoration area.
- 5. Please note two breeding bird survey visits is preferred to occur within a study year to attain the highest level of breeding status as possible for resident species, as per Ontario Breeding Bird Atlas protocols.
- 6. Please complete the screening for SAR bats in the SAR and SWH Screening exercises.

Further to the above, and for context, it maybe helpful to have a look at the attached memo which was provided as evidence for past proceedings.

Should you have any questions, please do not hesitate to contact me.

Regards,

Maricris

#### Maricris Marinas, M.Sc.

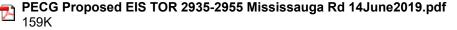
Senior Planner, Planning and Development Services | Credit Valley Conservation

905-670-1615 ext 220 | 1-800-668-5557

NEW: maricris.marinas@cvc.ca | cvc.ca

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#### 4 attachments





2935-2955 Miss Rd., EIS TOR Comments.eml

Mississauga EIS Checklist\_Draft 2017.pdf 598K



# **Appendix B**

**Flora List** 



# **Appendix B**

### **Flora List**

Scientific Name	Common Name	S Rank	SARO Status	CVC/PEEL STATUS (CVC, 2002)	Dungan 2017	Palmer 2019
Acer negundo	Manitoba Maple	S5			Х	Х
Acer nigrum	Black Maple	S4?			х	
Acer platanoides	Norway Maple	SNA			Х	
Acer saccharinum	Silver Maple	S5			х	
Acer saccharum	Sugar Maple	S5			Х	Х
Achillea millefolium	Common Yarrow	SNA			х	х
Aegopodium podagraria	Goutweed	SNA			Х	
Alliaria petiolata	Garlic Mustard	SNA			Х	х
Amelanchier arborea	Downy Serviceberry	S5			Х	
Amelanchier laevis	Smooth Serviceberry	S5			Х	
Amelanchier spicata	Running Serviceberry	S4		rare	Х	
Anemone quinquefolia	Wood Anemone	S5			х	
Antennaria howellii	Howell's Pussytoes	S5			Х	
Antennaria sp.	Pussytoes Species				х	
Apocynum androsaemifolium	Spreading Dogbane	S5			Х	
Arctium lappa	Great Burdock	SNA			Х	
Arctium minus	Common Burdock	SNA			Х	Х
Arenaria serpyllifolia	Thyme-leaved Sandwort	SNA			Х	
Arisaema triphyllum	Jack-in-the-pulpit	S5			Х	
Aruncus dioicus	Common Goatsbeard	SNA				х
Asclepias syriaca	Common Milkweed	S5			Х	Х
Asparagus officinalis	Garden Asparagus	SNA			Х	
Aster sp.	Aster Species				Х	
Berberis thunbergii	Japanese Barberry	SNA			Х	
Berberis x ottawensis	(Berberis thunbergii X Berberis vulgaris)	SNA			Х	
Betula papyrifera	Paper Birch	S5			Х	х
Betula pendula	Weeping Birch	SNA			Х	
Bromus inermis	Smooth Brome	SNA			х	х
Cardamine concatenata	Cut-leaved Toothwort	S5			Х	
Carex aurea	Golden Sedge	S5			Х	
Carex blanda	Woodland Sedge	S5			х	
Carex pensylvanica	Pennsylvania Sedge	S5			х	
Carex sp.	Sedge Species				х	
Carex spicata	Spiked Sedge	SNA			х	
Cichorium intybus	Wild Chicory	SNA			х	х



Scientific Name	Common Name	S Rank	SARO Status	CVC/PEEL STATUS (CVC, 2002)	Dungan 2017	Palmer 2019
Circaea canadensis	Broad-leaved Enchanter's Nightshade	S5			Х	
Cirsium arvense	Canada Thistle	SNA			Х	
Cirsium sp.	Thistle Species				х	х
Claytonia virginica	Eastern Spring Beauty	S5			Х	
Convallaria majalis	European Lily-of-the-valley	SNA			х	
Cornus racemosa	Grey Dogwood	S5			х	
Cornus rugosa	Round-leaved Dogwood	S5			х	
Cornus sericea	Red-osier Dogwood	S5			Х	
Cornus sp.	Dogwood Species					х
Crataegus crus-galli	Cockspur Hawthorn	S4			Х	
Crataegus sp.	Hawthorn Species				х	
Cryptotaenia canadensis	Canada Honewort	S5			Х	
Dactylis glomerata	Orchard Grass	SNA			х	х
Daucus carota	Wild Carrot	SNA			Х	Х
Dipsacus fullonum	Common Teasel	SNA			х	
Elymus canadensis	Canada Wildrye	S5		rare	Х	
Elymus repens	Quackgrass	SNA			х	
Elymus riparius	Eastern Riverbank Wildrye	S4		rare	Х	
Equisetum arvense	Field Horsetail	S5			х	
Erigeron philadelphicus	Philadelphia Fleabane	S5			Х	
Erythronium americanum	Yellow Trout-lily	S5			х	
Euonymus alatus	Winged Euonymus	SNA			Х	
Euphorbia esula	Leafy Spurge				Х	
Fagus grandifolia	American Beech	S4			Х	
Fragaria virginiana	Wild Strawberry	S5			х	
Fraxinus americana	White Ash	S4			Х	Х
Fraxinus excelsior	European Ash	SNA			х	
Fraxinus pennsylvanica	Red Ash	S4			Х	
Geranium maculatum	Spotted Geranium	S5			х	
Geranium robertianum	Herb-Robert	S5				Х
Geum aleppicum	Yellow Avens	S5			х	Х
Geum laciniatum	Rough Avens	S4			Х	
Geum macrophyllum	Large-leaved Avens	S5			х	
Geum sp.	Avens Species				Х	
Glechoma hederacea	Ground-ivy	SNA			х	
Hesperis matronalis	Dame's Rocket	SNA			Х	
Hordeum jubatum	Foxtail Barley	S5?				х
Hydrophyllum virginianum	Virginia Waterleaf	S5			Х	
Hypericum perforatum	Common St. John's-wort	SNA			Х	



Scientific Name	Common Name	S Rank	SARO Status	CVC/PEEL STATUS (CVC, 2002)	Dungan 2017	Palmer 2019
Impatiens capensis	Spotted Jewelweed	S5			Х	
Juglans nigra	Black Walnut	S4?			Х	х
Leonurus cardiaca	Common Motherwort	SNA				Х
Leucanthemum vulgare	Oxeye Daisy	SNA			х	х
Ligustrum vulgare	European Privet	SNA			Х	Х
Lonicera tatarica	Tatarian Honeysuckle	SNA			Х	х
Lotus corniculatus	Garden Bird's-foot Trefoil	SNA			Х	Х
Maianthemum racemosum	Large False Solomon's Seal	S5			х	х
Maianthemum sp.	Solomon's Seal Species				Х	
Maianthemum stellatum	Star-flowered False Solomon's Seal	S5			х	
Malus sp.	Apple Species				х	
Medicago lupulina	Black Medick	SNA			Х	Х
Melilotus albus	White Sweet-clover	SNA			Х	Х
Melilotus officinalis	Yellow Sweet-clover	SNA			х	
Nepeta cataria	Catnip	SNA			х	
Ostrya virginiana	Eastern Hop-hornbeam	S5			х	
Parthenocissus quinquefolia	Virginia Creeper	S4?			Х	
Parthenocissus vitacea	Thicket Creeper	S5			х	х
Penthorum sedoides	Ditch Stonecrop	S5			х	
Phleum pratense	Common Timothy	SNA			х	
Picea abies	Norway Spruce	SNA			х	
Picea glauca	White Spruce	S5			х	х
Pilosella caespitosa	Meadow Hawkweed	SNA				Х
Pilosella piloselloides ssp. praealta	King Devil Hawkweed	SNA			Х	
Pinus nigra	Austrian Pine	SNA			Х	
Pinus strobus	Eastern White Pine	S5			Х	х
Pinus sylvestris	Scots Pine	SNA			Х	
Plantago lanceolata	English Plantain	SNA				Х
Plantago major	Common Plantain	SNA			х	
Poa compressa	Canada Bluegrass	SNA			х	
Poa pratensis	Kentucky Bluegrass	S5			х	Х
Podophyllum peltatum	May-apple	S5			х	
Populus balsamifera	Balsam Poplar	S5			х	
Populus deltoides	Eastern Cottonwood	S5			х	
Populus grandidentata	Large-toothed Aspen	S5			Х	
Populus tremuloides	Trembling Aspen	S5			х	
Potentilla recta	Sulphur Cinquefoil	SNA			Х	Х
Prunella vulgaris	Common Self-heal	S5			х	
Prunus avium	Sweet Cherry	SNA			Х	



Scientific Name	Common Name	S Rank	SARO Status	CVC/PEEL STATUS (CVC, 2002)	Dungan 2017	Palmer 2019
Prunus serotina	Black Cherry	S5			Х	Х
Prunus virginiana	Chokecherry	S5			Х	
Quercus alba	White Oak	S5			Х	
Quercus macrocarpa	Bur Oak	S5			х	
Quercus rubra	Northern Red Oak	S5			х	х
Quercus velutina	Black Oak	S4		rare	х	
Ranunculus abortivus	Kidney-leaved Buttercup	S5			х	
Ranunculus acris	Common Buttercup	SNA			Х	
Ranunculus ficaria	Fig-root Buttercup	SNA			х	
Reynoutria japonica	Japanese Knotweed	SNA			Х	Х
Rhamnus cathartica	European Buckthorn	SNA			х	х
Rhus typhina	Staghorn Sumac	S5			Х	Х
Ribes sp.	Currant Species				х	
Ribes triste	Swamp Red Currant	S5			Х	
Robinia pseudoacacia	Black Locust	SNA			х	
Rosa multiflora	Multiflora Rose	SNA			Х	
Rosa sp.	Rose Species				х	х
Rubus idaeus	Red Raspberry	S5				Х
Rubus idaeus ssp. strigosus	North American Red Raspberry	S5			х	
Rubus occidentalis	Black Raspberry	S5			Х	
Rubus odoratus	Purple-flowering Raspberry	S5			х	
Rumex crispus	Curled Dock	SNA			х	
Rumex sp.	Dock Species				х	
Salix alba	White Willow	SNA			Х	
Salix fragilis (use S. euxina)	Crack Willow				х	
Salix sp.	Willow Species				Х	Х
Sanguinaria canadensis	Bloodroot	S5			х	х
Scilla siberica	Siberian Squill	SNA			Х	
Securigera varia	Purple Crown-vetch	SNA			х	х
Silene vulgaris	Bladder Campion	SNA			Х	
Solanum dulcamara	Bittersweet Nightshade	SNA			х	
Solidago altissima	Tall Goldenrod	S5			Х	
Solidago caesia	Blue-stemmed Goldenrod	S5			х	
Solidago canadensis	Canada Goldenrod	S5			Х	
Solidago flexicaulis	Zigzag Goldenrod	S5			х	х
Solidago gigantea	Giant Goldenrod	S5			Х	
Solidago nemoralis	Grey-stemmed Goldenrod	S5			х	
Solidago sp.	Goldenrod Species				Х	Х
Symphyotrichum cordifolium	Heart-leaved Aster	S5			х	



Scientific Name	Common Name	S Rank	SARO Status	CVC/PEEL STATUS (CVC, 2002)	Dungan 2017	Palmer 2019
Symphyotrichum lanceolatum	Panicled Aster	S5			Х	
Taraxacum officinale	Common Dandelion	SNA			Х	х
Thalictrum pubescens	Tall Meadow-rue	S5			Х	
Thuja occidentalis	Eastern White Cedar	S5			х	
Tilia americana	Basswood	S5			Х	Х
Tilia cordata	Little-leaved Linden	SNA			Х	
Toxicodendron radicans	Poison Ivy	S5			Х	Х
Tragopogon dubius	Yellow Goatsbeard	SNA			х	
Trifolium repens	White Clover	SNA			Х	
Tsuga canadensis	Eastern Hemlock	S5			Х	
Tussilago farfara	Coltsfoot	SNA			Х	
Ulmus americana	White Elm	S5			Х	х
Ulmus pumila	Siberian Elm	SNA			Х	
Urtica dioica	Stinging Nettle	S5			х	Х
Verbascum thapsus	Common Mullein	SNA			Х	
Veronica officinalis	Common Speedwell	SNA			х	
Veronica persica	Bird's-eye Speedwell	SNA			Х	
Viburnum acerifolium	Maple-leaved Viburnum	S5			х	
Viburnum opulus	Cranberry Viburnum	S5			Х	
Viburnum sp.	Viburnum Species				х	
Vicia cracca	Tufted Vetch	SNA			Х	Х
Viola cucullata	Marsh Blue Violet	S5		rare	х	
Viola sp.	Violet Species				Х	
Vitis riparia	Riverbank Grape	S5			х	х



# **Appendix C**

**Breeding Birds** 



## **Appendix C**

## **Breeding Birds**

_						S	urvey	s
Common Name	Scientific Name	SARO	S Rank	Area Sensitivity	Breeding Evidence	26-05-14	09-06-14	14-06-19
Mallard	Anas platyrhynchos		<b>S</b> 5		CONFIRMED	1X	5H, 5FY	
Common Loon	Gavia immer		S5			2X	1X	
Great Blue Heron	Ardea herodias		S4				1X	1X
Red-tailed Hawk	Buteo jamaicensis		S5		POSSIBLE		1H	
Killdeer	Charadrius vociferus		S5		CONFIRMED	2T, 2FY	2T, 2FY	
Ring-billed Gull	Larus delawarensis		S5				R	
Belted Kingfisher	Megaceryle alcyon		S4		PROBABLE		1P	
Northern Flicker	Colaptes auratus		S4		PROBABLE	2H, 1P	1H	
Eastern Kingbird	Tyrannus tyrannus		S4		POSSIBLE	1H		
Red-eyed Vireo	Vireo olivaceus		S5		PROBABLE	1S	1T	1S
Blue Jay	Cyanocitta cristata		S5		POSSIBLE	1H	1S, 2H	1S
American Crow	Corvus brachyrhynchos		S5		POSSIBLE		1S, 1H	
Northern Rough-winged Swallow	Stelgidopteryx serripennis		S4		POSSIBLE	4H	4H	
Bank Swallow	Riparia riparia	THR	S4		POSSIBLE	6H	2H	6X
White-breasted Nuthatch	Sitta carolinensis		S5	AS	POSSIBLE	1S		
House Wren	Troglodytes aedon		S5		POSSIBLE	1S		
American Robin	Turdus migratorius		S5		PROBABLE	1P, 1S, 1H		3S
Gray Catbird	Dumetella carolinensis		S4		PROBABLE	1H	1T	1S
European Starling	Sturnus vulgaris		SNA		POSSIBLE	1H		2S
Song Sparrow	Melospiza melodia		S5		PROBABLE	28	2T, 1S	2S
Northern Cardinal	Cardinalis cardinalis		S5		POSSIBLE	2S	2S	
Red-winged Blackbird	Agelaius phoeniceus		S4		POSSIBLE	3H	R	1X



						S	urvey	s
Common Name	Scientific Name	SARO	S Rank	Area Sensitivity	Breeding Evidence	26-05-14	09-06-14	14-06-19
Common Grackle	Quiscalus quiscula		S5		POSSIBLE		7X	
Baltimore Oriole	Icterus galbula		S4		PROBABLE	1S	1T	
American Goldfinch	Spinus tristis		S5		PROBABLE	1S		5P
House Sparrow	Passer domesticus		SE		PROBABLE			1X
Great Crested Flycatcher	Myiarchus crinitus		S4		PROBABLE			1S
Turkey Vulture	Cathartes aura		S5		POSSIBLE			2X
Black-capped Chickadee	Poecile atricapillus		S5		PROBABLE			2S

H – species observed in its breeding season in suitable nesting habitat.

FY - fledged young observed

A – agitated behaviour displayed by adult

CF - adult carrying food

X – species observed but not in appropriate breeding habitat or flying over

R - species recorded

T – permanent territory presumed through registration of territorial song on at least two days, a week or more apart, at the same place.

