City of Mississauga

Environmental Assessment:
Sawmill Creek Erosion Control Project
Reach 1: Folkway Drive to Erin Mills Parkway
EA Project File

July 2021

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Revision Log

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Ecosystem Recovery Signatures

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1. Introduction

The City of Mississauga's ongoing erosion monitoring of Sawmill Creek has identified several sites where erosion is impacting, or potentially will affect, infrastructure both within and adjacent to the waterway. The objective of this study is to identify potential causes of the erosion and to develop, evaluate and ultimately recommend erosion control alternatives. This study is being completed under Schedule "B" of the Municipal Class Environmental Assessment process.

1.1 Study Area Overview

This erosion control study is in response to unstable conditions observed over an approximately 1037 m length of Sawmill Creek that runs southeast through Sawmill Valley Trail study area, from Folkway Drive to Erin Mills Parkway. The study area is shown in **Figure 1-1**. The Sawmill Creek valley supports a community trail system and several pedestrian crossings. Opportunities to improve the crossings are being considered in this study.



Figure 1-1 - Sawmill Creek Erosion Control Study Area

1.2 Background

The City completed the Sawmill Creek Natural Channel Design Study in 1995 by Gore and Storrie. The study delineated Sawmill Creek into reaches and provided a review of previous works, and 1995 conditions. Based on the study findings, the report presented a remediation plan for each reach of Sawmill Creek that included a series of recommendations for stabilization works to address significant bed and bank erosion problems.

The Gore and Storrie (1995) report indicated that Reach 1, which extends from Folkway Drive to Erin Mills Parkway, had been altered with trapezoidal channelization in 1974; the upstream outfall and culvert (at Folkway Drive) was

implemented in 1974, and the downstream inlet structure and box culvert was implemented in 1972. Field observations (1995) indicated that the entire length of Reach 1 had been channelized using gabion baskets and no specific erosion sites were reported.

The preferred reach stabilization strategy identified for Reach 1 through the Gore and Storrie (1995) assessment was the Do Nothing alternative due to the anticipated change in flow regime from the proposed development on Churchill Meadows. However, it was noted that if the existing gabion structures began to deteriorate, then re-design of this reach should be considered.

Through its current ongoing erosion monitoring program, the City of Mississauga has identified several erosion concerns along Sawmill Creek Reach 1 which have led to its classification as a high priority site in need of rehabilitation. Some of the issues identified through the erosion monitoring program included, but were not limited to, the following:

- Broken or empty gabion baskets along creek banks and at drop structures;
- Fractured concrete at drop structures;
- Bank erosion impacting trees, vegetation and park trail;
- Exposed and damaged pedestrian bridge footings; and
- Deposition and vegetation growth within creek.

1.3 Key Project Objectives

The section of channel that is included in the current study exhibits characteristics of ongoing erosion. The current study is intended to further examine conditions of Sawmill Creek from Folkway Drive to Erin Mills Parkway. This project strives to assess the best options for rehabilitation of the stream and surrounding area.

Project objectives identified at the outset of this project include the following:

1. Refinement of the problem statement.
2. Establishment of a multi-disciplinary and integrated understanding of existing conditions.
3. Assessment of future risk to property and infrastructure.
4. Identification and evaluation of relevant alternatives that address the problem statement.
5. Determination of a preferred solution.
6. Preparation of a project file report that documents all aspects of the EA process.

Rehabilitation-specific project goals for the Reach 1 study area of Sawmill Creek include:

1. Development of long-term erosion protection solutions that are more ‘natural’ in appearance than existing structures and compatible with natural creek tendencies.
2. Maintenance or improvement of the hydraulic capacity of the creek.
3. Provision of environmental enhancement wherever possible.
4. Improvement or creation of high-quality fish habitat and creation of potential for fish passage.
5. Improvement in the condition of the community trail as needed.
6. Minimization of the need for future maintenance.
7. Minimization of property and infrastructure loss.
8. Minimization of capital and maintenance costs.
9. Enablement of adaptive management.

2. Environmental Assessment Process

2.1 Ontario's Environmental Assessment Act

The Sawmill Creek Erosion Control Project from Folkway Drive to Erin Mills Parkway is subject to the provisions of Ontario's *Environmental Assessment Act*. The Act requires that an environmental assessment of any major public sector project that has the potential for significant environmental effects be undertaken prior to implementation to determine the ecological, cultural, economic, and social impact of the project.

The Act exists to "provide for the protection, conservation, and wise management of Ontario's environment". The act mandates clear terms of reference, focused assessment hearings, ongoing consultation with all parties involved — including public consultation — and, if necessary, referral to mediation for decision. Environmental assessment is a key part of the planning process and must be completed before decisions are made to proceed on a project.

To comply with the requirements of the Act, two types of environmental assessment processes can be applied to projects:

1. **Individual Environmental Assessment** (under Part II of the Act): This process includes the development of a project-specific Terms of Reference that is submitted for review and approval to the Minister of the Environment. This process is typically applied to large, unique or complex projects that do not have precedents that demonstrate a predictable and manageable environmental impact.
2. **Class Environmental Assessment**: This process applies to routine projects that have predictable and manageable environmental effects, and follow a Terms of Reference that has been previously approved for certain types of projects. Provided that the approved Class EA process is followed, the project will comply with Section 13(3) a, Part II.1 of the *Environmental Assessment Act*.

2.2 Municipal Class Environmental Assessment

The Sawmill Creek Erosion Control Project from Folkway Drive to Erin Mills Parkway study falls under the Class Environmental Assessment (EA) process as a project with predictable and manageable environmental impacts, and will be carried out under the Terms of Reference established in the Municipal Class Environmental Assessment document, prepared by the Ontario Municipal Engineers Association in June 2000 (as amended in 2007, 2011, and 2015).

Figure 2-1 illustrates the Municipal Class EA Process for the planning and design of projects, which is divided into five phases as outlined below:

Phase 1	Identify the problem (deficiency) or opportunity
Phase 2	Identify alternative solutions to address the problem or opportunity by taking into consideration the existing environment, and establish the preferred solution taking into account public and review agency input.
Phase 3	Examine alternative methods of implementing the preferred solution, based upon the existing environment, public and review agency input, anticipated environmental effects and methods of minimizing negative effects and maximizing positive effects.
Phase 4	Document, in an Environmental Study Report, a summary of the rationale, and the planning, design and consultation process of the project as established through the above Phases, and make such documentation available for scrutiny by review agencies and the public.
Phase 5	Implementation. Complete contract drawings and documents, and proceed to construction and operation; monitor construction for adherence to environmental provisions and commitments. Where special conditions dictate, also monitor the operation of the completed facilities.

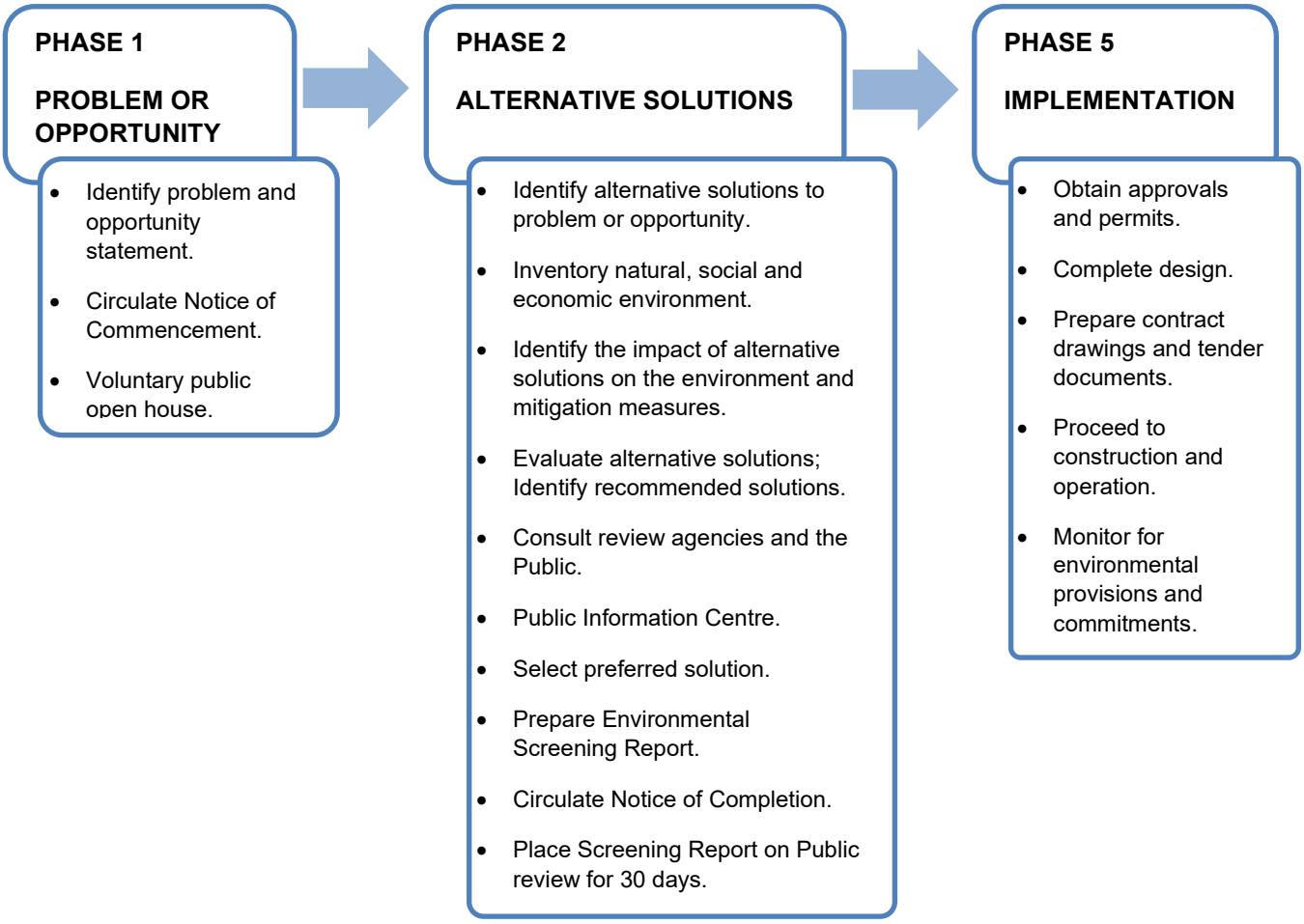


Figure 2-1. Municipal Class Environmental Assessment Planning and Design Process for Schedule B Projects (modified from MEA, 2007).

The Municipal Class EA applies to municipal infrastructure projects including roads, water, wastewater, and stormwater projects. There are several classifications of projects under the Class EA process, known as schedules, based on their potential environmental impact:

- **Schedule "A"** projects generally include normal or emergency operational and maintenance activities, where environmental effects are minimal. Only Phase 1 of the Class EA process must be completed prior to these projects being implemented.
- **Schedule "A+"** projects were introduced in 2007 and include an additional consultation component wherein the public is to be advised prior to the implementation of a Schedule "A" project.
- **Schedule "B"** projects generally include improvements and minor expansions to existing facilities, where there is the potential for some adverse environmental impacts. A screening process is followed which includes consultation with agencies and members of the public who may be affected by the project. The first two phases of the Class EA process are completed for these projects, including the preparation and submission for public review of a Project File, prior to implementation.
- **Schedule "C"** projects generally include the construction of new facilities and major expansions to existing facilities and have the potential for significant environmental impact. A complete Class EA process is required for these projects prior to implementation, including the production of an Environmental Study Report.

The present study is being completed under Schedule "B" of the Municipal Class EA process as the project involves works undertaken in a watercourse for the purposes of flood control or erosion control, which may include:

- Bank or slope regrading;
- Deepening the watercourse;
- Relocation, realignment or channelization of watercourse;
- Reconstruction of relevant trail infrastructure; or
- Revetment including soil bio-engineering techniques.

2.3 Part II Order

Throughout the Class EA process, Agency or public concerns may arise. The Municipality will attempt to resolve the concerns at best it can. If, at the completion of the Class EA process, there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal treaty rights, you may request the Minister of the Environment, Conservation and Parks (MECP), formerly MOECC, to issue an order requiring the Municipality to comply with Part II of the *Environmental Assessment Act* before proceeding with the implementation of the project. This is called a Part II Order request.

A Part II Order may only be requested if there are outstanding concerns that a project may adversely impact constitutionally protected Aboriginal and treaty rights.

In addition, the Minister may issue an order on his or her own initiative within a specified time period. The Director will issue a Notice of Proposed Order to the proponent if the Minister is considering an order for the project within 30 days after the conclusion of the comment period on the Notice of Completion. At this time, the Director may request additional information from the proponent. Once the requested information has been received, the Minister will have 30 days within which to make a decision or impose conditions on your project.

This means the Municipality cannot proceed with the project until at least 30 days after the end of the comment period provided for in the Notice of Completion. Further, the proponent may not proceed after this time if:

- a Part II Order request has been submitted to the Ministry regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, or
- the Director has issued a Notice of Proposed Order regarding the project.

After reviewing the Part II Order request and the relevant project detail, the Minister may make one of the following decisions:

- Deny the request;
- Deny the request with conditions;
- Refer the matter to mediation; or
- Issue a Part II Order whereby the Municipality will be required to prepare a Terms of Reference and an Individual EA for the undertaking.

Part II Order requests regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights must be submitted in writing to the Minister of the Environment, Conservation and Parks, after the proponent has issued a Notice of Completion of the environmental study report and during the 30 day review period. The proponent must also be copied on the request.

Minister Jeff Yurek
Ministry of the Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto, ON M7A 2J3
minister.mecp@ontario.ca

and

Director, Environmental Approvals Branch
Ministry of the Environment, Conservation and Parks
135 St. Clair Avenue West, 1st Floor
Toronto, ON M4V 1P5

If no Part II Order requests are received, the Municipality may proceed with detailed design and construction of the recommended projects as presented in this report.

3. Existing Conditions

This section provides a detailed characterization of the study area including assessment of the existing hydraulics, geomorphology, natural and social environment, and outlines the key erosion issues and potential opportunities for consideration.

3.1 Physiography and Geology

The physiography of an area refers to spatial groupings of similar landscape characteristics (i.e., landforms, rock or sediment type) that have a common geologic or evolutionary history. The physiography of a region is intrinsically linked to the topography of the landscape and the geomorphic influences acting upon it. Landscape characteristics exert an important influence on channel form and function and provide insight into sediment supply.

Physiography

The study area is situated on the border of the South Slope and Iroquois Plain physiographic regions. The South Slope till plain consists of several layers of sand, silts, and clays that lie above weathered shale bedrock (Karrow, 1967). The more southerly Iroquois Plain is comprised of well-drained sand deposits, commonly underlain by shale or clay rich materials (Geomatics International Inc, 1996). The topography of the area is subdued, containing low relief drumlins and moraines, much of which has been altered due to urbanization. Within Sawmill Creek, approximately 2-4 feet of sandy gravel alluvium is present.

Surficial and Bedrock Geology

Approximately half of the surficial study area is covered by a thin layer of Halton Till and the other half is classified as bedrock (Figure 3-1). AECOM (2013) describes the till as clayey-silt to sandy-silt till containing lenses of coarser material, the colour of which is influenced by the underlying geology; either the red-coloured shales of the Queenston Formation or the grey to olive-coloured shales of the Georgian Bay Formation. The bedrock belongs to the Upper Ordovician-age Queenston Formation, which consists of silty and sandy mudstone, argillaceous siltstone, and smaller amounts of argillaceous sandstone and limestone (Ayer et al., 2000).

Sawmill Creek has incised into the surficial geology and reworked the materials, over time, resulting in a corridor of modern alluvial deposits that is situated on top of the surficial geology. The modern alluvium is dominated by clay, silt, sand, gravel and some organic materials (Chapman & Putnam, 2007).

Soils

The soil type in the region is comprised of Oneida clay loam and Chinguacousy clay loam. Both soil types are derived primarily from shale with some contributions from limestone. Oneida clay loam is comprised of a friable clay loam layer atop of clay till. It is well-drained and susceptible to erosion. Chinguacousy clay loam is similar in composition, though imperfectly drained (Hoffman and Richards, 1953). Boreholes drilled in the vicinity of the study area in 1974 revealed surface layers of clayey silt followed by reddish brown alluvium within the first 4 inches. An approximately 15 inch layer of dense sandy silt till with sandy seams followed, supported by bedrock.

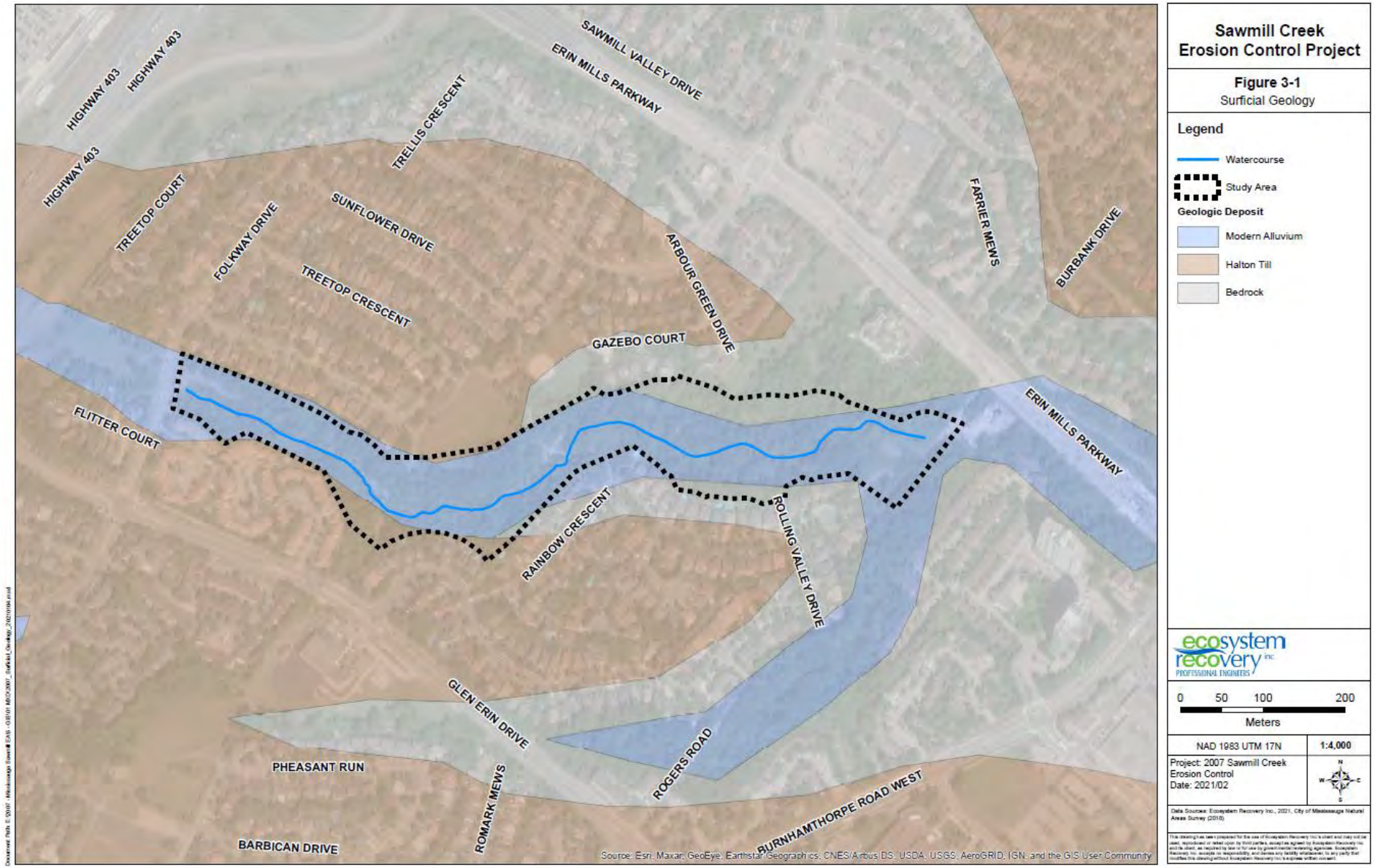


Figure 3-1. Surficial Geology in The Study Area.

3.2 Watershed and Drainage Network

The Sawmill Creek subwatershed of the Credit River drains an area of approximately 20 km^2 west of the Credit River and north of Dundas St. East. As the Sawmill Creek watershed became developed, many low order tributaries were shortened or removed from the drainage network either through realignments, regrading of the land surface, and/or routing of water through the storm drainage network. Upstream of Folkway Drive, the entire watershed area is conveyed via storm sewers. Therefore, the open section of Sawmill Creek originates at Folkway Drive and corresponds to the upstream limit of the Reach 1 study area. From Folkway Drive, the creek flows in a southeasterly direction and ultimately discharges into the Credit River at Dundas Street West. The Sawmill Creek subwatershed is largely urbanized with mid to high-density suburban neighbourhoods.

Review of historical aerial photography indicates that the Sawmill Creek watershed area consisted entirely of rural developments during the early 1950s. By 1966, subdivisions were under construction across lower parts of the city of Mississauga, as well as alongside the Credit River. The land surrounding the Reach 1 study area was urbanized in the 1970s. Modifications of the Reach 1 planform configuration, and construction of the Sawmill Creek trail, are apparent in aerial imagery from 1975 and 1977. The main pedestrian bridge north of Rainbow Crescent appeared to have undergone replacement or reconstruction during 2007.

Modification of Sawmill Creek occurred between 1954 and 1993 from Folkway Drive to its confluence at the Credit River (**Figure 1-1**) (see Figures G-9 and G-10 in the 1995 Gore & Storrie report). Channelization of Reach 1 occurred in 1974 (Gore & Storrie, 1995).

3.3 Channel Conditions

A review of existing conditions was completed through a field walk along Sawmill Creek in April 2020. While completing the reconnaissance level assessment it became apparent that within Reach 1 of Sawmill Creek, there was spatial variability with respect to boundary materials, channel conditions, and processes. Six subreaches were defined to enable spatial organization of data and observations, and to facilitate analyses (Error! Reference source n ot found.). An overview of subreach conditions, from a multi-disciplinary perspective, is provided in **Section 3.8.**

3.3.1 Erosion Control Measures

The 1995 Gore and Storrie report indicated that the entire length of the study area was altered to a gabion lined trapezoidal channel in 1974. During the 2020 (April and May) field assessment, discontinuous erosion control measures were observed along the channel bed and banks. Of the combined 2074 m of channel banks, 39% were lined with erosion control materials. This section of the report provides an overview of the structures with respect to condition and function. The locations of the erosion control measures are shown in **Figure 3-2,** and illustrated in the following section.

Table 3-1. Extent of Erosion Control Measures Along Channel Bed And Banks.

Channel Length Parameter	Value
Total channel length (m)	1037
Total length of banks (m)	2074
Total length of gabion lined bank (m)	715
Total length of concrete lined bank (m)	96
Percent of banks hardened (%)	39.1%
Total length of natural bank/valley wall (m)	1263
Percent of banks that are natural (%)	60.9%

Concrete-lining – lining of bed and banks with concrete was limited to subreaches 1 and 6, associated with the stormwater outlet (upstream) and inlet (downstream). The concrete wingwalls extended upstream/downstream to tie-into adjacent gabion bank protection. In subreach 6, concrete energy dissipating blocks were situated

downstream of the four stormwater outfall cells. Concrete pier nose extensions extended upstream of the concrete box culvert inlet of subreach 1.



Extended concrete wingwalls line channel banks for a short distance upstream of the subreach 1 outlet culvert.



Upstream limit of the study area (subreach 6) consists of a concrete lined channel, view upstream.

Gabion Bank Protection

The predominant engineered erosion control measure in the study area was gabion baskets that were implemented in 1974 (Gore and Storrie, 1995) and are now coming to the end of their design life. Except for the gabion mattresses that lined the channel banks adjacent to the concrete lined sections in subreaches 1 and 5, all other occurrences of gabions coincided with weir structures. In total, 34% of channel banks were lined with gabions (**Table 3-1**). The condition of the gabions ranged from intact to failing (sagging, corroded) or failed (empty, fallen) and/or outflanked. The failure of the gabions has contributed to failure of the weirs.



Gabion mattress on the south bank of subreach 1.



Tiered gabion protection on the south bank of subreach 1.

3.3.2 **Weirs/Grade Control Structures**

There are nineteen (19) grade control structures present within the study area **(Figure 3-2)**. These structures consisted of gabions and/or asphalt. The majority of the weirs were in states of disrepair, having corroded and/or displaced into the creek, with gabion materials deposited within the channel cross-section; many weirs were also outflanked. Two weirs coincided with sanitary sewer crossings. (**Table 3-2**)



Figure 3-2. Study Area Subreaches and Existing Conditions.

Table 3-2. Overview of Weirs.

	Value
Total Number of weirs	19
Gabion Weirs	
Number	18
Failing	18
Protecting Infrastructure	2
Asphalt Weir	
Number	1
Failing	1
Protecting Infrastructure	0


Failed asphalt weir at subreach 1 and 2.


Failed gabion weir structure in subreach 4.

3.3.3 Stormwater Outfalls

Throughout the study area, there are 4 outfalls that discharge into Sawmill Creek, excluding the stormwater outlet at the upstream limit of the study area (**Figure 3-2**). All 4 of the stormwater outfalls are situated at a distance from Sawmill Creek and discharge into a drainage channel that conveys flow to the creek.


Stormwater outfall into drainage channel (subreach 3)


Stormwater outfall into drainage channel (subreach 3)

3.3.4 Sanitary Sewer Manholes

Within the study area, there are eleven sanitary sewer manholes (**Figure 3-2**) . These occur along both the north and south sides of the creek. Two of the manholes are adjacent to trail crossings over the creek (subreach 4). The nearest manhole to the channel bank was within ~2 m.

Within subreach 2, erosion control measures (armourstone wall and slope regrading) were implemented in 2010 to protect the adjacent manhole. The upstream limit of the armourstone wall coincides with a failing weir structure. Erosion occurring immediately upstream, along the south bank, may pose a risk to the armourstone wall. The configuration of the armourstone wall appears to interfere with flow.

3.3.5 Crossings

Two formal pedestrian trail bridges cross over Sawmill Creek within subreach 4 of the study area (**Figure 3-2);** a low level concrete crossing also occurs in subreach 4. During the reconnaissance level field assessment (April 2020), concerns associated with the two pedestrian bridges were documented, including failure of erosion control protection surrounding the structures, outflanking of the bridges, etc. A pedestrian crossing assessment was completed and is included in **Appendix A**; a summary is provided below.

Pedestrian Bridge A

The span of the bridge at 0+555 is 10.8 m. This bridge is the furthest downstream of the two formal bridge crossings. Issues identified during the 2020 field reconnaissance included:

- Deterioration of erosion control under the bridge crossing, including displacement of large angular stone, and exposed filter cloth;
- Undercutting of the bridge footing/abutment measured at a minimum of 0.55 m;
- Channel bank and bed scour upstream of the pedestrian bridge (south bank); efforts to mitigate further erosion and damage to the bridge were previously implemented, including placement of sandbags and concrete slabs.

The City of Mississauga conducted an inspection of the crossing structure in 2018. Similar concerns were identified, including undermining of the east abutment, as well as concerns with the south slope exhibiting failure, and the crossing deck exhibiting chipping (tripping hazard). Rehabilitation (including replacement of trusses) of the bridge was recommended during the next major rehabilitation.



Undercutting of Bridge A abutment; displaced erosion control (stone); exposed filter cloth



Channel bed and bank scour upstream of pedestrian bridge A; previous mitigation efforts were failing

Pedestrian Bridge B

The span of the Bridge B at 0+300 is 12.5 m. Issues identified during field reconnaissance included:

- Displacement and cracking of concrete slabs below bridge; sanitary sewer crossing below concrete protection may be at risk if further failure occurs.

	
Uplifting and displacement of concrete slab protection under bridge (0+300).	Voids in concrete due to cracking and displacement measured at a minimum of 0.30 m; bridge 0+300.

The City of Mississauga conducted an inspection of the crossing structure in 2018. Major concerns regarding the crossing were attributed to the failing bridge deck. Rehabilitation (including replacement of trusses) of the bridge was recommended during the next major rehabilitation.

Low-level Crossing C

A low-level concrete crossing is located at station 0+200m. It is suspected that the original intention of this crossing was to provide protection to a sanitary sewer located near the creek. The crossing serves as an unofficial connection from an informal pedestrian pathway (south channel bank) to the formal pedestrian pathway (north channel bank). Issues identified during field reconnaissance included:

- Displacement and cracking of concrete slabs below bridge;
- Substantial drop height from channel bed upstream; height > 0.5 m;
- Potential risk to public safety.

	
Upstream view of low level crossing C (0+200). Connects informal pedestrian pathway (south / left bank) to formal pathway (north / right bank).	Broken concrete slabs and drop height > 0.5 m from upstream channel bed; impediment to potential fish passage.

A scoped hydraulic assessment completed for the two formal pedestrian bridges revealed that both crossings were deficient in terms of clear span and end area capacity (see **Appendix A** for detailed documentation); specifically, the top width of the 2 year flow (i.e., ranging from 15.65 – 22.75 m) is wider than the existing span of the two pedestrian bridges. Further, review of hydraulic model results indicated that high shear and stream power conditions surrounded the bridges, suggesting high energy of flows during the 2-year flow event. The capacity issues identified at the formal bridge crossings contribute to the ongoing erosion at the pedestrian bridges, promoting undercutting of the bridge footings/abutments, and leading to increasing risk of crossing failure.

3.4 Hydrology and Hydraulics

The hydrology of Sawmill Creek and hydraulic model for the study area was supplied by Credit Valley Conservation Authority (CVC).

3.4.1 Hydrology

The existing HEC-RAS model (2013) includes several return period events; these flows are summarized in **Table 3-3**. The hydrology reflects the urbanized condition of the watershed and the limited stormwater management measures that occur. All surface water upstream of Folkway Drive is conveyed through a stormwater system to Sawmill Creek,

Table 3-3. Summary of Return Period Flows within the Study Area of Sawmill Creek.

Flow event	2-year (m^3/s)	5-year (m^3/s)	10-year (m^3/s)	25-year (m^3/s)	50-year (m^3/s)	100-year (m^3/s)	Regional (m^3/s)
Reach 1	21.5	36.9	52.4	64.3	79.6	92.8	84.8

3.4.2 Hydraulic Model

The HEC-RAS hydraulic model received from CVC was updated with the 2020 topographic survey data and available mapping (Lidar). The model was updated with respect to cross-section geometries and channel bed elevations from station 3860 to 2906 (see **Figure 3-3** for section locations); review of model parameters was also taken to ensure consistency with field observations. Topographic survey data was used to create updated channel geometries, while available Lidar data was stitched to the surveyed channel geometry for areas beyond the survey scope (i.e., floodplain and valley). The updated HEC-RAS model provides a Basis of Comparison (BOC) for

changes to modelled water surface elevations and channel velocities under the preferred alternative. The BOC model also provides the basis for establishing existing conditions in support of the geomorphic assessment.