S – singing male present, or breeding calls heard, in its breeding season in suitable nesting habitat.

P – pair observed in their breeding season in suitable nesting habitat.



# **Appendix D**

Significant Wildlife Habitat Screening



# **Appendix D**

### **Significant Wildlife Habitat**

SWH Type	Associated Species	Associated ELC Ecosites	Habitat Criteria	Presence (Y/N)	Additional Notes and Species Observations				
Seasonal Concentration	Seasonal Concentration Areas of Animals								
Waterfowl Stopover and Staging Areas (Terrestrial)	Duck-like species, Tundra Swan	CUM + CUT ecosites	Fields with sheet-water flooding mid-March to May. Specific areas for Tundra Swan	N	Anthropogenic area without sheet flooding.				
Waterfowl Stopover and Staging Area (Aquatic)	Ducks, Geese	Ponds, Lakes, Inlets, Marshes, bays, coastal inlets, watercourse used in migration, Swamps, Shallow Water Ecosites	Sewage & SWM ponds <b>not</b> SWH. Reservoir managed as a large wetland or pond/lake qualifies. Abundant food supply (inverts, shallow water veg)	N	The Credit River may be a migratory route, but the portion of the watercourse adjacent to the Project Site does not provide stopover or staging area.				
Shorebird Migratory Stopover Area	Shorebirds	Beaches, Dunes, Meadow Marshes	Shorelines. Great Lakes Shores, including rocky ones. Sewage treatment ponds and storm water ponds <b>not</b> SWH.	N	Suitable vegetation community is absent.				
Raptor Wintering Area	Eagles, Hawks, Owls	Hawks/Owls: Combination of both Forest and Cultural Ecosites Bald Eagle: Forest or swamp near open water (hunting ground)	Raptors: >20ha, with a combo of forest and upland. Meadow (>15ha) with adjacent woodlands.  Eagles: open water, large trees & snags for roosting.	N	Extensive urban woodland present but meadow communities are believed to be insufficient. One hawk nest was noted on site but habitat is not believed to be significant.				
Bat Hibernacula	Big Brown Bat, Tri- coloured Bat	Caves, Crevices, mines, karsts	Buildings and active mine sites <b>not</b> SWH.	N	Suitable habitat is absent				



SWH Type	Associated Species	Associated ELC Ecosites	Habitat Criteria	Presence (Y/N)	Additional Notes and Species Observations
Bat Maternity Colonies	Big Brown Bat, Silver- haired Bat	Decidious or mixed forests and swamps.	Mature deciduous and mixed forests with >10/ha cavity trees >25 cm DBH.	N	Bat maternity roost surveys have not been conducted on site, but given the limit area of tree cover and the linear nature of the remnant woodland, the Project Site is not believed to support significant habitat.
Turtle Wintering Area	<b>Turtles</b> (Midland, N. Map, Snapping)	SW, MA, OA, SA, FEO, BOO (requires open waters)	Free water beneath ice. Soft mud substrate. Permanent water bodies, large wetlands, bogs, fens with adequate DO. Man-made is not SWH.	N	Suitable natural habitat is absent. The abandoned pool is a non-natural structure and is not believed to be a suitable wintering area.
Reptile Hibernaculum	Snakes	Snakes: Any ecosite (esp. w/ rocky areas), other than very wet ones. Talus, Rock Barren, Crevice, Cave, Alvar esp.	Access below frost line: burrows; rock crevices, piles or slopes, stone fences or foundations. Conifer/shrubby swamps/swales, poor fens, depressions in bedrock w/ accumulations of sphagnum moss or sedge hummock ground cover.	N	Suitable habitat is absent.
Colonially-nesting Bird Breeding Habitat (Bank and Cliff)	Cliff Swallow, N. Rough-winged Swallow	Banks, sandy hills/piles, pits, slopes, cliff faces, bridge abutments, silos, barns.	Exposed soil banks, <b>not</b> a licensed/permitted aggregate area or new man-made features (2 yrs).	N	Species absent during breeding bird surveys.



SWH Type	Associated Species	Associated ELC Ecosites	Habitat Criteria	Presence (Y/N)	Additional Notes and Species Observations
Colonially-nesting Bird Breeding Habitat (Tree/Shrubs)	Great Blue Heron, Black-crowned Night Heron, Great Egret, Green Heron	SWM2, SWM3, SWM5, SWM6, SWD1 to SWD7, FET1	Nests in live or dead standing trees in wetlands, lakes, islands and peninsulas. Shrubs and emergents may be used. Nests in trees are 11 - 15 m from ground, near tree tops.	N	Species absent during breeding bird surveys.
Colonially-nesting Bird Breeding Habitat (Ground)	Gull, Common Tern, Caspian Tern,	Gulls/Terns: Rocky island or peninsula in lake or river. Brewer's Blackbird: close to watercourses in open fields or pastures with scattered trees or shrubs.	Gulls/Terns: islands or peninsulas with open water or marshy areas. Brewers Blackbird colonies: on the ground in low bushes close to streams and irrigation ditches.	N	Species absent during breeding bird surveys.
Migratory Butterfly Stopover Area	Painted Lady, Red Admiral, <b>Special Concern:</b> Monarch	Combination of open (CU) and forested (FO) ecosites (need one from each).	≥10 ha, located within 5 km of Lake Ontario. Undisturbed sites, with preferred nectar species.	N	Within 5 km of Lake Ontario but site has been disturbed over time.
Landbird Migratory Stopover Areas	All migratory songbirds. All migrant raptor species.	Forest (FO) and Swamp (SW) ecosites	Woodlots >5 ha within 5 km of L. Ontario & L. Erie (2-5 ha if rare in area). If multiple woodlands are along the shoreline, those <2 km from L. Ontario are more significant.	N	Within 5 km of Lake Ontario but no significant numbers of song birds and/or raptors were recorded during breeding bird surveys and the site is occupied by only a small amount of forest habitat
Deer Winter Congregation Areas	White-tailed Deer	Mixed or Conifer ecosites	Determined by MNRF - no studies	N	Not identified to be present by MNRF mapping.



SWH Type	Associated Species	Associated ELC Ecosites	Habitat Criteria	Presence (Y/N)	Additional Notes and Species Observations
Cliffs and Talus Slopes		TAO, TAS, CLO, CLS, TAT, CLT e.g., Niagara Escarpment (contact NEC)	Cliff: near vertical bedrock >3m Talus Slope: coarse rock rubble at the base of a cliff	N	Vegetation community absent.
Sand Barren		SBO1, SBS1, SBT1	Sand Barrens >0.5 ha. Vegetation can vary from patchy and barren to tree covered, but <60%. <50% vegetation cover are exotic species.	N	Vegetation community absent.
Alvar	Carex crawei, Panicum philadelphicum, Eleocharis compressa, Scutellaria parvula, Trichostema brachiatum	ALO1, ALS1, ALT1, FOC1, FOC2, CUM2, CUS2, CUT2-1, CUW2	Alvar >0.5 ha. <b>Need 4 of the 5 Alvar Inidcator Spp.</b> <50% vegetation cover are exotic species.	N	Vegetation community absent.
Old Growth Forest	Trees >140 yrs; heavy mortaily = gaps. Multi-layer canopy, lots of snags and downed logs	FOD, FOC, FOM, SWD, SWC, SWM	Woodland areas 0.5 ha. No evidence of logging.	N	Vegetation community absent.
Savannah	Prairie Grasses w/ trees	TPS1, TPS2, TPW1, TPW2, CUS2	No min. size.A Savannah is a tallgrass prairie habitat that has tree cover of 25 – 60%. <50% cover of exotic species.	N	Vegetation community absent.
Tallgrass Prairie	Prairies Grasses dominate	TPO1, TPO2	No min. size. An <u>open Tallgrass Prairie</u> habitat has < 25% tree cover. Less than 50% cover of exotic species.	N	Vegetation community absent.



SWH Type	Associated Species	Associated ELC Ecosites	Habitat Criteria	Presence (Y/N)	Additional Notes and Species Observations
Other Rare Vegetation Communities		Provincially Rare S1, S2 and S3 vegetation communities are listed in Appendix M of SWHTG.	Rare Vegetation Communities may include beaches, fens, forest, marsh, barrens, dunes and swamps.	N	Rare vegetation communities are absent.
Waterfowl Nesting Area	Ducks	Upland habitats adjacent to: MAS1 to MAS3, SAS1, SAM1, SAF1, MAM1 to MAM6, SWT1, SWT2, SWD1 to SWD4 (>0.5 ha open water wetlands, alone or collectively).	Extends 120 m from a wetland or wetland complex. Upland areas should be at least 120 m wide. Wood Ducks and Hooded Mergansers use cavity trees (>40 cm dbh).	N	Vegetation community absent.
Bald Eagle & Osprey Nesting, Foraging and Perching Habitat	Osprey, Bald Eagle	FOD, FOM, FOC, SWD, SWM, SWC directly adjacent to riparian areas	Nesting areas are associated with waterbodies along forested shorelines, islands, or on structures over water. Not man-made structures.	N	Suitable vegetation community present but species not observed during breeding bird surveys.
Woodland Raptor Nesting Habitat	Barred Owl. Hawks: N. Goshawk, Cooper's, Sharp- shinned, Red- shouldered, Broad- winged.	Forests (FO), swamps (SW), and conifer plantations (CUP3)	>30 ha with > 4 ha interior habitat (200 m buffer)	N	Suitable interior habitat is absent.
Turtle Nesting Areas	Midland Painted Turtle Special Concern: Snapping Turtle, Northern Map Turtle	Exposed mineral soil (sand or gravel) areas adjacent (<100m) or within: MAS1 to MAS3, SAS1, SAM1, SAF1, BOO1, FEO1	Nest sites within open sunny areas with soil suitable for digging. Sand and gravel beaches.	N	Suitable habitat is absent.



SWH Type	Associated Species	Associated ELC Ecosites	Habitat Criteria	Presence (Y/N)	Additional Notes and Species Observations
Seeps and Springs	Deer, Salamander spp.	Seeps/Springs are areas where ground water comes to the surface.	Any forested area within the headwaters of a stream/river system. (2 or more confirms SWH type).	N	Not observe during field investigations.
Amphibian Breeding Habitat (Woodland)	Woodland Frogs and Salamanders, E. Newt	FOC, FOM, FOD, SWC, SWM, SWD	Open water wetlands, pond or woodland pool of >500 m² within or adjacent to wooded areas. Permanent ponds or holding water until mid-July preferred.	N	Suitable habitat is absent.
Amphibian Breeding Habitat (Wetlands)	Toads, Frogs, and Salamanders, E. Newt	SW, MA, FE, BO, OA and SA. Typically isolated (>120m) from woodland ecosites, however larger wetlands may be adjacent to woodlands.	Open water wetland ecosites >500m <sup>2</sup> isolated from woodland ecosites with high species diversity. Permanent water with abundant vegetation for bullfrogs.	N	Suitable habitat is absent.
Woodland Area- Sensitive Bird Breeding Habitat	Birds (area-sensitive species)	FOC, FOM, FOD, SWC, SWM, SWD	Large mature (>60 years) forest stands/woodlots >30 ha. Interior forest habitat >200m from forest edge.	N	Suitable interior habitat is absent.
Habitat of Species of C	Conservation Concern				
Marsh Bird Breeding Habitat	Wetland Birds	MAM1 to MAM6, SAS1, SAM1, SAF1, FEO1, BOO1 <b>Green Heron</b> : SW, MA and CUM1	Wetlands with shallow water and emergent vegetation. Gr. Heron @ edges of these types w/ woody cover.	N	Suitable habitat is absent.
Open Country Bird Breeding Habitat	Upland Sandpiper, Grasshopper Sparrow, Vesper Sparrow, N. Harrier, Savannah Sparrow, Short-eared Owl (SC)	CUM1, CUM2	Grassland/meadow >30 ha. Not being actively used for farming. Habitat established for 5 years or more.	N	Suitable habitat is absent.



SWH Type	Associated Species	Associated ELC Ecosites	Habitat Criteria	Presence (Y/N)	Additional Notes and Species Observations
Shrub/Early Successional Bird Breeding Habitat	Brown Thrasher + Clay-coloured Sparrow (indicators); Field Sparrow, Black-billed Cuckoo, E. Towhee, Willow Flycatcher, Yellow-breasted Chat, Golden-winged Warbler	CUT1, CUT2, CUS1, CUS2, CUW1, CUW2	Large field areas succeeding to shrub and thicket habitats > 10 ha. Areas not actively used for farming in the last 5 years.		Suitable habitat is absent.
Terrestrial Crayfish	Chimney or Digger Crayfish; Devil Crayfish or Meadow Crayfish	MAM1 to MAM6, MAS1 to MAS3, SWD, SWT, SWM. CUM1 sites with inclusions of the aforementioned.	Wet meadow and edges of shallow marshes (no minimum size) should be surveyed for terrestrial crayfish (typc. protected by wetland setbacks).	N	Suitable habitat is absent.
Special Concern and Rare Wildlife Species	Any species of concern or rare wildlife species	Any ELC code.	Presence of species of concern or rare wildlife species.	N	Snapping Turtle was observed at the abandonned pool which is not considered a natural feature.
<b>Animal Movement Cor</b>	ridors				
Amphibians	Amphibians	all ecosites assoc. w/ water	When Breeding Habitat - wetland confirmed	N	Species absent during breeding brid surveys.
Exceptions for Ecoreg	ion 7E				
Bat Migratory Stopover: 7E-2	Hoary Bat, Eastern Red Bat, Silver-haired Bat	No Specific ELC	Long Point (42°35' N, 80°30'E to 42°33' N, 80°,03'E) - Silver-haired.	N	Limited presence of woodland cover associated with the Project Site.



Region of Peel Correspondence

#### **Elliot Pai**

From: Sniatenchuk, Bernadette <bernadette.sniatenchuk@peelregion.ca>

**Sent:** December 23, 2020 3:40 PM

To: Deven Verma
Cc: Razao, Ricardo

**Subject:** DI-19-078M modelling results

Hi Deven, Here are the modelling results for the proposal associated with DI-19-078M:

#### Wastewater:

There is no existing municipal sanitary sewer on Mississauga Road. You inquired about a forcemain proposal however, so I'm just going to reiterate that we do not have any standards for forcemains within the road allowance and therefore we will not accept a forcemain. We will accept gravity only. The transition from forcemain to gravity shall occur on private side so that the sampling maintenance hole at the property does not experience the velocities from the forcemain. The property line sampling maintenance hole will accept flow by gravity. The Region only permits connections to sanitary trunk sewer maintenance holes where there is no other option available.

There are no future wastewater capital and masterplan projects planned in the vicinity of the proposed development. The calculated peak wet weather flow if 9.8L/s. The demand table submitted indicated that connection point is Existing MH 3T and it appears to be existing manhole on the 1050mm sanitary trunk along Mississauga Road, shown on as-constructed drawing C11328. The existing wastewater system has sufficient capacity to receive the proposed flows and we recommend connection to maintenance hole SA MH2T on the 1050mm Trunk Sewer along Mississauga Road instead of SAMH3T.

I found some emails in the system that you sent to Wastewater inquiring about the inverts for the manholes on the 1050mm trunk sewer around the time I had sent this site for modelling. I saw that my colleague, Bogdan, referred you to our Operations staff. What was the outcome of that? Please keep me in the loop regarding this. In future, if you have any questions related to the servicing of this site, please let me know.

#### Water:

As I mentioned previously, this type of development requires connection to a minimum size municipal watermain of 300mm and there is currently a 150mm watermain within Mississauga Road. This development would not be permitted to connect to the 150mm watermain on Mississauga Road. There are no future water capital and masterplan projects planned in the vicinity of the proposed development. The closest existing municipal watermain is the 400mm watermain on Dundas Street and modelling has confirmed that there is capacity in this watermain to service the proposed development. The 150mm watermain cannot be removed as it is servicing an existing resident. We recommend that you investigate connection to the 400mm watermain on Dundas. I suggest pulling the records for the intersection of Mississauga Road and Dundas and investigating the ownership/status of the lands between the subject site and the Roads. PUCC may be required.

When this proposal is submitted under a formal planning application, we will require a complete FSR (I sent the link earlier this year) which should include a servicing plan and a hydrant flow test. We will analyse the servicing proposal in further detail.

Thanks and I hope you have a happy holiday! **Bernadette Sniatenchuk, B.Sc.**Project Manager – Servicing Connections

Development Services, Public Works, Region of Peel 10 Peel Centre Drive, Suite B, 4th Floor

Brampton, On L6T 4B9

e-mail: bernadette.sniatenchuk@peelregion.ca

Phone: 905-791-7800, ext.8589

Mobile: 647-285-5919

In response to the emergence of the novel coronavirus, the Region of Peel is implementing various measures to protect our customers, employees and workplaces. Development Services will endeavour to maintain the continuity of our business operations, however delays in service may still be experienced. We appreciate your patience during this time.

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APPENDIX E

Watermain Calculations

#### WATER DEMAND CALCULATIONS

**G**Greck

PROJECT: 2935, 2955 Mississauga Road

DESIGNED BY: Deven Verma

LOCATION: Mississiauga, ON

REVIEWED BY: Khalid Mahmood, P. Eng

DATE: March 08, 2021

#### **Design Parameters**

Residential		
Persons Per Area - Townhouses (persons / ha):	175	(Region of Peel, Sanitary Design Criteria Section 2.1)
Residential Area - Townhouses (ha)	0.55	
Persons Per Unit - Apartments (persons / unit):	2.7	(Region of Peel, Sanitary Design Criteria Section 2.1)
Residential Apartments Units	187	
Total Population	602	
Average Day Residential flow (L/cap/day):	280	(Region of Peel, Watermain Design Criteria Section 2.3 Table 1)
Maximum Day Factor:	2	(Region of Peel, Watermain Design Criteria Section 2.3 Table 1)
Peak Hour Factor:	3	(Region of Peel, Watermain Design Criteria Section 2.3 Table 1)
Fire Flow for 12 Storey Condominium Building: (L/min)	8,000	Calculated (Fire underwriters survey, 1999)
Fire Flow for 12 Storey Condominium Building: (L/s)	133.33	

Manual Input
Automatic Output
Total Demand

#### **Demands**

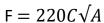
	Population	Average [	Daily Deman	d (ADD)	Max. Da	ily Demand	(MDD)	Peak Ho	our Demand	(PDD)	MDD+FrFL	Demand
	#	(L/day)	(L/min)	(L/s)	(L/day)	(L/min)	(L/s)	(L/day)	(L/min)	(L/s)	(L/min)	(L/s)
Total	602	168,560.00	117.06	1.95	337,120.00	234.11	3.90	505,680.00	351.17	5.85	8,234.11	137.24

#### FIRE FLOW CALCULATIONS

PROJECT: 2935, 2955 Mississauga Road LOCATION: Mississauga, ON DATE: March 08, 2021

DESIGNED BY: Deven Verma REVIEWED BY: Khalid Mahmood, P. Eng





\*NOTE\* Table based on procedures and figures from the Water Supply for Public Fire Protection - Fire Underwriters Survey of Canada, 1999.

Total Building Gross Floor Area (12 storeys) (m2)

14811.5

Exposure distance factor max adjustment is 75%

Residential Area - Condo (m2)

1234.3

A = The total floor area in square metres including all storeys, excluding basements at least 50% below grade.

Manual Input

#### PROPOSED 12 STOREY RESIDENTIAL CONDOMINIUM BUILDING

Step	Description	Term	Options		Multiplier Associated with Option	Value used	Unit	Total Fire Flow (L/min)
			Bui	lding Mate	rial			
			Wood Frame	!	1.5			
1	Frame Use for	Coefficient related to type of construction	Ordinary Constru	ction	1			
1 1	Construction of Unit	(C)	Non-Combustible Cor	nstruction	0.8	0.8	N/A	N/A
		(6)	Fire Resistive materia	ls (<2hrs)	0.7			
			Fire Resistive materia	ls (>2hrs)	0.6			
2	Number of Storeys	Number of floors not inlcuding basement				12	N/A	N/A
		Total Floor Area (A) - for all stories exluding	g basement (m²)			14811.5		
3	Floor Area (A)		Square Feet (f	t²)	0.093		(m²)	N/A
	Floor Area (A)	Average Floor Measurements	Square Metres (	m²)	1	1234.3	(111)	IN/A
			Hectares (ha	)	10,000			
4	Fire Flow	Required fire flow without reductions or in	creases (rounded to the	nearest 10	00 L/min:		L/min	21,000
			Reductions / Increase	s From Fact	tors Affecting Burning	g		
			Non-Combustible		-0.25			
5	Combustibility of	Occupancy content hazard reduction or	Limited Combustible		-0.15			
	Building Contents	surcharge Factor	Combustible		0.00	-0.15	N/A	-3,150
		a service garage	Free Burning		0.15			
			Rapid Burning		0.25			
	Building Equipped		Complete Automatic Sp	orinklers	-0.50			
6	with Sprinklers	Sprinkler Reduction Factor	Adequate Automatic Sp	orinklers	-0.30	-0.50	N/A	-10,500
			None		0.00			
			North Separation	45m +	0.00			
7	Separation Distance	Exposure Distance Factor *	South Separation	45m +	0.00	0.05	N/A	1,050
'	Between Buildings	Exposure Distance Factor		45m +	0.05	0.00	.,,,	1,050
			'	45m +	0.00			
			<b>Total Required F</b>	ire Flow				8,000
8	Required Fire Flow				<u> </u>	uired Fire Flow in L/s:	133.3	
	'					on of Fire Flow (hrs):	2	
					Required Volun	ne of Fire Flow (m <sup>3</sup> ):	960	

Separation Distance Factor as per Fire Underwriters Survey of Canada, 1999

	Seperation	Charge	Seperation	Charge
ſ	0 to 3m	25%	20.1 to 30m	10%
١	3.1 to 10m	20%	80.1 to 45m	5%
1	10.1m to 20m	15%		

Acceptable Fire Flow ranges as per Fire Underwriters Survey of Canada, 1999

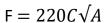
 $2,000 \; \text{Lpm} < F < 45,000 \; \text{Lpm}$ ; therefore acceptable

#### FIRE FLOW CALCULATIONS

PROJECT: 2935, 2955 Mississauga Road LOCATION: Mississauga, ON DATE: March 08, 2021

DESIGNED BY: Deven Verma REVIEWED BY: Khalid MahMood, P. Eng





\*NOTE\* Table based on procedures and figures from the Water Supply for Public Fire Protection - Fire Underwriters Survey of Canada, 1999.

Total Building Gross Floor Area (2 storey) (m2) Residential Area - Townhouses (m2) 975 487.5 Exposure distance factor max adjustment is 75%

A = The total floor area in square metres including all storeys, excluding basements at least 50% below grade.

Manual Input

#### PROPOSED RESIDENTIAL TOWNHOUSES

Step	Description	Term	Options		Multiplier Associated with Option	Value used	Unit	Total Fire Flow (L/min)
			Build	ing Mate	rial			
			Wood Frame		1.5			
1	Frame Use for		Ordinary Construct	ion	1			
1	Construction of Unit	Coefficient related to type of construction (C)	Non-Combustible Const	truction	0.8	0.8	N/A	N/A
		(6)	Fire Resistive materials	(<2hrs)	0.7			
			Fire Resistive materials	(>2hrs)	0.6			
2	Number of Storeys	Number of floors not inlcuding basement				2	N/A	N/A
		Total Floor Area (A) - for all stories exluding	g basement (m²)			975.0		
3	Floor Area (A)		Square Feet (ft²)		0.093		(m²)	N/A
	1 1001 Area (A)	Average Floor Measurements	Square Metres (m	<sup>2</sup> )	1	487.5	(111 )	N/A
			Hectares (ha)		10,000			
4	Fire Flow	Required fire flow without reductions or in					L/min	5,000
			Reductions / Increases I	rom Fact		3		
			Non-Combustible		-0.25			
5	Combustibility of	Occupancy content hazard reduction or	Limited Combustible		-0.15			
	Building Contents	surcharge Factor	Combustible		0.00	-0.15	N/A	-750
			Free Burning		0.15			
			Rapid Burning		0.25			
	Building Equipped		Complete Automatic Spri		-0.50			
6	with Sprinklers	Sprinkler Reduction Factor	Adequate Automatic Spri	nklers	-0.30	0.00	N/A	0
	·		None		0.00			
				im +	0.00			
7	Separation Distance	Exposure Distance Factor *		im +	0.00	0.05	N/A	250
	Between Buildings			im +	0.05			
			· ·	5m +	0.00			
			Total Required Fir	e Flow				5,000
8	Required Fire Flow				<u>.</u>	ired Fire Flow in L/s:	83.3	
	'					on of Fire Flow (hrs):	2	
					Required Volun	ne of Fire Flow (m³):	525	

#### Separation Distance Factor as per Fire Underwriters Survey of Canada, 1999

Seperation	Charge	Seperation	Charge
0 to 3m	25%	20.1 to 30m	10%
3.1 to 10m	20%	80.1 to 45m	5%
10.1m to 20m	15%		

Acceptable Fire Flow ranges as per Fire Underwriters Survey of Canada, 1999

 $2,000 \; \text{Lpm} < F < 45,000 \; \text{Lpm}$ ; therefore acceptable

## APPENDIX F

Sanitary Calculations



Residential Density (Townhouse) =

Manning 'n' = 0.013

Extran. Flow (manhole) 0.28 l/s/mh

Extran. Flow (general allowance) 0.2 l/s/ha

Uncertaintity Factor=

#### **Region of Peel SANITARY SEWER DESIGN SHEET**

Project / Subdivision: 2935, 2955 Mississauga Road Prepared by: Deven Verma Last Revised: April 21, 2021

Consulting Engineer: Greck and Associates Limited

**Project No.: 20-697** 

Checked by: Khalid Mahmood, P. Eng

**Design Parameters** 

Region Sect 2.3

Region Sect 2.3

**Design Equations** Residential Sanitary Residential Density (Apartments) = 475 person / ha 302.8 L/cap/day (Region STD DWG 2-9-2) Q(p) = peak population flow (L/s) Region Sect 2.1 Demand = P = population Region Sect 2.1 0.0035 L/cap/s i x A = peak extraneous flow (L/s) M = peaking factor (Harmon) M (Min) = 2 Residential Density (Apartments) = 2.7 person per unit Region Sect 2.1 Q(c) =c x A = peak commercial flow (L/s) P = p x # units / 1000

> li x A =peak light industrial flow (L/s) Q(li)= 86.4

Qcap =  $1/n*A*R^{0.67}S^{0.5}$  $Q = (P \times q \times M) / 86.4$ 

 $M = 1 + 14 / (4 + P^{1/2})$ 

Manning's Equation

Q(d) = Q(p) + Q(l) + Q(m) = peak design flow (L/s)

Notes/Comments: Minimum Allowable Actual Velocity 0.6 m/s, M	ax 3 m/s Apartment population to be higher of 475/ ha or 2.7 person per unit
--	--

References: Region of Peel Sanitary Sewer Design Criteria (Region), March 2017 REV (0.9 (CS)

	Location			Individual Values				Cur	nulative '	Values		Cumula	ative Flow	Data					Sewer	Data (TBD	))		
Area ID	From	То	Townhouse Residential Area	Building "A" Residential Area	Residential Units (Apartments)	Residential Population	Residential Townhouse Area (Ha)	Residential Apartment Area (Ha)	Residentual Units (Apartments)	Total Population	Residential P.F.	Population Peak Flow (L/s)	Peak Extran. Flow (General Allowance) (L/s)	Peak Extraneous Flow (Manhole) (ビs)	Total Design Flow (L/s)	Length	Pipe Size	Type of Pipe	Grade	Full Flow Capacity (Qcap)	Full Flow Velocity	Actual Velocity	%Full
	MH #	MH #	(ha)	(ha)	#	сар.		A(a)	#	Р	M(r)	Q(P)	Q(I)	Q(m)	Q(d)	(m)	(mm)		(%)	(L/s)	(m/s)	(m/s)	%
PRIVATE : Stack Apartment Townhomes PRIVATE :	BLDG	SAN PLUG	0.55		20	97	0.55			97	4.25	1.44	0.11		1.55								
CONDOMINIUM BUILDING "A"	BLDG	SAN PLUG		0.51	187	505	0.55	0.51	187	602	3.93	8.29	0.10		8.40								
PRIVATE	SAN PLUG	MH1A					0.55	0.51	187	602	3.93	<del>8.29*</del> 13.00	0.21	0.28	<del>8.79*</del> 13.49	11.9	200	PVC	1.00	32.80	1.04	0.88	26.8
												13.00			13.49								
OUTLET	MH1A	MH2A					0.55	0.51	187	602	3.93	13.0	0.21	0.28	13.49	18.0	250	PVC	0.50	42.05	0.86	0.76	32.1
OUTLET	MH2A	МНЗА					0.55	0.51	187	602	3.93	13.0	0.21	0.28	13.49	61.2	250	PVC	0.50	42.05	0.86	0.76	32.1
OUTLET	МНЗА	MH4A					0.55	0.51	187	602	3.93	13.0	0.21	0.28	13.49	49.4	250	PVC	0.50	42.05	0.86	0.76	32.1
OUTLET	MH4A	МН5А					0.55	0.51	187	602	3.93	13.0	0.21	0.28	13.49	54.1	250	PVC	0.50	42.05	0.86	0.76	32.1
OUTLET	MH5A	EX MH2T					0.55	0.51	187	602	3.93	13.0	0.21	0.28	13.49	14.7	250	PVC	0.50	42.05	0.86	0.76	32.1

\*Region STD DWG 2-9-2 Note 3 : Domestic sewage flow for less than 1000 persons shall be 0.013 m3/s (13 l/s). 13.49 l/s used as value for total sanitary demand as per Note : region standards.