A comparison between the original (Existing) and BOC model cross-section water surface elevation and flow velocities during the regional flow event was completed using sections common to both models (see **Table 3-4**). The BOC model results are different than the existing conditions for water surface elevation and flow velocity. These changes are largely attributable to the updated geometry data from the 2020 topographic survey. The water surface elevations in the BOC model are lower than the existing model, with the exception of station 2906 which exhibits an increase in water surface elevation by 0.58 m. The velocities are also generally lower for the BOC model.

The lower water surface elevations in the BOC model reflect the updates based on 2020 topography survey. That is, the BOC model sections typically had a lower bed invert than that was reflected in the Existing model; this lower elevation may reflect a loss of gabion channel bed and/or a natural lowering in the channel bed since the Existing hydraulic model was last modified in 2013. The complete model output data for the Existing and BOC HEC-RAS models are included in **Appendix B**.

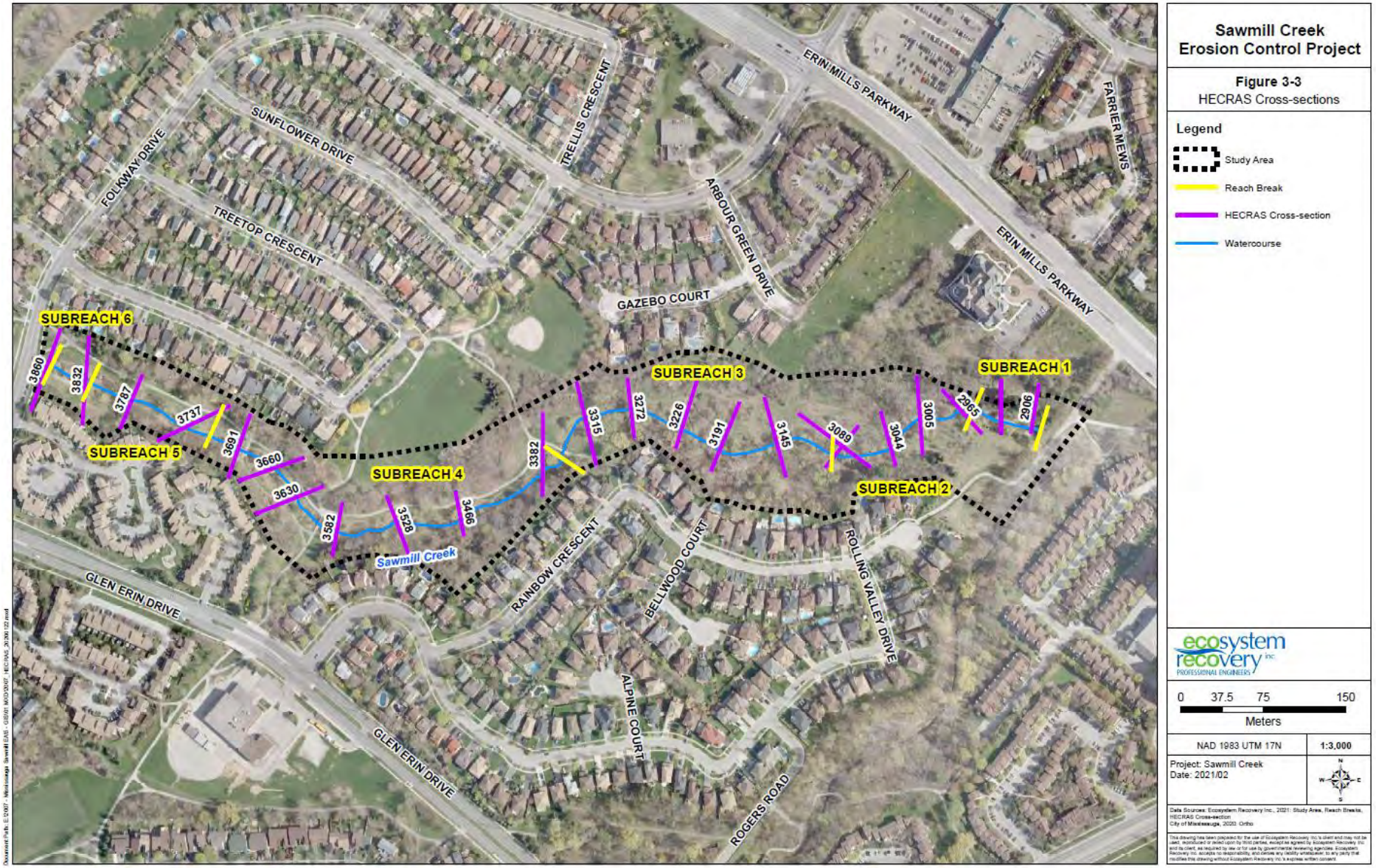


Figure 3-3. HEC-RAS Section Locations

Table 3-4. HEC-RAS Modelled Results for the Regional Flow Event.

		Existing		BOC		Comparison	
River Sta	**Q Total**	**W.S. Elev**	**Vel Chnl**	**W.S. Elev**	**Vel Chnl**	**W.S. Elev**	**Vel Chnl**
3860	84.8	162.39	4.8	161.08	3.96	-1.31	-0.84
3832	84.8	161.49	4.5	161.17	1.97	-0.32	-2.53
3787	84.8	161.31	3.92	160.61	4.33	-0.7	0.41
3737	84.8	161.22	3.22	160.64	2.22	-0.58	-1
3691	84.8	160.56	4.62	160.02	3.67	-0.54	-0.95
3660	84.8	159.84	6.12	158.85	5.26	-0.99	-0.86
3630	84.8	159.05	6.22	158.83	3.74	-0.22	-2.48
3582	84.8	158.59	5.09	157.87	5.05	-0.72	-0.04
3528	84.8	157.72	5.51	156.99	3.13	-0.73	-2.38
3466	84.8	156.33	6.46	156.33	4	0	-2.46
3382	84.8	155.28	5.58	154.59	5.16	-0.69	-0.42
3315	84.8	154.23	5.66	153.58	3.7	-0.65	-1.96
3272	84.8	153.24	6.12	152.59	4.33	-0.65	-1.79
3226	84.8	152.29	6.24	151.89	4.89	-0.4	-1.35
3191	84.8	151.64	6.28	151.15	4.28	-0.49	-2
3145	84.8	150.87	5.94	150.49	4.19	-0.38	-1.75
3089	84.8	150.08	4.9	148.47	5.86	-1.61	0.96
3077	84.8	149.25	6.47	148.8	2.07	-0.45	-4.4
3044	84.8	149.03	4.51	148	4.03	-1.03	-0.48
3005	84.8	148.76	4.34	147.59	3.19	-1.17	-1.15
2965	84.8	147.27	6.2	146.85	3.99	-0.42	-2.21
2930	84.8	146.86	5.23	146.84	2.6	-0.02	-2.63
2906	84.8	146.31	5.64	146.89	1.79	0.58	-3.85

3.5 Geomorphology

Observations of channel instability and/or erosion concerns along any watercourse should be placed in the context of its geomorphic system. This includes recognizing that the form and function of watercourses are a result of the interaction between controlling (e.g., geology, flow) and modifying (e.g., vegetation) factors to which the channel has adjusted. When a change in one or more of these factors is greater than what the channel is able to accommodate, then a temporary or permanent channel response may occur as the channel seeks to regain a dynamic equilibrium form. Since the response of a watercourse to a disturbance may take years or decades to accomplish, and since a specific site is part of a continuum along a drainage network, analyses of channel morphology should include a broader spatial and temporal perspective.

Characterization of the geomorphological conditions along Sawmill Creek within the Reach 1 study area was accomplished through review of historical data, background materials, field assessments, and data analyses. The intent of the geomorphic assessment was to gain insight into channel form and functions to inform the selection and evaluation of alternatives for channel restoration. Findings from the geomorphic assessment are presented and discussed in detail in **Appendix C,** and summarized in this section.

3.5.1 Historical Overview

A review of historical aerial photography and mapping was completed to gain insight into changes that have occurred within the watershed, drainage network and specifically within the study area. A sequence of historical airphotos was obtained from the City of Mississauga (1954, 1975, 1977, 1992, and 2006).

Review of the historical aerial photography indicates that the Sawmill Creek watershed has become increasingly urbanized since the 1970s. Gore & Storrie (1995) estimate that the percentage of urbanization increased from 2% in 1977 to 45% in 1993; today (2020), the watershed is nearly entirely urbanized. Major changes (i.e., straightening and channelization) to the study area channel configuration occurred between 1975 and 1977 (The Gore and Storrie (1995) report indicated that Reach 1 was altered to trapezoidal channelization in 1974). Much of the Sawmill Creek watershed does not include stormwater management (SWM) measures (e.g., SWM ponds).

Results from the Sawmill Creek Natural Channel Study (Gore and Storrie, 1995) indicate a reduction in channel length through the study area of 23% between 1954 and 1993. This decrease in channel length represents the overall impact to the length of the main channel and does not include any loss of tributaries. With the reduction in channel length, a reduction in channel sinuosity was reported (i.e., the sinuosity of 1.4 in 1954 was reduced to 1.1 by 1993) (Gore & Storrie, 1995).

3.5.2 Existing Conditions and Processes

A reconnaissance level field assessment was completed in May 2020, to document observations of channel form and processes, to identify specific areas for inclusion in the topographic site survey, and to compile a photographic inventory of channel conditions. Findings from the field assessment led to the delineation of six reaches within the study area, based on dominant channel configuration, engineered works, and channel processes (**Figure 3-2**). Data were subsequently collected in each subreach to enable quantification of channel dimensions and substrate materials as a basis for geomorphologic analyses (**Appendix C**). An overview of existing conditions is provided below and a summary of subreach characteristics is provided in **Table 3-5**.; a photo log is included in **Appendix C.**

The planform configuration of Sawmill Creek Reach 1 exhibits an altered meandering configuration; contact with valley walls occurred in Subreach 2.

The channel bed profile, derived from the topographic survey, clearly reveals that there is variability with respect to bed morphology and slope trends (**Figure 3-4)**. The bed morphology likely continues to be in development in response to previous alterations of the channel bed that occurred in conjunction with the 1974 channelization of Sawmill Creek within the study area. The 19 grade control weir structures create local base level controls to which the upstream channel bed profile becomes adjusted over time. Pool features occurred immediately adjacent to grade control weirs; many are attributable to scour due to flow hydrodynamics at the weir structures. One ~0.7 m high knickpoint occurred in subreach 3; this occurred near a weir structure and consisted of exposed till materials; another knickpoint was observed in subreach 4 (0.65 m above water surface). Continued regression of the knickpoints is expected.

Fifteen cross-sections were surveyed and assessed (**Figure 3-4**); most of the cross-sections were symmetrical in shape. The geomorphic characterization of cross-section form was limited to subreaches 2 to 5, as subreaches 6 and 1 were structurally controlled by concrete or gabion lined channels associated with the upstream culvert outlet and downstream culvert inlet structures, respectively. In general, the setting of the sections within the floodplain/valley setting varies, with some sections of the creek being well-connected to the floodplain and other sections demonstrating incised channel settings, generally lacking connection to the adjacent floodplain.

Substrate material were typified by gravel and cobble in riffles and finer sediment in pools. Given that the open channel of Sawmill Creek begins at the Folkway Drive stormwater outlet, the only supply of coarse sediment occurs from within the study area. Access to natural materials is limited by erosion control measures. Fine sediment enters the creek from all stormwater outfalls.

Glacial till was exposed on the channel bed in both pools and along riffles. Deposition of substrate materials was observed as point, lateral and medial bars. Many of the bars were dominated by angular cobbles (i.e., gabion stone); gravel and roundstone that originated from bank erosion. Notable deposition (now vegetated) in subreach 6 is attributable to sediment delivered to Sawmill Creek from overland flow through the stormsewer network; due to this accumulation, a defined channel had established that enabled a concentration of flows.

Active erosion was observed along channel banks and primarily in subreaches 2 and 3. Bank erosion tended to occur along outside meander bends and downstream of weir structures. Erosion of the lower bank contributed to cantilever failure of the upper bank; likewise bank erosion led to the undermining/undercutting of tree roots and tree fall into the creek (e.g., subreach 3).

Undercut banks were measured throughout the study area and included depths of 0.75 m in subreach 3 and 1.8 m in subreach 4). Bank undercuts often occurred under tree roots. Fallen and leaning trees were common, leading to large woody debris jams in subreaches 3 and 4

Outflanking of weirs and low lying erosion control materials in subreaches 3 and 4 is attributable to floodplain scour due to frequent overtopping of banks by bankfull and smaller flows. Failure of weirs in other subreaches is likely due to erosion of adjacent erodible bank materials and high energy flows.

An overall of general channel stability and assessment of dominant channel process was based on application of the Rapid Geomorphic Assessment tool (RGA). The dominant process common to subreaches 2 to 5 was channel widening. Subreaches 3 to 5 were considered to be 'in regime'; this likely reflects the floodplain connectivity that occurs through the majority of these subreaches and the grade control exerted by the weirs.

Given the extent of bank and bed hardening that occurs within the study area as well as the exposed till on the channel bed and banks, Sawmill Creek Reach 1 is referred to as semi-structural controlled and semi-alluvial.

Table 3-5. Summary of Geomorphic Characteristics by Subreach.

Subreach	Length (m)	Overall Gradient (%)	Characteristics	Geometry (m)	Boundary Materials	Dominant Flow Capacity
1	63.9	1.00	• Zone of substrate deposition (process) • Dominant Process (RGA): NA	Local pool 0.83 m deep	• Concrete wingwalls (culvert) • Gabion lined channel banks	25 year
2	147.3	1.30	• High channel banks that were eroded, steep, and included exposed till • Dominant Process (RGA): Widening and degradation; in adjustment (0.41)	**Width:** 5.08 – 6.15 **Depth:** 0.64 – 1.58	• Gabion lined channel banks (periodic) • Areas of natural banks (dominant); till exposed on channel bed and as basal unit of eroded banks	25 year
3	285.7	1.98	• Lower channel banks; increased floodplain access; deposition observed in overbank zones • local areas of incised channel within larger section • Knickpoint in exposed till, along channel bed profile, • Dominant Process (RGA): Widening; stable / in regime (0.19)	**Width:** 5.80 – 9.70 **Depth:** 0.36 – 0.76 Local pools > 1 m deep	• Gabion lined channel banks (periodic)	2 year; variable

4	381.6	1.40	• Low channel banks; floodplain access • Widened channel cross-section • Dominant Process (RGA): Widening; stable / in regime (0.19)	**Width:** 5.18 – 8.18 **Depth:** 0.47 – 0.93	• Dominated by natural channel banks; exposed till as basal unit along eroded banks • Gabion lined banks in proximity to weir structures	~ bankfull flows
5	120.0	0.07	• Backwatered channel through length of reach • Silt/sand deposition on channel bed • Dominant Process (RGA): Widening and aggradation; stable / in regime (0.07)	**Width:** 4.41 – 9.74 **Depth:** 0.59 – 0.69	• Natural channel banks • Gabion lined channel banks (periodic)	25 year
6	37.9	1.01	• Concrete lined channel; four (4) circular outfalls at upstream limit of reach • Deposition of sediment on ramp energy dissipators • Dominant Process (RGA): N/A	N/A	• Concrete lined channel	Regional Flood

3.5.3 **Hydrogeomorphic Conditions**

The updated hydraulic model (**Section 3.4**) was used to review hydro-geomorphic conditions within the study area. Review of the model results indicated the following:

- The estimated bankfull flows are contained within the cross-section through the majority of the study area. In portions of subreaches 3 and most of subreach 4, the bankfull flows fill the creek, or spill onto the floodplain. When flows remain within a channel, then the energy of those higher flows are available for erosion and sediment transport within the cross-section
- The energy conditions within the study area vary. Highest stream power conditions occur in subreach 2 followed by subreaches 4 and 3. Lowest energy conditions occur in subreaches 5, 6 and 1; these trends reflect the influence of local slopes, incised channel form. When the stream power conditions were compared to stream type classifications (e.g., Nanson and Croke, 1988), then it was evident that energy conditions typically corresponded to the high energy braided stream type. This classification is not consistent with the observed stream type and is reflective of the engineered state of the channel and channel characteristic, within), the urban flow regime.
- The grain sizes that are, theoretically, entrainable during estimated bankfull flows ranged from 12 to 280 mm throughout the entire study area. The largest potential entrainment size occurs in subreach 2, followed by subreach 4. From the field measured pebble count data, the collated substrate gradation (i.e., from subreaches 2 – 5), included a D50 of 30 mm and D84 of 80 mm. Clearly, the potential for entrainment exceeds the observed grain size, during bankfull flows. This infers high erosion potential mobility of channel bed materials.

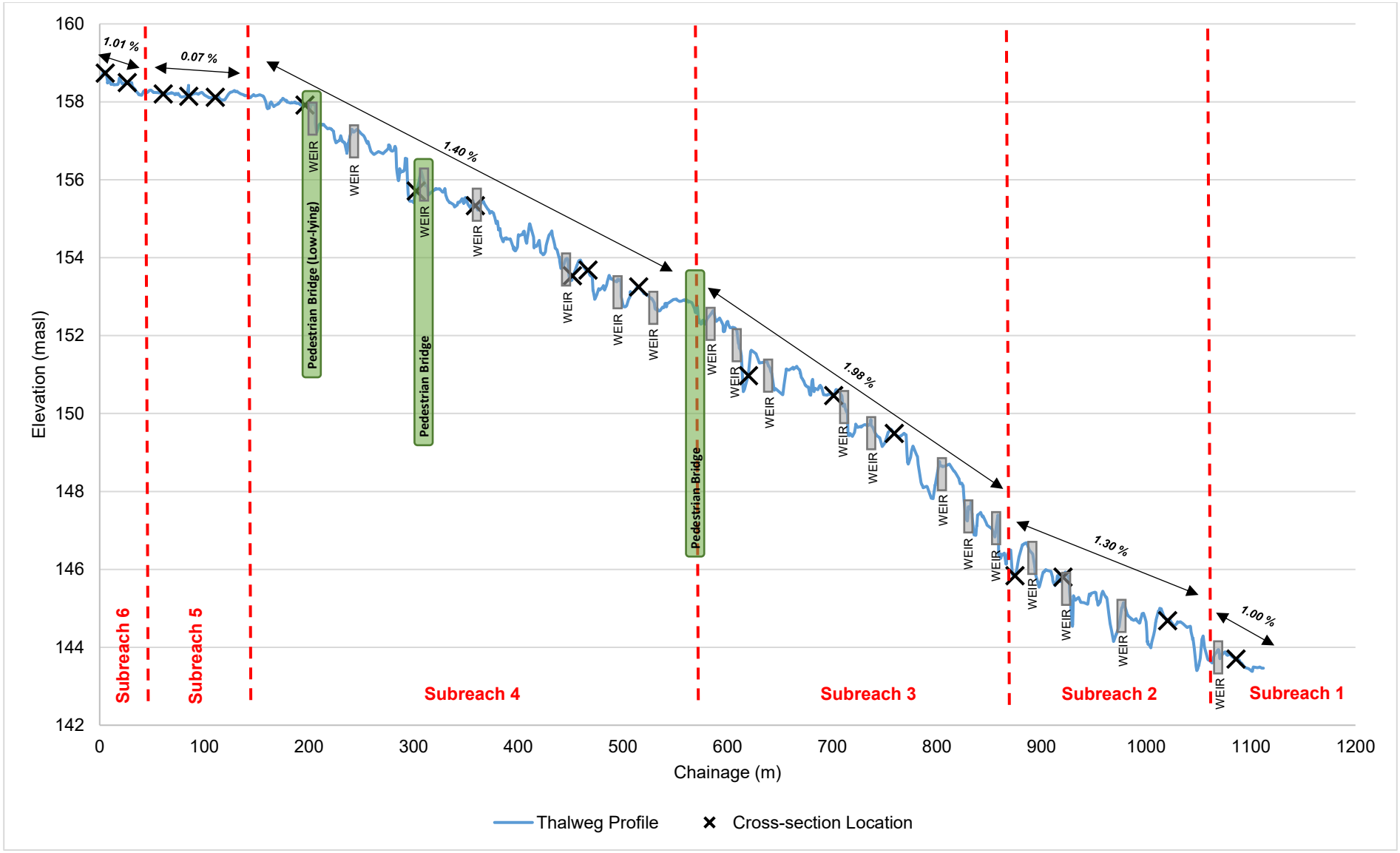


Figure 3-4. Longitudinal Bed Profile of Sawmill Creek Through the Study Area.

3.6 Natural Environment

The Sawmill Creek Reach 1 study area is located entirely within Credit Valley Conservation Authority regulation limits and contains MNRF delineated woodlands. In support of this study, a Natural Heritage Characterization was completed for Sawmill Creek and its creek corridor, extending from Folkway Drive to Erin Mills Parkway.

A desktop natural heritage review was completed prior to undertaking field investigations to understand the general wildlife conditions and potential for Species at Risk (SAR) to occur within the study area. Sources reviewed included:

- Natural Heritage Information Centre (NHIC);
- Credit Valley Conservation Authority (CVC) mapping and data;
- Land Information Ontario open data (MNRF, 2020);
- DFO's Aquatic Species at Risk Mapping (2019);
- Municipal Official Plans;
- Ontario Breeding Bird Atlas (OBBA; Birds Canada et al., 2020);
- Ontario Butterfly Atlas (Toronto Entomologists' Association, 2020);
- Ontario Herpetofaunal Atlas (Ontario Nature, 2019);
- Ontario Mammal Atlas (Dobbyn, 1994);
- eBird (the Cornell lab of Ornithology, 2020);
- City of Mississauga Natural Areas Survey (2019); and,
- iNaturalist (California Academy of Sciences and National Geographic, 2020).

3.6.1 **Aquatic Habitat**

Six aquatic habitat assessment reaches were identified and assessed on October 29th, 2020; these correlated with the subreaches delineated through the geomorphic assessment (**Figure 3-2**). The existing condition varied with the upstream subreaches being relatively stable and exhibiting minor evidence of erosion, and more degraded from upstream to downstream. The downstream reaches exhibited large areas of eroded and undercut banks, fallen trees across the creek, logjams within the creek, and failed historical bank hardening structures (i.e., gabion baskets and displaced armourstones within the creek). The 19 weirs observed along the channel profile appeared to be failing (see **Section 3.3.2**). Overall, there were many barriers to fish passage along Sawmill Creek Reach 1, including 19 failing weir structures with large drops, shallow water under trail bridges, log jams, displaced bank hardening materials and concrete structures in the creek.

The overall aquatic habitat was considered to be poor due to the presence of barriers to fish passage and high flow velocities that exist within the creek. Only a single minnow was observed within the study area; it was found in subreach 6, the furthest upstream reach. This observation may be an accidental or intentional release as mechanisms from a broken minnow trap were observed in close proximity to the minnow observation. Fish surveys conducted within Sawmill creek since the 1980's have identified no fish catch records and demonstrate no fish community population is present within the creek. There are several theories behind this including, historically having dried out during droughts, an energy dissipator at the mouth of Sawmill Creek impeding fish movement, discharge of contaminants and habitat destruction due to construction and erosion, periods of high flows washing fish downstream and numerous impediments to fish passage not allowing fish to move upstream again. The downstream Credit River has a strong fish community (G&S, 1995). CVC has classified Sawmill creek as a warmwater thermal regime (CVC, 2012). CVC has conducted recent (2006-2011) fish community surveys for Sawmill Creek in proximity to the study area and found brook stickleback (*Culaea inconstans*), creek chub (*Semotilus atromaculatus*), fathead minnow (*Pimephales promelas*), and pumpkinseed (*Lepomis gibbosus*) to be present within the watercourse.

Typical areas of the creek contained cobble and gravel substrate, with areas of exposed clay; sand and gravel deposits were observed as medial bars within the creek. The upstream channel reaches were relatively uniform but downstream reaches varied due to changes associated with erosion. Water was flowing clear at the time of assessment with moderate flow velocities. Overall, the system has limited in-stream vegetation, little diversity of

habitat, uniformity and poorly sorted substrate, little cover for fish species, and poor water quality. Garbage and other debris were occasionally observed within the channel and would be expected due to the creek being within the urban environment. Table 3-6 shows a summary of parameters to describe the existing habitat.

Table 3-6. Summary of Existing Habitat.

Subreach	Wetted Width (m)	Depth (cm)	Velocity (m/sec)	Shoreline Cover	Canopy Cover
1	2.05 – 4.07	14 – 78	0.14 – 0.33	60% – 90%	75% – 100%
2	0.47 – 1.95	14 – 105	0.45 – 1.95	30% - 60%	50% - 75%
3	0.80 – 1.55	Not recorded	0.91 – 1.39	60% - 90%	50% - 75%
4	1.78 – 5.7	13 – 99	0.19 – 0.74	60% – 90%	60 – 90%
5	3.76 – 3.9	7 – 28	0.08 – 0.48	60% - 90%	50% - 75%
6	Concrete-lined channel	5 – 15	0.43 – 0.5	30% - 60%	50% – 75%

Water quality and flow monitoring measurements were performed within each reach of the study area on October 29th, 2020. Water quality was monitored using a Horiba U-52 multiparameter meter, which measures pH, conductivity, dissolved oxygen (DO), oxidation reduction potential (ORP), turbidity, temperature, salinity, and total dissolved solids (TDS). Results of the water quality monitoring are presented in **Table 3-7**.

Table 3-7. Water Quality Parameters of Sawmill Creek by Reach.

Subreach	Temperature (°C)	pH	ORP (mV)	Conductivity (mS/cm)	DO (mg/L)
1	10.01	6.76	241	0.518	92.0
2	10.19	7.45	239	0.512	78.2
3	9.93	7.84	233	0.530	82.0
4	10.83	7.94	239	0.523	76.0
5	11.36	8.14	228	0.551	75.6
6	11.61	8.15	231	0.581	73.2

3.6.2 Terrestrial Habitat

Vegetation

Four vegetation communities were delineated by ERI ecologists on June 16 and July 6, 2020. These included a cultural woodland (CUW1), a willow lowland deciduous forest (FOD7-3), a red oak deciduous forest (FOD1-1), and a sugar maple oak deciduous forest (FOD5-3); a small cultural meadow inclusion was also observed stretching along the paved pedestrian trails. All of the delineated communities within the study area are considered contiguous, are approximately 14 ha in size, and are at various stages of succession. A total of 101 species were observed within the study area during ERI field investigations. Of these, 57 were native and 44 were non-native species. The total Floristic Quality Index (FQI) value of the study area was 27.68 and with a mean Coefficient of Conservatism (CC) of 3.67. A total of 6 regionally rare species were observed during field investigations, these included: red pine, Philadelphia fleabane, silky dogwood, summer grape, white spruce, and cleaver. All of the observed vegetation communities are considered common in Ontario. A full list of species, detailed description of each community and representative photographs can be found in **Appendix D.** A comprehensive tree inventory of the study area should be completed during the detailed design phase. Moreover, a visual overlay of opportunities and constraints on a reach-basis would be beneficial during the detailed design phase in order to identify significant terrestrial features or higher quality habitat that should be avoided within the study area.

Wildlife

Two breeding bird surveys were completed (June 19th and July 6th, 2020) according to Ontario Breeding Bird Atlas protocols. In total, 31 bird species were observed, all of which are considered common in Ontario. See **Appendix D** for a full list of wildlife species within the study area.

One Dekay's Brownsnake was observed on the paved pedestrian trail. No other reptiles or amphibians were observed by ERI during field investigations. Sawmill Creek could support amphibian and reptile movement between upstream and downstream portions of Sawmill Creek; however, this was not confirmed.

Species at Risk (SAR) and Species of Conservation Concern (SCC)

A habitat screening was completed to determine the potential occurrence of SAR within the study area. For this screening, SAR are defined as species that are listed as either Threatened (THR) or Endangered (END) under the Endangered Species Act (*ESA)*. Individual species, as well as their habitat, are protected in Ontario. Species listed as Special Concern (SC) under the *ESA* receive protection under the Provincial Policy Statement (PPS) and their habitat is considered Significant Wildlife Habitat (SWH). Species listed under *SARA* are only protected on federal land, as part of projects that are otherwise being permitted by a federal agency. This includes aquatic SAR; however, no aquatic SAR have been identified within the study area. SARA also requires consideration for any migratory bird listed on Schedule 1 where critical habitat has been identified; however, should the species also be listed under *ESA* and provides equal or greater protection, the *ESA* take precedence.

Twenty-two SAR species were identified, during the background review, as potentially occurring within the study area. This number was refined through this study, based on habitat assessments, targeted wildlife surveys and ELC surveys. This resulted in two confirmed species within the study area and four species with candidate habitat within the study area, these species are presented below. The full SAR and SWH screenings can be found in **Appendix D**.

Confirmed SAR

Butternut (END) – In Ontario, Butternut usually grows alone or in small groups in deciduous forests. It prefers moist, well-drained soil and is often found along streams. It is also found on well-drained gravel sites and rarely on dry rocky soil (MNRF 2014d). Seven butternuts were located within the study area during field surveys.

It is currently not anticipated that butternut will require removal to accommodate proposed works; however, this is to be confirmed through the selection of the preferred alternative. A butternut health assessment may be required for those specimens located near the preferred alternative.

Monarch (SC) – Species can typically be found in open or disturbed habitats such as roadsides, fields, wetlands, prairies, and open forests with the presence of an abundance of milkweed. Any recommended planting lists will include milkweed species.

Candidate SAR

SAR Bats (Eastern Small-footed Bat, Little Brown Myotis, Northern (Long-eared) Myotis, and Tri-colored Bat) END - These species could be associated with any forested community where suitable roosting (i.e., cavity trees, houses, abandoned buildings, barns, etc.) habitat is available in the study area. Where feasible, cavity trees will be avoided when planning access routes and laydown areas.

Candidate Significant Wildlife Habitat

The SWH screening found that the criteria for candidate SWH were met for the 2 categories listed below.
These habitats are considered candidate as species-specific surveys were either not conducted, were not completed at the appropriate time of year or observations of the species did not confirm the use of these habitats (i.e., bird flyovers).

Bat Maternity Colonies - study area contained deciduous forest with several mature snags suitable for bat maternity colonies. However, bat-specific surveys were not conducted by ERI.

Special Concern and Rare Wildlife Species: candidate habitat for eastern ribbonsnake is located within Sawmill Creek.

Confirmed Significant Wildlife Habitat

The SWH screening found that the criteria for confirmed SWH were met for the following category:

Special Concern and Rare Wildlife Species: Birds – Monarch was observed incidentally during site visits. Common milkweed was recorded in several vegetation communities within the study area.

3.7 Social Environment

Typical social environment factors to consider during an Environmental Assessment include built infrastructure, property impacts, recreational areas and uses, and other components of the human environment. The study area is located in the highly urbanized core of Mississauga. This section describes the different aspects of the social environment that may impact the evaluation and selection of a preferred erosion control alternative.