**Project No.: 20-704** 

Prepared by: Elliot Pai

Last Revised: April 19, 2021

Project / Subdivision: 2935 & 2955 Mississauga Road, Mississauga

**Consulting Engineer:** Greck and Associates Limited

Checked by: Khalid Mahmood, P.Eng

CITY OF MISSISSAUGA STORM SEWER DESIGN SHEET

Design Parameters (5 Year Storm)

A = drainage area (ha)  $T_{init}(hr) = 0.167$ C = runoff coefficient A= 820  $T_c$  = time of concentration B= 4.600 C = 0.780

**Design Parameters (100 Year Storm)** 

 $A = drainage area (ha) \qquad \qquad T_{init}(hr) = 0.167$   $C = runoff coefficient \qquad \qquad A = 1450$   $T_c = time of concentration \qquad \qquad B = 4.900$  C = 0.780

Manning's (n): 0.013

System to be Designed for: 100 Year Storm

**Design Equations** 

 $I = \frac{A}{(t + B)^{C}}$   $Q = 2.78 \times A \times C \times I$ 

	Location			Drainag	e Area C	haracteri	stics		Ra	infall / Rur	off					Sewer	Data			
Street Area ID	From	То	Area	Area	Cum. Area	Runoff Coeff. R	AR in Section	Cum. AR	Time of Concentratio	Rainfall Intensity	Runoff Q	Pipe Diameter	Pipe Length	Grade	Total Flow (Q Max)	% FULL	Full Flow Velocity	V (Actual)	Sect. Time	Accum. Time
	MH#	MH#	(m2)	(ha)	(ha)				(min)	(mm/hr)	m3/sec	(mm)	(m)	(%)	(m3/s)	%	(m/s)	(m/s)	(Min)	(Min)
	Building	MH1	5,423.67	0.54	0.54	0.79	0.43	0.43	15.00	140.69	0.209	525	5.80	0.50	0.30	68.9%	1.40	1.51	0.06	15.06
	MH1	HW1		0.00	0.54	0.00	0.00	0.43	15.06	140.34	0.209	525	3.16	0.50	0.30	68.7%	1.40	1.51	0.03	15.10

Page 1 STORM DS

#### Site Characteristics

Site: 2935, 2955 Mississauga Road

April 19, 2021



Pre-Development									
Land-Use	Impervious Ratio	Area A1 (m²)	Area B1 (m²)	Area C2 (m²)	Area D1 (m²)	Total (m²)			
Roof	1.00	0	0	0	0	0	-		
Asphalt Driveway	1.00	0	0	0	0	0			
Hardscape	1.00	0	0	0	0	0			
Grassed area	0.00	584	485	1921	8751	11740	_		
Total		584	485	1921	8751	11740	-		
	% Impervious =	0%	0%	0%	0%	0%			
	Runoff Coefficient* =	0.25	0.25	0.25	0.25	0.25			
Post-Development									
Land-Use	Impervious Ratio	Area A1 (m²)	Area A2 (m²)	Area B1 (m²)	Area B2 (m²)	Area C2 (m²)	Area D1 (m²)	Area D2 (m²)	Total (m²)
Roof	1.00	0	0	0	0	0	2484	0	2484
Asphalt Driveway	1.00	0	0	0	0	0	979	379	1357
Hardscape	1.00	0	0	0	0	0	659	0	659
Grassed area	0.00	584	1808	485	1518	1921	869	54	7239
Total		584	1808	485	1518	1921	4991	433	11740
	% Impervious =	0%	0%	0%	0%	0%	83%	88%	38%
	Runoff Coefficient* =	0.25	0.25	0.25	0.25	0.25	0.79	0.82	0.50
Drainage Area to Proposed Drivewa	y Culvert (External Drainag		+ Area D1 + Area D2)						
Land-Use	Impervious Ratio	Area C1 (m²)	Area C2 (m²)	Area D1 (m²)	Area D2 (m²)	Total (m²)	_		
Roof	1.00	0	0	2484	0	2484	-		
Asphalt Driveway	1.00	0	0	979	379	1357			
Hardscape	1.00	5595	0	659	0	6254			
Grassed area	0.00	11180	1921	869	54	14023	_		
Total		16775	1921	4991	433	24119	-		
	% Impervious =	33%	0%	83%	88%	42%			
	Runoff Coefficient* =	0.47	0.25	0.79	0.82	0.52			

<sup>\*</sup> Total Imperviouness (TIMP) Conversion Equation:  $TIMP = \frac{C - 0.25}{0.65}$  linearly Interpolated based on a 0.25 runoff for pervious areas and 0.9 runoff for impervious areas

#### Peak Runoff Assessment

Site: 2935, 2955 Mississauga Road

April 22, 2021



#### **Time of Concentration Calculations**

#### Time of Concentration

Airport

Bransby

If Runoff Coefficient < 0.4

$$T_c = 3.26 (1.1 - C) L^{0.5}$$
 where, L = Flow length (m)  
 $S_w^{0.33}$  Sw = slope (%)  
 $C = Runoff Coefficient$ 

If Runoff Coefficient > 0.4

$$\Gamma_{c} =$$
 0.057 L where, L = Flow length (m)   
  $S_{w}^{0.2} A^{0.1}$  Sw = slope (%)   
  $A =$  Area (ha)

Existing

Area	Runoff Coefficient	Method	Length (m)	Area (ha)	S (%)	T (min)
Area A1 + B1 + D1	0.25	Airport	132.6	0.982	4.70	19.15
Area C1 + C2	0.44	Bransby	300.4	1.870	38.90	7.73

#### Proposed

Area	Runoff Coefficient	Method	Length (m)	Area (ha)	S (%)	T (min)
Area A1 + A2	0.25	Airport	98.2	0.239	1.20	25.86
Area B1 + B2	0.25	Airport	82.2	0.200	4.40	15.41
Area C1 + C2	0.44	Bransby	300.4	1.870	38.90	7.73
Area D1 + D2	0.79	Bransby	-	0.542	-	15.00

<sup>\*</sup> Majority of Area D1 is roof or driveway area, which is serviced by floor drains. Therefore, the post-development time of concentration was assumed to be the minimum inlet time of 15 minutes as per City of Mississauga Design Criteria

#### **Peak Runoff Assessment**

2 year Rainfall Intensity,  $I = 610 (T+4.6)^{0.78}$  Peak Runoff, Q = 2.78 ACI / 1000 C = Runoff Coefficient

100 year Rainfall Intensity,  $I = 1450 (T+4.9)^{0.78}$  A = Area (ha)

T = Time of Concentration I = Rainfall Intensity (mm/hr)

a correctional factor of 1.25 as been applied to the 100 year peak runoff calculation

#### **Existing**

	Area (ha)	Intensity (mm/hr)		Runoff Coefficient		Peak Runoff (L/s)	
Drainage Area		2 Year	100 Year	2 Year	100 Year	2 Year	100 Year
Area A1 + B1 + D1	0.982	52	121	0.25	0.25	35.2	103.5
Area C1 + C2	1.870	86	201	0.44	0.44	198.4	578.7
		-			Total	233.6	682.2

#### **Proposed**

	Area (ha)	Intensity (mm/hr)		Runoff Coefficient		Peak Runoff (L/s)	
Drainage Area		2 Year	100 Year	2 Year	100 Year	2 Year	100 Year
Area A1 + A2	0.239	42	100	0.25	0.25	7.1	20.8
Area B1 + B2	0.200	59	138	0.25	0.25	8.2	24.1
Area D1 + D2	0.542	60	141	0.79	0.79	71.2	209.2
Area C1 + C2	1.870	86	201	0.44	0.44	198.4	578.7
					Total	284.9	832.7

#### Capacity calculations for storm sewer directing runoff to the underground storage chambers

The stormsewers directing runoff to the underground storage chambers are to be sized for the water quality storm event, the 25mm storm event

#### MOE SWM Planning & Design Manual Equation 4.9: 25mm Storm Intensity

i = 43C + 5.9

Area D1 Runoff Coefficient = 0.79

> 39.7 Intensity = mm/hr

#### MOE SWM Planning & Design Manual Equation 4.8: 25mm Storm Intensity

 $m^2$ 

Q = CiA/360

Runoff Coefficient = 0.79

> Intensity = 39.73 mm/hr

Drainage Area (Area D1) = 0.50 ha

> $m^3/s$ Q = 0.04

Q = L/s 43.34

#### Stormsewer Sizing to underground storage chambers

Pipe Size = 300.00 mm

0.50% Slope =

Manning's roughness = 0.013

> Area = 0.071

Perimeter = 0.942 m

Hydraulic Radius = 0.075 m

 $m^3/s$ Capacity = 0.07

#### Erosion Assessment of Area A1 + A2 swale outlet

#### Determine velocity of flows for rip rap protection at swale discharge towards valley slope (Area A1 + A2)

Spillway Length = 3 m

Weir Coefficient = 1.84

Weir Equation:  $Q = C L H^{3/2}$ 

H = 0.024

m  $m^2$ Flow Area = 0.07

Flow Velocity = 0.29 m/s

Flow velocities do not exceed 1.5 m/s, therefore rip rap protection is not required. However as a precaution, 150mm diameter riprap with 300mm depth is proposed

#### Infiltration Chamber Storage

Site: 2935, 2955 Mississauga Road

April 19, 2021



#### CULTEC underground chamber depth-storage-drawdown time table

Infiltration Rate\* = 17 mm/hr

\*The minimum percolation rate reported from the Test Pit Investigation completed by Terraprobe dated September 22, 2015

\*\*Obtained from the Recharger 330XLHD Incremental Storage Volumes

Depth (m)	**Obtained from the Recharg  Cum. Volume (m³)**	Drawdown Time (hr)	
1.08	21.61	53	_
1.05	21.28	53	
1.03	20.95	52	
1.00	20.61	51	
0.98	20.28	51	
0.95	19.95	50	
0.93	19.62	49	*MAXIMUM WSEL BEFORE STORMWATER IS REDIRECTED TO OUTLET
0.91	19.45	48	*maximum storage provided
0.89	19.10	47	
0.86	18.72	45	
0.84	18.30	44	
0.81	17.85	42	
0.79	17.36	41	
0.76	16.86	39	
0.74	16.33	38	
0.71	15.80	36	
0.69	15.24	35	
0.66	14.68	33	
0.64	14.10	32	
0.61	13.51	30	
0.58	12.92	29	
0.56	12.31	27	
0.53	11.70	26	
0.51	11.07	24	
0.48	10.44	23	
0.46	9.81	21	
0.43	9.17	20	
0.41	8.53	18	
0.38	7.90	17	
0.36	7.25	15	
0.33	6.61	14	
0.30	5.95	12	
0.28	5.29	11	
0.25	4.64	9	
0.23	3.98	8	
0.20	3.32	7	
0.18	2.66	5	
0.15	1.99	4	
0.13	1.66	3	
0.10	1.33	2	
0.08	1.00	2	
0.05	0.66	1	
0.03	0.33	1	
0.00	0.00	0	

#### **Erosion Control/Infiltration Targets**

Site: 2935, 2955 Mississauga Road

March 19, 2021



#### **Erosion Control / Infiltration Target Volume Calculations**

The 5mm volume is required to be infiltrated throughout the development (Area D1+D2+A2+B2).

Runoff from Area D1 directed to the underground infiltration chambers.

Runoff from Area A2, B2, and D2 are uncontrolled

Development Area (Area A2 + B2 + D1 + D2) =  $8750.49 \text{ m}^2$ 

Erosion Control Volume Required = Total Drainage Area X 5mm as per TRCA erosion control criteria

Erosion Control Volume Required = 43.75 m<sup>3</sup>

Total Volume Infiltrated = Depression Storage + LID Storage

#### **Depression Storage Calculations =**

	Area	Depression Sto	orage Provided
Surface	m <sup>2</sup>	mm	m <sup>3</sup>
Roof <sup>2</sup>	2484.18	0.0	0.0
Road <sup>1</sup>	1357.09	2.0	2.7
Hardscape <sup>1</sup>	659.09	2.0	1.3
Grassed <sup>1</sup>	4250.13	5.0	21.3
•		Total	25.3

<sup>&</sup>lt;sup>1</sup>Industry standard depression storage values of 2mm for impervious areas and 5mm for pervious areas applied

Depression Storage Available = 25.3 m<sup>3</sup>

Storage provided by LIDs (Infiltration Chambers) = 19.5 m<sup>3</sup>

Total Volume Infiltrated =  $44.7 \text{ m}^3$ 

<sup>&</sup>lt;sup>2</sup>To be conservative the roof areas were assumed to provide no depression storage

#### Treatment Train TSS Removal Calculations

Site: 2935, 2955 Mississauga Road

April 19, 2021



LID	<b>Initial Loading</b>	TSS Removal Efficiency	Remaining TSS Loading
OGS	1.00	50.00%	0.50
Infiltration Chambers	0.50	80.00%	0.10
Vegetated Filter Strip	0.10	50.00%	0.05
Fotal Removal Efficiency =	95.00%		

The OGS unit was sized for 50% TSS removal (see OGS Sizing Report)

The Low Impact Development Stormwater Management Planning and Design Guide by TRCA and CVC reports a TSS removal of 70% - 90% provided by infiltration trench. Therefore a median value of 80% was used

The Low Impact Development Stormwater Management Planning and Design Guide by TRCA and CVC reports a TSS removal of 20% - 80% provided by vegetated filter strips. Therefore a median value of 50% was used

#### **Quality Control**

Site: 2935, 2955 Mississauga Road

April 19, 2021



Provide Enhanced Treatment (80% TSS)

### Water Quality Volume

Only the asphalt areas for Area D1 requires water quality treatment

		water Quality	voiume*
Runoff	% Impervious		
Coefficient	= (C-0.2) / 0.7	(m³/ha)	(m³)

44.2

4.3

100%

\*as per Table 3.2 of MOE SWM Planning and Design Manual for infiltration

0.95

Area Total Area (m²)

Asphalt

979

## Culvert Outlet Rip-Rap Protection Calculator

### Rip-Rap Stone Sizing Quantifier



 $D_{50} = 0.2 D \left( \frac{Q}{\sqrt{g} D^{2.5}} \right)^{4/3} \left( \frac{D}{TW} \right)$ 

0.4D

Reference: U.S. Department of Transportation (Federal Highway Administration) https://www.fhwa.dot.gov/engineering/hydraulics/pubs/06086/hec14.pdf

Details:

#### **Culvert Properties**

Flow from Area D1 + D2, Q (m3/s): 0.209 Culvert Diameter, D (m): 0.525

Tailwater depth, TW (m): 0.21

Acceleration due to gravity, g (m/s2) 9.81

If TW/D < 0.4D = 0.4D, otherwise = 1D. Tailwater depth should be limited to

between 0.4D and 1.0D. If tailwater is unknown, use 0.4D. TW =

#### **Rip-Rap Outlet Control Results:**

Calculated D50 (mm) = 61

Proposed D50 (mm) = **150**Apron Length (m) = 2.1

Apron Depth (m) = 0.5

Apron Width (m) = 3.0

Class	D <sub>50</sub> (mm)	D <sub>50</sub> (in)	Apron Length*	Apron Depth***
1	125	5	4D	3.5D <sub>50</sub>
2	150	6	4D	3.3D <sub>50</sub>
3	250	10	5D	2.4D <sub>50</sub>
4	350	14	6D	2.2D <sub>50</sub>
5	500	20	7D	2.0D <sub>50</sub>
6	550	22	8D	2.0D <sub>50</sub>
*D is the culvert rise.				

<sup>\*\*</sup>Reference: U.S. Department of Transportation (Federal Highway Administration)

#### Irregular Shaped Channel Rating Curve Design Sheet

Site: 2935, 2955 Mississauga Road, Mississauga

-INPUT -

CHANNEL SLOPE 0.0050 (m/m)

Left Slope Low Channel 3 # of horiz/vert [x] Right Slope Low Channel = 3 # of horiz/vert [y] Left Slope High Channel = 3.000 # of horiz/vert [w] Right Slope High Channel = 3.000 # of horiz/vert [z]

Elev. Top of Left Bank Low Channel = 0 Elev. Top of Right Bank Low Channel = 0

'n' Channel Base 0.035 'n' Left Low Channel Wall = 0.035 'n' Right Low Channel Wall = 0.035 'n' Left High Channel Wall = 0.035 'n' Right High Channel Wall= 0.035

Width of Low Channel Base (m) = 0

Notes: V-Swale Conveying Major Drainage from Area A1 and A2

The v-swale has a minimum slope of 0.5%, 3:1 side slopes and a min. depth of 0.15m