3.7.1 Archaeology Potential

A Stage 1 Archaeological Assessment was conducted by Timmins Martelle Heritage Consultants (TMHC, 2020) to determine the archaeological potential of the study area, to identify previously known archaeological sites (if any), and to provide recommendations for further assessment if necessary. The Stage 1 report indicated that, within proximity to the site, there were two previously identified archaeological sites, an area of early 19th-century settlement and early historical transportation routes. Given these findings, a Stage 1 property inspection was conducted to evaluate current conditions of the project area and to evaluate integrity. Results indicated that portions of the project area have prior disturbance, primarily related to paved pathways, footbridges and culvert; these areas are not considered to retain archaeological potential. Low and wet areas, and areas of slope are likewise not considered to retain archaeological potential. TMHC recommends that a Stage 2 survey be completed for the grassed and wooded areas (23% of study area) as shown on Maps 11 and 12 of their report (**Appendix E**) in coordination with detailed design of the preferred alternative for erosion control. Additionally, it was recommended that a location (Find Spot P2) identified during the 1999 ASI assessment be revisited and subject to a Stage 2 survey in order to reassess its significance.

3.7.2 Public Recreation

Sawmill Creek Reach 1 is part of the Sawmill Creek Valley system. In the study area, the City owned park is referred to as Sawmill Valley Trail study area and supports a trail system that includes two pedestrian bridges and one low-lying crossing over Sawmill Creek Reach 1 that provide connections to adjacent residential developments as illustrated in **Figure 3-2**. The trail parallels the channel throughout the study area and is primarily located along the north bank of Sawmill Creek. The trail experiences heavy use by area residents and is in close proximity (< 6 m) to Sawmill Creek, locally, within subreaches 3 and 4. **Section 3.3.5** summarizes findings of the pedestrian bridge assessment.

Considering the prominence of the park setting and pedestrian trails through the study area, maintaining the utility of the trail and aesthetic character of the park will be important factors in the evaluation of potential alternatives. Opportunities for continued access must be balanced with safety considerations.

3.7.3 Private Property

Sawmill Creek flows through a relatively open, well-vegetated natural corridor with generally adequate buffers between the channel and adjacent private property. Private properties are located adjacent to the City-owned Sawmill Creek corridor, as mapped in **Figure 3-2.** Study Area Subreaches and Existing Conditions.; this includes

single family homes, townhomes and an assisted living facility. Considerations of the proximity and potential flood and erosion risk to these private properties was included during the alternative development and evaluation process, and will be included in detailed design.

3.7.4 Utilities and Infrastructure

Utilities and other infrastructure are often located adjacent to watercourses due to the availability of space in an urban setting and the natural available gradient to facilitate gravity drainage (i.e., sanitary sewers). An east to west aligned sanitary sewer network (30" diameter, according to 1974 Proctor & Redfern drawings provided by the City of Mississauga) is located along Sawmill Creek. Based on available mapping, six (6) sanitary sewer crossings were identified under the channel. **Table 3-8** summarizes the estimated depth of cover over the sanitary sewer crossings, based on the 1974 Proctor & Redfern Limited design drawings and existing condition topographic surveys. None of the sanitary sewers were exposed on the channel bed during field investigations, despite available mapping which suggests the sanitary sewer crossing in Subreach 2 is above the existing ground surface. Long term protection of the sanitary sewer should form an important consideration for erosion control alternatives within the study area.

There are no watermains present in the study area (**Figure 3-2**) for a map showing the infrastructure present in the study area. Through the preferred alternatives, it is important to maintain protection of any existing infrastructure in the study area.

Table 3-8. Estimated Depth of Cover Over Known Sanitary Sewer Crossings.

Station	Subreach	Obvert (masl)	Existing Ground (masl)	Estimated Depth of Cover (m)	Notes
0+182.25	4	155.65	158.00	2.35	Located upstream (approx. 5 m) of low-lying pedestrian bridge crossing
0+300	4	154.21	156.30	2.09	Located under pedestrian bridge crossing
0+918	2	145.07	145.00	-0.07	No exposure of sanitary sewer identified during field investigations

3.8 Summary

Sawmill Creek Reach 1 extends nearly 1037 m from the stormwater outlet at Folkway Drive to the stormwater inlet culvert near Erin Mills Parkway in the City of Mississauga. Through the various assessments completed, it was evident that the study area included compromised/failed erosion protection measures, undersized and compromised bridges, altered channel morphology, occurrence of erosion and channel instability, high energy conditions, poor aquatic habitat, species at risk and/or species at risk habitat. The study area supports well used recreational trails and infrastructure that services the surrounding residential areas.

3.8.1 Subreach Conditions, Opportunities and Constraints.

The Sawmill Creek Reach 1 study area was divided into 6 subreaches due to the spatial variability in channel conditions from hydraulic, geomorphic and aquatic habitat perspectives. A summary of key findings from all assessments completed is presented, by subreach, in **Table 3-9.** Presentation of study findings in this manner integrates study area findings from the different disciplines and aids in the identification of opportunities and constraints with respect to identifying actions to address the observed erosion and degraded site conditions. In addition to opportunities and constraints at the subreach scale, others are relevant to the entire study area as follows:

Opportunities:

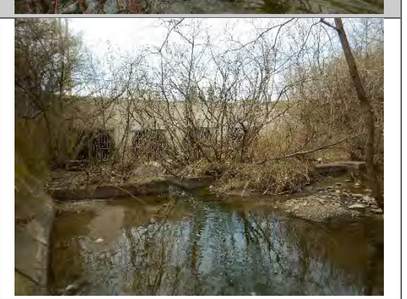
- to protect and/or preserve species at risk (e.g., Butternut trees)
- to improve the overall native species composition within the study area and creek side woodlands (e.g., removal of invasive and non-native species)
- include locally rare species in proposed restoration seed mixes (red pine, field thistle, summer grape and Philadelphia fleabane)
- to remove impediments to fish passage
- to reduce flow energy
- to remove gabions and, where necessary, replace with bio-engineered measures that provide both aquatic and terrestrial habitat enhancements
- repair or replace pedestrian bridge crossings
- to enhance morphological form and function that will promote channel stability and enhance aquatic habitat
- to re-use materials from gabions and other erosion control measures within any proposed alternative
- to protect till bed from continued degradation/lowering and knickpoint regression
- to increase channel length, where feasible to reduce average channel slope
- to enhance recreational enjoyment of the area

Constraints:

- to minimize impact to Reach 1 as a Significant Natural Area
- to avoid impact to Species at Risk and Species at Risk habitat
- to minimize removal of trees, and specifically of trees with bat habitat
- to minimize loss of channel length
- to avoid impacts to the sanitary sewer infrastructure
- to avoid impacts to the existing pedestrian trail system

Table 3-9. Sawmill Creek Subreach Characterization Summary.

Reach	Length (m)	Boundary Materials / Structural Controls	Infrastructure and Utilities	Overall Reach Conditions and Characteristics	Concerns / Risks	Opportunities and Constraints	Photo
1	63.9	• Concrete wingwalls (culvert) • Gabion lined channel banks	Weirs: 0 Manholes: 0 Pedestrian crossings: 0 Sanitary sewer crossings: 0	• Double concrete outfall at downstream limit • Zone of substrate deposition (process); island feature directly upstream of culvert; comprised of angular cobble/gravel • Vegetation (shrubs) has established within the channel along areas of deposition • Dominant Process (RGA): NA • Dominant flow capacity of cross-section: 25 year flow	• Sections of gabion erosion control on channel banks are deformed and/or emptied	• Enhance riparian vegetation in gabion bank matress	
2	147.3	• Gabion lined channel banks (periodic) • Areas of natural banks; till exposed as basal unit of eroded banks	Weirs: 4 Manholes: 1 Pedestrian crossings: 0 Sanitary sewer crossings: 1	• High and steep channel banks; active erosion, steep, exposed till • Gabion and concrete weirs as grade control structures • Depositional features (medial, lateral, point bars) consisting of gravel, and angular cobble; vegetation on medial bars • over-wide channel cross-section • Deep pools • Large woody debris and fallen trees; undercut trees; overhanging vegetation • Erosion along high banks • Dominant Process (RGA): Widening and degradation; in adjustment (0.41) • Dominant flow capacity of cross-section: 25 year flow	• Broken concrete and large angular stone weir structures in disrepair • Failed gabions along north bank (toe of slope) • exposed filter cloth surround weirs • risk to armourstone wall • High/steep eroded banks • Exposed till on channel bed • Sanitary sewer crossing may be in close proximity to existing ground surface; risk of exposure	• Establish defined bankfull section and provide floodplain connectivity for frequent flows • Protect till bed from further incision • Minimize loss of trees • Remove failed erosion control materials (concrete, asphalt) • Maintain protection over sanitary sewer	
3	285.7	• Gabion lined channel banks (periodic)	Weirs: 8 Manholes: 1 Pedestrian crossings: 0 Sanitary sewer crossings: 1	• Lower channel banks; increased floodplain access; deposition observed in overbank zones • Root control common along both channel banks • Narrowed channel cross-section locally and incised in other parts of subreach • Depositional features (medial, lateral, point bars) consisting of gravel, and angular cobble (potential gabion basket materials from failed erosion and grade controls) • Fallen trees and large woody debris jams caused channel widening upstream and local backwatered conditions • Active bank erosion • Knickpoint along profile • Concrete pad at weirs perched above water surface • Tributaries; storm sewer outfalls • Dominant Process (RGA): Widening; stable / in regime (0.19) • Dominant flow capacity of cross-section: 2 year flow or lower flows	• Emptied/failed gabion erosion control on channel banks • Grade control weirs structures in disrepair / not functional; created perched conditions • Exposed till on channel bed will lead to further incision • Knickpoint will continue to regress and contribute to weir destabilization	• Enlarge bankfull cross-section to convey bankfull flows and/or provide floodplain connectivity locally • Stabilize knickpoint to prevent further upstream regression and remove as barrier for future potential fish habitat • Protect till bed from further incision • Replace failed gabion weirs with alternate treatment • Maintain protection over sanitary sewer	
4	381.6	• Dominated by natural channel banks; exposed till as basal unit along eroded banks • Gabion lined banks in proximity to weir structures	Weirs: 6 Manholes: 4 Pedestrian crossings: 3 Sanitary sewer crossings: 2	• Low channel banks; floodplain access • Widened channel cross-section • Depositional features (bars); primarily angular cobble • Exposed tree roots; fallen/leaning trees • Knickpoint along profile • Concrete pad at weirs perched above water surface • Dominant Process (RGA): Widening; stable / in regime (0.19) • Dominant flow capacity of cross-section: 60% of 2 year flow (~ bankfull flow) or lower flows	• Deterioration of erosion control under pedestrian bridge; bridge footing undercut 0.55 m, bank scour upstream of pedestrian bridge abutment; uplifted concrete slabs • Grade control weirs structures in disrepair / not functional; created perched conditions • Emptied/failed gabion erosion control • Exposed till on channel bed; knickpoint regression	• Enlarge bankfull cross-section to convey bankfull flows • Replace bridges with wider structures • Remove low-level concrete crossing and establish defined channel • provide suifficient buffer between creek and trail • Protect channel bed (till) from further incision • Remove failing gabions and replace with alternative materials, as appropriate	

Reach	Length (m)	Boundary Materials / Structural Controls	Infrastructure and Utilities	Overall Reach Conditions and Characteristics	Concerns / Risks	Opportunities and Constraints	Photo
					• Trail in proximity to creek • Manhole close to creek	• Replace failed weirs with alternate treatment • Maintain protection over sanitary sewer	
5	120.0	• Natural channel banks • Gabion lined channel banks (periodic)	Weirs: 0 Manholes: 2 Pedestrian crossings: 0 Sanitary sewer crossings: 0	• Backwatered channel through length of reach • Filter socks were in channel, likely due to water contamination management • Wide channel cross-section; narrows in upstream direction • Silt/sand deposition on channel bed • Exposed tree roots along channel banks • Some areas of deposition (bar features) • Dominant Process (RGA): Widening and aggradation; stable / in regime (0.07) • Dominant flow capacity of cross-section: 25 year flow	• Emptied/failed gabion erosion control	• Establish defined bankfull section and improve floodplain connectivity • Remove filter socks • Remove gabions and replace with alternate treatment if needed	
6	37.9	• Concrete lined channel	Weirs: 1 Manholes: 0 Pedestrian crossings: 0 Sanitary sewer crossings: 0	• Concrete lined channel; four (4) circular outfalls at upstream limit of reach • Deposition of sediment on ramp energy dissipators • Some vegetation established within the channel at areas of deposition (both at the energy dissipators and laterally along the channel. • Dominant Process (RGA): aggradation • Dominant flow capacity of cross-section: Regional flow	• Potential issues with deposition and vegetation establishment on energy dissipators and	• Complete maintenance if needed to ensure appropriate flood capacity	

3.8.2 **Key Issues and Processes**

By completing the multi-disciplinary assessments and analyses, key factors that contribute to existing conditions were identified and are provided in **Table 3-10**.

Table 3-10. Overview of Key Issues and Considerations within Study Area

Key Issues	Description	Subreaches
Urbanization and Storm Sewer Network	Storm sewers have replaced small surface water drainage features and enable the efficient drainage of urban areas. This reduces the attenuating effect of flow that occurs in small tributaries and reduces beneficial organic and nutrient inputs into the aquatic system. Discharge from stormwater sewers alters the hydrology of receiving watercourses, especially when there is no stormwater management. Effects include an increase in flow magnitude, decreased time to peak flows, and increase in flow volume. Altered flow hydrology results in a channel response through an adjustment in physical parameters (cross-section area, bed morphology and planform configuration). The timescale for adjustment can be decades or centuries. The historical loss of channel length and increased surface runoff due to urbanization have resulted in an increase in stream power within Sawmill Creek. The effect of these changes are evident in the study area (e.g., widening, incision into till) and have, in part, been managed through the weir structures (i.e., control of bed profile). Any erosion control measures must consider the effect of previous channel alterations and anticipated channel response to regain an equilibrium form. Any channel alterations need to manage the altered flow regime.	All subreaches
Erosion and Grade Control Measures	Erosion and grade control measures are prominent along Sawmill Creek Reach 1, all of which are in various conditions and/or states of disrepair, and are coming to the end of their design life. In addition to failing, the weirs were often outflanked and perched above the low flow water surface; scour pools and bank erosion were often situated downstream of the weirs. These indicators suggest active channel widening and bank scour processes that may pose further risk to the study area. Implementation of the weirs enables control of the profile and manages flow energy. This has been beneficial in managing the channel adjustment process (e.g., incision, planform development) in response to urban hydromodification. Outflanking of the weirs in subreaches 3 and 4 may be due to the frequent overtopping of the floodplain and increased volume of flows that are now conveyed through the channel than may have been anticipated when channelization occurred in 1974. Many of the weirs may pose an impediment to fish passage. The presence of hard bank materials result in flow energy being applied to the unprotected creek bed and exposed channel banks. The erosion control materials also limits the natural boundary adjustments that can occur, and volume of sediment supply, in those areas.	All subreaches

Key Issues	Description	Subreaches
	Where the channel is concrete or gabion lined, energy is conserved and available for downstream erosion. Opportunities to remove and/or replace the weirs and gabions should be explored. Further, opportunities to integrate bioengineered materials into bank erosion protection measures should be considered. For any harder erosion control materials, these must account for future channel bed lowering by being placed sufficiently deep to avoid exposure for an acceptable 'maintenance time cycle'.	
Exposed Till and Sediment Supply	The study area is underlain by native glacial till. Most of the till is protected by an accumulation of alluvium; however, areas of exposed till were identified locally along eroded channel banks and the channel bed where scour pool development has occurred downstream of weir structures. Given the relatively small volume of gravel and cobble supply within channel banks to replenish substrate materials, removal of the substrate exposes the underlying glacial till to scour. Natural re-establishment of an alluvial cover over the till is difficult, given the low roughness of the fine grained and cohesive till. Scour of glacial till tends to be progressive, leading to channel bed incision and eventual entrenched conditions; the loss of substrate cover over the till leads to a loss in aquatic habitat diversity. Given the underlying geology, any alterations within the study area should maintain cover over the glacial till. Since the open channel of Sawmill Creek begins at the stormwater outlet at Folkway Drive, the only supply of coarse sediment occurs from within the study area. Access to natural materials is limited by erosion control measures. Fine sediment enters the creek from all stormwater outfalls. Therefore, there is a limited volume available to replenish any substrate materials that are transported downstream.	2 and 3
Channel Capacity and Erosion	Results of the hydraulic modeling indicated that, for subreach 4, the estimated bankfull flows generally occur at the bank elevation or spills onto the floodplain. Channel capacity is variable through subreach 3, with some locations allowing for the estimated bankfull flow to coincide with the bank elevation or spill onto the floodplain. The frequent flooding of the floodplain adjacent to the weirs contributes to scour and outflanking around the structures. Subreaches 1 and 6 are directly associated with the stormwater outfalls at the upstream and downstream limits of the study area, where the channel is lined in concrete and/or gabions. The capacity of these subreaches is much larger than the bankfull flow event. Energy associated with the regional flood events that are conveyed through subreach 6 is available for erosion in the downstream subreach 5. Subreach 2 demonstrates high channel banks, where the watercourse has incised into native materials and become disconnected from its floodplain..	All subreaches

Key Issues	Description	Subreaches
	This results in larger flows being contained within the cross-section, which contributes to bank erosion and downcutting given the higher energy conditions contained within the channel. This higher energy contributes to the loss of substrate materials, bank erosion, and failure of weir structures. Any proposed alternatives must not cause an increase to the regional flood elevations or exacerbate erosional conditions. The existing flow regime has the potential to entrain substrate materials larger than those observed. This will lead to a gradual depletion of bed materials and continued exposure of the underlying till bed. Any proposed channel works will need to ensure suitable sized substate materials for long term stability and protection of the underlying till.	
Channel Form and Function	The form and function of Sawmill Creek have been historically altered and constrained due to the erosion control measures. The flow regime and energy conditions have likewise been altered and requires a channel response. The dominant response appears to be channel widening. Occurrence of erosion is expected given that channels are rarely straight and the channel planform is redeveloping and/or induced due to the flow trajectory from weirs under high flow conditions. The loss of channel lining materials has provided an opportunity for Sawmill Creek to begin re-establishing a bed morphology and planform configuration. Opportunities exist to enhance the morphological form and function of the study area. Results of analyses suggest that the grain sizes that may be entrained during bankfull and larger flow events are larger than those observed in the study area. This suggests that the channel bed is mobile and loss of the material is expected, in the long term. Removal of substrate materials leads to exposure of underlying till materials. Re-establishment of channel form and function, in support of aquatic habitat creation, and flow management is recommended. Opportunity may exist to modify in-channel hydraulic conditions through re-configuration of the channel (e.g., widening, enhanced floodplain occupation in incised reaches (subreach 2)).	All subreaches
Aquatic Conditions	The overall aquatic habitat within Sawmill Creek is considered poor with little instream aquatic vegetation. Several barriers to fish passage occur along Sawmill Creek in Reach 1, including 19 failing weir structures with large drops, concrete structures within the creek, log jams, displaced bank hardening materials (gabion baskets) and concrete structures in the creek. Improvement of fish habitat and removal of barriers to fish passage could assist in restoring a fish community within Sawmill Creek if/when future restoration of the creek upstream and downstream of the current study area are completed. This will allow an unimpeded fish passage system within Sawmill Creek. Aquatic habitat restoration would include providing more	All subreaches

Key Issues	Description	Subreaches
	diversity in bed morphology, instream habitat features, stream shading by riparian vegetation and addition of in-stream cover.	
Terrestrial Habitat and Vegetation	Minimize impacts to Significant Natural Area, locally rare vegetation species and limit the total area of disturbance where possible to maintain as much of the existing terrestrial habitat as possible. An opportunity exists to remove invasive and non-native species and increase native vegetation cover and diversity within the terrestrial habitat. Removal and replacement of vegetation would alter the visual aesthetic of the study area; it is important to recognize that growth of trees will take time. Selection of local native species that provide aesthetic value and that are beneficial to wildlife would be carefully selected and installed in the appropriate growing conditions. There is also an opportunity to provide enhancement to the riparian corridors surrounding Sawmill Creek that may improve water quality and aquatic habitat.	Areas surrounding all subreaches
Threatened and Endangered Species	Butternut (END) – Butternut prefers moist, well-drained soil and is often found along streams. It is also found on well-drained gravel sites and rarely on dry rocky soil (MNRF 2014d). Seven butternuts were located within the study area during field surveys. It is currently not anticipated for these trees to be affected by the design; however, is to be confirmed at detailed design. Monarch (SC) – Species can typically be found in open or disturbed habitats such as roadsides, fields, wetlands, prairies, and open forests with the presence of an abundance of milkweed. Any recommended planting lists will include milkweed species. SAR Bats (Eastern Small-footed Bat, Little Brown Myotis, Northern (Long-eared) Myotis, and Tri-colored Bat) END - These species could be associated with any forested community where suitable roosting (i.e. cavity trees, houses, abandoned buildings, barns, etc.). Suitable habitat is present in the study area. Where feasible, cavity trees will be avoided when planning access routes and laydown areas.	Areas surrounding all subreaches
Public Recreation (trails and bridges)	Maintaining public access to the creek is desirable, while preserving integrity of the trail system. Repair or replacement of the pedestrian bridge crossings was identified through a specific study area assessment due to their deteriorated conditions.	crossings – subreach 4
Subsurface Infrastructure	There are four sanitary sewer crossings, based on available mapping, under Sawmill Creek Reach 1. Long term protection of these sewer crossings should be considered within any proposed alternative.	2, 3, 4

4. Development of Alternative Solutions

The section of Sawmill Creek extending from Folkway Drive to Erin Mills Parkway has been identified, by the City, as an area with erosion concerns. Assessments completed through this study, have confirmed the concerns. Through the completed technical assessments (**Section 3**), an understanding of the factors that contribute to the erosion issues include deteriorated or failing erosion control works, local energy conditions, and natural channel adjustment processes (**Section 3.8**).

The alternative solutions should address the key erosion issues identified, if feasible, and consider site specific aspects for enhancement or restoration. These include, but are not limited to:

- Channel adjustment processes (profile and planform development)
- Long-term protection of underlying native till
- Failing gabion erosion control and grade control structures (corroded, deteriorated)
- Poor floodplain connectivity in subreaches 2 and 5, and locally in subreach 3.
- High stream power and substrate entrainment potential
- Protection and/or enhancement of aquatic habitat
- Protection and/or enhancement of riparian vegetation

As a part of the Environmental Assessment process, several potential alternative solutions or approaches are required to be identified to address the identified erosion issues or concerns. Each alternative must represent a viable solution (i.e., is constructible, is an effective method to mitigate the erosional concerns, etc.). The alternative solutions for Sawmill Creek through the study area include:

Alternative 1: Do Nothing

Alternative 2: Spot Repairs

Alternative 3: Channel Realignment

Alternative 4: Reach-Based Solutions

These alternatives are described in the sections below and evaluated in **Section 4.5.** The preferred alternative is described in further detail in **Section 7**.

4.1 Alternative 1: Do Nothing

In the Do-Nothing alternative (**Figure 4-1**), no action is taken to address the identified issues as outlined in **Section 3.8**. This alternative is always considered in an Environmental Assessment in order to assess the impact of taking no action to address the issues under evaluation. This alternative enables a continuation of natural channel adjustment processes that are also leading to the failure of erosion and grade control measures. Continued knickpoint regression, channel bed and bank erosion may place existing sanitary sewer infrastructure at risk (e.g., channel crossings and associated manholes) and create additional barriers to fish passage Further failure of weirs and erosion control measures is anticipated which, if these become situated in the channel, may result in deflection of erosive energy towards the banks; this will further exacerbate erosion and the integrity of adjacent or nearby bank treatments and may also pose a risk to the trail.

The Do-Nothing alternative will result in no impacts to the natural environment within the study area related to construction activity or site alteration. Although this alternative protects the natural environment from impacts of site alteration and construction, impacts to the natural environment will result from continued erosion and failure of the weirs and associated bank treatments. Aquatic habitat will continue to be, lacking in complexity, and remain in poor condition. Erosion, degradation, and outflanking of existing erosion and grade control measures (e.g., gabions, weirs) could further degrade the quality of aquatic habitat (e.g., increased sedimentation, abandoned gabion mesh and filter cloth in channel).

While Sawmill Creek Reach 1 does not currently support a fish community, the Do Nothing alternative provides no improvements for future potential habitat. This alternative is a static alternative and provides no opportunity to improve the degraded aquatic and terrestrial habitats within the study area.

The cost of implementing Alternative 1 is low in the short-term. There will be costs associated with maintenance and potential future emergency works in the event of pedestrian bridge crossing failure and/or exposure of sanitary sewer crossings.

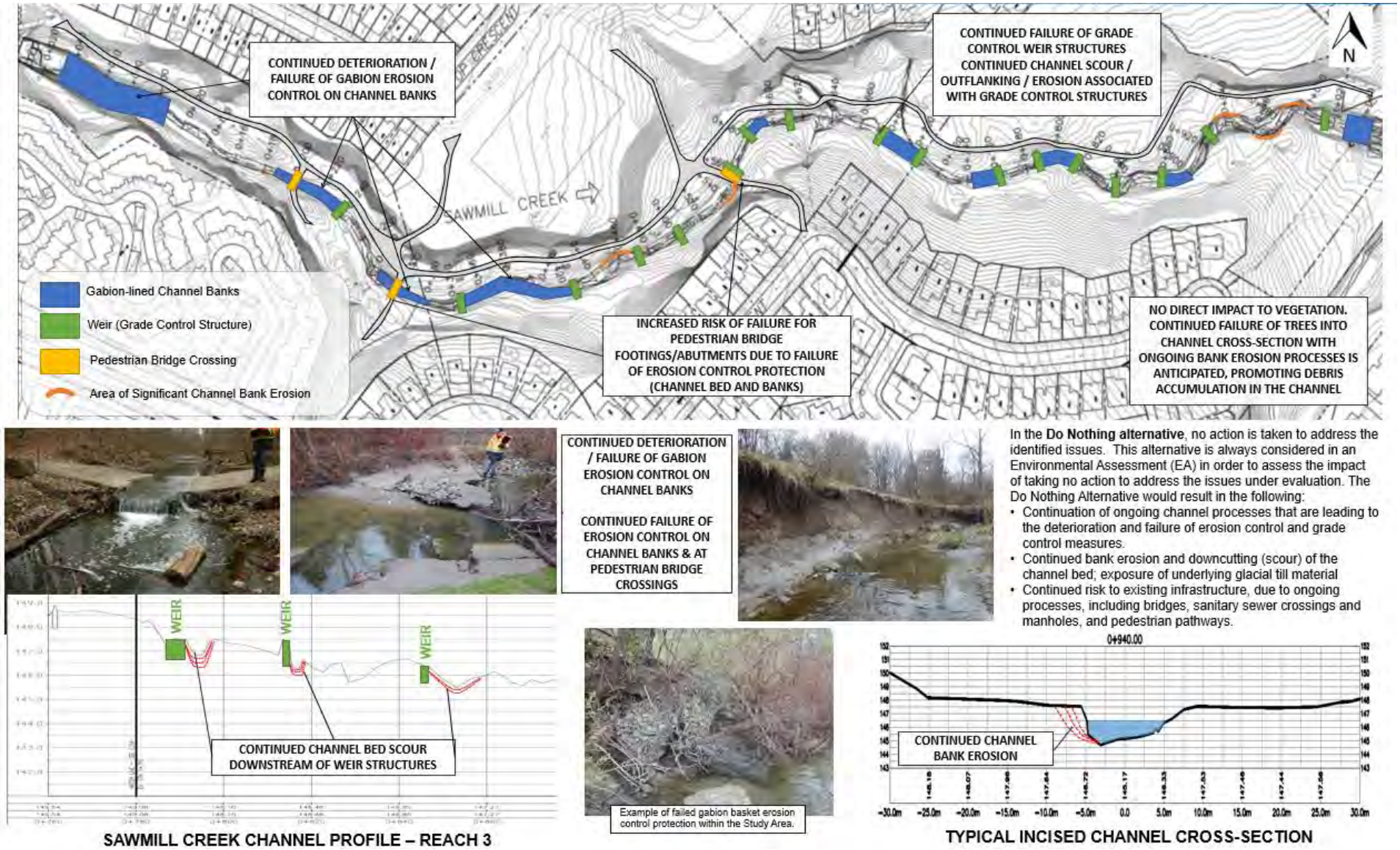


Figure 4-1. Do Nothing Alternative.

4.2 Alternative 2: Spot Repairs

Alternative 2 refers to the repair or replacement of failed gabion erosion control protection, failed weir grade control structures, and deteriorated pedestrian bridge crossings where necessary (**Figure 4-2**). Essentially, the spot repairs would re-establish intended function with new materials and include some alterations to ensure stability and reduce associated risk to adjacent channel bed and banks and to infrastructure (manhole, sanitary sewer, trail). Where opportunities exist, enhancements to manage creek processes, reduce flow energy, and to improve aquatic habitat in the vicinity of proposed repairs/replacement could be implemented. Mitigation of channel processes (e.g., knickpoint in subreach 3) that have been identified as a risk to weirs or infrastructure, would also be addressed. New areas of erosion concern that have not been previously protected would be also be addressed.

This alternative maintains, or nearly maintains, the existing footprint of Sawmill Creek and would re-establish erosion control protection where identified as necessary. Existing channel processes will continue in areas that are unprotected. Minimal alteration to the hydraulic conditions and erosion potential of flows would be anticipated; where feasible mitigation of high energy conditions through the design of replacement weirs and erosion control measures could occur.

Where erosion control measures are unnecessary, they may be removed. Where replacement of failing erosion control measures is appropriate, then the replacement materials will consist of 'softer' treatments, where feasible (e.g., replace gabion bank erosion control with bioengineering) and incorporate vegetation where suitable. Leaving existing gabions that do not mitigate risk or provide infrastructure protection, and that are near the end of their design life would continue to prohibit natural channel boundary adjustments (e.g., widening) and not uncover any natural sediment sources; where feasible, these gabions would be removed.

Repairing and replacing failing treatments will result in some localized impact to the natural environment that are associated with construction access (i.e., removal of trees and other vegetation). The impacts would be minimized by selecting site access through less sensitive areas of the forested communities, where possible, and minimizing the footprint of proposed works to areas required to address the erosion. Natural environment impacts due to construction will be temporary; any areas disturbed during construction would be re-vegetated using native vegetation upon completion of the work. Impacts to birds and bats would be mitigated by completing a cavity tree assessment prior to any tree removal to avoid impacts to potential bat maternal roosts; tree removals would need to occur outside of the breeding bird window.

Alternative 2 allows for enhancement opportunities to the terrestrial natural environment. Removed vegetation should be replaced with a diversity of native species and riparian vegetation.

Temporary impacts to the aquatic natural environment will occur but are also expected to be localized to the selected treatment areas. Minor impacts will result from temporary worksite isolation and dewatering. This will temporarily impact the benthic invertebrate community due to the reduction in wetted habitat. Since a fish community is not currently present within the Reach 1 Sawmill Creek study area, impacts to fish are not anticipated. Repairing and/or replacing failing treatments provides limited opportunity to improve the aquatic habitat within Sawmill Creek; the alternative does provide opportunity to reduce barriers to fish passage by ensuring appropriate concentration of low flows within cross-sections and reducing vertical drops in water surface elevation. The overall benefits to the creek system provided by this alternative are considered to outweigh the potential temporary impacts to the aquatic habitat environment. Repairing and replacing failing structures will improve bank stability and overall sorting of bed material which would result in some improvement to habitat diversity. Riparian plantings will also provide some additional cover and refuge habitats at these localized treatments for future fish communities. The habitat will continue to lack complexity and some barriers to fish movement through Sawmill Creek Reach 1 will persist.

The cost of implementing Alternative 2 is considered to be moderate in comparison to the other alternatives. A continued need for maintenance activity, in the future, would occur.

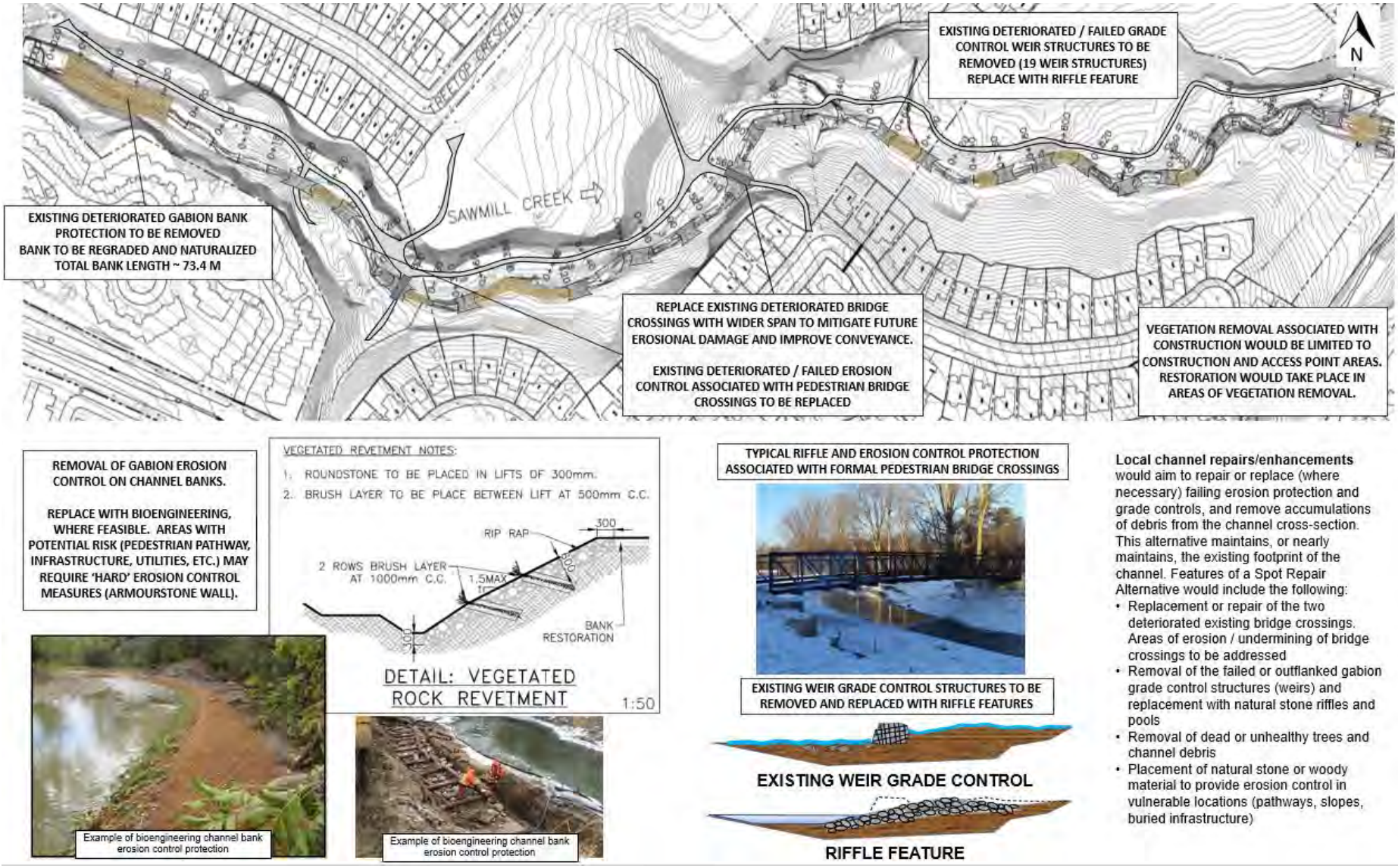


Figure 4-2. Alternative 2: Spot Repairs

4.3 Alternative 3: Channel Modification and Realignment

In Alternative 3, full channel restoration would be based upon the principles of natural channel design with the objective that the channel will function dynamically to manage the erosion and sediment transport processes and accommodate the urban flow regime (Figure 4-3). Realignment of Sawmill Creek would occur into the adjacent City-owned parkland. The intent of this alternative would be to re-establish natural channel planform and profile configurations that mitigate erosion risk within the study area. This would include improved bankfull flow conveyance within a bankfull channel and improved floodplain connectivity for larger flows in relevant subreaches. Instream materials would be suitably sized to remain stable under a range of flow conditions and provide continued protection to the underlying till. Elements of the channel configuration would provide diverse aquatic habitat (i.e., variable pool depth and riffle grades) and also enable in-stream flow energy dissipation. Protection of the sanitary sewer crossings would be provided by in-stream grade control measures that are designed to be stable for the contemporary flow regime.

Through detailed design, the footprint of the channel realignment, and configuration of the proposed profile and cross-section will be determined; the channel realignment would be determined to increase channel length, minimize impact to the natural environment (i.e., avoid SAR species) while supporting channel function, and protecting infrastructure. The suitable stream type for the study area would be determined in consideration of the stream power, sediment supply and boundary materials. The proposed profile sequence would be in-phase with the proposed planform configuration. Where realignment is not feasible, profile enhancements could occur (e.g., subreaches 1 and 6). The channel design would be developed based on natural channel principles and promote natural channel functions.

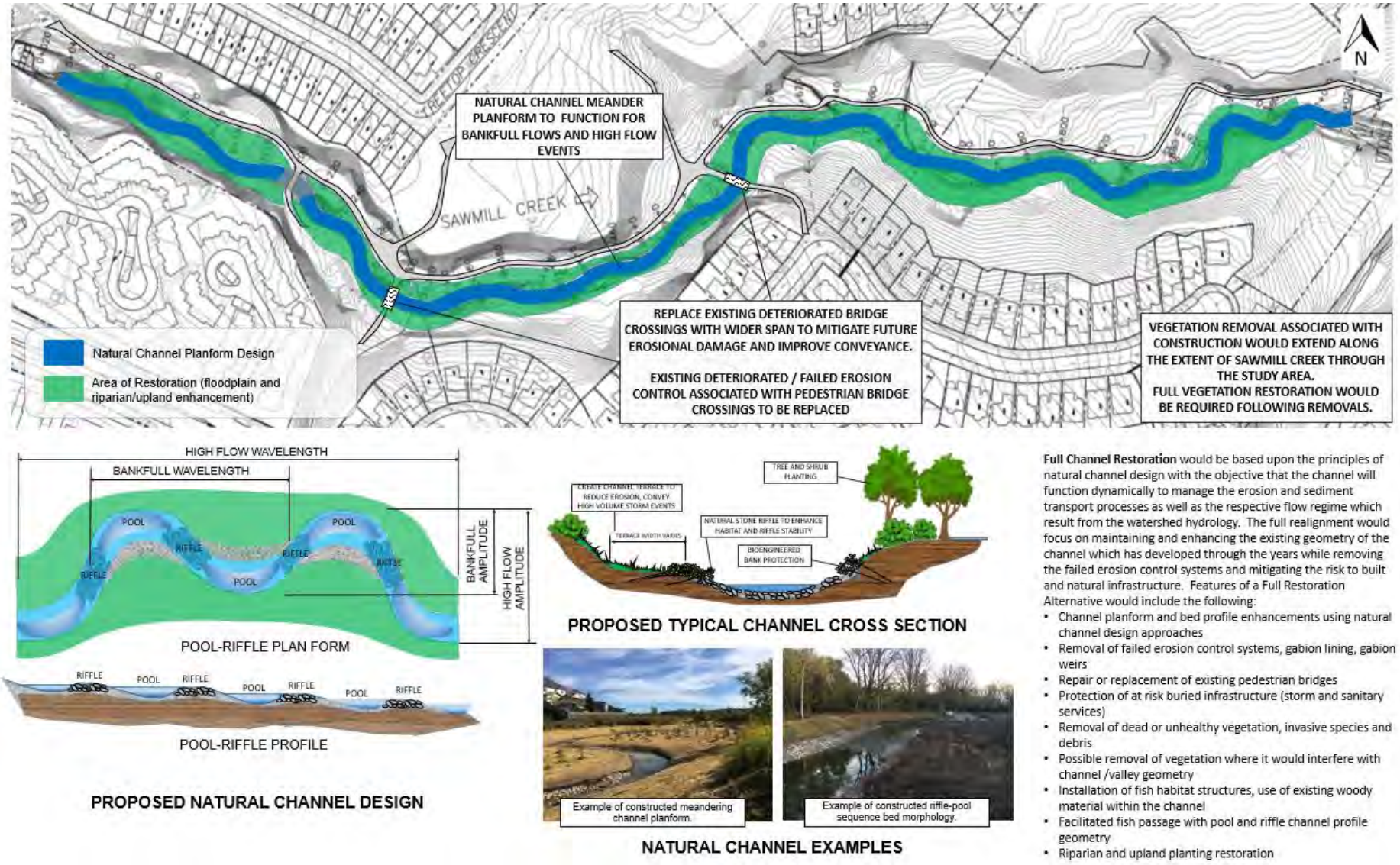
By increasing the channel length, a reduction in slope and flow energy would occur that would reduce erosion potential and reduce risk of failure of any erosion control measures that are required to protect the sanitary sewer, trail or manholes. This alternative would reduce the need for the 19 grade control weir structures and would instead manage the change in channel bed elevation through bed morphology. Any trail crossings over Sawmill Creek Reach 1 would be suitably sized to allow for conveyance of frequent flows, in compliance with CVC (2019) Watercourse Crossing Guideline document. The proposed channel alignment would maintain setbacks from the existing toe of slope, where feasible. Where not feasible, a geotechnical investigation and slope stability analysis would be required if the proposed works involved disturbing (including through construction activities), altering the valley slope, and/or altering the slope hazard (by any potential channel realignment). Slope stability analyses must be completed in accordance with CVC's Slope Stability Guideline

Alternative 3 provides an opportunity to remove invasive species, dead or unhealthy vegetation and debris. The alternative also provides opportunity to establish new natural environment features within the existing channel corridor valley and improve the existing terrestrial natural environment by increasing diversity and enhancing wildlife habitat. This could enhance recreational enjoyment and provides opportunity for public education. Impacts to the natural environment from this alternative are expected to be the greatest of all the proposed alternatives. Temporary impacts to the terrestrial natural environment will result at the locations of construction access and of the proposed channel alignment due to the required removal of mature trees and other vegetation. These areas can be restored once construction is complete with small trees, shrubs and native seed, but would change the forest age and community type within these localized areas. Construction access should occur within the less sensitive areas of the forested communities, tree removal should have regard for breeding birds and a cavity tree assessment should be completed prior to any removal to avoid impacts to bat maternal roosts.

Impacts to the aquatic natural environment will result from temporary worksite isolation and dewatering. This will temporarily impact the benthic invertebrate community due to the temporary reduction in wetted habitat. The duration of construction is expected to be longer for this alternative due to the more extensive amount of work that will be required to realign the channel. Since a fish community is not currently present within the Reach 1 Sawmill Creek study area, impacts to fish are not anticipated. The realigned sinuous channel, with naturalized channel banks, would improve aquatic habitat diversity and complexity. Removal of barriers to fish passage within the study area would occur by replacing weir structures with a naturalized bed morphology (e.g., riffles). Opportunity to install fish habitat structures and re-use large woody materials within the channel would be

explored within the design. Re-creation of the riparian area will allow for significant improvements to cover and refuge habitat to occur through the planting of overhanging and dense vegetation. The overall benefits provided by this alternative outweigh the potential impacts to the aquatic environment.

The cost of implementing Alternative 3 is considered to be the highest of all alternatives.



Full Channel Restoration would be based upon the principles of natural channel design with the objective that the channel will function dynamically to manage the erosion and sediment transport processes as well as the respective flow regime which result from the watershed hydrology. The full realignment would focus on maintaining and enhancing the existing geometry of the channel which has developed through the years while removing the failed erosion control systems and mitigating the risk to built and natural infrastructure. Features of a Full Restoration Alternative would include the following:

- Channel planform and bed profile enhancements using natural channel design approaches
- Removal of failed erosion control systems, gabion lining, gabion weirs
- Repair or replacement of existing pedestrian bridges
- Protection of at risk buried infrastructure (storm and sanitary services)
- Removal of dead or unhealthy vegetation, invasive species and debris
- Possible removal of vegetation where it would interfere with channel /valley geometry
- Installation of fish habitat structures, use of existing woody material within the channel
- Facilitated fish passage with pool and riffle channel profile geometry
- Riparian and upland planting restoration

Figure 4-3. Alternative 3: Channel Realignment.

4.4 Alternative 4: Reach-Based Solutions

In Alternative 4, the approach used to address the various issues and concerns identified through this study varies by subreach and would include both spot repairs and channel modifications (**Figure 4-4**). By considering the findings from each study component, the approach that best manages channel processes, flow energy and infrastructure protection is determined by subreach. In this manner, only those measures necessary to fulfill study objectives are implemented, thereby reducing extent of impact compared to Alternative 3, but promoting long term stability and restoration of channel functions, in comparison to Alternative 2.

Key components of the Reach-Based Solutions alternative include the following:

- Channel realignment within subreach 2 and 3 to improve planform stability and provide floodplain access for higher flow. This will reduce flow energy.
- Replace or repair deteriorated trail bridges in subreach 4.
- Remove failing weirs in all reaches and, where appropriate, replace with naturalized bed profile features (e.g., riffle/cascade/step) that are suitable for the flow regime.
- Mitigate knickpoint regression in subreach 3.
- Improve channel capacity in undersized channel sections within subreaches 3 and 4, in conjunction with weir replacement.
- Manage in-creek large woody debris jams and accumulations within subreach 3.
- Enhance floodplain connectivity and improve natural channel form in subreach 5, coincident with removal of the low-level concrete crossing in subreach 4.

Impacts to the natural environment from this alternative are expected to be intermediate between Alternatives 2 and 3. Temporary impacts to the terrestrial natural environment will result at the locations of construction access and of any proposed channel alignment due to the required removal of mature trees and other vegetation. The impacts would be minimized by selecting site access through less sensitive areas of the forested communities, where possible, and minimizing the footprint of proposed works to areas required to address the erosion concerns. Any disturbed or impacted areas would be restored once construction is complete with small trees, shrubs and native seed; these would locally change the forest age and community type within these areas. Construction access should always occur within the less sensitive areas of the forested communities, where possible; tree removal should have regard for breeding birds and a cavity tree assessment should be completed prior to any removal to avoid impacts to bat maternal roosts.

Impacts to the aquatic natural environment will result from temporary worksite isolation and dewatering. This will temporarily impact the benthic invertebrate community due to the temporary reduction in wetted habitat. The duration of construction is expected to be shorter than Alternative 3, but longer than Alternative 2 for this alternative due to the more extensive amount of work that will be required to realign the channel. Since a fish community is not currently present within the Reach 1 Sawmill Creek study area, impacts to fish are not anticipated. The realigned sinuous channel, with naturalized channel banks, would improves aquatic habitat diversity and complexity. Removal of barriers to fish passage within the study area would occur by replacing weir structures with a naturalized bed morphology (e.g., riffles). Opportunity to install fish habitat structures and re-use large woody materials within the channel would be explored within the design. Re-creation of the riparian area will allow for significant improvements to cover and refuge habitat to occur through the planting of overhanging and dense vegetation. The overall benefits provided by this alternative outweigh the potential impacts to the aquatic environment.

The cost of implementing Alternative 4 is considered to be the intermediate of all alternatives.

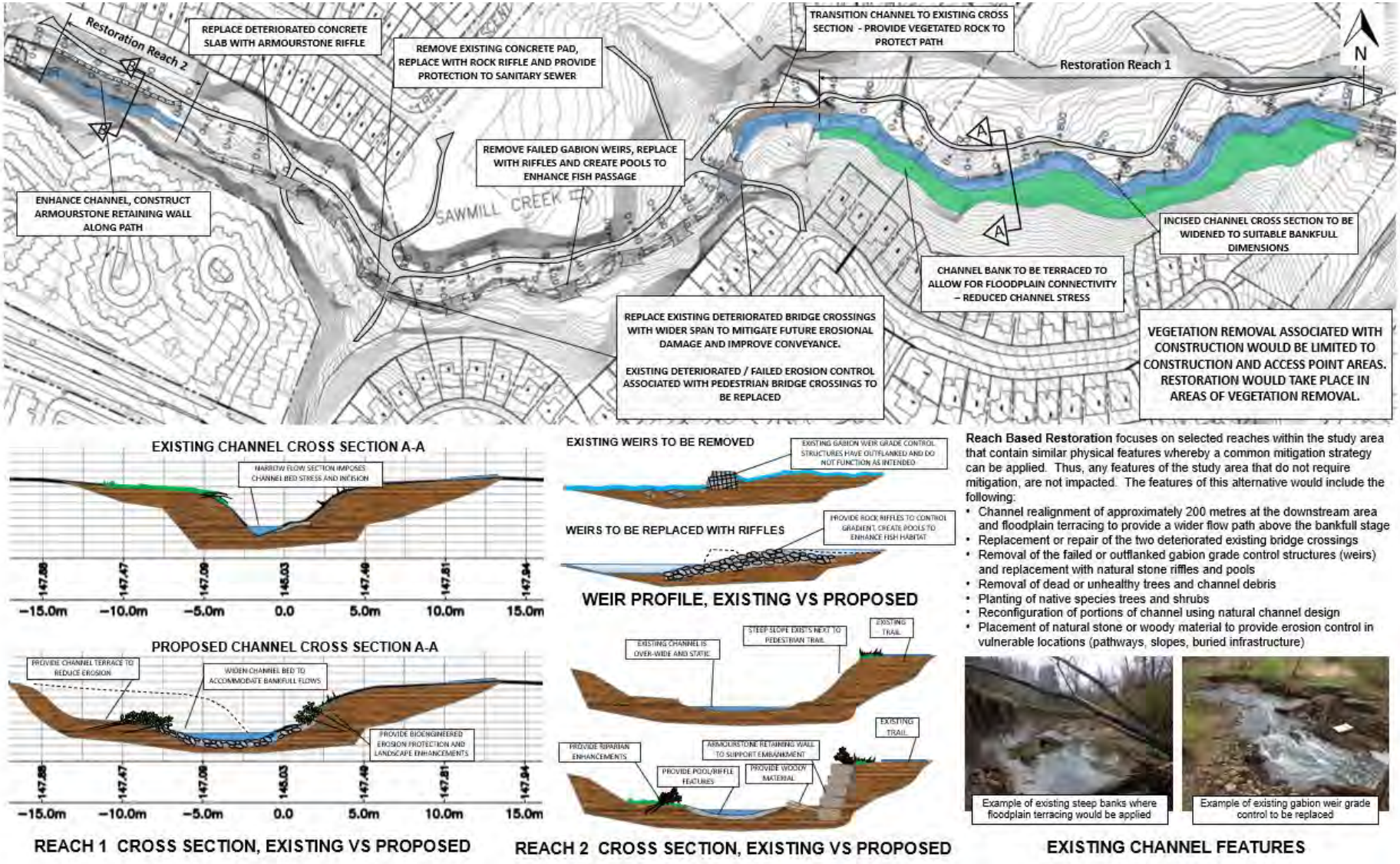


Figure 4-4. Alternative 4: Reach-Based Solutions

4.5 Alternative Solutions Cost Estimates

The costs associated with implementing any of the alternatives which propose an improvement to the issues identified in the study would include the following general elements:

- Construction mobilization and demobilization
- Site preparation, erosion and sediment controls and safety measures
- Removal of materials in excess of the project requirements
- Excavation and grading of channel features
- Installation of erosion control features
- Installation of new pathways and pedestrian crossings
- Installation of planting, restoration and habitat enhancements

The range of costs associated with the alternatives could range within the values listed in the table below:

Table 4-1. Cost Estimates for Sawmill Creek Alternative Solutions.

Alternative Solution	Cost Estimate
Alternative 1 – Do Nothing	No immediate costs but would require regular maintenance and repairs. Long term costs would need to address vulnerability of infrastructure. (Alternative 1 does not address the problem statement and a cost has not been estimated).
Alternative 2 – Spot Repairs	$650,000.00 to $800,000.00
Alternative 3 – Channel Modification and Realignment	$3,100,000.00 to $3,600,000.00
Alternative 4 – Reach-based Solutions	$1,700,000.00 to $2,000,000.00

5. Alternative Evaluation

In order to identify a preferred alternative that best addresses the study objectives, each of the erosion control alternatives developed in **Section 4** are rated against a consistent set of evaluation criteria (**Table 5-1**). The criteria include consideration for technical, economic, environmental, and social factors that are defined by the Ministry of Environment as part of the Environmental Assessment process. The alternatives are considered and evaluated in comparison to the 'do nothing' scenario.

5.1 Evaluation Criteria and Methodology

The erosion control alternatives need to be evaluated with a consistent methodology, the goal of which is to identify potential challenges and opportunities within the alternatives and enable comparison between alternatives. **Table 5-1** describes the evaluation criteria. A qualitative rating scale, shown in **Figure 5-1,** is used to assess each alternative against the evaluation criteria. Each of the criteria are weighted by their relative importance to the evaluation of erosion control alternatives, with the highest weighting being assigned to the effectiveness of the alternative (i.e., other considerations are not as relevant if the erosion control will not be effective), and to the implementation and construction costs (i.e., alternatives must consider economic realities of infrastructure management).

Table 5-1. Criteria for the Evaluation of Erosion Control Alternatives.

Category	Criteria	Description
Technical / Engineering	Flooding	Effectiveness of the alternative to manage or reduce flooding (i.e., effect on regional water level) or not cause negative impacts to flood hazards
	Channel Processes / Erosion	Effectiveness of the alternative to promote dynamic stability of channel processes and mitigate erosional impacts
	Protection of Infrastructure	Effectiveness of the alternative in mitigating risk to adjacent, or underlying, infrastructure (e.g., sanitary sewer)
	Constructability	Potential to construct the project using conventional, accepted construction and engineering practices
	Approvability	Potential for regulatory agencies to grant approval for implementation
	Lifespan of Works	Expected lifespan before intervention needs to be repeated
Environmental	Terrestrial Habitat	Impact on connectivity, diversity and quantity/quality of habitat, SWH and SAR habitat)
	Terrestrial Vegetation	Impact on existing riparian vegetation, trees and rare species.
	Aquatic Vegetation	Impact on contributing aquatic habitat
Social	Archaeology Impacts	Measure of the impact to potential archaeological areas in the study area.

Category	Criteria	Description
	Impact to Property and Utility	Measure of the impact to adjacent private property (i.e., loss of property, access to property, aesthetic, basement flooding)
	Impact to Public Access	Measure of impact to public access (e.g., trails, recreation - picnic, fish, boat)
	Impact to Public Safety	Measure of the impact to public safety in the surrounding area resulting from the alternative
Economic	Construction Costs	Relative measure of the initial costs to install/construct the proposed works, including environmental mitigation, sediment management, well mitigation etc.
	Maintenance / Future Costs	Relative measure of the ongoing maintenance costs following implementation (sedimentation)

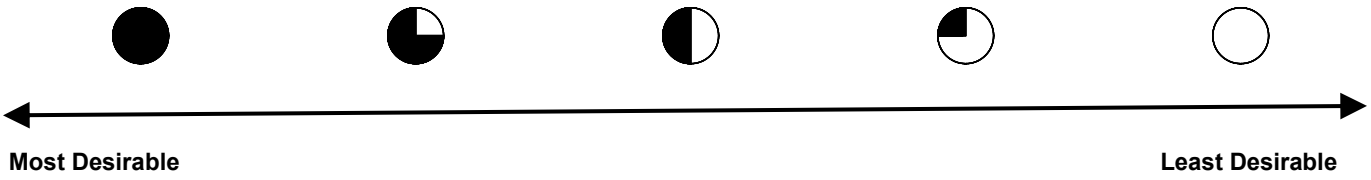


Figure 5-1. Evaluation Criteria Rating Scale

5.2 Alternatives Evaluation Matrix

The evaluations of the erosion control alternatives for each of the study reaches are shown in **Table 5-2**. Each of the criteria listed in **Section 5.1** is assigned a desirability score; results are collated to yield an overall score for each alternative. A description of the rating justification for each criterion is also included on the matrix, to provide insight into the benefits and shortcomings of each alternative. In this way an informed recommendation can be made as to the preferred erosion control alternative for this project.

Table 5-2. Potential Alternatives Evaluation Matrix

Criteria	Description	Alternative 1: Do Nothing	Alternative 2: Spot Repairs	Alternative 3: Channel Realignment	Alternative 4: Reach-Based Solutions
Technical/Engineering (30%)					
Flooding	Effectiveness of the alternative to manage or reduce flooding (i.e., effect on regional water level) or not cause negative impacts to flood hazards	This alternative does not alter the regional flood elevation or existing flooding conditions.	This alternative does not alter the regional flood elevation or existing flooding conditions.	This alternative may lead to a minimal decrease in regional flood elevation by increasing in-stream flow capacity through the realigned channel.	This alternative may lead to a minimal decrease in regional flood elevation by increasing in-stream flow capacity through the realigned channel.
Channel Processes	Effectiveness of the alternative to promote dynamic stability of channel processes and mitigate sediment impacts	This alternative will not alter channel conditions or processes; movement of substrate is expected to continue; widening processes and planform development are expected to continue, which will further compromise stability and effectiveness of erosion and grade control measures.	This alternative will enhance the bed morphology through replacement of the weir structures. and some management of erosive forces can be incorporated into the design. There is some potential for reconfiguration, or relocation, of erosion and grade control measures so that they minimize interference with natural processes; this may include local re-exposure of channel banks to re-establish a natural source of sediment.	This alternative will enhance geomorphic form (planform, profile, section) and expose natural sediment sources. Grade control structures would be removed but grade control function would be replicated by instream features (riffles/step/cascacdes) where necessary. Failed erosion control measures would be removed and replaced, where necessary, with bioengineering. Reconnection to the floodplain will be established where relevant and reduction of stream power would occur.	This alternative can enhance geomorphic form by replacing grade control structures with naturalized channel features (e.g., riffles/steps/cascade) to maintain grade control. Removal of unnecessary erosion control measures will expose natural sediment sources. Failed erosion control measures would be removed and replaced, where necessary, with bioengineering. Reconnection of the channel to the floodplain will occur to reduce instream stresses and overall stream power.
Protection of Infrastructure	Effectiveness of the alternative in mitigating risk to adjacent, or underlying, infrastructure (e.g., sanitary sewer)	No opportunity is provided to enhance protection of manholes that are in proximity to channel banks. No enhancement of cover over subsurface creek crossings would occur. No protection of the pedestrian bridge crossings would be implemented.	Protection over the sanitary sewer crossings would be maintained. Where relevant, erosion protection around manholes that are inproximity to the creek will also be established. Protection would be re-estabilshed around the exisitng pedestrian bridges, with potential to replace the existing crossings.	Protection over the sanitary sewer crossings would be maintained. Where relevant, erosion protection around manholes that are inproximity to the creek will also be established. Any new bridges would be sufficiently wide and conform to CVC Watercourse Crossing guidelines.	Protection over the sanitary sewer crossings would be maintained. Where relevant, erosion protection around manholes that are inproximity to the creek will also be established. Protection would be re-estabilshed around the exisitng pedestrian bridges, with potential to replace the existing crossings.
Constructability	Potential to construct the project using conventional, accepted construction and engineering practices	There is no construction involved, therefore this alternative is the least complex to implement.	All elements of this alternative can be constructed using conventional and accepted construction and engineering practices.	All elements of this alternative can be constructed using conventional and accepted construction and engineering practices.	All elements of this alternative can be constructed using conventional and accepted construction and engineering practices.
Approvability	Potential for regulatory agencies to grant approval for implementation	No approval is needed for a Do-Nothing alternative.	Upon completion of detailed design and submission of supporting materials, a typical approval process is anticipated.	Upon completion of detailed design and submission of supporting materials, a typical approval process is anticipated.	Upon completion of detailed design and submission of supporting materials, a typical approval process is anticipated.
Lifespan of Works	Expected lifespan before intervention needs to be repeated	The Do Nothing alternative will result in the shortest lifespan of works due to the deteriorated state of the existing infrastructure.	The spot repair alternative will result in a relatively moderate lifespan of channel works prior to which intervention or maintenance of works may be required.	Channel realignment will provide the longest lifespan of works as all infrastructure and erosion control which require maintenance will be removed.	This alternative will result in a relatively moderate lifespan of channel works prior to which intervention or maintenance of works may be required. Areas of channel restoration will provide longer lifespan of potential maintenance.
Environmental (30%)					
Terrestrial Habitat	Impact on connectivity, dversity and quantity/quality of habitat, SWH and SAR habitat)	This alternative will incur no environmental impacts as a result of construction activities; however, continued failure of erosion control works and unstable channel banks could impact bankside vegetation and terrestrial habitat. No anticipated impacts to rare plant species or SAR trees; however, continued erosion could lead to loss of SAR trees through slumping.	This alternative will require disturbance of overbank and channel areas for construction access; however, the overall area of disturbance will be less than required for Alternative 3. Potential for the loss of Candiate Bat SAR trees as well as butternut in areas selected for spot repairs and access routes; however, these impacts would be localized and minimized where possible. Removals would occur outside of the MBCA and Bat Roosting timing window.	Channel realignment will require extensive disturbance in the area of the proposed channel and the installation of erosion control measures. Removal of trees will be most extensive in this alternative; temporary loss in forest cover will occur. Potential for the loss of a substantial number of Candidate SAR bat trees, as well as butternut to achieve full restoration and realignment as well as for access routes. Where feasible, removals would be minimized and protected. Removals would occur outside of the MBCA and Bat Roosting timing window.	Reach-based solutions will require disturbance in the area of the proposed channel realignment and where access is required to remove, repaior, or enhance erosion and grade control measures. Removal of trees will be less than in Alternative 3 but more than in Alternative 2; temporary loss in forest cover will occur. Potential for the loss of a large number Candidate SAR bat trees, as well as butternut within a 200 m stretch of creek, as well as for access routes; however, removals would be minimized and trees would be protected where possible. Removals would occur outside of the MBCA and Bat Roosting timing window.
Terrestrial Vegetation	Impact on existing riparian vegetation, trees and rare species.	No environmental enhancements will occur	Limited potential for vegetation enhancement would occur through the study area, primarily focussed around areas of repairs.	Vegetation will be re-established in the footprint of the creek alignment, providng an enhancement opportunity. Various opportunities for terrestrial habitat enhancements occur. Removal of invasive species would be most extensive in this alternative.	Vegetation will be re-established in the footprint of the creek alignment and in areas where removal was required. Potential for enhancement.
Aquatic Vegetation	Impact on contributing aquatic habitat	Through the continuation of erosion and undermining of bank erosion control materials, some increase in overhanging aquatic habitat will occur, and the loss of large angular bank material into the channel will provide further instream cover. No other increases to aquatic habitat would occur.	Minimal changes to aquatic habitat would occur. Gaps created under angular boulders in subreach 3, which mimic an undercut bank condition, but compromise the stability of the bank protection, will be removed and replaced with continuous bank protection. Replacement erosion control measures could include materials beneficial to aquatic species.	Channel realignment provides an opportunity to improve existing aquatic habitat through the enhancement of morphological channel form (riffle, pool), substrate and hydaulic diversity (velocity), increased channel length, and to remove instream barriers to potential upstream fish migration.	Improvements to existing aquatic habitat will occur, through the enhancement of morphological channel form (riffle, pool), substrate and hydaulic diversity (velocity), increased channel length and removal of instream barriers to potential upstream fish migration.