Area A1 + A2 = 100-year flow of 20.8L/s

The proposed V-swale has a capacity of 0.023m<sup>3</sup>/s

Therefore, the proposed v-swale has sufficient capacity to convey major flows

FLOW DEPTH INCRIMENT 0.01

							Area Calculations					Wetted Perimeter				
Flow	Flow	Wetted	Equiv.	Hydr.	Velocity	Q										
Depth	Area	Perimeter	'n'	Radius			Base	Low Left	Low Righ	High Left	High Righ	Base	Low Left	Low Righ	High Left	High Right
(m)	(sq m)	(m)		(m)	(m/s)	(cms)	(sq.m)	(sq.m)	(sq.m)	(sq.m)	(sq.m)	(m)	(m)	(m)	(m)	(m)
														1		
0.000	0.00	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00
0.010	0.00	0.06	0.035	0.005	0.06	0.000	0.00	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.03	0.03
0.020	0.00	0.13	0.035	0.009	0.09	0.000	0.00	0.000	0.000	0.001	0.001	0.00	0.00	0.00	0.06	0.06
0.030	0.00	0.19	0.035	0.014	0.12	0.000	0.00	0.000	0.000	0.001	0.001	0.00	0.00	0.00	0.09	0.09
0.040	0.00	0.25	0.035	0.019	0.14	0.001	0.00	0.000	0.000	0.002	0.002	0.00	0.00	0.00	0.13	0.13
0.050	0.01	0.32	0.035	0.024	0.17	0.001	0.00	0.000	0.000	0.004	0.004	0.00	0.00	0.00	0.16	0.16
0.060	0.01	0.38	0.035	0.028	0.19	0.002	0.00	0.000	0.000	0.005	0.005	0.00	0.00	0.00	0.19	0.19
0.070	0.01	0.44	0.035	0.033	0.21	0.003	0.00	0.000	0.000	0.007	0.007	0.00	0.00	0.00	0.22	0.22
0.080	0.02	0.51	0.035	0.038	0.23	0.004	0.00	0.000	0.000	0.010	0.010	0.00	0.00	0.00	0.25	0.25
0.090	0.02	0.57	0.035	0.043	0.25	0.006	0.00	0.000	0.000	0.012	0.012	0.00	0.00	0.00	0.28	0.28
0.100	0.03	0.63	0.035	0.047	0.26	0.008	0.00	0.000	0.000	0.015	0.015	0.00	0.00	0.00	0.32	0.32
0.110	0.04	0.70	0.035	0.052	0.28	0.010	0.00	0.000	0.000	0.018	0.018	0.00	0.00	0.00	0.35	0.35
0.120	0.04	0.76	0.035	0.057	0.30	0.013	0.00	0.000	0.000	0.022	0.022	0.00	0.00	0.00	0.38	0.38
0.130	0.05	0.82	0.035	0.062	0.32	0.016	0.00	0.000	0.000	0.025	0.025	0.00	0.00	0.00	0.41	0.41
0.140	0.06	0.89	0.035	0.066	0.33	0.019	0.00	0.000	0.000	0.029	0.029	0.00	0.00	0.00	0.44	0.44
0.150	0.07	0.95	0.035	0.071	0.35	0.023	0.00	0.000	0.000	0.034	0.034	0.00	0.00	0.00	0.47	0.47
0.160	0.08	1.01	0.035	0.076	0.36	0.028	0.00	0.000	0.000	0.038	0.038	0.00	0.00	0.00	0.51	0.51
0.170	0.09	1.08	0.035	0.081	0.38	0.033	0.00	0.000	0.000	0.043	0.043	0.00	0.00	0.00	0.54	0.54
0.180	0.10	1.14	0.035	0.085	0.39	0.038	0.00	0.000	0.000	0.049	0.049	0.00	0.00	0.00	0.57	0.57
0.190	0.11	1.20	0.035	0.090	0.41	0.044	0.00	0.000	0.000	0.054	0.054	0.00	0.00	0.00	0.60	0.60
0.200	0.12	1.26	0.035	0.095	0.42	0.050	0.00	0.000	0.000	0.060	0.060	0.00	0.00	0.00	0.63	0.63
0.210	0.13	1.33	0.035	0.100	0.43	0.057	0.00	0.000	0.000	0.066	0.066	0.00	0.00	0.00	0.66	0.66
0.220	0.15	1.39	0.035	0.104	0.45	0.065	0.00	0.000	0.000	0.073	0.073	0.00	0.00	0.00	0.70	0.70
0.230	0.16	1.45	0.035	0.109	0.46	0.073	0.00	0.000	0.000	0.079	0.079	0.00	0.00	0.00	0.73	0.73
0.240	0.17	1.52	0.035	0.114	0.47	0.082	0.00	0.000	0.000	0.086	0.086	0.00	0.00	0.00	0.76	0.76
0.250	0.19	1.58	0.035	0.119	0.49	0.091	0.00	0.000	0.000	0.094	0.094	0.00	0.00	0.00	0.79	0.79
0.260	0.20	1.64	0.035	0.123	0.50	0.102	0.00	0.000	0.000	0.101	0.101	0.00	0.00	0.00	0.82	0.82
0.270	0.22	1.71	0.035	0.128	0.51	0.112	0.00	0.000	0.000	0.109	0.109	0.00	0.00	0.00	0.85	0.85
0.280	0.24	1.77	0.035	0.133	0.53	0.124	0.00	0.000	0.000	0.118	0.118	0.00	0.00	0.00	0.89	0.89
0.290	0.25	1.83	0.035	0.138	0.54	0.136	0.00	0.000	0.000	0.126	0.126	0.00	0.00	0.00	0.92	0.92
0.300	0.27	1.90	0.035	0.142	0.55	0.149	0.00	0.000	0.000	0.135	0.135	0.00	0.00	0.00	0.95	0.95
0.310	0.29	1.96	0.035	0.147	0.56	0.162	0.00	0.000	0.000	0.144	0.144	0.00	0.00	0.00	0.98	0.98
0.320	0.31	2.02	0.035	0.152	0.57	0.177	0.00	0.000	0.000	0.154	0.154	0.00	0.00	0.00	1.01	1.01



#### Irregular Shaped Channel Rating Curve Design Sheet

Site: 2935, 2955 Mississauga Road, Mississauga

-INPUT -

CHANNEL SLOPE 0.0060 (m/m)

Left Slope Low Channel 3 # of horiz/vert [x] Right Slope Low Channel = 3 # of horiz/vert [y] Left Slope High Channel = 3.000 # of horiz/vert [w] Right Slope High Channel = 3.000 # of horiz/vert [z]

Elev. Top of Left Bank Low Channel = 0 Elev. Top of Right Bank Low Channel = 0

'n' Channel Base 0.035 'n' Left Low Channel Wall = 0.035 'n' Right Low Channel Wall = 0.035 'n' Left High Channel Wall = 0.035

'n' Right High Channel Wall= 0.035

Width of Low Channel Base (m) =

0

Notes: V-Swale Conveying Major Drainage from Area B1 and B2

The v-swale has a minimum slope of 0.6%, 3:1 side slopes and a min. depth of 0.15m

**⊘**Greck

Area B1 + B2 = 100-year flow of 24.1L/s

The proposed V-swale has a capacity of 0.026m<sup>3</sup>/s

Therefore, the proposed v-swale has sufficient capacity to convey major flows

FLOW DEPTH INCRIMENT 0.01

							Area Calculations						,	Wetted Pe	rimeter	
Flow Depth	Flow Area	Wetted Perimeter	Equiv. 'n'	Hydr. Radius	Velocity	Q	Base Low LeftLow Righ High LeftHigh Ri				High Righ	Base	Low Left	Low Righ	High Left	High Right
(m)	(sq m)	(m)		(m)	(m/s)	(cms)	(sq.m)	(sq.m)	(sq.m)	(sq.m)	(sq.m)	(m)	(m)	(m)	(m)	(m)
	(-1 )	( )			()	(* ")	(* 1 )	(-1-)	(-1-)	(-1-)	(-4-)	( )		( )		
0.000	0.00	0.00	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	0.00	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.00	0.00
0.010	0.00	0.06	0.035	0.005	0.06	0.000	0.00	0.000	0.000	0.000	0.000	0.00	0.00	0.00	0.03	0.03
0.020	0.00	0.13	0.035	0.009	0.10	0.000	0.00	0.000	0.000	0.001	0.001	0.00	0.00	0.00	0.06	0.06
0.030	0.00	0.19	0.035	0.014	0.13	0.000	0.00	0.000	0.000	0.001	0.001	0.00	0.00	0.00	0.09	0.09
0.040	0.00	0.25	0.035	0.019	0.16	0.001	0.00	0.000	0.000	0.002	0.002	0.00	0.00	0.00	0.13	0.13
0.050	0.01	0.32	0.035	0.024	0.18	0.001	0.00	0.000	0.000	0.004	0.004	0.00	0.00	0.00	0.16	0.16
0.060	0.01	0.38	0.035	0.028	0.21	0.002	0.00	0.000	0.000	0.005	0.005	0.00	0.00	0.00	0.19	0.19
0.070	0.01	0.44	0.035	0.033	0.23	0.003	0.00	0.000	0.000	0.007	0.007	0.00	0.00	0.00	0.22	0.22
0.080	0.02	0.51	0.035	0.038	0.25	0.005	0.00	0.000	0.000	0.010	0.010	0.00	0.00	0.00	0.25	0.25
0.090	0.02	0.57	0.035	0.043	0.27	0.007	0.00	0.000	0.000	0.012	0.012	0.00	0.00	0.00	0.28	0.28
0.100	0.03	0.63	0.035	0.047	0.29	0.009	0.00	0.000	0.000	0.015	0.015	0.00	0.00	0.00	0.32	0.32
0.110	0.04	0.70	0.035	0.052	0.31	0.011	0.00	0.000	0.000	0.018	0.018	0.00	0.00	0.00	0.35	0.35
0.120	0.04	0.76	0.035	0.057	0.33	0.014	0.00	0.000	0.000	0.022	0.022	0.00	0.00	0.00	0.38	0.38
0.130	0.05	0.82	0.035	0.062	0.35	0.018	0.00	0.000	0.000	0.025	0.025	0.00	0.00	0.00	0.41	0.41
0.140	0.06	0.89	0.035	0.066	0.36	0.021	0.00	0.000	0.000	0.029	0.029	0.00	0.00	0.00	0.44	0.44
0.150	0.07	0.95	0.035	0.071	0.38	0.026	0.00	0.000	0.000	0.034	0.034	0.00	0.00	0.00	0.47	0.47
0.160	0.08	1.01	0.035	0.076	0.40	0.030	0.00	0.000	0.000	0.038	0.038	0.00	0.00	0.00	0.51	0.51
0.170	0.09	1.08	0.035	0.081	0.41	0.036	0.00	0.000	0.000	0.043	0.043	0.00	0.00	0.00	0.54	0.54
0.180	0.10	1.14	0.035	0.085	0.43	0.042	0.00	0.000	0.000	0.049	0.049	0.00	0.00	0.00	0.57	0.57
0.190	0.11	1.20	0.035	0.090	0.44	0.048	0.00	0.000	0.000	0.054	0.054	0.00	0.00	0.00	0.60	0.60
0.200	0.12	1.26	0.035	0.095	0.46	0.055	0.00	0.000	0.000	0.060	0.060	0.00	0.00	0.00	0.63	0.63
0.210	0.13	1.33	0.035	0.100	0.48	0.063	0.00	0.000	0.000	0.066	0.066	0.00	0.00	0.00	0.66	0.66
0.220	0.15	1.39	0.035	0.104	0.49	0.071	0.00	0.000	0.000	0.073	0.073	0.00	0.00	0.00	0.70	0.70
0.230	0.16	1.45	0.035	0.109	0.51	0.080	0.00	0.000	0.000	0.079	0.079	0.00	0.00	0.00	0.73	0.73
0.240	0.17	1.52	0.035	0.114	0.52	0.090	0.00	0.000	0.000	0.086	0.086	0.00	0.00	0.00	0.76	0.76
0.250	0.19	1.58	0.035	0.119	0.53	0.100	0.00	0.000	0.000	0.094	0.094	0.00	0.00	0.00	0.79	0.79
0.260	0.20	1.64	0.035	0.123	0.55	0.111	0.00	0.000	0.000	0.101	0.101	0.00	0.00	0.00	0.82	0.82
0.270	0.22	1.71	0.035	0.128	0.56	0.123	0.00	0.000	0.000	0.109	0.109	0.00	0.00	0.00	0.85	0.85
0.280	0.24	1.77	0.035	0.133	0.58	0.136	0.00	0.000	0.000	0.118	0.118	0.00	0.00	0.00	0.89	0.89
0.290	0.25	1.83	0.035	0.138	0.59	0.149	0.00	0.000	0.000	0.126	0.126	0.00	0.00	0.00	0.92	0.92
0.300	0.27	1.90	0.035	0.142	0.60	0.163	0.00	0.000	0.000	0.135	0.135	0.00	0.00	0.00	0.95	0.95
0.310	0.29	1.96	0.035	0.147	0.62	0.178	0.00	0.000	0.000	0.144	0.144	0.00	0.00	0.00	0.98	0.98
0.320	0.31	2.02	0.035	0.152	0.63	0.193	0.00	0.000	0.000	0.154	0.154	0.00	0.00	0.00	1.01	1.01

Climate Data								Pe	rvious Area		Imp	ervious Area	
Month	Days in the month	Hours of Sunlight*	Mean Temperat ure**	Heat Index	Potential Evapo- transpiration *	Daylight Correction Value	Total Precipitation*	Adjusted Potential Evapo-transpiration ##	Surplus	Deficit	Evaporation	Surplus	Deficit
			(T) #	ı	mm/month		mm	mm	mm	mm	mm	mm	mm
January	31	9.3	-4.7	0.00	0.0	0.80	59.8	0.00	59.8	0.0	6.0	53.8	0.0
February	28	10.5	-3.9	0.00	0.0	0.82	46.7	0.00	46.7	0.0	4.7	42.0	0.0
March	31	12.1	0.1	0.00	0.3	1.04	54.4	0.31	54.1	0.0	5.4	49.0	0.0
April	30	13.6	6.4	1.45	28.4	1.13	65.2	32.19	33.0	0.0	6.5	58.7	0.0
May	31	14.7	12.3	3.91	58.2	1.27	73.9	73.69	0.2	0.0	7.4	66.5	0.0
June	30	15	17.7	6.78	86.8	1.25	71.0	108.53	0.0	37.5	7.1	63.9	0.0
July	31	14.8	20.9	8.72	104.2	1.27	75.8	132.80	0.0	57.0	7.6	68.2	0.0
August	31	14.2	20.1	8.22	99.8	1.22	78.3	122.07	0.0	43.8	7.8	70.5	0.0
September	30	13.1	15.6	5.60	75.6	1.09	73.5	82.50	0.0	9.0	7.4	66.2	0.0
October	31	10.7	9.3	2.56	42.8	0.92	70.0	39.45	30.5	0.0	7.0	63.0	0.0
November	30	9.7	4.0	0.71	17.0	0.81	79.3	13.70	65.6	0.0	7.9	71.4	0.0
December	31	8.8	-1.3	0.00	0.0	0.76	58.8	0.00	58.8	0.0	5.88	52.9	0.0
TOTAL	365			38.0	513.1		807	605	348.8	147	80.7	726.0	0
<u>Notes</u>	**Canadian C https://clima =&selPark=&	75 * 10 <sup>-9</sup> * I <sup>3</sup> ) – limate Normals e.weather.gc.co pptProxType=cu	1981-2010 Stat a/climate_norm istom&txtCentr	tion Data - Oak nals/results_19 alLatDeg=43&	<sup>-5</sup> * I) + 0.49239 = 1.07 ville Southeast WPCP - I81_2010_e.html?seard txtCentralLatMin=32&t &txtLatDecDeg=&txtLo	located 6.84km s chType=stnProx& xtCentralLatSec=	southwest of the site, txtRadius=25&selCity 32.85&txtCentralLong	Pervious Surplus:	201.5	mm	Impervious Surplus: Assumes 10% of rainfall is evapo	<b>726.0</b> Drated (no evapotran:	mm spiration occurs)
	the site, https://clima =&selPark=&	e.weather.gc.ca	a/climate_norm ustom&txtCentr	nals/results_19	ronto Lester B. Pearsor 181_2010_e.html?searc txtCentralLatMin=32&t &txtLatDecDeg=&txtLo	chType=stnProx& xtCentralLatSec=	txtRadius=25&selCity 32.85&txtCentralLong				Impervious Factor =	0.10	