Criteria	Description	Alternative 1: Do Nothing	Alternative 2: Repair and Replace/Enhance	Alternative 3: Channel Realignment	Alternative 4: Hybrid Solution
Social (20%)					
Archaeology	Measure of the impact on archaeological potentials within the study area	No immediate impacts on potential archaeological resources.	Limited impacts on potential archaeological resources.	Moderate to significant impacts on potential archaeological resources.	Limited impacts on potential archaeological resources.
Impact to Property and Utility	Measure of the impact to adjacent private property (i.e., loss of property, access to property, aesthetic)	This alternative will provide no opportunity to address potential risk to the sanitary sewer; no risk to private property has been identified.	Spot repairs will provide an effective approach to protecting infrastructure and managing channel grades and re-establishing erosion protection.	Channel realignment is expected to provide effective long-term protection of utilities and trails from the impacts of creek erosion .	Channel realignment is expected to provide effective long-term protection of utilities and trails from the impacts of creek erosion .
Impact to Public Access	Measure of impact to public access (e.g., trails, recreation - picnic)	Public access to Sawmill Valley Trail study area will not be affected.	Temporary access to Sawmill Valley Trail study area may be restricted during construction activity.	Temporary access to Sawmill Valley Trail study area may be restricted during construction activity. The duration of restriction will be longer than for Alternative 2. Once works are complete, more direct access to the creek along the trail could be provided. A loss of public property would occur due to the footprint of the proposed channel and where an increase in cross-sectional capacity occurs.	Temporary access to Sawmill Valley Trail study area may be restricted during construction activity. The duration of restriction will be longer than for Alternative 2, but less than for Alternative 3. Once works are complete, more direct access to the creek along the trail could occur. A loss of public property would occur due to the footprint of the proposed channel and where an increase in cross-sectional capacity occurs.
Impact to Public Safety	Measure of the impact to public safety in the surrounding area resulting from the alternative	This alternative will provide no opportunity to address erosion risk issues to public safety for users of the area (e.g., public access to the creek).	Repair and Replace is anticipated to provide an effective approach to mitigating risk to public safety, particularly at crossings and does not encroach, into existing private areas.	Full restoration is expected to provide the most effective long-term protection to safety for the users of Sawmill Valley Trail study area from the impacts of creek erosion. Minimal improvement to flooding conditions may occur.	The hybrid solution is expected to provide effective long-term protection to safety for the users of Sawmill Valley Trail study area from the impacts of creek erosion. Minimal improvement to flooding conditions may occur.
Economic (20%)					
Construction Costs	Relative measure of the initial costs to install/construct the proposed works, including environmental mitigation, sediment management, well mitigation etc.)	No immediate construction costs will be incurred as a result of this alternative.	Moderate construction costs are expected to implement repair/replacement oftreatments.	High construction costs are expected to implement channel realignment.	Moderate to high construction costs are expected to implement this alternative
Maintenance/ Future Costs	Relative measure of the ongoing maintenance costs following implementation (sedimentation)	It is expected that extensive maintenance costs will be required to address erosion issues in the future if the Do Nothing alternative is selected.	Local Restoration may provide a sustainable long-term erosion control approach, requiring only moderate maintenance costs for minor repairs.	Channel Realignment is expected to be a sustainable approach to erosion control in this reach, resulting in the low future maintenance costs and total lifecycle costs.	Channel Realignment is expected to be a sustainable approach to erosion control in this reach, resulting in the low future maintenance costs and total lifecycle costs.
Overall Evaluation Score:					

6. Public and Agency Consultation

The public and agency consultation requirements for a Schedule "B" project under the Municipal Class Environmental Assessment process include:

- Notice of Study Commencement to inform the public and applicable agencies that the Class EA is being undertaken;
- Public Information Centre to present information and solicit feedback on the problem or opportunity, the need for the project, the inventories of the natural, social and economic environments, and the planning and design details based on these inventories; and
- Notice of Study Completion to inform the public and applicable agencies that the Class EA has been completed and that the project file is available for review and comment.

This section describes the public and agency consultation undertaken for this study.

6.1 Public and Agency Notification

A Notice of Study Commencement was distributed to agencies and stakeholders on July 23, 2020. The notice was distributed to homes adjacent to the study area on July 24, 2020. It was also posted on the City of Mississauga website and in the Mississauga News on July 23, 2020. The notice included information on the project objectives, as well as the Environmental Assessment process. Contact information for both the City and Ecosystem Recovery was provided.

6.2 Public Information Centre

A virtual Public Information Center (PIC) was posted on the City's website and in the Mississauga News on March 25, 2021. Notices for the PIC were posted on the website and hand delivered in a mailout to residents located adjacent to the creek. The purpose of the PIC was to outline the Environmental Assessment process, present background information, characterize the existing conditions of the study area, and to present the different alternatives for Sawmill Creek.

Two completed comment forms were received. One resident indicated their preference for Alternative 3 "Full Restoration", and would like to see planting of indigenous species, improvements to pedestrian bridges, and removal of fallen trees and brush. Another resident indicated a preference for Alternative 3 or 4 and was concerned that their backyard was at risk due to erosion and preferred a retaining wall to be built at the rear of their property. Full comments received from residents after the online PIC are included in **Appendix F**.

6.3 Agency Consultation

A mailing list of review agencies and other stakeholders was established for this project. The Notice of Study Commencement was distributed to these contacts to describe the project and to invite feedback. A copy of the mailing list, sample letter, and agency correspondence is included in **Appendix F**. Correspondence with the Ministry of Environment, Conservation and Parks regarding the requirements to consult with Indigenous Communities is also included in **Appendix F**.

Credit Valley Conservation (CVC) was consulted and involved through the project. CVC provided input on the alternative development and attended a site walk on November 4, 2021; minutes from the site walk are in **Appendix F**. General comments from CVC include the need to balance addressing risks and erosion control issues with maintaining natural assets. Overall, the EA study should consider a planning time frame of 50 years. Consideration for re-use of materials within any proposed designs should be included.

7. Selection of Preferred Alternative

The purpose of the Class EA is to evaluate the existing technical, natural, social, and economic conditions related to the identified problem or opportunity, to develop and evaluate potential alternatives to address the problem, and to select a preferred alternative that would proceed to implementation. This section describes the results of the alternative evaluation process which includes input received from the public and describes the preferred approach for addressing identified erosion issues in the study area.

7.1 Preferred Alternative

The evaluation matrix, having screened the alternatives through the applicable criteria has identified Alternative No. 4 as the preferred. Alternative 4 proposes to address the problem statement by implementing a 'Reach Based Solution' (FIGURE). This approach focuses on the reaches of the study area which would benefit most from a restoration while minimizing the impacts to reaches that do not require significant improvement. This reduces the site disturbance compared with the 'Full Restoration' alternative, thus preserving natural features where possible.

The work will see a channel improvement strategy involving removal of earth material to form a bank accessible to high flood flow volumes. This is intended to be done without significant impact to the base channel that has been forming for many years into a well defined meander planform. The earth material removal is intended to reduce the impact of flow against the north bank which is susceptible to erosion and slope stability risk. This strategy will be applied for a restoration length of approximately 400 metres within the downstream sections of the creek and approximately 100m at the upstream reach as defined by the study area limits. Features of the Preferred Alternative are summarized below:

- Floodplain terracing at downstream reach and restoration using natural channel design elements (pool/riffle profile and planform adjustments, bioengineered banks, creation of pool habitat, riparian planting and landscape restoration with native trees, shrubs, topsoil, native seed mix, coir mat erosion control)
- Slope stability improvements at the upstream reach including construction of an armourstone retaining wall where the pathway approaches the channel slope.
- Removal of all failed gabion basket weirs and replacement with stone riffles
- Removal and replacement of 2 pedestrian bridges with new pedestrian bridges of longer span and protection (encasement) of sanitary sewer crossings that are located adjacent to them.
- Removal of debris in the channel which is deemed to be detrimental to flow conveyance capacity.
- Creation of fish habitat, overhanging vegetation, pool habitat, enhanced fish passage

7.2 Potential Impact to Creek Hydraulics

The proposed restoration in the downstream reach (station 2906 to station 3272) will increase conveyance through enlargement of the channel cross section above the bankfull stage. This will lower the flood levels locally and reduce flow velocity in the frequent events to lessen the erosive impact on the banks which are currently experiencing scour and erosion resulting in near vertical bank slopes. The creation of the terrace will allow flood flows to access the floodplain and provide additional flood storage. This would also reduce the impact of flow through the channel downstream of the study area.

The geometry of the Basis of Comparison HEC RAS hydraulic model was modified between the stations proposed for floodplain terracing to determine the impact of the proposed channel cross sections on flow velocity and flood levels. No other hydraulic values were modified in the BOC model. The results of the simulation indicate that for the majority of the sections, both the flood level and the velocity would be reduced. The simulation results show some instance where velocity and/or water surface elevation increased; however, the increase in these parameters is considered minimal. The detailed design will refine the extent of channel modifications to ultimately be planned for implementation. The final channel design will likely include changes to the bed profile such that grade is normalised according to the enhanced pool/riffle geometry. This is expected to render more consistent HEC RAS model results when identifying conveyance improvements.

No modifications in channel geometry were completed for any sections upstream of the terraced channel areas because no significant channel gradient modification work is being proposed that will result in impacts to flood levels. The detailed design model however will include all modified sections to accurately represent the proposed improvements to the channel.

The model comparison tables for the proposed terraced channel are shown in **Table 7-1** and **Table 7-2** below.

Table 7-1. Comparison of BOC and Proposed Terraced Channel for 2 Year Flow Event.

		BOC		Terraced Channel Q2		Comparison	
River Sta	**Q Total**	**W.S. Elev**	**Vel Chnl**	**W.S. Elev**	**Vel Chnl**	**W.S. Elev**	**Vel Chnl**
3272	21.5	151.86	2.65	151.69	2.66	-0.17	0.01
3226	21.5	151.31	2.74	150.83	1.8	-0.48	-0.94
3191	21.5	150.35	3.19	150.32	2.2	-0.03	-0.99
3145	21.5	149.57	2.7	149.28	2.64	-0.29	-0.06
3089	21.5	147.56	3.94	147.49	3.29	-0.07	-0.65
3077	21.5	146.73	4.38	146.49	4.08	-0.24	-0.3
3044	21.5	146.6	2.86	146.46	2.48	-0.14	-0.38
3005	21.5	146.31	2.17	146.18	1.68	-0.13	-0.49
2965	21.5	145.72	2.72	145.63	2.56	-0.09	-0.16
2930	21.5	144.86	3.08	144.97	1.86	0.11	-1.22
2906	21.5	144.86	1.65	144.86	1.65	0	0

Table 7-2. Comparison of BOC and Proposed Terraced Channel for 100 Year Flow Event.

		BOC		Terraced Channel Q100		Comparison	
River Sta	**Q Total**	**W.S. Elev**	**Vel Chnl**	**W.S. Elev**	**Vel Chnl**	**W.S. Elev**	**Vel Chnl**
3272	84.8	152.58	4.37	152.26	4.33	-0.32	-0.04
3226	84.8	151.9	4.87	151.33	3.58	-0.57	-1.29
3191	84.8	151.14	4.32	151.06	3.14	-0.08	-1.18
3145	84.8	150.5	4.16	150.02	3.89	-0.48	-0.27
3089	84.8	148.47	5.84	148.26	4.8	-0.21	-1.04
3077	84.8	148.79	2.08	148.18	1.74	-0.61	-0.34
3044	84.8	148	4.03	147.46	3.68	-0.54	-0.35
3005	84.8	147.58	3.21	147.15	2.78	-0.43	-0.43
2965	84.8	146.85	3.99	146.91	2.69	0.06	-1.3
2930	84.8	146.84	2.6	146.91	1.84	0.07	-0.76
2906	84.8	146.89	1.79	146.89	1.79	0	0

7.3 Potential Impact to Hydro-Geomorphic Environment

The current condition of Sawmill creek within the study area shows that erosion and sedimentation are occurring in area where it can cause negative impacts to the trail, bridges, sanitary sewers, and slope stability. The proposed preferred alternative seeks to normalise the erosion and sediment process such that both natural and built infrastructure are protected from future risk. This is accomplished by the following:

- Replacement of both pedestrian bridges will result in a reduction of flow velocity and thus reduced erosion potential, this allows the channel to remain stable upstream and downstream of the bridge
- Replacement of the failed gabion weirs with appropriately designed and configured riffles will direct flow toward pool areas. This will allow the channel to function within a natural meander pattern and facilitate the erosion and sediment processes to occur without outflanking its banks. The proper function of the pool/riffle sequences will allow sediment to be transported to nourish the downstream areas of the channel beyond the study area.
- The bank terracing strategy in the downstream reach will result in lower flow velocities and significantly reduce the incision currently ongoing. This will provide a long term solution to stabilize bank stability between the existing pathway and creek valley slope. The channel plan and profile in this area will also be enhanced. The existing pool/riffle geometry will be stabilized by augmenting the riffles with new stone materials and deepening the areas where pools would form. Sporadically positioned armourstone from a previous erosion control attempt currently in the channel will be removed and reused elsewhere in the restoration.

7.4 Natural Environment

Several of the comments received from the public as well as from City Parks staff have expressed a preference to reduce invasive species and implement native species. Though the majority of the work is proposed for the downstream reach of the study area, efforts will be made to make such improvement in the upper reach as well. This will be coupled with selective debris removal from the channel and valley where it is deemed to cause a risk rather than a benefit. Some of the debris and material recovered from any tree removals will be reused to the extent possible in the creation of erosion control measures and in habitat structures. Fish habitat enhancement using woody material will be located based on the physical environment to ensure its long term viability. This is anticipated to be within the mid-reach of Sawmill creek where low bank zones will reduce the risk of erosion or exposure to high flow velocity impacts.

7.5 Potential Impact to the Social Environment

The long term works is expected to provide an enhanced passive recreation experience to members of the community. The new pedestrian bridges will provide a safer environment for connecting links with the pathway networks that occur between subdivisions. Improvements to the riparian zone and slope stabilization measures will also improve public safety.

Temporary impacts to the social environment will result from construction activity that will require temporary closure of the pathway. Construction equipment and pumps that bypass the flow will also cause an elevated level of noise. The daily duration of construction activity is governed by City bylaws and policies. Efforts would be made to stage the area such that path closures are phased to limit loss of access and for construction machinery to adhere with working hours and project duration. Notices advising of the construction will be posted to allow community members to plan alternative commute route and alternate recreational activities.

7.6 Utilities/Infrastructure

The deteriorated state of the existing pedestrian crossings over Sawmill Creek will be addressed through the replacement and/or repair of the existing bridges which will result in an overall improvement to public health and safety. The bridge replacement or the existing bridge requiring significant abutment repairs and erosion protection shall be designed in consideration of CVC's Technical Guidelines for Watercourse Crossings as it relates to local scour around bridge crossings.

Through the preferred alternative, it is important to maintain protection of the existing sanitary sewer infrastructure(under the creek and adjacent to the creek). Existing infrastructure will be protected from vulnerability of exposure and/or failure through the protection of the sanitary sewer crossings through Sawmill Creek.

Slope stability improvements through the study area, where necessary, will provide support for the trail network through the study area, resulting in improvement to public health and safety, and long-term protection of the trial itself.

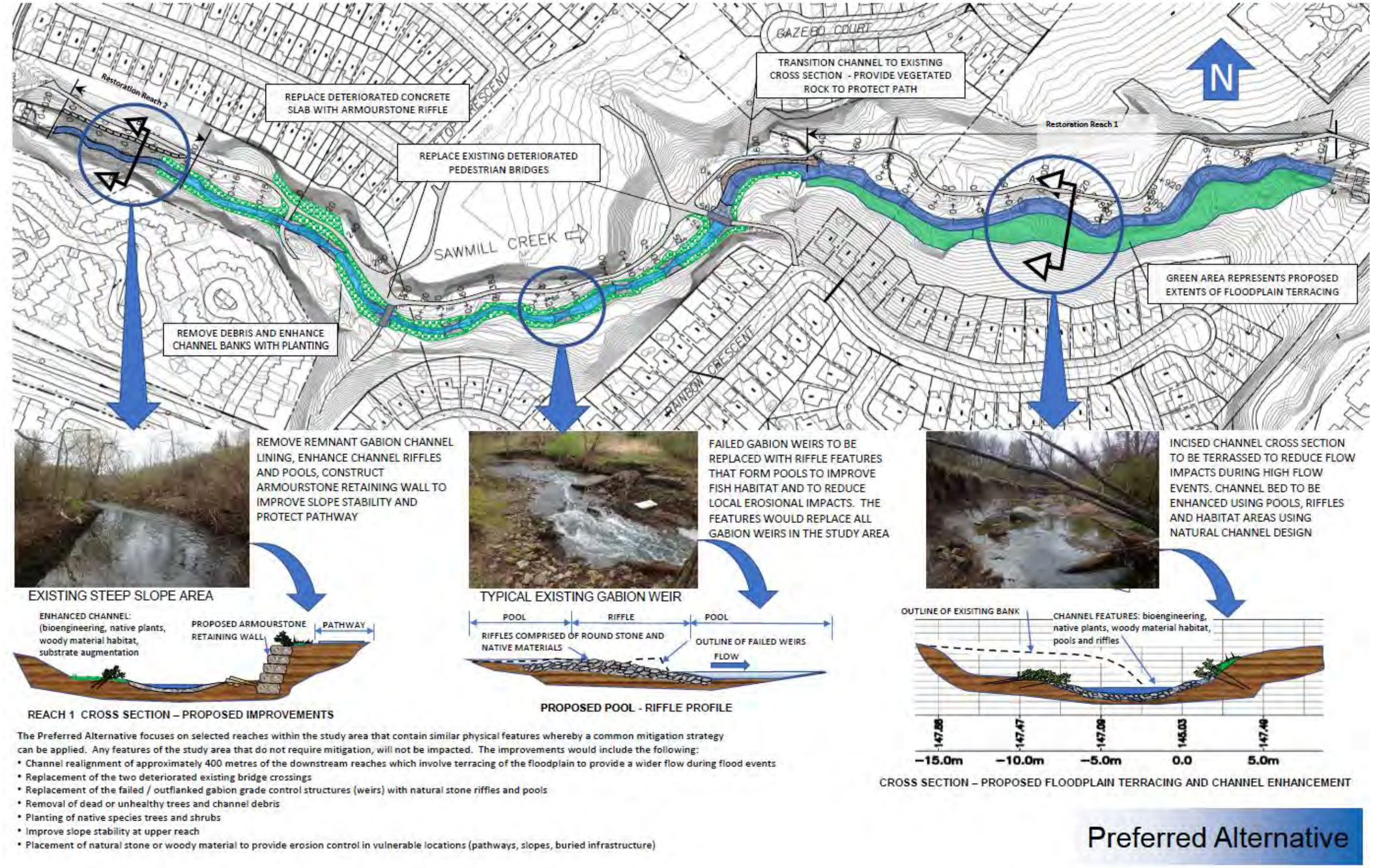


Figure 7-1. Preferred Alternative for Sawmill Creek.

8. Project Implementation

8.1 Next Steps

It is recommended that the City of Mississauga proceed with implementation of the erosion control works for the study area as detailed in the preferred alternative concept (**Section 7**), subject to budgetary constraints.

Detailed design is required to ensure that recommended erosion control works will be sustainable considering the flow characteristics in Sawmill Creek, to confirm the extent of channel improvements that can be undertaken, and to develop engineering drawings for tender and construction.

In preparation for detailed design, the following is recommended:

- **Tree Inventory and Cavity Tree Assessment –** Once the details of the creek restoration construction area are known, a detailed tree inventory & cavity tree assessment should be completed to assess the potential for regulated SAR bats within the proposed limits of construction. Any removal of trees with suitable cavities for SAR bats should consider the appropriate mitigation strategies.
- **Construction Access & Laydown Areas** - All areas selected for construction access routes and as laydown areas, should be confirmed and staked in the field in consultation with an ecologist prior to construction in order to avoid sensitive species and larger trees to the extant possible.
- **Stage 2 Archaeological Assessment** – A stage 2 archaeological assessment is required for any areas anticipated to be disturbed in conjunction with the preferred alternative, as outlined in the **Appendix E** report.
- **Geotechnical Investigation** – A geotechnical investigation will be conducted in areas of disturbance to confirm subsurface conditions.

8.2 Agency Consultation and Approvals

Consultation with Credit Valley Conservation is recommended to receive input into technical aspects of the design, particularly as this pertains to aquatic and terrestrial habitat enhancement and future flow conditions.

Continued communication with local landowners and residents will facilitate the construction process.

Ministry of Environment, Conservation & Parks (MECP) may need to be consulted once the impacts of the implementation of the detailed design as they relate to Species at Risk (SAR) are identified. A Request for Review from the Department of Fisheries and Oceans (DFO) will be required for any work that is to take place below the high water mark.

The detailed design of the proposed erosion control works, and supporting documentation, must be submitted for approval to Credit Valley Conservation. The submission must include not only the design of the erosion control repair and channel realignment/modifications, but also include plans for erosion and sediment control, project staging/phasing and restoration. The submission will include a completed “Application for Development, Interference with Wetlands and Alterations to Shorelines and Watercourses” form (pursuant to Ontario Regulation 160/06), prior to any construction activities taking place.

Once the required permits and approvals have been received, eligible contractors are recommended to be evaluated and pre-qualified on the basis of their previous creek rehabilitation and erosion control experience, with particular emphasis on in-water work experience, to help contribute to the quality and effectiveness of implementation.

8.3 Construction Mitigation Measures

Implementation of the preferred alternatives will result in local impacts to the study area. Mitigation measures should be implemented both in the design and during construction. While specific mitigation measures will be identified during detailed design, the following should be considered.

- **Erosion and Sediment Control**: Mitigation measures must be used for erosion and sediment control to prohibit sediment from entering the surrounding natural areas. The primary principles associated with sedimentation and erosion protection measures are to: (1) minimize the duration of soil exposure, (2) retain existing vegetation, where feasible, (3) encourage re-vegetation, (4) divert runoff away from exposed soils, (5) keep runoff velocities low, and (6) trap sediment as close to the source as possible.

- **Grading Techniques**: Site grading and runoff controls should be developed during final design to mitigate potential stormwater runoff impacts to the surrounding natural areas. This plan should provide for post-construction contours that minimize runoff to the natural areas.

- **Tree Removals**: Where tree removal is proposed, then all removals must be in compliance with the City of Mississauga Tree Protection and Preservation specifications. Tree removal should be completed by or overseen by a Certified Arborist using proper arboricultural techniques. If a new woodland edge is created during the removal of trees, the new edge should be inspected before and after tree removal in order to analyze the reaction of newly exposed trees. This will reduce structural failure of potentially poorly adapted trees to increased winds and other external forces. Native species should be replaced, if possible, at a 3:1 ratio.

- **Riparian Vegetation Removals**: Clearing of riparian trees and/or shrubs should be minimized such that physical and biological functional attributes of the terrestrial vegetation can be maintained as they relate to aquatic ecological function.

- **Timing Restrictions for Wildlife** – Restricting construction related activities outside of sensitive periods for local or significant wildlife species can limit disturbance during life cycle stages. Construction related activities should be limited to the daylight hours (i.e. 7am to 7pm) to reduce the amount of noise disturbance to resident wildlife. Any vegetation clearing should occur outside of the breeding bird period (i.e. April 1 to August 31) as well as the bat roosting period (April 1 to October 15) to reduce impacts to breeding birds avoiding incidental take under *MBCA* and bats under *ESA*.

- **Controlled Construction Vehicle Access Construction:** Vehicle access should be limited to areas outside of the drip-line of the tree being protected and limited to less sensitive areas to prevent soil compaction and/or the initiation of soil erosion events. Construction vehicle re-fueling stations should be centralized away from vegetation communities and watercourses. Vehicle washing should be prohibited in areas adjacent to vegetation communities and watercourses. The following recommendations are provided to address these potential sources of impacts.

    - Construction vehicle access should be limited to existing roadways and construction paths, away from the identified vegetation communities when feasible.
    - For areas immediately adjacent to Sawmill Creek, periodic supervision of the construction is recommended.
    - Machinery will arrive on site in a clean, washed condition and is to be maintained free of fluid leaks;
    - Wash, refuel and service machinery and store fuel and other materials for the machinery away from water to prevent any deleterious substance from entering the water.

- **Construction Timing (Fish):** Construction should adhere to the MNRF and DFO in-water works timing restriction for warm water systems which is March 15 to July 15 or if specified otherwise by the MNRF, DFO and CH (DFO 2013, MNRF 2013). All in-water works should be completed during the dry, low flow season and not during or after a significant rainfall event. The duration of in-water works should be kept to a minimum. In-

water works should be completed in isolation from the main flow of the creek and a fish salvage should be completed during any worksite isolation and dewatering.

- **Restoration of Disturbed Areas** – Vegetation clearing occurring for the proposed works can be mitigated through the planting of native vegetation in any areas disturbed by construction activities. Areas disturbed should be revegetated once construction is complete through the planting of native trees, shrubs and native grasses and sedges. Milkweed should be incorporated into the plantings plans, where feasible.

- **Ecological Restoration & Habitat Compensation Plan** – Implementation of a planting plan can result in a net benefit to an ecosystem through the removal and control of non-native species and the planting of a mixture of native trees, shrubs and herbaceous species appropriate to the location. In addition, the inclusion of wildlife habitat features, where appropriate, into the plan (e.g., bird or bat boxes, perches, pits & mounds etc.) could increase the health of the overall ecosystem. An Ecological Restoration and Habitat Compensation Plan tailored to the Sawmill Creek area should be developed prior to the initiation of construction.

- **Contaminant and Spill Response Plan** - A plan should be developed, and implemented immediately in the event of a sediment release or spill of a deleterious substance and an emergency spill kit must be kept on site. No storage of construction equipment, materials, chemicals, stockpiled resources of soil or storage of any other objects associated with site alteration is to occur within the delineated natural area, or within 30m of Sawmill Creek. Also, maintenance of machinery during construction should occur a minimum of 30m away from the watercourse.

- **Construction Monitoring -** is undertaken during the implementation of proposed works to ensure that methods for mitigating concerns and for environmental enhancement are performed as planned and approved, and that any problems that may arise during construction are effectively addressed. Construction activities are to be undertaken in accordance with all applicable guidelines, policies, regulations, and statutes.

8.4 Post Construction Monitoring

Post-construction monitoring of the creek remediation works is typically recommended to assess the effectiveness and environmental performance of a project. For the Sawmill Creek Reach 1 Erosion Control project, the following components and features would be monitored following completion of construction, as required:

- Locations where erosion control works appear to be deficient, if any, through indications of erosion or channel migration;
- Movement of rock or other erosion control works from installed locations;
- Indications of sedimentation in the channel;
- Degree of establishment of bioengineering installations;
- Success of site restoration measures and riparian plantings;
- Algae or excessive plant growth in the channel;
- Description and/or photographs of any fish or other wildlife observed; and
- Signs of vandalism or other social-based encroachments onto the creek corridor, outside of established pathways and bridges.

These features should be monitored every three months for the first year following construction, and once per year following, if required. In addition, the creek remediation works should be inspected after any large flow events during the first year following construction to assess performance under high-stress conditions.

Typically, a post construction effectiveness monitoring and evaluation report is completed within one year of project completion, submitted to the project proponents and agencies or government reviewers who expressed a concern during the planning and design of the project.

9. References

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Appendix A

Bridge Assessment

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

Memorandum

80 Courtland Ave. East, Unit 2, Kitchener, ON, N2G 2T8
Tel 519.621.1500 ■ Fax 226.240.1080

To:	Anthony DiGiandomenico (CoM)	**Date:**	October 8, 2020
From:	Wolfgang Wolter (ERI)	**ERI Project No.:**	2007
Re:	Sawmill Creek Erosion Control Project: Folkway Drive to Erin Mills Parkway		

1. Introduction

The City of Mississauga's ongoing erosion monitoring of Sawmill Creek has identified several sites where erosion is impacting, or potentially will affect, infrastructure both within and adjacent to the waterway. The objective of this study is to identify potential causes of the erosion and to develop, evaluate and ultimately recommend erosion control alternatives. This study is being completed under Schedule "B" of the Municipal Class Environmental Assessment process.

Sawmill Creek, a tributary of the Credit River, is located almost entirely in the City of Mississauga, draining an area of 9.86 km^2 (Gore & Storrie, 1995). The Sawmill Creek watershed is situated in an area that has rapidly urbanized. As such, concerns regarding the long term stabilization of the system are apparent. Through the study area, the Sawmill Creek valley corridor serves as valuable urban greenspace (Gore & Storrie, 1995). Recreational pathways have been established along the channel.

Two formal pedestrian bridge crossings are located within the Sawmill Creek EA study area. During the reconnaissance level field assessment (April 2020), concerns associated with the two pedestrian bridges were documented, including failure of erosion control protection surrounding the structures, outflanking of the bridges, etc. The objective of this memo is to summarize existing conditions of the pedestrian bridges, along with identified issues and concerns. **Figure 1** identifies the location of the two pedestrian crossings within the Sawmill Creek study area.



Sawmill Creek Erosion Control Project

Figure 1
Study Area

Legend

Study Area

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

NAD 1983 UTM 17	1:5,000
Project: 2007 Sawmill Creek Date: 2020/09	

Data Sources: Ecosystem Recovery Inc., 2020

2. Existing Conditions

Two formal pedestrian bridge crossings are located within the Sawmill Creek EA study area. Below is a summary of the existing conditions of the pedestrian bridges, including issues and/or concerns.

Pedestrian Bridge (0+555)

The pedestrian bridge located at station 0+555 is the furthest downstream of the two formal bridge crossings. A summary of existing conditions is provided in **Table 2-1** and subsequent text.

Table 2-1. Summary of Pedestrian Bridge 0+555 Conditions

	Description	Condition	Deficiency
Bridge Type	Steel prefabricated truss	Poor	Structural capacity, steel sections significantly corroded under deck, need repairs, replacement
Clear Span	10.8m	Rectangular section	Insufficient conveyance capacity
Foundation	Concrete abutments on caissons	Caissons exposed; abutment stem base undermined	No frost protection, material surface spalling
Channel under deck	Gabion basket lined	Displaced lining, absent gabion material, scoured	Failed, requires replacement. Risk Sanitary sewer nearby

Issues identified during field reconnaissance at the pedestrian bridge crossing (0+555) included:

- Deterioration of erosion control under the bridge crossing, including displacement of large angular stone, and exposed filter cloth
- Undercutting of the bridge footing/abutment measured at a minimum of 0.55m;
- Channel bank and bed scour upstream of the pedestrian bridge (south bank); efforts to mitigate further erosion and damage to the bridge have been pursued, including placement of sandbags and concrete slabs



View looking upstream towards pedestrian bridge (0+555)



View looking downstream towards pedestrian bridge (0+555)

	
Undercutting of bridge abutment; displaced erosion control (stone); exposed filter cloth	Channel bed and bank scour upstream of pedestrian bridge; mitigation efforts

Pedestrian Bridge (0+300)

The pedestrian bridge located at station 0+300 spans approximately of the bridge is 12.5 m. A summary of existing conditions is provided in **Table 2-2** and subsequent text.

Table 2-2. Summary of Pedestrian Bridge 0+300 Conditions

	Description	Condition	Deficiency
Bridge Type	Steel prefabricated truss	Good	N/A
Clear Span	12.5m	Trapezoidal section	Insufficient conveyance capacity
Foundation	Concrete abutments	Unknown	N/A
Channel under deck	Concrete lined, bed elevation change	Poor, Fractured, Scoured, bank erosion	Failed, requires replacement. Risk: sanitary sewer crossing under bridge vulnerable

Issues identified during field reconnaissance at the pedestrian bridge crossing (0+555) included:

- Displacement and cracking of concrete slabs below bridge; sanitary sewer crossing below concrete protection may be at risk if further failure occurs;



View looking upstream towards pedestrian bridge (0+300)



View towards left (south) bank (0+300)



Uplifting and displacement of concrete slab protection under bridge.



Voids in concrete due to cracking and displacement measured at a minimum of 0.30 m.

2.1 Hydrologic and Hydraulic Conditions

Table 2-3 summarizes key hydraulic conditions within proximity (both upstream and downstream) of the two formal pedestrian bridge crossings through the study area. Review of the HEC-RAS results indicates high shear and stream power conditions surrounding the bridges, suggesting high energy of flows during the 2 year flow event. The top width of the 2 year flow, ranging from 15.65 – 22.75 m, indicates a larger flow width than the existing span of the two pedestrian bridges.

Table 2-3. HEC-RAS Modelled Results in Proximity to Pedestrian Bridge Crossings for the 2 Year Flow Event.

Station	2 Year Flow (cms)	Top Width (m)	Velocity Chnl (m/s)	Shear Channel (N/m^2)	Stream Power (W/m^2)
Pedestrian Bridge Crossing (0+555)					
3630 (D/S)	21.5	22.75	2.61	85.21	222.08
3582 (U/S)	21.5	17.56	3.57	155.09	553.17
Pedestrian Bridge Crossing (0+300)					
3382 (D/S)	21.5	15.65	2.72	95.23	258.73
3315 (U/S)	21.5	11.39	2.87	116.82	335.31

Condition and function of existing pedestrian bridge crossing structures

3. Summary

It is evident based on the observations that both pedestrian bridge crossings are in poor condition and require repairs to avoid further failures of erosion and grade control systems and to avoid risk to the sanitary sewer infrastructure which is located in close proximity.

The EA study incorporates the two crossings as part of the evaluation of alternatives that considers long term solutions to the built and natural infrastructure. The two options that can mitigated the pedestrian crossings are 'repair' or replacement'.

When evaluating the 'repair' option, it become evident that the superstructure needs to be removed to gain access to repair the stream channel linings and to repair/underpin the foundations. This will however only result in a short term structural repair that addresses the critical deficiencies but does not address the conveyance issues.

The hydraulic component of the study reveals that both crossings are deficient in terms of clear span and end area capacity. The geomorphic assessment of the channel suggests that spanning only the 2 year event flow requires a span of over 15m to 22m within a constrained valley area.

4. Conclusions and Recommendations

The ultimate decision on whether to replace or repair the two structures hinges on the following criteria:

- Life span
- Hydraulic capacity to sustain channel flows and manage erosion potential
- Structural capacity
- Channel morphology
- Protection of sanitary sewer system
- Cost

Potential Costs

Recently tendered pedestrian crossing structures have resulted in cost of $130,000 for a steel bridge superstructure spanning 20m including reinforced concrete abutments with a 10 tonne load capacity. The estimated cost to carry out repairs to the existing structures could result in an average cost of $60,000.00 per crossing. The repaired crossings would still be deficient in hydraulic capacity and would have a shorter life cycle.

Appendix B

Hydraulic Modelling

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan	Power Chan
			(m3/s)	(m)	(m)	(m)	(m)	(m/m)	(m/s)	(m2)	(m)		(N/m2)	(N/m s)
East	3860	2 year	21.5	158.58	159.93	159.71	160.2	0.007372	2.3	9.35	9.07	0.72	65.59	150.81
East	3860	5 year	36.9	158.58	160.3	160.11	160.72	0.008724	2.87	12.86	9.96	0.81	95.38	273.67
East	3860	10 year	52.4	158.58	160.58	160.43	161.14	0.009962	3.33	15.73	10.63	0.87	123.3	410.62
East	3860	25 year	64.3	158.58	160.76	160.66	161.43	0.01072	3.63	17.74	11.07	0.91	142.61	516.97
East	3860	50 year	79.6	158.58	160.99	160.92	161.77	0.011297	3.93	20.26	11.55	0.95	162.98	640.23
East	3860	100 year	92.8	158.58	161.21	161.12	162.05	0.010905	4.05	22.9	12.04	0.94	169.23	685.68
East	3860	Regional	84.8	158.58	161.07	161	161.88	0.011302	4	21.2	11.73	0.95	167.52	670.13
East	3860	60% 2 Year	12.9	158.58	159.64	159.43	159.82	0.006553	1.88	6.86	8.39	0.66	47.13	88.64
East	3832	2 year	21.5	158.16	159.9		159.96	0.001153	1.07	21.15	20.24	0.31	13.15	14.1
East	3832	5 year	36.9	158.16	160.3		160.39	0.001247	1.36	29.7	22.09	0.34	19.07	25.88
East	3832	10 year	52.4	158.16	160.62		160.74	0.001353	1.59	36.85	23.55	0.37	24.77	39.48
East	3832	25 year	64.3	158.16	160.83		160.98	0.001416	1.75	41.95	24.69	0.38	28.8	50.37
East	3832	50 year	79.6	158.16	161.09		161.26	0.001455	1.91	48.5	26.25	0.4	33.21	63.58
East	3832	100 year	92.8	158.16	161.33		161.53	0.001419	2.02	55.77	33.47	0.4	35.76	72.2
East	3832	Regional	84.8	158.16	161.17		161.36	0.001466	1.97	50.94	29.27	0.4	34.74	68.42
East	3832	60% 2 Year	12.9	158.16	159.59		159.63	0.001147	0.88	15.15	18.83	0.3	9.69	8.49
East	3787	2 year	21.5	158.13	159.69		159.85	0.004318	2.16	17.47	19.81	0.61	52.36	113.24
East	3787	5 year	36.9	158.13	160.01		160.27	0.005428	2.81	24.09	22.11	0.71	82.14	230.89
East	3787	10 year	52.4	158.13	160.24		160.6	0.006445	3.35	29.38	23.47	0.79	111.52	373.53
East	3787	25 year	64.3	158.13	160.39		160.83	0.007075	3.7	33.03	24.61	0.84	132.61	490.8
East	3787	50 year	79.6	158.13	160.56	160.37	161.1	0.008018	4.16	37.37	27.16	0.9	162.91	677.39
East	3787	100 year	92.8	158.13	160.67	160.5	161.36	0.009426	4.66	40.61	31.28	0.99	201.42	939.12
East	3787	Regional	84.8	158.13	160.61	160.38	161.2	0.008453	4.33	38.72	28.37	0.93	175.63	761.07
East	3787	60% 2 Year	12.9	158.13	159.41		159.53	0.004143	1.8	12.11	18.43	0.57	39.33	70.77
East	3737	2 year	21.5	158.1	159.56		159.65	0.002086	1.51	23.62	33.4	0.43	25.5	38.55
East	3737	5 year	36.9	158.1	159.9		160.02	0.002254	1.84	40.68	53.55	0.46	34.87	64.09
East	3737	10 year	52.4	158.1	160.17		160.3	0.002092	1.97	55.52	54.1	0.46	37.95	74.75
East	3737	25 year	64.3	158.1	160.36		160.49	0.002022	2.06	65.58	54.46	0.46	40.32	83.15
East	3737	50 year	79.6	158.1	160.57		160.71	0.001981	2.18	77.18	54.87	0.46	43.56	94.91
East	3737	100 year	92.8	158.1	160.74		160.89	0.001959	2.27	86.41	55.19	0.46	46.28	105.17
East	3737	Regional	84.8	158.1	160.64		160.78	0.001971	2.22	80.89	55	0.46	44.65	98.96
East	3737	60% 2 Year	12.9	158.1	159.28		159.34	0.001925	1.23	15.61	24.01	0.4	18.27	22.41
East	3691	2 year	21.5	157.88	159.13	159.13	159.45	0.011663	2.52	9.47	21.95	0.93	84.43	212.8
East	3691	5 year	36.9	157.88	159.44	159.44	159.81	0.009189	2.82	17.69	28.27	0.87	94.06	265.11
East	3691	10 year	52.4	157.88	159.65	159.65	160.09	0.009051	3.16	23.96	30.65	0.89	111.21	351.33
East	3691	25 year	64.3	157.88	159.79	159.79	160.29	0.009035	3.38	28.38	32.19	0.91	123.22	416.95
East	3691	50 year	79.6	157.88	159.97	159.97	160.51	0.008704	3.59	34.25	33.96	0.91	133.49	479.44
East	3691	100 year	92.8	157.88	160.09	160.09	160.68	0.008797	3.79	38.48	34.84	0.92	145.32	551.32
East	3691	Regional	84.8	157.88	160.02	160.02	160.58	0.008738	3.67	35.95	34.32	0.91	138.19	507.57
East	3691	60% 2 Year	12.9	157.88	158.89	158.89	159.15	0.015316	2.26	5.71	10.99	1	76.75	173.45
East	3660	2 year	21.5	156.87	158.13	158.33	158.74	0.026437	3.5	6.81	14.69	1.35	169.48	593.03
East	3660	5 year	36.9	156.87	158.39	158.65	159.18	0.023758	4.11	12.37	27.9	1.35	209.89	862.19
East	3660	10 year	52.4	156.87	158.56	158.87	159.48	0.023295	4.56	17.53	30.43	1.37	244.22	1113.45
East	3660	25 year	64.3	156.87	158.68	159	159.67	0.023241	4.85	21.38	35.95	1.39	268.1	1301.29
East	3660	50 year	79.6	156.87	158.8	159.16	159.89	0.023459	5.2	26.13	40.24	1.42	297.69	1546.92
East	3660	100 year	92.8	156.87	158.9	159.3	160.06	0.023683	5.46	30.04	42.5	1.44	321.32	1754.18
East	3660	Regional	84.8	156.87	158.84	159.2	159.96	0.023516	5.3	27.71	41.21	1.43	306.88	1626.69
East	3660	60% 2 Year	12.9	156.87	157.95	158.06	158.37	0.027013	2.89	4.49	10.42	1.29	128.1	370.58
East	3630	2 year	21.5	156.69	157.94	157.94	158.26	0.009892	2.61	10.96	22.75	0.86	85.21	222.08
East	3630	5 year	36.9	156.69	158.26	158.26	158.63	0.008607	2.96	20.4	36.49	0.85	99.59	294.78
East	3630	10 year	52.4	156.69	158.48	158.51	158.9	0.008531	3.29	29.1	40.63	0.87	116.31	382.37
East	3630	25 year	64.3	156.69	158.63	158.65	159.07	0.008076	3.42	35.49	41.94	0.86	121.7	416.1
East	3630	50 year	79.6	156.69	158.78	158.79	159.26	0.008381	3.68	41.52	42.64	0.89	137.4	506.22
East	3630	100 year	92.8	156.69	158.89	158.9	159.41	0.008628	3.89	46.28	43.18	0.91	150.33	585.26
East	3630	Regional	84.8	156.69	158.82	158.83	159.32	0.00851	3.77	43.38	42.85	0.9	142.94	539.31
East	3630	60% 2 Year	12.9	156.69	157.66	157.66	157.95	0.013428	2.4	5.68	13.85	0.95	81.48	195.89
East	3582	2 year	21.5	155.72	156.94	157.12	157.52	0.016532	3.57	8.73	17.56	1.13	155.09	553.17
East	3582	5 year	36.9	155.72	157.25	157.46	157.95	0.015568	4.14	16.01	26.91	1.15	191.28	792.49
East	3582	10 year	52.4	155.72	157.48	157.64	158.24	0.015146	4.54	22.49	30.06	1.17	218.13	990.97
East	3582	25 year	64.3	155.72	157.63	157.9	158.43	0.014607	4.76	27.42	32.93	1.16	231.83	1103.49
East	3582	50 year	79.6	155.72	157.82	158.05	158.64	0.01376	4.96	34.56	38.35	1.15	242.83	1204.06
East	3582	100 year	92.8	155.72	157.95	158.16	158.79	0.013705	5.16	39.21	38.6	1.16	257.25	1326.45
East	3582	Regional	84.8	155.72	157.87	158.1	158.7	0.013717	5.04	36.46	38.46	1.15	248.35	1250.67
East	3582	60% 2 Year	12.9	155.72	156.69	156.78	157.12	0.016634	2.98	5.42	11.28	1.09	118.37	352.24

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan	Power Chan
East	3528	2 year	21.5	154.42	155.66	155.79	156.16	0.026638	3.15	6.83	11.56	1.31	145.01	456.76
East	3528	5 year	36.9	154.42	155.89	156.1	156.63	0.027349	3.82	9.93	15.5	1.38	195.27	746.7
East	3528	10 year	52.4	154.42	156.09	156.37	157	0.025135	4.27	13.3	18.51	1.38	225.48	962.49
East	3528	25 year	64.3	154.42	156.79	156.52	157.14	0.005207	2.78	32.81	37.74	0.69	80.12	223.04
East	3528	50 year	79.6	154.42	156.93	156.75	157.35	0.005688	3.08	38.61	41.47	0.73	95.15	292.72
East	3528	100 year	92.8	154.42	157.12	156.92	157.54	0.005054	3.1	46.84	43.51	0.7	93.5	289.96
East	3528	Regional	84.8	154.42	157.01	156.84	157.43	0.00541	3.09	41.9	42.42	0.71	94.38	291.19
East	3528	60% 2 Year	12.9	154.42	155.46	155.54	155.83	0.024314	2.69	4.79	9.6	1.22	111.94	301.24
East	3466	2 year	21.5	153.71	154.98	154.94	155.37	0.010287	2.84	8.64	11.73	0.88	97.79	277.56
East	3466	5 year	36.9	153.71	155.35	155.35	155.91	0.010202	3.45	13.49	14.58	0.92	131.01	452.53
East	3466	10 year	52.4	153.71	155.66	155.66	156.34	0.009715	3.85	18.77	18.36	0.93	152.52	587.82
East	3466	25 year	64.3	153.71	155.87	155.87	156.63	0.009614	4.13	23.15	23.97	0.95	168.58	695.73
East	3466	50 year	79.6	153.71	156.27	156.27	156.9	0.006691	3.91	34.98	30.96	0.81	141.81	554
East	3466	100 year	92.8	153.71	156.42	156.42	157.11	0.006861	4.12	39.74	31.77	0.83	154.81	638.57
East	3466	Regional	84.8	153.71	156.33	156.33	156.99	0.006766	4	36.88	31.29	0.82	147.12	587.94
East	3466	60% 2 Year	12.9	153.71	154.75	154.64	155	0.008473	2.2	6.23	9.91	0.77	63.64	140.13
East	3382	2 year	21.5	152.9	153.93	153.93	154.3	0.012027	2.72	8.83	15.65	0.95	95.23	258.73
East	3382	5 year	36.9	152.9	154.17	154.3	154.75	0.013992	3.48	13.33	21.41	1.07	143.2	497.94
East	3382	10 year	52.4	152.9	154.35	154.62	155.12	0.015594	4.07	17.81	29.7	1.16	186.57	760.02
East	3382	25 year	64.3	152.9	154.46	154.82	155.36	0.016675	4.46	21.92	42.86	1.22	217.08	967.38
East	3382	50 year	79.6	152.9	154.56	154.94	155.65	0.018968	4.98	26.53	49.93	1.31	264.63	1317.18
East	3382	100 year	92.8	152.9	154.66	155.04	155.82	0.019394	5.25	31.61	56.23	1.34	288.3	1513.75
East	3382	Regional	84.8	152.9	154.6	154.98	155.72	0.019123	5.09	28.56	52.58	1.33	274.04	1394.26
East	3382	60% 2 Year	12.9	152.9	153.68	153.68	153.97	0.014356	2.35	5.58	11.31	0.98	80.27	188.95
East	3315	2 year	21.5	151.46	152.65	152.72	153.07	0.019594	2.87	7.49	11.39	1.13	116.82	335.31
East	3315	5 year	36.9	151.46	152.97	153.07	153.5	0.018212	3.24	11.4	13.73	1.13	137.31	444.33
East	3315	10 year	52.4	151.46	153.24	153.34	153.8	0.017341	3.32	15.99	20.19	1.13	141.11	468.83
East	3315	25 year	64.3	151.46	153.4	153.53	153.99	0.016712	3.43	19.49	25.72	1.12	146.79	503.77
East	3315	50 year	79.6	151.46	153.56	153.68	154.2	0.01567	3.55	24.39	32.49	1.11	152.27	541.29
East	3315	100 year	92.8	151.46	153.66	153.79	154.36	0.01561	3.76	27.56	33.35	1.12	165.53	622.53
East	3315	Regional	84.8	151.46	153.6	153.73	154.26	0.015662	3.64	25.64	32.84	1.11	157.74	574.12
East	3315	60% 2 Year	12.9	151.46	152.46	152.47	152.75	0.017243	2.38	5.43	9.96	1.03	85.17	202.28
East	3272	2 year	21.5	150.86	151.86	151.88	152.2	0.01513	2.65	8.95	15.1	1.02	96.97	256.65
East	3272	5 year	36.9	150.86	152.09	152.19	152.6	0.017925	3.26	13.13	22.85	1.15	138.52	452.06
East	3272	10 year	52.4	150.86	152.27	152.42	152.92	0.017945	3.72	17.81	29.44	1.19	168.76	628.14
East	3272	25 year	64.3	150.86	152.38	152.63	153.12	0.018029	4.01	21.35	32.15	1.21	188.78	756.61
East	3272	50 year	79.6	150.86	152.54	152.78	153.37	0.017187	4.27	26.97	39.88	1.21	205.39	877.74
East	3272	100 year	92.8	150.86	152.64	152.89	153.53	0.017291	4.5	30.91	41.23	1.23	222.36	1000.89
East	3272	Regional	84.8	150.86	152.58	152.83	153.44	0.01722	4.37	28.56	40.43	1.22	212.14	926.03
East	3272	60% 2 Year	12.9	150.86	151.7	151.63	151.91	0.010856	2.06	6.72	12.93	0.85	61.38	126.59
East	3226	2 year	21.5	149.64	151.31	151.36	151.6	0.008456	2.74	16.15	38.55	0.82	88.3	241.92
East	3226	5 year	36.9	149.64	151.54	151.55	151.89	0.009328	3.25	25.49	42	0.88	116.94	380.1
East	3226	10 year	52.4	149.64	151.72	151.81	152.15	0.010565	3.75	34.69	56.71	0.96	149.76	562.28
East	3226	25 year	64.3	149.64	151.8	151.92	152.3	0.012085	4.15	39.28	59.35	1.03	179.98	746.88
East	3226	50 year	79.6	149.64	151.87	152.06	152.49	0.015011	4.74	43.11	61.45	1.16	232.17	1101.21
East	3226	100 year	92.8	149.64	151.94	152.15	152.62	0.016112	5.06	47.78	63.87	1.21	260.08	1314.91
East	3226	Regional	84.8	149.64	151.9	152.1	152.54	0.015438	4.87	45.01	62.44	1.18	243.06	1183.09
East	3226	60% 2 Year	12.9	149.64	151.04	151.04	151.34	0.010642	2.57	7.62	20.25	0.87	84.86	217.9
East	3191	2 year	21.5	149.41	150.35	150.49	150.87	0.027377	3.19	6.86	14.1	1.36	149.12	476.32
East	3191	5 year	36.9	149.41	150.62	150.82	151.26	0.020909	3.62	12	27.51	1.26	167.93	607.34
East	3191	10 year	52.4	149.41	150.81	151.04	151.54	0.018925	3.95	18.02	36.17	1.24	187.06	739.13
East	3191	25 year	64.3	149.41	150.94	151.15	151.7	0.017317	4.1	23.28	41.91	1.21	193.42	793.1
East	3191	50 year	79.6	149.41	151.09	151.37	151.88	0.01596	4.27	29.92	46.78	1.19	201.23	858.86
East	3191	100 year	92.8	149.41	151.22	151.47	152.01	0.01491	4.38	36.11	53.71	1.17	205.73	901.26
East	3191	Regional	84.8	149.41	151.14	151.41	151.93	0.015563	4.32	32.24	48.82	1.18	203.48	878.59
East	3191	60% 2 Year	12.9	149.41	150.19	150.28	150.55	0.028387	2.67	4.84	11.6	1.31	114.85	306.4
East	3145	2 year	21.5	148.36	149.57	149.57	149.94	0.012829	2.7	8.5	14.02	0.97	96	259.4
East	3145	5 year	36.9	148.36	149.88	149.93	150.4	0.011834	3.23	13.84	22.05	0.98	123.09	397.88
East	3145	10 year	52.4	148.36	150.11	150.23	150.73	0.01171	3.64	19.91	29.2	1.01	146.69	533.96
East	3145	25 year	64.3	148.36	150.25	150.4	150.94	0.011738	3.9	24.12	30.46	1.02	162.58	633.52
East	3145	50 year	79.6	148.36	150.44	150.5	151.17	0.011064	4.1	30.24	34.09	1.01	172.79	708.19
East	3145	100 year	92.8	148.36	150.61	150.79	151.36	0.010312	4.22	36.56	43.72	0.99	177.15	746.92
East	3145	Regional	84.8	148.36	150.5	150.72	151.25	0.010904	4.16	32.29	35.63	1.01	176.33	734.28
East	3145	60% 2 Year	12.9	148.36	149.34	149.34	149.61	0.015308	2.33	5.56	10.75	0.99	80.51	187.87

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Shear Chan	Power Chan
East	3089	2 year	21.5	146.63	147.56	147.82	148.35	0.035176	3.94	5.46	8.11	1.53	217.41	856.43
East	3089	5 year	36.9	146.63	147.84	148.21	148.94	0.031567	4.67	8.61	14.26	1.54	273.41	1277.63
East	3089	10 year	52.4	146.63	148.08	148.47	149.37	0.028693	5.16	12.36	17.95	1.52	309.49	1596.06
East	3089	25 year	64.3	146.63	148.23	148.8	149.63	0.02703	5.44	15.24	19.32	1.51	329.97	1793.7
East	3089	50 year	79.6	146.63	148.41	148.96	149.93	0.025445	5.74	19.39	23.92	1.49	353.01	2027.51
East	3089	100 year	92.8	146.63	148.55	149.09	150.17	0.024573	5.99	23.16	31.24	1.49	372.61	2231.48
East	3089	Regional	84.8	146.63	148.47	149.01	150.03	0.024996	5.84	20.82	25.52	1.49	360.11	2102.2
East	3089	60% 2 Year	12.9	146.63	147.36	147.52	147.93	0.036057	3.35	3.85	7.53	1.5	171.9	576.62
East	3077	2 year	21.5	145.9	146.73	147.04	147.71	0.056006	4.38	4.91	8.94	1.89	285.96	1251.36
East	3077	5 year	36.9	145.9	146.97	147.43	148.34	0.052572	5.18	7.13	9.44	1.9	362.18	1874.99
East	3077	10 year	52.4	145.9	147.19	147.73	148.78	0.053721	5.58	9.38	11.28	1.95	407.97	2278.36
East	3077	25 year	64.3	145.9	147.33	147.89	149.05	0.053237	5.81	11.07	12.5	1.97	431.76	2507.78
East	3077	50 year	79.6	145.9	148.7	148.07	148.9	0.002433	2.09	51.89	52.08	0.48	42.95	89.56
East	3077	100 year	92.8	145.9	148.94	148.22	149.13	0.002043	2.07	64.74	54.65	0.45	40.65	84.13
East	3077	Regional	84.8	145.9	148.79	148.12	148.99	0.002263	2.08	56.95	53.11	0.47	41.98	87.27
East	3077	60% 2 Year	12.9	145.9	146.57	146.78	147.26	0.059092	3.69	3.49	8.67	1.86	224.61	829.32
East	3044	2 year	21.5	145.02	146.6	146.5	147.02	0.011369	2.86	7.51	7.06	0.89	101.55	290.68
East	3044	5 year	36.9	145.02	147.01	147.01	147.61	0.013898	3.43	10.76	9	1	139.94	479.75
East	3044	10 year	52.4	145.02	147.35	147.35	148.06	0.0127	3.73	14.31	12.1	0.98	155.23	578.85
East	3044	25 year	64.3	145.02	147.6	147.6	148.36	0.011465	3.87	17.73	15.26	0.95	160.15	620.29
East	3044	50 year	79.6	145.02	147.9	147.9	148.69	0.010499	3.99	22.85	20.16	0.92	164.12	655.62
East	3044	100 year	92.8	145.02	148.1	148.1	148.94	0.00997	4.15	27.28	25.24	0.91	171.8	713.69
East	3044	Regional	84.8	145.02	148	148	148.79	0.010004	4.03	24.86	22.6	0.91	164.07	660.59
East	3044	60% 2 Year	12.9	145.02	146.33	146.18	146.59	0.008873	2.26	5.7	6.49	0.77	67.09	151.82
East	3005	2 year	21.5	144.7	146.31		146.55	0.007145	2.17	9.89	10.59	0.72	59.88	130.22
East	3005	5 year	36.9	144.7	146.69	146.47	147.04	0.007546	2.59	14.22	12.02	0.76	79.09	205.22
East	3005	10 year	52.4	144.7	147.01	146.76	147.43	0.007631	2.89	18.11	12.94	0.78	93.39	270.18
East	3005	25 year	64.3	144.7	147.23	146.96	147.7	0.007738	3.04	21.12	14.02	0.79	101.19	308.12
East	3005	50 year	79.6	144.7	147.51	147.21	148.01	0.007718	3.16	25.22	15.79	0.8	106.74	336.92
East	3005	100 year	92.8	144.7	147.12	147.41	148.26	0.0191	4.72	19.66	13.34	1.24	244.79	1155.42
East	3005	Regional	84.8	144.7	147.58	147.29	148.11	0.007557	3.21	26.5	19.12	0.79	108.87	349.45
East	3005	60% 2 Year	12.9	144.7	146.05		146.21	0.006704	1.79	7.2	9.99	0.67	44.08	79
East	2965	2 year	21.5	144.62	145.72	145.72	146.1	0.014467	2.72	7.91	10.45	1	99.78	271.19
East	2965	5 year	36.9	144.62	146.06	146.06	146.58	0.01337	3.17	11.63	11.32	1	123.4	391.53
East	2965	10 year	52.4	144.62	146.35	146.35	146.97	0.012716	3.49	15	12.05	1	140.73	491.47
East	2965	25 year	64.3	144.62	146.55	146.55	147.24	0.012361	3.69	17.43	12.55	1	151.65	559.29
East	2965	50 year	79.6	144.62	146.78	146.78	147.56	0.011683	3.92	20.42	14.36	0.99	163.87	642.47
East	2965	100 year	92.8	144.62	146.96	146.96	147.81	0.0109	4.08	23.31	16.43	0.98	170.93	697.27
East	2965	Regional	84.8	144.62	146.85	146.85	147.66	0.011397	3.99	21.5	15.17	0.99	167.23	667.27
East	2965	60% 2 Year	12.9	144.62	145.48	145.48	145.76	0.015858	2.37	5.45	9.6	1	82.97	196.39
East	2930	2 year	21.5	143.84	144.86	144.97	145.33	0.023043	3.08	7.53	14.2	1.24	135.48	417.78
East	2930	5 year	36.9	143.84	145.08	145.26	145.8	0.024004	3.84	10.79	15.3	1.33	190.52	732.43
East	2930	10 year	52.4	143.84	145.7	145.53	146.13	0.007093	3.01	21.36	18.58	0.79	97.43	293.51
East	2930	25 year	64.3	143.84	146.01	145.7	146.42	0.005435	2.99	27.36	20.35	0.72	90.37	270.64
East	2930	50 year	79.6	143.84	146.51	145.91	146.87	0.003533	2.84	39.16	27.8	0.6	75.11	213.66
East	2930	100 year	92.8	143.84	145.68	146.07	147.06	0.023539	5.43	20.93	18.47	1.44	318.22	1727.85
East	2930	Regional	84.8	143.84	146.84	145.97	147.14	0.002462	2.6	49.28	39.99	0.51	59.98	155.96
East	2930	60% 2 Year	12.9	143.84	144.71	144.76	145.02	0.021171	2.47	5.46	13.45	1.14	94.81	233.73
East	2906	2 year	21.5	143.48	144.86	144.47	144.99	0.003577	1.65	13.03	13.1	0.53	33.27	54.87
East	2906	5 year	36.9	143.48	145.24	144.79	145.45	0.00387	2.01	18.34	14.34	0.57	45.7	91.94
East	2906	10 year	52.4	143.48	145.71		145.93	0.003092	2.07	25.31	15.63	0.52	45.12	93.42
East	2906	25 year	64.3	143.48	146.03		146.26	0.002717	2.11	30.88	22.74	0.49	44.8	94.34
East	2906	50 year	79.6	143.48	146.56		146.75	0.001697	1.97	47.56	35.54	0.41	35.95	70.71
East	2906	100 year	92.8	143.48	146.33	145.61	146.67	0.003361	2.59	39.48	33.22	0.56	64.33	166.44
East	2906	Regional	84.8	143.48	146.89		147.04	0.001177	1.79	59.2	35.54	0.35	28.38	50.68
East	2906	60% 2 Year	12.9	143.48	144.52	144.26	144.63	0.004103	1.46	8.86	12.03	0.54	28.55	41.57

Appendix C

Fluvial Geomorphology

APPENDIX C: GEOMORPHIC ASSESSMENT

1. Introduction

The City of Mississauga initiated a Class Environmental Assessment to identify and select alternative methods for addressing failing erosion control works along 1037 m of Sawmill Creek between Folkway Drive and Erin Mills Parkway (**Figure 1-1**). Through the City of Mississauga's ongoing erosion monitoring program, this section of channel has been identified as a high priority site in need of rehabilitation, based on several sites where erosion is impacting, or potentially will affect, infrastructure both within and adjacent to the watercourse. Specific concerns that have been identified in the study area include outflanked and failing gabions, trail bridges, and sanitary sewers. This study is being completed under Schedule "B" of the Municipal Class Environmental Assessment process.