#### Water Balance Design Sheet Pre-Development Site: 2935, 2955 Mississauga Road Mississauga, Ontario Existing Drainage Area April 29, 2021 Area D1 **Catchment Parameter** Units Perv Imperv Total 8750.8 8750.8 Area $m^2$ 0.0 m<sup>2</sup> 8750.8 Pervious Area 8750.8 0.0 $m^2$ Impervious Area 0.0 0.0 0.0 **Infiltration Factors** Topography 0.1 0.1 0.10 Soil 0.2 0.2 0.20 Land Cover 0.1 0.1 0.10 MOE Infiltration Factor 0.40 0.40 0.40 Actual Infiltration Factor 0.40 0.40 0.00 Runoff Coefficient 0.25 0.90 0.25 Runoff from Impervious Surfaces\* 0% 0% 0% Inputs (per Unit Area) Precipitation mm/yr 807 807 807 Run- on mm/yr 0 0 0 Other mm/yr 0 0 0 **Total Inputs** 807 807 807 mm/yr Outputs (per Unit Area) **Precipitation Surplus** 201 726 mm/yr Net Surplus mm/yr 0 0 Total Evapotranspiration mm/yr 605 81 Infiltration 81 0 mm/yr Rooftop Infiltration 0 mm/yr 0 **Total Infiltration** 0 mm/yr 81 Runoff Pervious Areas mm/yr 121 726 Runoff Impervious Areas mm/yr 0 0 Total Runoff mm/yr 121 726 **Total Outputs** 807 807 mm/yr Difference (input - output) mm/yr 0 0 Inputs (Volumes) m<sup>3</sup>/yr Precipitation 7059 0 7059 0 0 0 Run-on m<sup>3</sup>/yr Other Inputs 0 0 0 m<sup>3</sup>/vr Total Inputs m³/yr 7059 0 7059 Outputs (Volumes) **Precipitation Surplus** m<sup>3</sup>/yr 1763 0 1763 Net Surplus 0 0 0 m<sup>3</sup>/yr Total Evapotranspiration 5296 0 5296 m<sup>3</sup>/yr 0 Infiltration 705 705 m<sup>3</sup>/yr Rooftop Infiltration m<sup>3</sup>/yr 0 0 0 **Total Infiltration** m<sup>3</sup>/yr 705 0 705 Runoff Pervious Areas 1058 0 1058 m³/yr **Runoff Impervious Areas** 0 m<sup>3</sup>/yr 0 0 **Total Runoff** 1058 0 1058 m³/yr 7059 0 7059 Total Outputs m³/yr

m<sup>3</sup>/yr

Difference (input - output)

0

0

0

Water Balance Design Sheet				Post Dev	elopment			
-	Site: 2935, 2955 M				_			
	Mississauga, C	Ontario						
			Proposed Dr	•				
April 29, 2021			2 + B2	Are	a D1	Are	a D2	
Catchment Parameter	Units	Perv	Imperv	Perv	Imperv	Perv	Imperv	Total
Area	m <sup>2</sup>	3326.8	0.0	869.3	4121.8	54.1	378.5	8750.5
Pervious Area	m <sup>2</sup>	3326.8	0.0	869.3	0.0	54.1	0.0	4250.1
Impervious Area	m <sup>2</sup>	0.0	0.0	0.0	4121.8	0.0	378.5	4500.4
Infiltration Factors								
Topography		0.1	0.1	0.1	0.1	0.1	0.1	0.10
Soil		0.2	0.2	0.2	0.2	0.2	0.2	0.20
∟and Cover		0.1	0.1	0.1	0.1	0.1	0.1	0.10
MOE Infiltration Factor		0.40	0.40	0.40	0.40	0.40	0.40	0.40
% Impervious		0%	0%	0%	100%	0%	100%	51%
Actual Imperv Factor		0.40	0.40	0.40	0.00	0.40	0.00	0.19
Inputs (per Unit Area)		007	007	007	907	007	007	
Precipitation	mm/yr	807	807	807	807	807	807	
Run- on	mm/yr	0	0	0	0	0	0	
Other	mm/yr	0	0	0	0	0	0	
Total Inputs	mm/yr	807	807	807	807	807	807	
Outputs (per Unit Area)								
Precipitation Surplus	mm/yr	201	726	201	726	201	726	
Net Surplus	mm/yr	201	726	201	726	201	726	
Total Evapotranspiration	mm/yr	605	81	605	81	605	81	
nfiltration	mm/yr	81	290	81	0	81	0	
LID Infiltration	mm/yr	0	0	0	0	0	0	
Total Infiltration	mm/yr	81	290	81	0	81	0	
Runoff Pervious Areas	mm/yr	121	436	121	0	121	0	
Runoff Impervious Areas	mm/yr	0	0	0	726	0	726	
Total Runoff	mm/yr	121	436	121	726	121	726	
Total Outputs	mm/yr	807	807	807	807	807	807	
Difference (input - output)	mm/yr	0	0	0	0	0	0	
Inputs (Volumes)	2							
Precipitation	m³/yr	2684	0	701	3325	44	305	7059
Run-on	m³/yr	0	0	0	0	0	0	0
Other Inputs	m³/yr	0	0	0	0	0	0	0
Total Inputs	m³/yr	2684	0	701	3325	44	305	7059
Outputs (Volumes)	2							
Precipitation Surplus	m³/yr	670	0	175	2993	11	275	4124
Net Surplus	m³/yr	670	0	175	2993	11	275	4124
Total Evapotranspiration	m³/yr	2014	0	526	333	33	31	2935
nfiltration	m³/yr	268	0	70	0	4	0	342
Rooftop Infiltration	m³/yr	0	0	0	0	0	0	0
Total Infiltration	m³/yr	268	0	70	0	4	0	342
Runoff Pervious Areas	m³/yr	402	0	105	0	7	0	514
Runoff Impervious Areas	m³/yr	0	0	0	2993	0	275	3267
Total Runoff	m³/vr	402	0	105	2993	7	275	3781
Total Outputs	m³/yr	2684	0	701	3325	44	305	7059
Difference (input - output)	m <sup>3</sup> /yr	0	0	0	0	0	0	0

Water Balance Design Sheet	Post Development with SWM, FS = 1.0 Site: 2935, 2955 Mississauga Road												
	Site: 2935, 2955 M Mississauga, (	•											
			Proposed Dr	ainage Area									
April 29, 2021		Area A	A2 + B2	Are	a D1	Are	ea D2						
Catchment Parameter	Units	Perv	Imperv	Perv	Imperv	Perv	Imperv	Total					
Area	m <sup>2</sup>	3326.8	0.0	869.3	4121.8	54.1	378.5	8750.5					
Pervious Area	$m^2$	3326.8	0.0	869.3	0.0	54.1	0.0	4250.1					
Impervious Area	m <sup>2</sup>	0.0	0.0	0.0	4121.8	0.0	378.5	4500.4					
Infiltration Factors													
Гороgraphy		0.1	0.1	0.1	0.1	0.1	0.1	0.10					
Soil		0.2	0.2	0.2	0.2	0.2	0.2	0.20					
Land Cover		0.1	0.1	0.1	0.1	0.1	0.1	0.10					
MOE Infiltration Factor		0.40	0.40	0.40	0.40	0.40	0.40	0.40					
% Impervious		0%	0%	0%	100%	0%	100%	51%					
Actual Imperv Factor		0.40	0.40	0.40	0.00	0.40	0.00	0.19					
Inputs (per Unit Area)													
Precipitation	mm/yr	807	807	807	807	807	807						
Run- on	mm/yr	0	0	0	0	0	0						
Other	mm/yr	0	0	0	0	0	0						
Total Inputs	mm/yr	807	807	807	807	807	807						
Outputs (per Unit Area)	/ ֈ '	307			23,								
Precipitation Surplus	mm/yr	201	726	201	726	201	726						
Net Surplus	mm/yr	201	726 726	201	726 726	201	726 726						
Total Evapotranspiration	mm/yr	6 <b>05</b>	81	6 <b>05</b>	81	605	81						
Infiltration	mm/yr	81	290	81	0	81	0						
		0	0	111	-	0	0						
LID Infiltration	mm/yr				399								
Total Infiltration	mm/yr	81	290	191	399	81	0						
Runoff Pervious Areas	mm/yr	121	436	10	0	121	0						
Runoff Impervious Areas	mm/yr	0	0	0	327	0	726						
Total Runoff	mm/yr	121	436	10	327	121	726						
Total Outputs	mm/yr	807	807	807	807	807	807						
Difference (input - output)	mm/yr	0	0	0	0	0	0						
Inputs (Volumes)	2												
Precipitation	m³/yr	2684	0	701	3325	44	305	7059					
Run-on	m³/yr	0	0	0	0	0	0	0					
Other Inputs	m³/vr	0	0	0	0	0	0	0					
Total Inputs	m³/yr	2684	0	701	3325	44	305	7059					
Outputs (Volumes)													
Precipitation Surplus	m³/yr	670	0	175	2993	11	275	4124					
Net Surplus	m <sup>3</sup> /yr	670	0	175	2993	11	275	4124					
Total Evapotranspiration	m³/yr	2014	0	526	333	33	31	2935					
Infiltration	m <sup>3</sup> /yr	268	0	70	0	4	0	342					
LID Infiltration	m3/yr	0	0	96	1646	0	0	1742					
Total Infiltration	m³/yr	268	0	166	1646	4	0	2085					
Runoff Pervious Areas	m³/yr	402	0	9	0	7	0	417					
Runoff Impervious Areas	m <sup>3</sup> /yr	0	0	0	1347	0	275	1621					
			-			-		2039					
Total Runoff	m³/vr	402	U	9	1347	,	2/5	2059					
Total Runoff Total Outputs	m³/yr m³/yr	402 2684	0	9 <b>701</b>	1347 3325	<u>7</u> 44	275 305	7059					

<sup>\*\*55%</sup> of rainfall events are less than 5mm - FS = 1.0

Water Balance Design Sheet	Post Development with SWM, FS = 1.5 Site: 2935, 2955 Mississauga Road												
	Site: 2935, 2955 M Mississauga, (	•											
		51164116	Proposed D	rainage Area									
April 29, 2021		Area A	\2 + B2 <sup>'</sup>	•	a D1	Are	a D2						
Catchment Parameter	Units	Perv	Imperv	Perv	Imperv	Perv	Imperv	Total					
Area	m <sup>2</sup>	3326.8	0.0	869.3	4121.8	54.1	378.5	8750.5					
Pervious Area	$m^2$	3326.8	0.0	869.3	0.0	54.1	0.0	4250.1					
Impervious Area	m <sup>2</sup>	0.0	0.0	0.0	4121.8	0.0	378.5	4500.4					
Infiltration Factors													
Topography		0.1	0.1	0.1	0.1	0.1	0.1	0.10					
Soil		0.2	0.2	0.2	0.2	0.2	0.2	0.20					
Land Cover		0.1	0.1	0.1	0.1	0.1	0.1	0.10					
MOE Infiltration Factor		0.40	0.40	0.40	0.40	0.40	0.40	0.40					
% Impervious		0%	0%	0%	100%	0%	100%	51%					
Actual Imperv Factor		0.40	0.40	0.40	0.00	0.40	0.00	0.19					
Inputs (per Unit Area)	,												
Precipitation	mm/yr	807	807	807	807	807	807						
Run- on	mm/yr	0	0	0	0	0	0						
Other	mm/yr	0	0	0	0	0	0						
Total Inputs	mm/yr	807	807	807	807	807	807						
Outputs (per Unit Area)													
Precipitation Surplus	mm/yr	201	726	201	726	201	726						
Net Surplus	mm/yr	201	726	201	726	201	726						
Total Evapotranspiration	mm/yr	605	81	605	81	605	81						
Infiltration	mm/yr	81	290	81	0	81	0						
LID Infiltration	mm/yr	0	0	74	266	0	0						
Total Infiltration	mm/yr	81	290	154	266	81	0						
Runoff Pervious Areas	mm/yr	121	436	47	0	121	0						
Runoff Impervious Areas	mm/yr	0	0	0	460	0	726						
Total Runoff	mm/yr	121	436	47	460	121	726						
Total Outputs	mm/yr	<b>807</b> 0	<b>807</b> 0	<b>807</b> 0	<b>807</b> 0	<b>807</b> 0	<b>807</b> 0						
Difference (input - output)	mm/yr	U	U	U	U	U	U						
Inputs (Volumes) Precipitation	m³/yr	2684	0	701	3325	44	305	7059					
F		0	0	701		0	0	7059					
Run-on	m³/yr	0	0	0	0 0	0	0	0					
Other Inputs	m <sup>3</sup> /vr	2684	0	701	3325	44	305	7059					
Total Inputs	m³/yr	2084	U	701	3323	44	303	7039					
Outputs (Volumes)	m³/yr	670	0	175	2993	11	275	4124					
Precipitation Surplus		670 670	0	175 175	2993 2993	11 11	275 275	4124 4124					
Net Surplus  Total Evapotranspiration	m³/yr 3.	2014	<b>0</b>	175 <b>526</b>	2993 <b>333</b>	33	275 <b>31</b>	4124 <b>2935</b>					
Infiltration	m³/yr	268	0	<b>526</b> 70	0	4	0	342					
LID Infiltration	m³/yr	0	0	64	1097	0	0	342 1161					
Total Infiltration	m3/yr m³/yr	268	0	134	1097	4	0	1504					
Runoff Pervious Areas	1	402	0	41	0	<b>4</b>	0	450					
Runoff Impervious Areas	m³/yr <sup>3</sup> /	402 0	0	0	1895	0	275	450 2170					
Total Runoff	m³/yr ³/	4 <b>02</b>	<b>0</b>	4 <b>1</b>	1895 <b>1895</b>	7	275 <b>275</b>	2170 <b>2620</b>					
Total Outputs	m³/yr	2684	0	701	3325	44	305	7059					
Difference (input - output)	m³/yr	0	0	0	0	0	0	0					
Dinerence (input - output)	m³/yr	•	<u> </u>		,	<u> </u>							

<sup>\*\*55%</sup> of rainfall events are less than 5mm - FS = 1.5

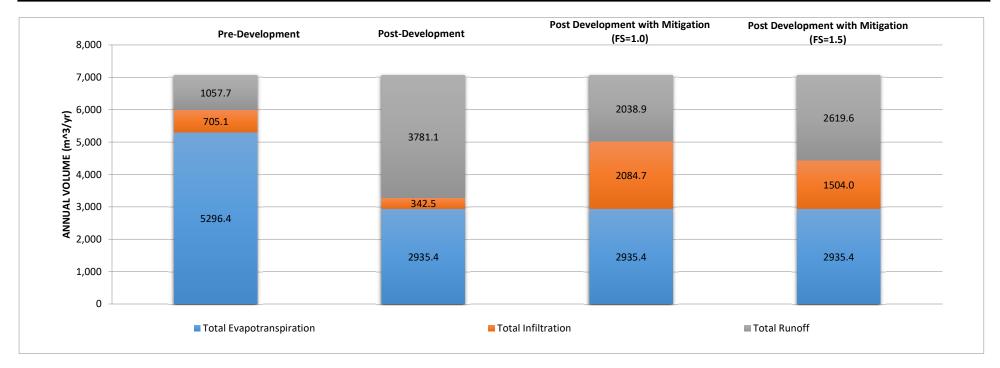
Water Balance Summary Sheet

Site: 2935, 2955 Mississauga Road

Mississauga, Ontario

April 29, 2021

	Units	Pre-Development	Post-Development	Change (Pre- to Post-)	Post Development with Mitigation (FS=1.0)	Post Development with Mitigation (FS=1.5)	Change (Pre- to Post-Mitigation)
Inputs (Volumes)							
Precipitation	m³/yr	7059.2	7059.0	0%	7059.0	7059.0	0%
Run-on	m³/yr	0.0	0.0	0%	0.0	0.0	0%
Other Inputs	m³/vr	0.0	0.0	0%	0.0	0.0	0%
Total Inputs		7059	7059	0%	7059	7059	0%
Outputs (Volumes)							
Precipitation Surplus	m³/yr	1762.9	4123.6	134%	4123.6	4123.6	134%
Net Surplus	m³/yr	0.0	4123.6	0%	4123.6	4123.6	0%
Total Evapotranspiration	m³/yr	5296.4	2935.4	-45%	2935.4	2935.4	-45%
Infiltration	m³/yr	705.1	342.5	-51%	342.5	342.5	-51%
LID Infiltration	m³/yr	0.0	0.0	0%	1742.2	1161.5	0%
Total Infiltration	m³/yr	705.1	342.5	-51%	2084.7	1504.0	196%
Runoff Pervious Areas	m³/yr	1057.7	513.7	-51%	417.4	449.5	-61%
Runoff Impervious Areas	m³/yr	0.0	3267.4	0%	1621.5	2170.1	0%
Total Runoff	m³/vr	1057.7	3781.1	257%	2038.9	2619.6	93%
Total Outputs	m³/yr	7059.2	7059.0	0%	7059.0	7059.0	0%





## STORMCEPTOR® ESTIMATED NET ANNUAL SEDIMENT (TSS) LOAD REDUCTION

04/19/2021

Province:	Ontario
City:	Mississauga
Nearest Rainfall Station:	TORONTO CENTRAL
NCDC Rainfall Station Id:	0100
Years of Rainfall Data:	18
Sito Namo:	

Site Name:

Drainage Area (ha):
% Imperviousness:

100.00

Runoff Coefficient 'c': 0.90

0.10

Particle Size Distribution: CA ETV

Target TSS Removal (%): 60.0

Required Water Quality Runoff Volume Capture (%):	90.00
Estimated Water Quality Flow Rate (L/s):	1.41
Oil / Fuel Spill Risk Site?	No
Upstream Flow Control?	No
Peak Conveyance (maximum) Flow Rate (L/s):	
Site Sediment Transport Rate (kg/ha/yr):	

Project Name:	2935, 2955 Mississauga Road
Project Number:	20-697
Designer Name:	Elliot Pai
Designer Company:	Greck and Associates Ltd.
Designer Email:	epai@greck.ca
Designer Phone:	289-657-9797
EOR Name:	
EOR Company:	
EOR Email:	
EOR Phone:	

### Net Annual Sediment (TSS) Load Reduction Sizing Summary

Stormceptor Model	TSS Removal Provided (%)
EF4	69
EF6	70
EF8	70
EF10	70
FF12	70

Recommended Stormceptor EF Model:

Estimated Net Annual Sediment (TSS) Load Reduction (%):

Water Quality Runoff Volume Capture (%):

69 > 90

EF4





#### THIRD-PARTY TESTING AND VERIFICATION

► Stormceptor® EF and Stormceptor® EFO are the latest evolutions in the Stormceptor® oil-grit separator (OGS) technology series, and are designed to remove a wide variety of pollutants from stormwater and snowmelt runoff. These technologies have been third-party tested in accordance with the Canadian ETV Procedure for Laboratory Testing of Oil-Grit Separators and performance has been third-party verified in accordance with the ISO 14034 Environmental Technology Verification (ETV) protocol.

#### **PERFORMANCE**

▶ Stormceptor® EF and EFO remove stormwater pollutants through gravity separation and floatation, and feature a patent-pending design that generates positive removal of total suspended solids (TSS) throughout each storm event, including high-intensity storms. Captured pollutants include sediment, free oils, and sediment-bound pollutants such as nutrients, heavy metals, and petroleum hydrocarbons. Stormceptor is sized to remove a high level of TSS from the frequent rainfall events that contribute the vast majority of annual runoff volume and pollutant load. The technology incorporates an internal bypass to convey excessive stormwater flows from high-intensity storms through the device without resuspension and washout (scour) of previously captured pollutants. Proper routine maintenance ensures high pollutant removal performance and protection of downstream waterways.

### **PARTICLE SIZE DISTRIBUTION (PSD)**

► The Canadian ETV PSD shown in the table below was used, or in part, for this sizing. This is the identical PSD that is referenced in the Canadian ETV *Procedure for Laboratory Testing of Oil-Grit Separators* for both sediment removal testing and scour testing. The Canadian ETV PSD contains a wide range of particle sizes in the sand and silt fractions, and is considered reasonably representative of the particle size fractions found in typical urban stormwater runoff.

Particle	Percent Less	Particle Size	Davaant	
Size (µm)	Than	Fraction (µm)	Percent	
1000	100	500-1000	5	
500	95	250-500	5	
250	90	150-250	15	
150	75	100-150	15	
100	60	75-100	10	
75	50	50-75	5	
50	45	20-50	10	
20	35	8-20	15	
8	20	5-8	10	
5	10	2-5	5	
2	5	<2	5	





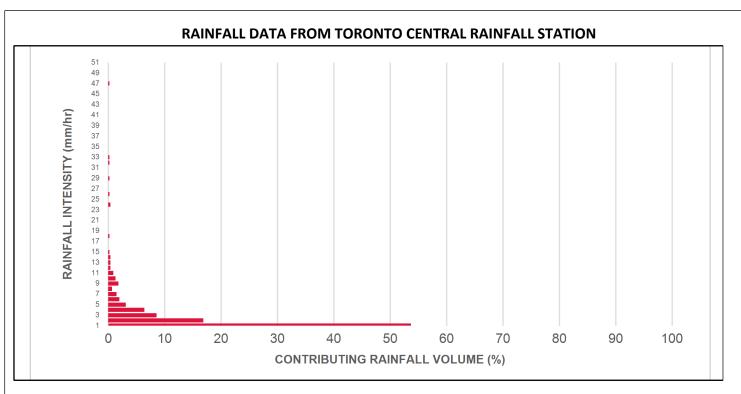
Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
1	53.7	53.7	0.25	15.0	13.0	70	37.8	37.8
2	16.9	70.6	0.50	30.0	25.0	70	11.9	49.7
3	8.6	79.2	0.75	45.0	38.0	70	6.1	55.8
4	6.4	85.6	1.00	60.0	50.0	69	4.4	60.2
5	3.1	88.7	1.25	75.0	63.0	67	2.1	62.2
6	2.0	90.7	1.50	90.0	75.0	66	1.3	63.6
7	1.5	92.2	1.75	105.0	88.0	64	1.0	64.5
8	0.7	92.9	2.00	120.0	100.0	62	0.4	65.0
9	1.8	94.7	2.25	135.0	113.0	62	1.1	66.1
10	1.3	96.0	2.50	150.0	125.0	61	0.8	66.8
11	0.9	96.9	2.75	165.0	138.0	60	0.5	67.4
12	0.4	97.3	3.00	180.0	150.0	58	0.2	67.6
13	0.4	97.7	3.25	195.0	163.0	57	0.2	67.8
14	0.4	98.1	3.50	210.0	175.0	57	0.2	68.1
15	0.2	98.3	3.75	225.0	188.0	56	0.1	68.2
16	0.0	98.3	4.00	240.0	200.0	54	0.0	68.2
17	0.0	98.3	4.25	255.0	213.0	54	0.0	68.2
18	0.2	98.5	4.50	270.0	225.0	53	0.1	68.3
19	0.0	98.5	4.75	285.0	238.0	53	0.0	68.3
20	0.0	98.5	5.00	300.0	250.0	53	0.0	68.3
21	0.0	98.5	5.25	315.0	263.0	52	0.0	68.3
22	0.0	98.5	5.50	330.0	275.0	52	0.0	68.3
23	0.0	98.5	5.75	345.0	288.0	52	0.0	68.3
24	0.4	98.9	6.00	360.0	300.0	51	0.2	68.5
25	0.0	98.9	6.26	375.0	313.0	51	0.0	68.5



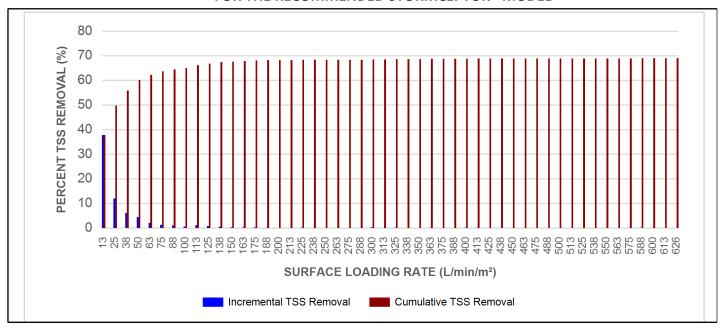


Rainfall Intensity (mm / hr)	Percent Rainfall Volume (%)	Cumulative Rainfall Volume (%)	Flow Rate (L/s)	Flow Rate (L/min)	Surface Loading Rate (L/min/m²)	Removal Efficiency (%)	Incremental Removal (%)	Cumulative Removal (%)
26	0.2	99.1	6.51	390.0	325.0	50	0.1	68.6
27	0.0	99.1	6.76	405.0	338.0	50	0.0	68.6
28	0.0	99.1	7.01	420.0	350.0	50	0.0	68.6
29	0.2	99.3	7.26	435.0	363.0	49	0.1	68.7
30	0.0	99.3	7.51	450.0	375.0	49	0.0	68.7
31	0.0	99.3	7.76	465.0	388.0	49	0.0	68.7
32	0.2	99.5	8.01	480.0	400.0	48	0.1	68.8
33	0.2	99.7	8.26	495.0	413.0	48	0.1	68.9
34	0.0	99.7	8.51	510.0	425.0	48	0.0	68.9
35	0.0	99.7	8.76	525.0	438.0	48	0.0	68.9
36	0.0	99.7	9.01	540.0	450.0	48	0.0	68.9
37	0.0	99.7	9.26	555.0	463.0	47	0.0	68.9
38	0.0	99.7	9.51	570.0	475.0	47	0.0	68.9
39	0.0	99.7	9.76	585.0	488.0	47	0.0	68.9
40	0.0	99.7	10.01	600.0	500.0	47	0.0	68.9
41	0.0	99.7	10.26	615.0	513.0	47	0.0	68.9
42	0.0	99.7	10.51	631.0	525.0	47	0.0	68.9
43	0.0	99.7	10.76	646.0	538.0	47	0.0	68.9
44	0.0	99.7	11.01	661.0	550.0	47	0.0	68.9
45	0.0	99.7	11.26	676.0	563.0	46	0.0	68.9
46	0.0	99.7	11.51	691.0	575.0	46	0.0	68.9
47	0.2	99.9	11.76	706.0	588.0	46	0.1	69.0
48	0.0	99.9	12.01	721.0	600.0	46	0.0	69.0
49	0.0	99.9	12.26	736.0	613.0	46	0.0	69.0
50	0.0	99.9	12.51	751.0	626.0	46	0.0	69.0
				Estimated Net A	Annual Sedim	ent (TSS) Loa	d Reduction =	69 %





## INCREMENTAL AND CUMULATIVE TSS REMOVAL FOR THE RECOMMENDED STORMCEPTOR® MODEL







#### **Maximum Pipe Diameter / Peak Conveyance**

Stormceptor EF / EFO	Model Diameter		Model Diameter		l Model Dismeter		Min Angle Inlet / Outlet Pipes	Max Inle	•	Max Outl	•		nveyance Rate
	(m) (ft)			(mm)	(in)	(mm)	(in)	(L/s)	(cfs)				
EF4 / EFO4	1 1.2 4		90	609	24	609	24	425	15				
EF6 / EFO6	1.8	6	90	914	36	914	36	990	35				
EF8 / EFO8	2.4	8	90	1219	48	1219	48	1700	60				
EF10 / EFO10	3.0 10		90	1828	72	1828	72	2830	100				
EF12 / EFO12	3.6	12	90	1828	72	1828	72	2830	100				

#### **SCOUR PREVENTION AND ONLINE CONFIGURATION**

► Stormceptor® EF and EFO feature an internal bypass and superior scour prevention technology that have been demonstrated in third-party testing according to the scour testing provisions of the Canadian ETV Procedure for Laboratory Testing of Oil-Grit Separators, and the exceptional scour test performance has been third-party verified in accordance with the ISO 14034 ETV protocol. As a result, Stormceptor EF and EFO are approved for online installation, eliminating the need for costly additional bypass structures, piping, and installation expense.

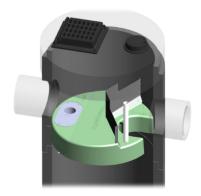
#### **DESIGN FLEXIBILITY**

► Stormceptor® EF and EFO offers design flexibility in one simplified platform, accepting stormwater flow from a single inlet pipe or multiple inlet pipes, and/or surface runoff through an inlet grate. The device can also serve as a junction structure, accommodate a 90-degree inlet-to-outlet bend angle, and can be modified to ensure performance in submerged conditions.

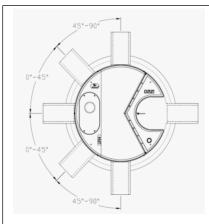
#### **OIL CAPTURE AND RETENTION**

▶ While Stormceptor® EF will capture and retain oil from dry weather spills and low intensity runoff, **Stormceptor® EFO** has demonstrated superior oil capture and greater than 99% oil retention in third-party testing according to the light liquid reentrainment testing provisions of the Canadian ETV **Procedure for Laboratory Testing of Oil-Grit Separators**. Stormceptor EFO is recommended for sites where oil capture and retention is a requirement.









#### **INLET-TO-OUTLET DROP**

Elevation differential between inlet and outlet pipe inverts is dictated by the angle at which the inlet pipe(s) enters the unit.

 $0^{\circ}$  -  $45^{\circ}$  : The inlet pipe is 1-inch (25mm) higher than the outlet pipe.

45° - 90°: The inlet pipe is 2-inches (50mm) higher than the outlet pipe.

#### **HEAD LOSS**

The head loss through Stormceptor EF is similar to that of a 60-degree bend structure. The applicable K value for calculating minor losses through the unit is 1.1. For submerged conditions the applicable K value is 3.0.

#### **Pollutant Capacity**

Stormceptor EF / EFO	Mod Diam		Pipe In	e Invert to Oil Volume Se Mainten		t to Oil Volume		mended ment ace Depth *	Maxii Sediment '	_	Maximum Sediment Mass *	
	(m)	(ft)	(m)	(ft)	(L)	(Gal)	(mm)	(in)	(L)	(ft³)	(kg)	(lb)
EF4 / EFO4	1.2	4	1.52	5.0	265	70	203	8	1190	42	1904	5250
EF6 / EFO6	1.8	6	1.93	6.3	610	160	305	12	3470	123	5552	15375
EF8 / EFO8	2.4	8	2.59	8.5	1070	280	610	24	8780	310	14048	38750
EF10 / EFO10	3.0	10	3.25	10.7	1670	440	610	24	17790	628	28464	78500
EF12 / EFO12	3.6	12	3.89	12.8	2475	655	610	24	31220	1103	49952	137875

<sup>\*</sup>Increased sump depth may be added to increase sediment storage capacity

<sup>\*\*</sup> Average density of wet packed sediment in sump = 1.6 kg/L (100 lb/ft<sup>3</sup>)

Feature	Benefit	Feature Appeals To		
Patent-pending enhanced flow treatment	Superior, verified third-party	Regulator, Specifying & Design Engineer		
and scour prevention technology Third-party verified light liquid capture	performance Proven performance for fuel/oil hotspot	Regulator, Specifying & Design Engineer,		
and retention for EFO version	locations	Site Owner		
Functions as bend, junction or inlet structure	Design flexibility	Specifying & Design Engineer		
Minimal drop between inlet and outlet	Site installation ease	Contractor		
Large diameter outlet riser for inspection and maintenance	Easy maintenance access from grade	Maintenance Contractor & Site Owner		

#### STANDARD STORMCEPTOR EF/EFO DRAWINGS

For standard details, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

#### STANDARD STORMCEPTOR EF/EFO SPECIFICATION

For specifications, please visit http://www.imbriumsystems.com/stormwater-treatment-solutions/stormceptor-ef

#### Table of TSS Removal vs Surface Loading Rate Based on Third-Party Test Results Stormceptor® EF

SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL	SLR (L/min/m²)	TSS % REMOVAL
1	70	660	46	1320	48	1980	35
30	70	690	46	1350	48	2010	34







60	67	720	45	1380	49	2040	34	
90	63	750	45	1410	49	2070	33	
120	61	780	45	1440	48	2100	33	
150	58	810	45	1470	47	2130	32	
180	56	840	45	1500	46	2160	32	
210	54	870	45	1530	45	2190	31	
240	53	900	45	1560	44	2220	31	
270	52	930	44	1590	43	2250	30	
300	51	960	44	1620	42	2280	30	
330	50	990	44	1650	42	2310	30	
360	49	1020	44	1680	41	2340	29	
390	48	1050	45	1710	40	2370	29	
420	48	1080	45	1740	39	2400	29	
450	48	1110	45	1770	39	2430	28	
480	47	1140	46	1800	38	2460	28	
510	47	1170	46	1830	37	2490	28	
540	47	1200	47	1860	37	2520	27	
570	46	1230	47	1890	36	2550	27	
600	46	1260	47	1920	36	2580	27	
630	46	1290	48	1950	35			
								1



## STANDARD PERFORMANCE SPECIFICATION FOR "OIL GRIT SEPARATOR" (OGS) STORMWATER QUALITY TREATMENT DEVICE

#### **PART 1 – GENERAL**

#### 1.1 WORK INCLUDED

This section specifies requirements for selecting, sizing, and designing an underground Oil Grit Separator (OGS) device for stormwater quality treatment, with third-party testing results and a Statement of Verification in accordance with ISO 14034 Environmental Management – Environmental Technology Verification (ETV).