Figure 1-1 - Sawmill Creek Erosion Control Study Area

From Erin Mills Parkway to Folkway Drive, Sawmill Creek flows southeast through Greenlands Park, an urban greenway. Characterization of the geomorphological conditions within this study area was undertaken to support understanding of existing conditions, to enhance understanding of the identified issues within the study area, and to inform the selection and evaluation of alternatives for erosion mitigation. The geomorphic assessment included a review of historical aerial photographs and background materials, field reconnaissance, topographic survey, and scoped data analyses. An overview of the geomorphic characterization completed for this study is provided within this technical memorandum.

2. Background Information and Historical Changes

2.1 Study Area Overview

Sawmill Creek, a tributary of the Credit River, is located almost entirely in the City of Mississauga and drains an area of 9.86 km^2 (Gore & Storrie, 1995). The entire Sawmill Creek watershed experienced rapidly urbanization. Coincident with urban growth was the piping of surface flows through the storm drainage system which first outlets into an open channel feature at Folkway Drive (i.e., the upstream limit of the current study area). Concerns regarding the long term stability of the system were identified by Gore & Storrie (1995) which prompted erosion control projects to be completed.

The study reach is located entirely within City-owned property (i.e., Arbour Green Park) which serves as valuable urban greenspace (Gore & Storrie, 1995). Recreational pathways have been established along the channel and several trail crossings occur over the creek. A sanitary sewer runs parallel to, and crosses under, the creek in 2 locations within the study area.

2.2 Background Reports

The City of Mississauga completed the Sawmill Creek Natural Channel Design Study in 1995 (Gore & Storrie) which set out a remediation plan for Sawmill Creek; the report included a series of recommendations for stabilization works to address significant bed and bank erosion problems. The section of Sawmill Creek between Folkway Drive and Erin Mills Parkway corresponds to Reach 1 of the Gore & Storrie (1995) report and was subsequently treated with erosion control works. Several significant storm events have since resulted in failure of structures including gabion baskets and concrete drop structures, causing increased erosion in unprotected areas.

Key findings documented within the Gore & Storrie (1995) report are summarized within the current study report.

2.3 Historical Conditions

A sequence of historical airphotos was obtained from the City of Mississauga (1954, 1975, 1977, 1992, and 2006). Review of aerial photography provides insight into changes that have occurred within the watershed, to the drainage network, and within the immediate study area (**Figure 2-1**). A summary of key observations is provided in **Table 2-1** and excerpts of the airphotos that focus on the study area are attached to this report.

Review of the historical aerial photography indicates that the Sawmill Creek watershed has become increasingly urbanized since the 1970s. Gore & Storrie (1995) estimate that the percentage of urbanization increased from 2% in 1977 to 45% in 1993; today (2020), the watershed is nearly entirely urbanized. Major changes (i.e., straightening and channelization) to the study area channel configuration occurred between 1975 and 1977. Gore & Storrie (1995) noted that a 10% reduction in drainage area occurred between 1954 and 1993. During this same time frame, they noted that most of the tributaries downstream of Highway 403 were replaced by sewer systems. Today (2020), the culverts at Folkway Drive mark the upstream limit of the open channel portion of Sawmill Creek.

Results from the Sawmill Creek Natural Channel Study (Gore and Storrie, 1995) indicate a reduction in channel length through the study area of 23% between 1954 and 1993. This decrease in channel length represents the overall impact to the length of the main channel and does not include any loss of tributaries. With the reduction in channel length, a reduction in channel sinuosity was reported (i.e., the sinuosity of 1.4 in 1954 was reduced to 1.1 by 1993) (Gore & Storrie, 1995)).

Historical changes within the watershed and of the drainage network may upset the equilibrium balance of a watercourse due to urban hydro-modification and change in channel slopes (i.e., steepening due to loss of channel length). A reduction in channel length due to straightening and/or removal of low order tributaries from the drainage network (i.e., elimination or piping) increases energy potential and may exacerbate hydrologic effects from urbanization (i.e., faster conveyance of water to the main branch of the channel through a storm

sewer network). At the reach scale of the study area, when there is a reduction in channel length, the slope of the realigned channel will increase (i.e., shorter distance over the same vertical elevation drop). The increased slope contributes to an increase in energy conditions within Sawmill Creek Reach 1. The implications for a loss of drainage network channel length, change to urban landuse, and storm sewer conveyance systems, have altered the hydrology and energy of flows in Sawmill Creek.

Table 2-1. Overview of Historical Changes Along Sawmill Creek in Proximity to the Study Area.

Image year	Key observations
1954	• Land use surrounding the study area was dominated by agriculture. A defined channel corridor is visible around Sawmill Creek • Irregular meander planform configuration through study area; areas of floodplain scour, meander scrolls, and secondary channels visible in downstream lengths of study area
1975	• No major change in planform configuration through study area • Construction of Erin Mills Parkway, north of study area, has occurred
1977	• Sawmill Creek straightened and channelized through study area; tributaries of Sawmill Creek through study area conveyed through sewer systems (no longer visible) • Large culverts at upstream and downstream limits of study area constructed • Pedestrian crossings through study area established; pedestrian trails adjacent to channel not yet developed • Agricultural lands surrounding study area cleared for residential developments • Construction of Glen Erin Drive (south of study area) completed to Highway 403
1992	• Residential developments along Folkway Drive and Rolling Valley Drive construction completed • Pedestrian trails adjacent to Sawmill Creek through study area have been established
2006	• No major change in channel planform configuration • No major change in urban development • Vegetation through the Sawmill Creek valley corridor through the study area has matured between 1992 and 2006



Figure 2-1. Historical Channel Planform Overlay.

3. Existing Field Conditions

Existing conditions and an understanding of channel functions and processes within Sawmill Creek were established through completing field investigations and data analyses.

3.1 Subreaches

A reconnaissance level field assessment was completed in April 2020 to document observations of channel form and processes that may contribute to the instability/failure of engineering countermeasures, to identify specific areas for inclusion in the topographic and geomorphic data collection programs, and to compile a photographic inventory of channel conditions. The geomorphic data collection field program was focused on quantification of channel dimensions and substrate materials in support of subsequent geomorphologic analyses.

Through the field reconnaissance and subsequent data analyses, it became apparent that there was spatial variability with respect to boundary materials, channel conditions, and processes within the study area. Six subreaches were defined to enable spatial organization of data and observations, to facilitate analyses, and to provide baseline understanding to inform the identification and selection of potential alternatives as part of the EA process for the erosion control works (Error! Reference source not found.). Subreach boundaries were determined primarily by a change in boundary material, and/or observed geomorphic processes. **Figure 3-1** shows the study area, including the surveyed thalweg chainage that is referenced through the remainder of this report. An overview of subreach characteristics and conditions is provided below, beginning at the downstream end of the study area; a photo log is attached at the end of this report

Subreach 1

Subreach 1 extends approximately 52 m upstream, from the double cell concrete outfall at the downstream limit of the study area. The two cells were separated by a concrete wall (i.e., pier nose extension); in front of each cell, a concrete debris fin was situated. The channel banks immediately upstream of the culvert are protected by extended concrete wing walls. Gabion mattress bank protection extended from the concrete wingwalls along both banks, through the majority of the subreach.

Substrate materials consisted of rip-rap; till was exposed at the base of the upstream facing left bank. Depositional features in the form of lateral or medial bars were observed through the subreach; a vegetated island feature comprised of angular cobble/gravel substrate extended upstream of the concrete pier nose extension. Some vegetation (shrubs) have established within the channel cross-section along other areas of sediment deposition. The average bed gradient through the subreach is 1.00%. A previously installed erosion pin was observed along the upstream facing left bank; the pin was exposed 0.34 m along its length.

One weir was situated within this subreach; the weir was covered with concrete that had broken, leaving the weir in disrepair.

Subreach 2

Subreach 2 extends approximately 189 m in length. Distinguishing features associated with the subreach are the high, near vertical unvegetated channel banks, wide channel cross-section, confined valley setting, and deep pool features (water depth measured at deeper than 1.0 m). The bed morphology of the subreach was that of a pool-riffle sequences, typically with short riffles, and long, deep pools. The average bed gradient through subreach 2 is 1.30%. Riparian vegetation was dominated by trees, shrubs, and herbaceous vegetation.

Banks were periodically protected through subreach 2 with gabion baskets; the gabion erosion control protection associated with three weirs, was in varied condition, ranging from intact to emptied and not functioning. One of the weirs located in the subreach is comprised of asphalt. Where present, areas of natural channel banks were commonly eroded, as demonstrated in the subreach photos included in the attached photo log. A basal unit of glacial till was documented at the base of the eroded bank, in addition to exposed till on the channel bed (see further discussion in in **Section 3.4**). Substrate materials consisted of sands and small gravels; eroded till was

observed as gravel sized particles within the substrate gradation. Depositional bars (point, medial, lateral) occurred throughout the subreach; woody debris was accumulating on the medial bars.

Based on the Rapid Geomorphic Assessment (RGA), the dominant processes through subreach 2 are widening and degradation; a Stability Index (SI) value of 0.41 indicates that the subreach is 'in adjustment' and evidence of instability is widespread. Indicators of channel widening included exposed tree roots; the maximum depth of undercutting was observed to be 0.80 m.

Armourstone erosion control measures intended to protect a manhole along the south bank were failing.

Subreach 3

Subreach 3 extends for approximately 308 m in length, and is bound upstream by a pedestrian bridge crossing. The subreach was characterized by a narrower channel, low channel banks and greater floodplain access when compared to the downstream subreaches (i.e., subreaches 1 and 2). Observations of sand/silt deposition in the overbank zone and 'trash' lines in bankside vegetation confirmed floodplain connectivity through the subreach; floodplain scour was also observed. Riparian vegetation through the subreach was comprised of primarily trees and grasses. Root control was common along the channel banks through the subreach.

The existing bed morphology is that of a pool-riffle sequence; local areas of backwatered conditions were associated with large woody debris jams that filled the cross-section. Large woody debris was observed within the subreach; scour of the channel bed occurred in these locations. Several deep pools occurred in the subreach; the maximum measured pool water depth exceeded 1 m. An exposed till knickpoint in the channel bed profile was followed by a deeper than 1 m pool.

Substrate materials consisted of sands and gravel; till was commonly exposed in pools and under riffle; till was also observed as gravel sized particles within the substrate gradation, Depositional bars (point, medial, alternating lateral) occurred throughout the subreach and consisted of sand to gabion stone sized materials; woody debris was accumulating on the medial bars.

The average channel bed gradient through the subreach is 1.98%; this is the maximum average bed gradient through the entire study area. Channel banks were periodically treated with gabion basket erosion control; conditions of the gabion baskets were generally poor (i.e., emptied, deformed, failed). Unprotected banks exhibited undercutting (max 1.0 m deep) and/or active erosion.

Grade control structures in the form of gabion weirs (8) through the subreach were in disrepair, commonly demonstrating deformation, outflanking, and loss of gabion materials; gabions were also perched along the profile. Two stormwater outfall channels discharged into the creek; exposed reddish shale (Queenston formation) was observed in the banks of the channels.

Based on the Rapid Geomorphic Assessment (RGA), the dominant process through subreach 3 was widening; a Stability Index (SI) value of 0.19 indicates that the reach is 'in regime'.

Subreach 4

Subreach 4 extends approximately 421 m upstream of the most downstream pedestrian bridge crossing. The walking trail was in close proximity to the creek in several locations. Similar to subreach 3, subreach 4 was generally characterized by low channel banks and a well-connected floodplain. Riparian vegetation was dominated by trees and herbaceous plants; some trees had fallen or were leaning. A maximum undercut, located at exposed tree roots, was measured at 1.8 m deep.

Substrate materials were primarily dominated by angular cobble sized substrate (gabion stone). Alternating bars were documented through the reach as depositional features. The reach was dominated by natural channel banks that appeared to be well connected to the floodplain. Exposed glacial till was present as the basal bank unit along eroded channel banks, extending into the channel along the bed, similar to Reach 2. Some nodules of glacial till were identified in the channel substrate. Boundary materials within the study area are discussed further in **Section 3.4**.

Subreach 4 includes two formal pedestrian bridge crossings and one low-level bridge crossing. Deterioration of the erosion control, undercutting of bridge abutments, and areas of bank erosion associated with each pedestrian bridge was noted as a concern in this reach.

There were 5 grade control weir structures were in disrepair or not functional; several weirs were perched above the water level. Channel banks were engineered with gabion baskets in proximity to grade control weirs. Based on the Rapid Geomorphic Assessment (RGA), the dominant process through Reach 3 was widening; a Stability Index (SI) value of 0.19 indicates the reach is 'in regime'.

Subreach 5

Subreach 5 extends for approximately 95 m. The reach is distinguishable from other reaches in Sawmill Creek due to the long pool/ backwatered condition that extends throughout the majority of its length.

The dominant channel bed gradient through this subreach is 0.07%. In the downstream sections of this subreach, the channel is situated in an overwide cross-section, which narrows in the upstream direction; the channel was generally well connected to a floodplain which demonstrated areas of scour and of sand/silt deposition. Backwatered conditions through Reach 5 may be due to the low-lying pedestrian bridge crossing in Reach 4. Riparian vegetation was dominated by trees and shrubs; root control was observed on the channel banks.

Deposition of fine silt and sand materials along the channel bed was common through subreach 5; likely accumulating due to the backwatered effect and low gradient. Sand dominated medial and lateral depositional bars were documented through the reach. Substrate was dominated by sand, gravel, and some cobble sized gabion stone.

Similar to most of the study area, the channel banks were periodically lined with gabion erosion control protection; gabions were in disrepair or emptied through Reach 5. Where natural channel banks were present, exposed tree roots were visible along the channel banks.

Subreach 6

Subreach 6 consists of approximately 47 m of concrete lined channel extending downstream of the four cell Sawmill Creek stormwater outlet at Folkway Drive.

Although the reach is structurally controlled, sediment deposition within the channel has occurred, particularly surrounding the four energy dissipators at the upstream outlet and along the north side of the concrete lined channel. Vegetation (shrubs) has established within the channel cross-section on the depositional areas.

A defined active channel had formed and was situated along the south side of the flood conveyance channel.



Figure 3-1. Existing conditions.

3.2 Channel Planform and Profile

Through the study area, Sawmill Creek is situated within a valley setting. The planform configuration of Sawmill Creek is confined in its valley and exhibits a relatively low sinuosity; a reflection of the historical straightening and alteration of the system due to urbanization and installation of subsurface infrastructure.

The channel bed profile was surveyed along the thalweg of the reach for the purpose of the geomorphic assessment (**Figure 3-1**). The thalweg typically meanders within the channel and thus the length of the thalweg profile is longer than the reach. The thalweg profile provides additional detail of channel bed configuration and controls and is therefore appropriate for the geomorphic assessment. **Figure 3-2** clearly reveals that there is variability in the channel bed profile with respect to bed morphology, slope trends, and the presence of vertical drops (i.e., gabion grade control weir structures) in elevation. The bed profile is influenced by the erosion and grade control measures implemented in the reach. Pool features are common directly downstream of grade control weirs structures.

The overall gradient of the study area is 1.58%. Slope units were defined along the profile, as demonstrated in **Figure 3-2**. Reach 5 had the lowest grade within the study area (0.07%) which contributed to the extensive backwater conditions in the reach. Through Reaches 2, 3 and 4, the bed grade ranged from 1.30 – 1.69%, with locally steeper sections There were 19 weirs situated along the study area; these provide local controls on channel bed grade.

3.3 Cross-Sections

As part of the geomorphic channel assessment, fifteen cross-sections were surveyed and assessed (**Figure 3-2**). The geomorphic characterization of cross-section form was limited to Reaches 2 to 5, as Reaches 1 and 6 were structurally controlled by concrete or gabion lined channels associated with the culvert inlet and outlet structures of the flood conveyance channel. **Table 3-1** provides an overview of the channel dimensions based on the surveyed cross-sections. Cross-sections through the study area were generally symmetrical in shape. The average bankfull width and depth dimensions were 6.51 m and 0.54 m, respectively. These bankfull dimensions correspond well to those reported by Gore and Storrie (1995) (i.e., bankfull width of 6.1 m, and bankfull depth of 0.53 m). This suggests relatively minimal change to the sections since 1995, with some widening apparent.

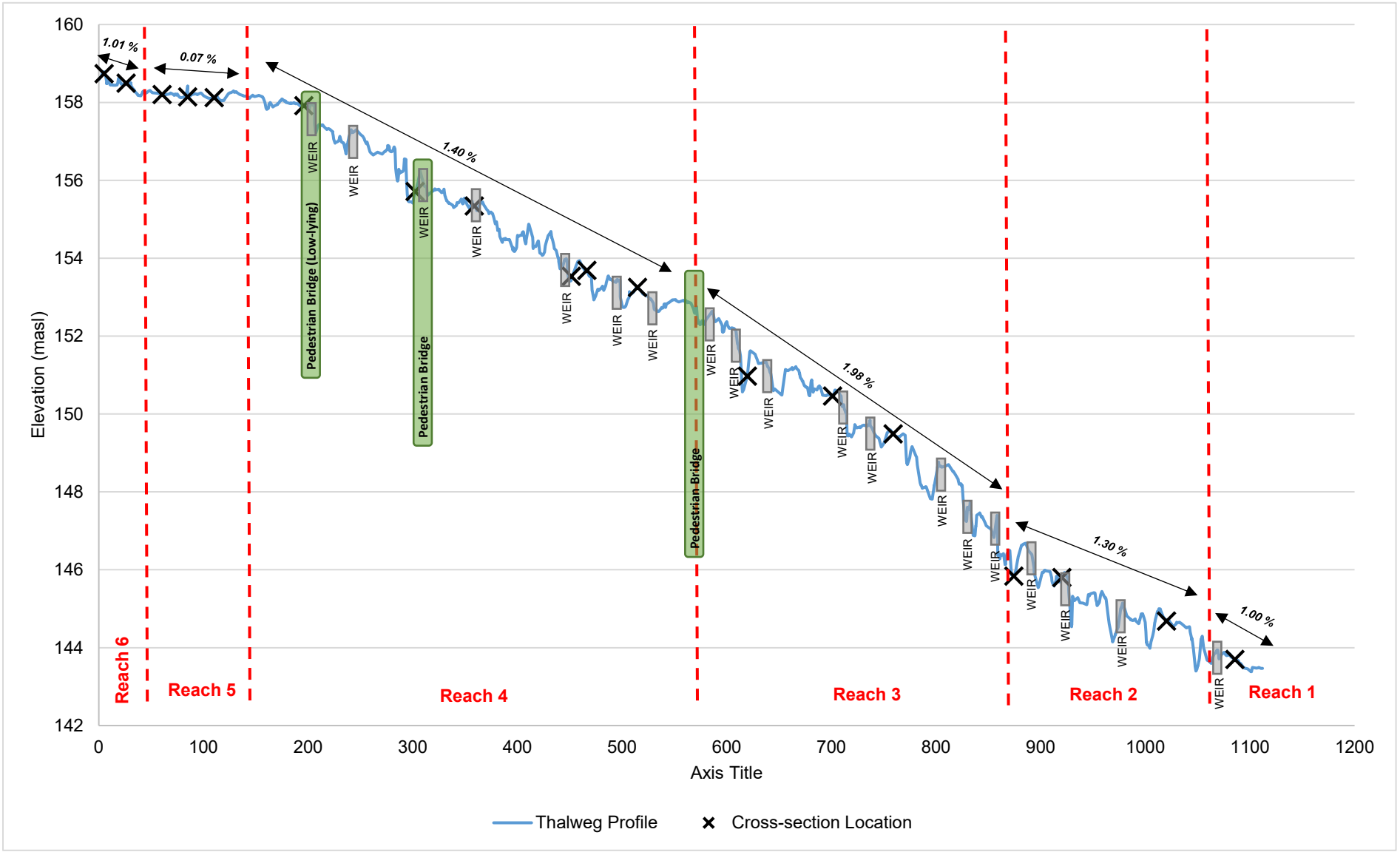


Figure 3-2. Channel bed profile with cross-section locations.

Table 3-1. Overview of Channel Cross-section and Substrate Measurements.

	Reach 2		Reach 3		Reach 4		Reach 5				
Number of sections	**3**		**3**		**6**		**3**				
	Range	**Avg.**	**Range**	**Avg.**	**Range**	**Avg.**	**Range**	**Avg.**	**Min**	**Max**	**Avg.**
Section Length (m)	15.38 – 23.85	18.77	15.30 – 18.40	17.18	15.43 – 22.75	18.49	17.48 – 26.63	21.20			
Bankfull Dimensions											
Width (m)	5.08 – 6.15	5.64	5.80 – 9.70	7.57	5.18 – 8.18	6.49	4.41 – 9.74	6.39	4.41	9.74	6.51
Max Depth (m)	0.64 – 1.58	1.06	0.36 – 0.76	0.55	0.47 – 0.93	0.68	0.59 – 0.69	0.62	0.36	1.58	0.72
Avg Depth (m)	0.61 – 1.10	0.85	0.25 – 0.45	0.32	0.31 – 0.64	0.49	0.44 – 0.70	0.57	0.25	1.10	0.54
Area (m^2)	3.11 – 6.30	4.87	1.47 – 4.37	2.55	1.77 – 3.93	3.10	2.54 – 4.28	3.44	1.47	6.30	3.41
Width: Depth Ratio (m/m)	5.16 – 8.32	6.91	21.54 – 28.72	24.38	8.13 – 22.17	14.71	7.14 – 22.18	12.33	5.16	28.72	14.61
Perimeter (m)	7.52 – 10.85	8.88	8.41 – 10.76	9.25	6.02 – 10.20	7.66	14.49 – 15.84	15.11	6.02	15.84	9.71
Hydraulic Radius (m)	0.29 – 0.84	0.58	0.17 – 0.41	0.26	0.27 – 0.55	0.42	0.17 – 0.30	0.23	0.17	0.84	0.38
Wetted Channel Dimensions											
Width (m)	2.51 – 5.12	3.98	4.05 – 4.45	4.28	3.98 – 5.50	4.78	4.09 – 8.93	21.01	2.51	8.93	4.71
Max Depth (m)	0.09 – 0.58	0.29	2.29 – 3.02	2.76	0.15 – 0.45	0.28	0.18 – 0.26	20.91	0.09	3.02	0.84
Avg Depth (m)	0.16 – 0.81	0.41	1.04 – 1.36	1.24	0.24 – 0.73	0.43	0.26 – 0.31	0.86	0.16	1.36	0.58
Perimeter (m)	3.82 – 6.05	5.03	15.75 – 19.18	17.77	5.23 – 6.33	5.63	4.54 – 9.87	6.50	3.82	19.18	8.49
Substrate											
	Bar Feature		**Riffle**	**Pool**	**Riffle**	**Pool**	**Run**				**ALL**
D5	10		10	5	10	5	5				5
D10	15		10	5	10	10	10				5
D16	15		10	10	10	10	10				10
D25	15		15	10	15	10	20				15
D35	20		20	15	20	15	20				20
D50	25		30	20	30	20	40				30
D65	35		55	20	60	40	70				50
D75	65		70	30	70	50	75				70
D84	80		90	60	80	70	90				80
D90	100		100	70	90	90	90				90
D95	125		100	70	110	90	100				100

3.4 Boundary Materials

Along much of the study reach, engineering measures occur along the channel banks and/or bed. These measures included concrete and gabion baskets. Bank protection was present on one or both channel banks throughout the 1112 m of surveyed channel.

Of the 2074 m of total channel bank length in the reach (i.e., 1037 m long reach), 39% of the banks were hardened. Where not protected, high eroded channel banks demonstrated exposed glacial till as the basal boundary unit. Till composition varied from harder grey till to softer beige coloured till. Overtop of the native material was modern alluvium; commonly a mix of sand and soil with some gravel. The boundary materials found during field investigations confirm the surficial geology of the study area, which is dominated by alluvium surrounding Sawmill Creek corridor, with areas of glacial till.

Rooting depth of bankside vegetation varied through the study area; along a high vertical bank as shown in the images below, a rooting depth of 0.6 m from the top of the bank was measured, associated with the grasses, herbaceous and shrub vegetation.



Eroded vertical bank; glacial till basal unit (grey).



Eroded vertical bank; dominated by sand materials, with some glacial till on bank toe/channel bed.

3.5 Hydro-geomorphic Conditions

The updated hydraulic model of the study area was used as a basis for the hydro-geomorphic assessment. Since the intent of the analyses was to examine existing hydraulic conditions, the existing (rather than future) flows were used for the assessment. Results of the assessment are summarized in **Table 3-2** and discussed below.

Channel Capacity

The flow events that are contained in the cross-sections, and those that begin to access the floodplain, were examined in the HEC-RAS model. Results indicated variability within the study area. The capacity of the concrete-lined channel in subreaches 1, 2, 5 and 6 was sufficient to contain from the 25 year flow to the Regional flow. In subreaches 3 and 4, the bankfull flow was near the bank elevation, or spilled onto the adjacent floodplain; other sections of subreach 3 conveyed somewhat larger flows. When larger than bankfull flows remain within a channel, then the energy of those flows is available for erosion.

Table 3-2. Hydraulic Parameters and Potential Sediment Mobility During 60% of the 2 Year Flow Event.

HEC Stn	Flow Event Capacity of section	60% of 2-year flow	Velocity (m/s)	Froude	Stream Power (W/m^2)	Estimated Stream Type	Shear stress (N/m^2)	Grain Entrainable (m)	Grain Transportable (m)	Entrenchment Ratio
REACH 6										
3860	Regional	12.9.0	1.88	0.66	88.64	Braided	47.13	0.058	0.134	1.38
REACH 5										
3832	50 year	12.90	0.88	0.3	8.49	Meandering	9.69	0.012	0.026	1.39
3787	25 year	12.90	1.80	0.57	70.77	Braided	39.33	0.049	0.122	1.47
3737	60% 2 year	12.90	1.23	0.40	22.41	Braided	18.27	0.023	0.053	2.29
REACH 4										
3691	60% 2 year	12.90	2.26	1.00	173.45	Braided	76.75	0.095	0.200	1.38
3660	60% 2 year	12.90	2.89	1.29	370.58	Braided	128.1	0.158	0.341	3.86
3630	60% 2 year	12.90	2.40	0.95	195.89	Braided	81.48	0.101	0.228	3.08
3582	2 year	12.90	2.98	1.09	352.24	Braided	118.37	0.146	0.364	3.40
3528	2 year	12.90	2.69	1.22	301.24	Braided	111.94	0.138	0.292	4.32
3466	> 60% 2 year	12.90	2.2	0.77	140.13	Braided	63.64	0.079	0.188	3.12
3382	> 60% 2 year	12.90	2.35	0.98	188.95	Braided	80.27	0.099	0.217	4.41
REACH 3										
3315	5 year	12.90	2.38	1.03	202.28	Braided	85.17	0.105	0.224	3.26
3272	2 year	12.90	2.06	0.85	126.59	Braided	61.38	0.076	0.163	3.08
3226	> 60% 2 year	12.90	2.57	0.87	217.9	Braided	84.86	0.105	0.264	3.03
3191	2 year	12.90	2.67	1.31	306.4	Braided	114.85	0.142	0.287	4.03
3145	2 year	12.90	2.33	0.99	187.87	Braided	80.51	0.099	0.213	3.17
REACH 2										
3089	2 year	12.90	3.35	1.5	576.62	Braided	171.9	0.212	0.470	3.18
3077	25 year	12.90	3.69	1.86	829.32	Braided	224.61	0.277	0.580	6.01
3044	10 year	12.90	2.26	0.77	151.82	Braided	67.09	0.083	0.200	3.11
3005	50 year	12.90	1.79	0.67	79.00	Braided	44.08	0.054	0.120	1.58
2965	25 year	12.90	2.37	1.00	196.39	Braided	82.97	0.102	0.222	1.50
REACH 1										
2930	25 year	12.90	2.47	1.14	233.73	Braided	94.81	0.117	0.242	2.07
2906	25 year	12.90	1.46	0.54	41.57	Meandering	28.55	0.035	0.077	2.95

Floodplain Connectivity

The connectivity of the channel to the floodplain determines whether flood flow energy remains largely focused within the channel cross-section, or becomes dissipated on the floodplain. That is, while the analyses of channel capacity indicated that the bankfull flows locally overtop the channel banks in subreaches 3 and 4, the configuration of the floodplain adjacent to the banks determines how far flood waters extend into the floodplain. The assessment of floodplain connectivity thus provides insight into which flow events tend to continue to exert an influence on in-channel processes/dynamics by remaining confined in a larger channel cross-section and those which flow events spill onto the floodplain. Examining channel and floodplain interactions is especially relevant in urban systems where an increase in water depth and energy conditions within the creek can increase erosive conditions beyond a threshold of tolerance.

Entrenchment ratio, as defined by Rosgen (1994) is the ratio of the flood width at twice the bankfull depth (~ equivalent to the 50 year flood event) to the bankfull width. Rosgen (1994) suggests that when the ratio is < 1.1, then flows are 'entrenched' and remain within the cross-section; ratios 1.2 – 1.4 indicate moderate entrenchment, and ratios larger than 1.4 indicate partial entrenchment. Review of **Table 3-2** reveals that the entrenchment ratio is above 1.4 through the majority of the study area and extends to 6.01. Overall, the study area is not considered to be entrenched and the energy of larger than bankfull flows is generally dissipated on the floodplain, with the exception of Subreaches 1, 6, and upstream portion of Subreach 5. While, by definition, Sawmill Creek Subreach 1 is not considered to be entrenched, it is considered to be incised (subreach 2) and to be situated within a larger flow conveyance channel.

Stream Power, Shear Stress, and Sediment Entrainment Potential

A summary of the hydraulic conditions associated with the estimated bankfull (60% of the 2 year) flows are provided in **Table 3-2**. Review of the table indicates that the flow energy (i.e., stream power) of the estimated bankfull flow is generally high; values are highest in Subreach 2 and 4. The stream power values are within the naturally occurring range associated with braided type channels as per established stream power classifications (Brookes (1988), Nanson and Croke (1992)).

The shear stresses exerted on the channel bed demonstrate similar trends as the stream power.