#### 1.2 REFERENCE STANDARDS & PROCEDURES

ISO 14034:2016 Environmental management – Environmental technology verification (ETV)

Canadian Environmental Technology Verification (ETV) Program's **Procedure for Laboratory Testing of Oil-Grit Separators.** 

#### 1.3 SUBMITTALS

- 1.3.1 All submittals, including sizing reports & shop drawings, shall be submitted upon request with each order to the contractor then forwarded to the Engineer of Record for review and acceptance. Shop drawings shall detail all OGS components, elevations, and sequence of construction.
- 1.3.2 Alternative devices shall have features identical to or greater than the specified device, including: treatment chamber diameter, treatment chamber wet volume, sediment storage volume, and oil storage volume.
- 1.3.3 Unless directed otherwise by the Engineer of Record, OGS stormwater quality treatment product substitutions or alternatives submitted within ten days prior to project bid shall not be accepted. All alternatives or substitutions submitted shall be signed and sealed by a local registered Professional Engineer, based on the exact same criteria detailed in Section 3, in entirety, subject to review and approval by the Engineer of Record.

#### **PART 2 - PRODUCTS**

#### 2.1 OGS POLLUTANT STORAGE

The OGS device shall include a sump for sediment storage, and a protected volume for the capture and storage of petroleum hydrocarbons and buoyant gross pollutants. The **minimum** sediment & petroleum hydrocarbon storage capacity shall be as follows:

2.1.1 4 ft (1219 mm) Diameter OGS Units: 1.19 m³ sediment / 265 L oil
6 ft (1829 mm) Diameter OGS Units: 3.48 m³ sediment / 609 L oil
8 ft (2438 mm) Diameter OGS Units: 8.78 m³ sediment / 1,071 L oil
10 ft (3048 mm) Diameter OGS Units: 17.78 m³ sediment / 1,673 L oil
12 ft (3657 mm) Diameter OGS Units: 31.23 m³ sediment / 2,476 L oil

#### **PART 3 - PERFORMANCE & DESIGN**

3.1 GENERAL







The OGS stormwater quality treatment device shall be verified in accordance with ISO 14034:2016 Environmental management – Environmental technology verification (ETV). The OGS stormwater quality treatment device shall remove oil, sediment and gross pollutants from stormwater runoff during frequent wet weather events, and retain these pollutants during less frequent high flow wet weather events below the insert within the OGS for later removal during maintenance. The Manufacturer shall have at least ten (10) years of local experience, history and success in engineering design, manufacturing and production and supply of OGS stormwater quality treatment device systems, acceptable to the Engineer of Record.

#### 3.2 SIZING METHODOLOGY

The OGS device shall be engineered, designed and sized to provide stormwater quality treatment based on treating a minimum of 90 percent of the average annual runoff volume and a minimum removal of an annual average 60% of the sediment (TSS) load based on the Particle Size Distribution (PSD) specified in the sizing report for the specified device. Sizing shall be determined using historical rainfall data and a sediment removal performance curve derived from the actual third-party verified laboratory testing data. The OGS device shall also have sufficient annual sediment storage capacity as specified and calculated in Section 2.1.

#### 3.3 CANADIAN ETV or ISO 14034 ETV VERIFICATION OF SCOUR TESTING

The OGS device shall have Canadian ETV or ISO 14034 ETV Verification of third-party scour testing conducted in accordance with the Canadian ETV Program's **Procedure for Laboratory Testing of Oil-Grit Separators**.

3.3.1 To be acceptable for on-line installation, the OGS device must demonstrate an average scour test effluent concentration less than 10 mg/L at each surface loading rate tested, up to and including 2600 L/min/m<sup>2</sup>.





Canada

#### **CULTEC Stormwater Design Calculator**

**Date:** April 19, 2021

#### Project Information:

2935, 2955 Mississauga Road 2935, 2955 Mississauga Road Mississauga Ontario

#### **RECHARGER 330XLHD**

Project Number:	20-697					
Calculations Performed By:						
Elliot Pai						
Greck and Associates	Greck and Associates Limited					
Unit 3, 5770 Highway 7						
Woodbridge	Ontario					
L4L 1T8						
Canada						
289-657-9797						
epai@greck.ca						

Recharger 330XLHD Chamber Specifications					
Height	775	mm			
Width	1321	mm			
Length	2.59	meters			
Installed Length	2.13	meters			
Bare Chamber Volume	1.48	cu. meters			
Installed Chamber Volume	2.24	cu. meters			

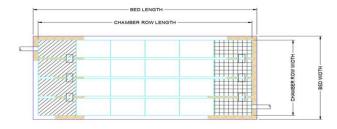


Breakdown of Storage Provided by Recharger 330XLHD Stormwater System					
Within Chambers	<b>12.46</b> cu. meters				
Within Feed Connectors	<ul> <li>cu. meters</li> </ul>				
Within Stone	<b>9.13</b> cu. meters				
Total Storage Provided	21.6 cu. meters				
Total Storage Required	18.50 cu. meters				

#### **Materials List**

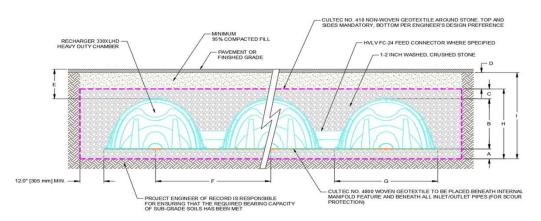
Recharger 3			
Total Number of Chambers Required	8	pieces	
Separator Row Chambers	4	pieces	Separator Row Qty Included in Total
Starter Chambers	2	pieces	
Intermediate Chambers	4	pieces	
End Chambers	2	pieces	
HVLV FC-24 Feed Connectors	2	pieces	Based on 2 Internal Manifold
CULTEC No. 410 Non-Woven Geotextile	117	sq. meters	
CULTEC No. 4800 Woven Geotextile	16	meters	
Stone	23	cu. meters	

#### **Bed Detail**



**Bed Layout Information** Number of Rows Wide pieces Number of Chambers Long Chamber Row Width 2.79 meters Chamber Row Length 8.99 meters Bed Width 3.40 meters Bed Length meters Bed Area Required Length of Separator Row 32.68 sq. meters 8.99 meters

Bed detail for reference only. Not project specific. Not to scale.



Conceptual graphic only. Not job specific.

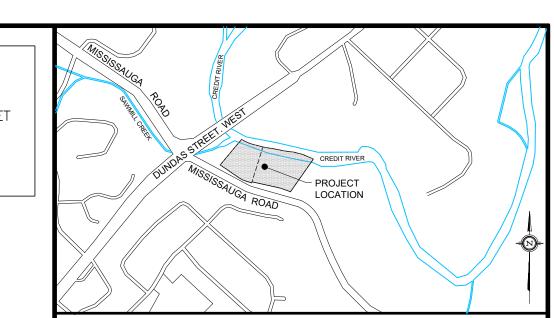
	Cross Section Table Reference		
Α	Depth of Stone Base	152	mm
В	Chamber Height	775	mm
С	Depth of Stone Above Units	152	mm
D	Depth of 95% Compacted Fill	254	mm
E	Max. Depth Allowed Above the Chamber	3.66	meters
F	Chamber Width	1321	mm
G	Center to Center Spacing	1.47	meters
н	Effective Depth	1.08	meters
I	Bed Depth	1.33	meters

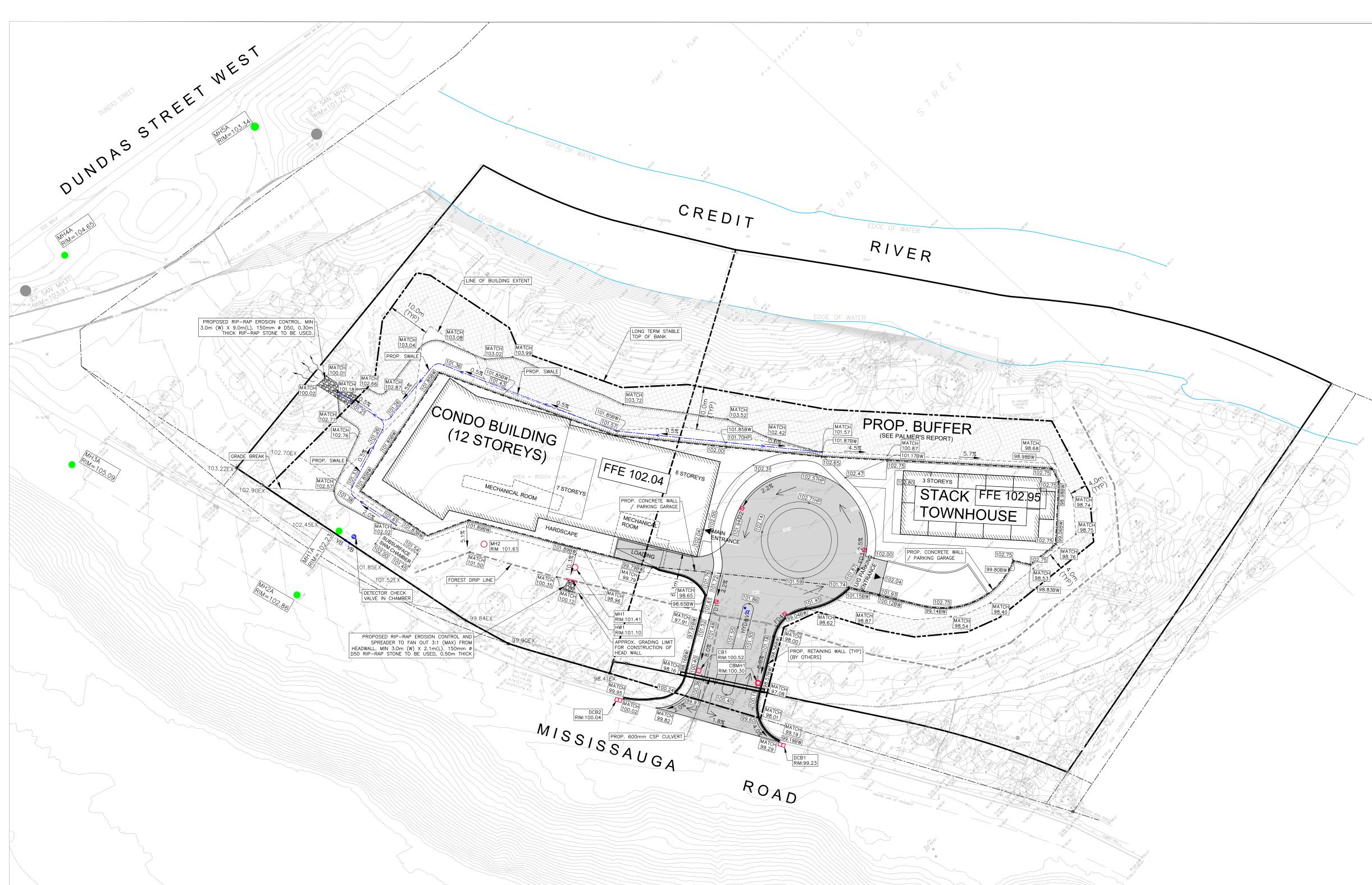
APPENDIX H

**Engineering Drawings** 



PLAN OF TOPOGRAPHY OF PART OF LOTS 3 AND 4, RANGE 1, SOUTH OF DUNDAS STREET RACEY TRACT (ORIGINALLY IN TOWNSHIP OF TORONTO) CITY OF MISSISSAUGA REGIONAL MUNICIPALITY OF PEEL





# N.T.S.

**KEY PLAN** 

L	Ε	G	Ε	

LEGEND					
<b>EXISTING</b>	PROPOSED				
MH1 🔘	MH1 🔾	STORM MANHOLE			
MH1A 🎱	MH1A 🛑	SANITARY MANHOLE			
	FD 🗷	FLOOR DRAIN TO INTERNAL OGS			
CB m	CB 🗖	SINGLE CATCHBASIN			
DCB mm	DCB 🞞	DOUBLE CATCHBASIN			
HYD&V <del>-⊗-</del> -∳-	HYD&V <mark>⊗-</mark> - <mark></mark>	FIRE HYDRANT			
VB ⊗	VB <mark>⊗</mark>	VALVE & BOX			
		SLOPE LINE (3:1 MAX)			
		CURRENT PROPERTY LIMIT			
		FUTURE PROPERTY LIMIT			
		SWALE			
		LIMIT OF BUILDING EXTENT			
		RIGHT OF WAY			
		LOT LINE			
—	——×——	FENCE LINE			
		CURB/SIDEWALK			
		CONCRETE RETAINING WALL			
		PARKING GARAGE / CONCRETE WALL			
		FOREST DRIPLINE			
		ASPHALT SURFACE			

. ALL DIMENSIONS ARE IN METRES UNLESS OTHERWISE NOTED.
2. ALL DIMENSIONS SHALL BE CHECKED AND VERIFIED IN THE FIELD BY THE CONTRACTOR PRIOR TO ANY CONSTRUCTION, AND ANY DISCREPANCIES SHALL BE REPORTED IMMEDIATELY TO THE ENGINEER.
3. ALL WORK SHALL BE IN ACCORDANCE WITH CURRENT CITY OF MISSISSAUGA STANDARD SPECIFICATIONS AND DRAWINGS UNLESS OTHERWISE NOTED HEREIN.
4. ORDER OF PRECEDENCE OF STANDARDS DRAWINGS IS FIRSTLY CITY OF MISSISSAUGA, AND SECONDLY ONTARIO PROVINCIAL STANDARD DRAWINGS (OPSD).
5. THE CONTRACTOR TO BE RESPONSIBLE FOR LOCATION OF ALL EXISTING U/G AND

THE CONTRACTOR TO BE RESPONSIBLE FOR LOCATION OF ALL EXISTING U/G AND OVERHEAD UTILITIES. CONTRACTOR IS REQUIRED TO OBTAIN ALL LOCATIONS & NOTIFY THE VARIOUS UTILITY COMPANIES 72 HOURS PRIOR TO THE COMMENCEMENT OF ANY WORK. THE CITY OF MISSISSAUGA AND CONSULTANT ASSUMES NO RESPONSIBILITY FOR THE ACCURACY OF THE LOCATIONS OF EXISTING UTILITIES AS INDICATED ON

## **BENCHMARK**

BENCHMARK: CITY OF MISSISSAUGA No. 58 BENCHMARK: CITY OF MISSISSAUGA No. 58
ELEVATION = 108.293m
LOCATION: CITY OF MISSISSAUGA
DATED: DEC 10, 2019
COMPLETED BY:
TARASICK McMILLAN KUBICKI LTD.
ONTARIO LAND SURVEYORS
4181 SLADVIEW CRESCENT, UNIT 42, MISSISSAUGA, ONTARIO L5L 2R2

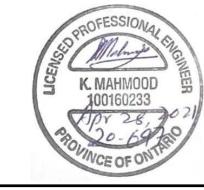
(905) 569-8849

DATE BY APPROVE ISSUED FOR FIRST SUBMISSION 2021/04/26 K.M.

# SUBMISSION DRAWING

NOT TO BE USED FOR CONSTRUCTION





CLIENT NAME: 590816 ONTARIO INC. 2616 CYNARA ROAD MISSISSAUGA, ON L5B 2R7

PROJECT NAME:

2935 & 2955 MISSISSAUGA ROAD

MISSISSAUGA, ON

## **GRADING PLAN**

DESIGNED BY: E.F	⊃./K.M.	SCALES:		PROJECT No.	20-697
CHECKED BY:	E.G.	HORIZONTAL:	1: 500	DRAWING No.	GP1
DRAWN BY:	K.M.	VERTICAL:	N/A	SHEET No.	Ω1
DATE: APR 26	5, 2021	SHEET SIZE:	24"x36"	SHEET NO.	O I