The grain sizes that are, theoretically, entrainable during estimated bankfull flows ranged from 12 to 280 mm throughout the entire study area. The largest potential entrainment size occurs in subreach 2, followed by subreach 4. From the field measured pebble count data (Table 3-1), the collated substrate gradation (i.e., from subreaches 2 – 5), included a D50 of 30 mm and D84 of 80 mm. Clearly, the potential for entrainment exceeds the observed grain size, during bankfull flows. This infers high erosion potential mobility of channel bed materials especially in those subreaches where the channel is oversized and conveys larger than bankfull flows.

3.6 Geomorphic Processes

Geomorphic understanding of Sawmill Creek through the study area was gained through completing a review of background documents, a field investigation, and data analyses. A summary of geomorphic processes that affect channel stability and erosion is provided in this section.

The profile of all watercourses tends to exhibit a concave up configuration and is adjusted (or works to adjust) to a downstream base level control point. Base level control points are elevation points along the channel, and typically occur at the mouth of the channel or along 'hard' points along the profile (i.e., weirs, bridge crossings). The elevation of this point either does not change, or changes very gradually (e.g., lower lake levels over time). Through the study area, Sawmill Creek has 19 grade control weir structures; the original intent of these features is unclear as only two coincide with the occurrence of underlying sanitary sewer crossings. These structures can create local base level controls to which the upstream channel bed profile becomes adjusted. Review of the channel profile of Sawmill Creek through the study area reveals the formation of pool features surrounding grade control weirs, which may suggest this adjustment to the engineered profile.

The historical changes in channel length and flows that accompanied urban development have altered the flow regime and channel processes of Sawmill Creek. Gore & Storrie (1995) indicated a reduction in channel length through the study area at 23% between 1954 and 1993 (straightening of Sawmill Creek occurred between 1975 – 1977).

Review of the potential channel capacity through the study area indicates that the estimated bankfull flows are contained within the cross-section through the majority of the study area, but are near bankfull elevation or overtop the banks in subreaches 3 and 4. These subreaches, where bankfull flows spill from the channel cross-section are those, where the adjacent floodplain is more accessible to channel flows and outflanking of weirs occurs.

Review of the HEC-RAS data and associated analyses indicated that relatively high energy conditions occur throughout the study area, with local areas of moderate energy. When the stream power conditions were compared to stream type classifications (e.g. Nanson and Croke, 1988), then it was evident that through most of the study area, the naturally stream type was a braided channel (**Table 3-2**); this is not consistent with the observed stream type in the study area, as is likely represented of the engineered state of the channel.

4. Recommendations

Through the review of background materials and the geomorphic assessment completed for the study area, several recommendations have been identified for consideration when developing alternative solutions to address the failing erosion control materials and grade control structures. A summary of general and specific considerations for enhancement of existing conditions, while addressing the failing erosion control works is provided in tables **Table 4-1** and **Table 4-2**.

Table 4-1. Key Issues Affecting the Study Area Along Sawmill Creek.

Key Issue	Description
Native Till Material	The study area is underlain by glacial till. Through the majority of the study area, the native till was protected by an accumulation of alluvium along the channel bed and banks. Gradual lowering/downcutting of the channel bed in the study area could lead to the exposure of native glacial till on the channel bed and undermining of erosion control measures (i.e., gabion baskets and large angular stone banks). Continued protection (i.e., cover) of the till is necessary to protect infrastructure which crosses the channel (sewer crossings). Since the open channel of Sawmill Creek begins at the stormwater outlet at Folkway Drive, the only supply of coarse sediment occurs from within the study area. Access to natural materials is limited by erosion control measures. Fine sediment enters the creek from all stormwater outfalls. Therefore, there is a limited volume available to replenish any substrate materials that are transported downstream.
Channel capacity	Review of the hydraulic model results indicates that, except for subreaches 4 and 5, the estimated bankfull flows are generally contained within the channel; this indicates that the cross-sectional area may be oversized for the frequent flows that are regularly conveyed through the study area. Reconnecting the channel to the adjacent floodplain may reduce erosive forces concentrated within the channel cross-section. Any proposed alternatives must not cause an increase to the regional flood elevations
Channel Type	Review of hydraulic model results indicate relatively high energy conditions (stream power) through the Sawmill Creek study area. The stream power values are within the naturally occurring range associated with braided type channels as per established stream power classifications (Brookes (1988), Nanson and Croke (1992)). This does not reflect the meandering channel type of Sawmill Creek. The reduction of energy conditions through the study area will reduce erosive conditions within the channel cross-section.
Flow management	The thalweg of the flow is oriented towards, or along, the channel bank in several areas; this exacerbates erosive stresses leading to the failure of bank erosion control measures.

	Management of the flow trajectory should occur as part of any restoration work, to direct the flow away from areas where risk to structures or property may occur.
Channel form and function	The form and function of Sawmill Creek have been altered and constrained. This includes a loss of sediment supply, loss of diversity in cross-section, planform, and profile. Hydraulic conditions increase the potential of substrate entrainment. Re-establishment of channel form and function, in support of aquatic habitat creation, and flow management is recommended. Naturalization of the channel banks provides roughness to the flow (i.e., flow energy reduction), a source of sediment to downstream subreaches, and a benefit to both terrestrial and aquatic habitat. Opportunities exist to enhance the morphological form and function of the study area.

Table 4-2. Subreach Specific Recommendations for Enhancement.

Subreach	Recommendations
1	• Repair and/or replace gabion lining along channel banks to maintain erosion control where necessary. Consider establishing defined bankfull channel if feasible, and enlarging cross-section to reduce erosive stresses
2	• Remove broken concrete grade control weir structure and re-establish natural channel profile. Repair and/or replace gabion erosion control banks, commonly associated with weirs, which are deformed and/or not functioning, with alternative erosion control materials that can respond to erosive forces and enhance environmental benefits • The creek is spatially constrained; where possible, re-connect channel to adjacent floodplain (south bank) to reduce energy conditions (stream power) and erosive forces (shear) concentrated on channel bed and banks • Incorporate measures to reduce flow energy • Provide alluvial cover over glacial till to prevent further incision and disconnection from the floodplain • Incorporate measures to reduce flow energy
3	• Repair and/or replace gabion erosion control banks which are deformed and/or not functioning with alternative erosion control materials that can respond to erosive forces and enhance environmental benefits • Remove failed grade control weirs structures and re-establish natural channel form and function (profile and cross-section) while maintaining grade control • Manage and/or remove large woody debris jams which are causing bank erosion, channel widening, and local backwatered conditions • Stabilize channel bed at knickpoint to prevent upstream migration and risk to weirs.
4	• Repair and/or replace gabion erosion control measures which are deformed and/or not functioning as intended with alternative erosion control materials that can respond to erosive forces and enhance environmental benefits • Remove broken concrete low level crossing and re-establish natural channel profile • Repair erosion control associated with pedestrian bridge crossings that have deteriorated/failed; potentially consider replacement of pedestrian bridges with larger span • Increase cross-section width to accommodate bankfull flows and reduce overbank flooding for frequent flows Incorporate measures to reduce flow energy
5	• Repair and/or replace gabion erosion control banks which are deformed and/or not functioning with alternative erosion control materials that can respond to erosive forces and enhance environmental benefits • Address backwatered conditions by re-establishing natural channel function and form through enhancement of channel bed profile (i.e., development of riffle-pool profile)
6	• Manage accumulation of sediment, and associated vegetative growth, directly downstream of Sawmill Creek outlet (Folkway Drive) • Maintain a defined bankfull channel and incorporate a pool, if possible, to support aquatic habitat

5. Summary

A geomorphological assessment was completed for the section of Sawmill Creek that extends from Folkway Drive to the downstream outlet east of Erin Mills Parkway. The intent of the assessment was to document existing conditions and to gain an understanding of channel functions and processes within the study area. The geomorphic assessment included a review of background materials, a review of historical aerial imagery, field investigations, and data analyses.

Sawmill Creek, including the study area, has been the focus of previous study, dating back to 1995 (Gore & Storrie). Background information provides a context and understanding of existing conditions. Findings from the field assessment led to the delineation of six subreaches within the study area, based on dominant channel configuration, engineered works, and channel processes. The dominant processes within each subreach included channel widening and long-term channel bed lowering. Key controls on the configuration of Sawmill Creek included channel bank erosion control protection (gabions), grade control structures along the channel profile (gabion or concrete weirs), underlying glacial till, and the urban influence of the surrounding landscape.

Results from analyses indicated that the channel cross-section capacity generally conveys the bankfull flows; however, larger flows up to the Regional event are contained within the channel locally. Thus, the erosive forces associated with such flows are concentrated on the channel bed and banks and are able to entrain sediment that is larger than observed on the channel bed. This high energy condition of the channel is reflected through hydraulic modelling results in both stream power and shear stress.

Key factors that affect morphological form and function, and those which contribute to the failure of erosion and grade control materials within the study area were identified. Considerations for the identification and evaluation of alternatives were provided.

6. References

Brookes, A. 1988. *Channelized Rivers: Perspectives for Environmental Management.* Toronto: John Wiley & Sons, 326 pp.

Gore & Storrie. 1995, March. Sawmill Creek Natural Channel Design Study. Final Report. Volume 1: Main Report. Report for City of Mississauga

Nanson, G.C. and J.C. Croke. 1992. A genetic classification of floodplains. Geomorphology. 4: 459-486.

APPENDIX C ATTACHMENT
PHOTOGRAPHIC INVENTORY

Photographic Inventory April 2020 – Subreach 1

	
View upstream of Sawmill Creek at culvert inlet near Erin Mills Parkway	View of double culvert at downstream limit of study area; Sawmill Creek near Erin Mills Parkway
	
Downstream view towards Erin Mills Parkway culvert inlet; angular cobble accumulation of sediment as medial bar formation in channel.	Gabion erosion control along Subreach, extending upstream from concrete wingwalls. Gabions are generally in fair condition, with emptied cages along toe of slope.
	
Trees established in channel cross-section (toe of gabion slope protection); root control along channel bed and banks.	South bank of broken asphalt weir; low flow directed towards south bank (left bank, looking upstream).

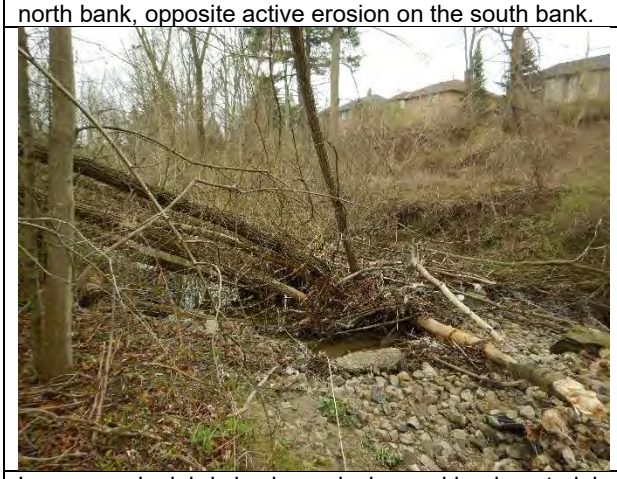
Photographic Inventory April 2020 – Subreach 2

	
Upstream view of large angular stone across channel and on channel banks; exposed filter cloth on south bank (left bank, looking upstream)	Downstream view of failed gabions and large angular stone on north channel bank (right bank, looking upstream). Bare channel bank and exposed roots.
	
Outflanked and failing armourstone bank protection, view downstream.	Downstream view of ~2 m high eroding south channel bank (left bank, looking upstream). Boulder in channel; gravel and sand deposition as medial bar.
	
Exposed glacial till at toe of eroding channel bank; weathering of material apparent in fracture lines along water surface elevation.	Upstream view of Sawmill Creek from south channel slope. Accumulation of cobble-sized angular stone in overwide channel cross-section.

Photographic Inventory April 2020 – Subreach 2

	
Failed gabion grade control structure; view from north channel bank. Emptied gabion cages in channel cross-section with large angular stone on channel banks.	Failed gabion grade control structure; view from south channel bank. Concrete-topped gabions extend up channel bank.
	
Upstream view of Sawmill Creek; fallen trees over channel cross-section.	Active south bank slumping; slump block of materials in channel cross-section with failure of mature trees.
	
Upstream view of failed grade control gabion weir across channel cross-section.	Upstream view of overwide channel cross-section; accumulations of gravel and cobble-sized materials. North bank (right bank, looking upstream) erosion.

Photographic Inventory April 2020 – Subreach 2

	
Large woody debris accumulation in channel; partial backwatering conditions in channel.	Upstream view of north channel bank erosion (right bank, looking upstream). Exposed glacial till as basal bank unit; hanging roots at top of bank.
	
Upstream view of Sawmill Creek. Accumulations of sand, gravel and cobble materials concentrated on the north bank, opposite active erosion on the south bank.	Exposure of glacial till on actively eroding channel bank (south bank). Some input of sand and gravel materials from the natural bank substrate visible.
	
Large woody debris in channel, slumped bank material and accumulation of cobble-sized substrate.	Actively eroding channel bank; slumped vegetation and sand bank materials.

Photographic Inventory April 2020 – Subreach 3

	
Upstream view of Subreach 3; narrowed cross-section, exposed roots and fallen trees on both banks.	Accumulation of woody debris in channel; fallen trees in cross-section around remnant grade control weir. Exposed glacial till on eroding/steep channel bank.
	
Accumulation of woody debris in channel; fallen trees in cross-section around remnant grade control weir. Loose gabion material in channel.	Upstream view of failed/emptied erosion control gabion bank protection on north channel bank. Lateral bar deposition
	
Development of a knickpoint feature into underlying glacial till. Feature located at failed weir grade control structure.	Upstream view of channel and valley setting. Reduced channel bank heights. Accumulation of gravel and cobble materials as lateral bar formation.

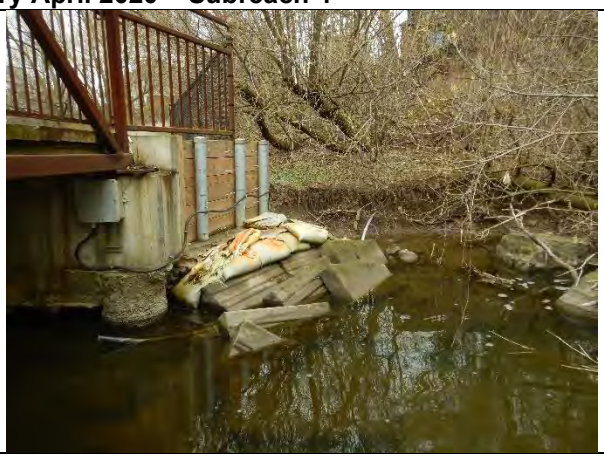
Photographic Inventory April 2020 – Subreach 3

	
Downstream view. Large tree in channel cross-section; flow concentrated to south channel bank around tree roots, causing narrowed active channel cross-section.	Downstream view of channel; increased floodplain connectivity on north channel bank with reduction in bank heights.
	
Urban debris in channel, buried by sediment materials.	Evidence of floodplain scour and outflanking of gabion erosion protection on channel bank.
	
Accumulation of fine sand and gravel sediment along gentle slope channel bank.	Failed grade control weir. Large angular stone on north channel bank (right bank, looking upstream).

Photographic Inventory April 2020 – Subreach 3

	
Upstream view of overwide channel cross-section; formal pedestrian	Stormwater outfall channel extending from north channel bank. Pedestrian bridge over drainage channel associated with pedestrian pathway.
	
Stormwater outfall channel extending from south channel bank.	Narrowed channel cross-section through gabion lined channel (banks only).
	
Upstream view of active channel bank erosion on north channel bank. Formal pedestrian pathway approximately 6 m from top of channel bank.	Upstream view of failed grade control structure; Narrowed channel cross-section upstream of weir structure. Pedestrian pathway and pedestrian bridge visible in image background.

Photographic Inventory April 2020 – Subreach 4

	
View of pedestrian bridge abutment. Undercutting of bridge on upstream south channel bank. Exposed filter cloth around large angular stone.	Erosion protection installed on upstream south bank around pedestrian bridge abutment. Channel bank erosion visible upstream of pedestrian bridge (south bank).
	
Downstream view towards pedestrian bridge. Accumulation of sediment on north channel bank toe.	Floodplain access and reduced channel bank heights (north channel bank).
	
Upstream view of failed gabion grade control weir.	Undercutting of tree and exposed roots on north channel bank.

Photographic Inventory April 2020 – Subreach 4

	
Upstream view of gabion grade control weir; concrete poured on portion of gabions.	Failed gabion bank erosion protection; emptied cage and gabion materials in channel.
	
Manhole associated with sanitary sewer system.	Upstream view towards steep/high eroding channel bank (south bank).
	
Downstream view of gabion grade control weir; concrete poured on portion of gabions.	Upstream view of planform development and channel bank scour directly downstream of failed grade control weir.

Photographic Inventory April 2020 – Subreach 4

	
Floodplain scour and accumulation of cobble and gravel side materials.	Upstream view of pedestrian bridge and weir grade control structure.
	
Downstream view towards pedestrian bridge. Proximity of channel bank to pedestrian bridge ~6-8 m.	Upstream view towards low-lying channel crossing. Narrowed channel cross-section and reduced channel bank heights.
	
View from north channel bank of low-lying crossing and weir grade control structure. Perched condition.	Upstream view towards Subreach 5; widened channel cross-section and sediment deposition along north bank.

Photographic Inventory April 2020 – Subreach 5

	
View upstream towards deposition mid-channel. Overwide cross-section and backwatering.	Upstream view of valley setting. Overwide channel cross-section and backwatered conditions.
	
Gabion based erosion protection along south valley slope toe.	Upstream view of narrowed channel cross-section; backwatered conditions continue upstream.
	
Woody debris down valley slope into channel.	Downstream view of narrowed channel cross-section.

Photographic Inventory April 2020 – Subreach 6



Upstream view towards subreach 6 transition from subreach 5.



Upstream view of transition from concrete lined channel to natural channel bed.



Upstream view towards Folkway Drive outfalls. Active channel flow concentrated to south bank concrete wingwall. Deposition of materials and vegetation establishment along north channel bank.



Energy dissipators located at Folkway Drive outfall. Vegetation has established on the energy dissipaters.



Fine deposition of materials directly downstream of outfalls.



Downstream view from Folkway Drive outfall.

Appendix D

Natural Environment

APPENDIX D: Natural Environment Existing Conditions

1. Introduction

The City of Mississauga has been engaged in ongoing erosion monitoring of Sawmill Creek and has identified several locations where erosion is affecting, or could potentially affect, infrastructure within and adjacent to Sawmill Creek. The study area for this project includes a 1030 m stretch of Sawmill Creek running southeast through Greenlands Park, from Folkway Drive to Erin Mills Parkway. The study area can be seen on **Figure 1**.

The Natural Environment Characterization was completed by ecological staff at Ecosystem Recovery Inc. between May to October 2020 for the study area comprising the 1030 m stretch of Sawmill Creek. Available background information was reviewed to enable an understanding of the natural heritage features and species that are known to, or have the potential to occur within, the study area. This information was provided by the Mississauga Natural Areas Survey EM14 (2019), Ministry of Natural Resources and Forestry (MNRF) correspondence, Natural Heritage Information Centre (NHIC) data records (MNRF, 2020) and Credit Valley Conservation Authority. Surficial Geology and Identified Features are presented on **Figure 2** and **Figure 3**.

1.1 Agency Consultation

Available natural heritage information and relevant wildlife records were requested from the Aurora District Ministry of Natural Resources and Forestry (MNRF). The MNRF was contacted on September 22, 2020, and a response has yet to be received. CVC was engaged in November 2020 to conduct a field walk to review the project conditions and to relay potential alternatives to be considered. The Ministry of Environment Conservation and Parks (MECP) has assumed responsibility for Species at Risk (SAR) and will be responsible for any permitting relating to SAR for the project at the detailed design stage.

Information on the Terrestrial and Aquatic Environment Existing Conditions within the Study Area was gathered from a combination of secondary source research, field investigations and agency consultation.

1.2 Secondary Source Information

Available secondary sources of information were collected and reviewed to determine existing Natural Environment conditions within the Study Area. The sources reviewed are outlined in Error! Reference source not found..

Table 1-1. Background Data Sources

Source	Information Reviewed
Ministry of Natural Resources and Forestry (MNRF)	Species at Risk (SAR) Natural Heritage Features Data layers, Land Information Ontario
Fisheries and Oceans Canada (DFO)	Species at Risk Fish and Mussel Maps (2019)
Natural Heritage Information Centre	Data records for study area
Ontario Breeding Bird Atlas	Species records for study area
Ontario Mammal Atlas	Species records for study area
Ontario Reptile and Amphibian Atlas	Species records for study area
Ontario Butterfly Atlas	Species records for study area
iNaturalist	Species records for study area



Sawmill Creek Erosion Control Project

Figure 1
Study Area

Legend

- Study Area
- Study Area 120 m Buffer
- Sawmill Creek

ecosystem recovery inc.
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0 50 100 200
Meters

NAD 1983 UTM 17N	1:4,000
Project: 2007 Sawmill Creek Erosion Control Date: 2021/01	N W E S

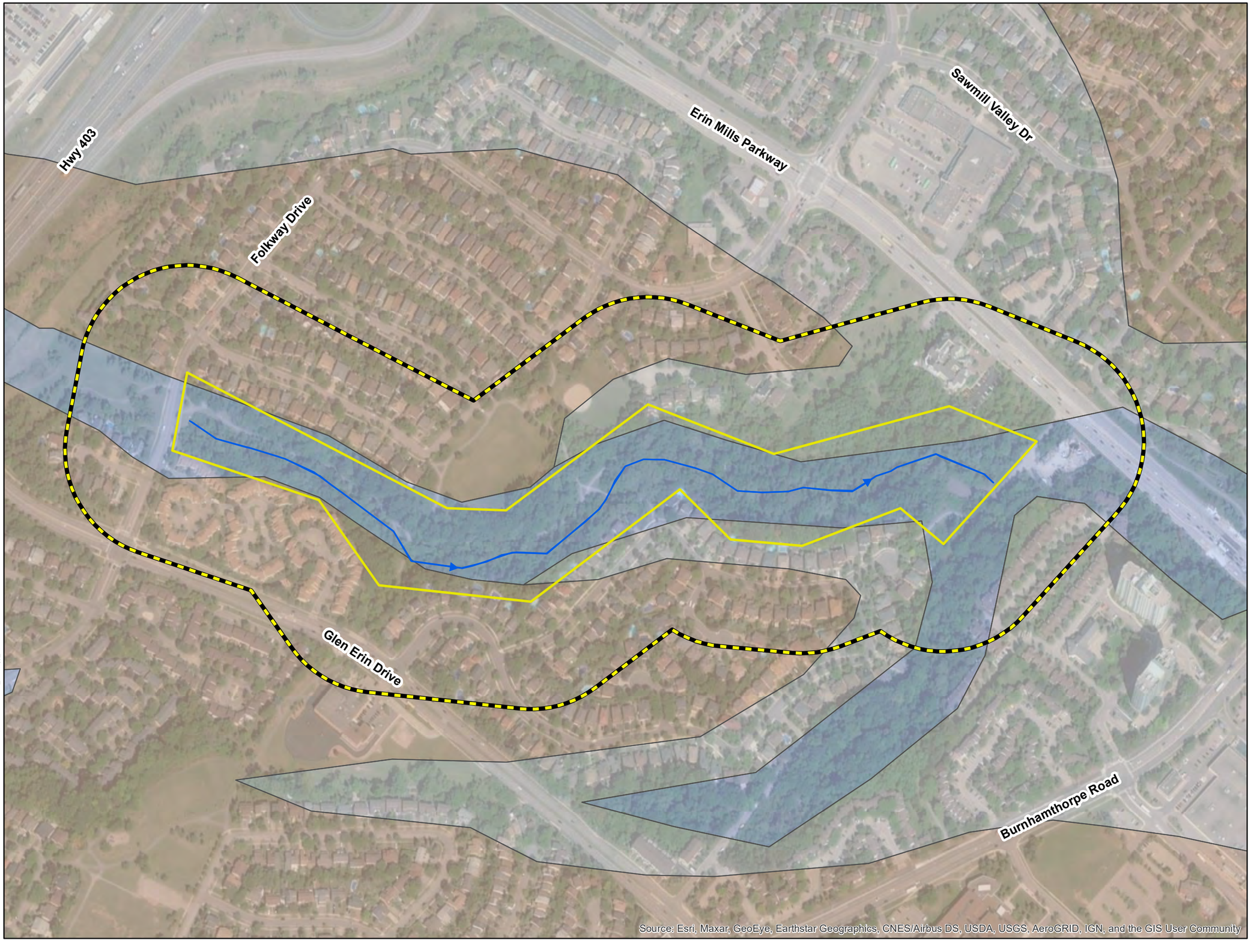
Data Sources: Ecosystem Recovery Inc., 2021, City of Mississauga Natural Areas Survey (2018)

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Sawmill Creek Erosion Control Project

Figure 2
Surficial Geology



Legend

- Study Area
- Study Area 120 m Buffer
- Sawmill Creek

Geologic Deposit

- Modern Alluvium
- Halton Till
- Bedrock

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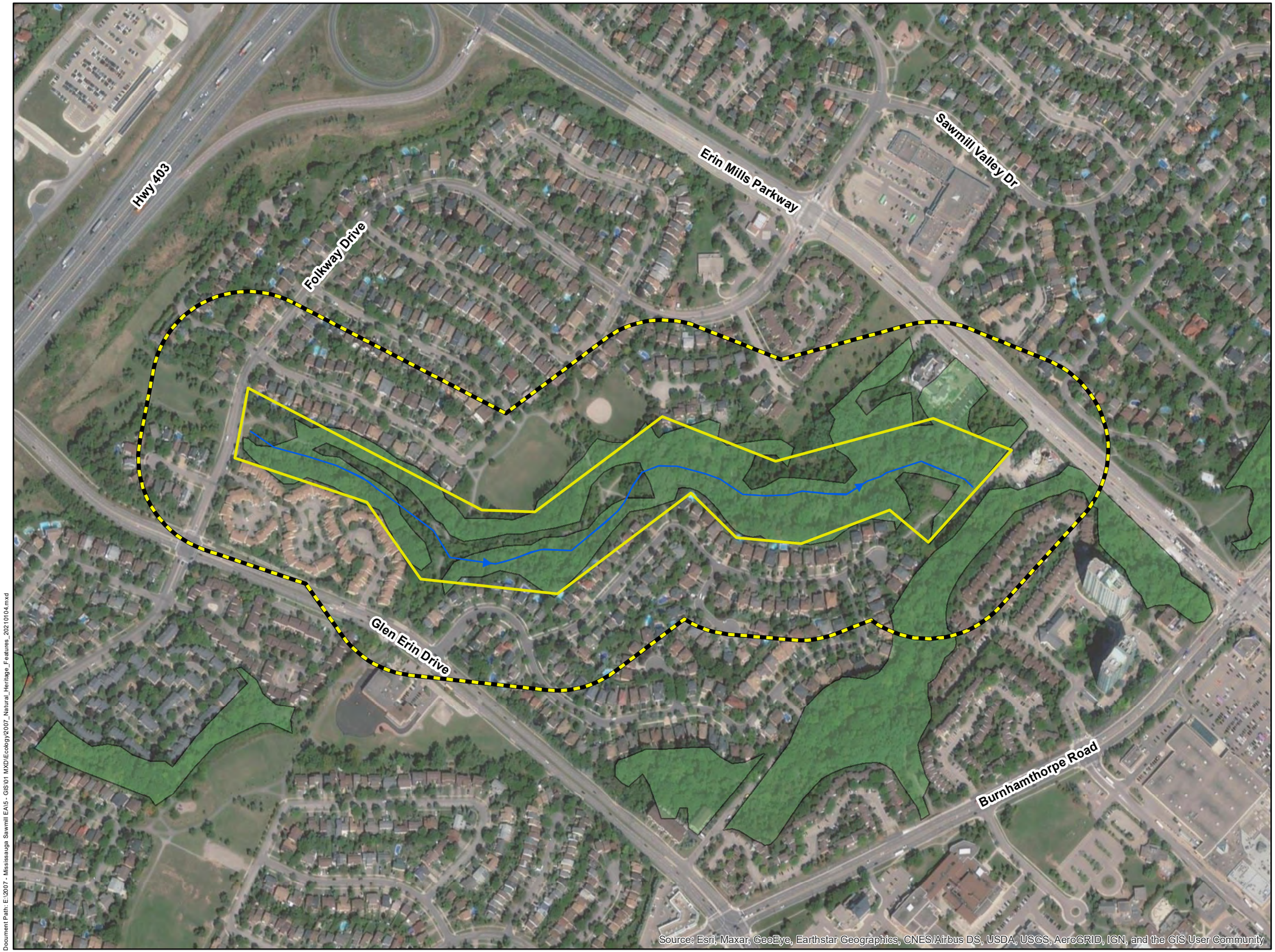
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Project: 2007 Sawmill Creek Erosion Control Date: 2021/01	N W E S

Data Sources: Ecosystem Recovery Inc., 2021, City of Mississauga Natural Areas Survey (2018)

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Sawmill Creek Erosion Control Project

Figure 3
Natural Heritage Features

Legend

- Study Area
- Study Area 120 m Buffer
- Sawmill Creek
- Wooded Area (MNRF)

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Meters

NAD 1983 UTM 17N	1:4,500
Project: 2007 Sawmill Creek Erosion Control Date: 2021/01	N W E S

Data Sources: Ecosystem Recovery Inc., 2021, City of Mississauga Natural Areas Survey (2018)

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eBird	Species records for study area
City of Mississauga Records	Natural Areas Survey EM14 2019

1.3 City of Mississauga Official Plan & Natural Areas Survey

City of Mississauga Official Plan

According to the City of Mississauga Official Plan Schedule 3 - Natural System, Sawmill Creek is classified as a Significant Natural Area and Natural Green Space. A small section near the intersection of Burnhamthorpe Road W and Erin Mills Parkway is classified as a linkage area.

The Natural Heritage System includes natural areas such as valley and watercourse corridors, meadows, woodlands, and wetlands that represent the pre-settlement landscape and include remnant parcels of native vegetation or areas that have been restored to a natural state through naturalization or successional growth. The City's Natural Heritage System is composed of the following: Significant Natural Areas; Natural Green Spaces; Special Management Areas; Residential Woodlands; and Linkages.

Significant Natural Areas are areas that meet one or more of the following criteria:

- provincially or regional significant life science areas of natural and scientific interest (ANSI);
- environmentally sensitive or significant areas;
- habitat of threatened species or endangered species;
- fish habitat;
- significant wildlife habitat;
- significant woodlands
- significant wetlands
- other wetlands greater than 0.5 hectares; and,
- significant valleylands.

Natural Green Spaces are areas that meet one or more of the following criteria:

- woodlands greater than 0.5 hectares that do not fulfill the requirements of a significant woodland;
- wetlands that do not fulfill the requirements of a significant wetland;
- watercourses that do not fulfill the requirements of a significant valleyland, even if they are predominantly engineered; and
- all natural areas greater than 0.5 hectares that have vegetation that is uncommon in the city.

According to Section 6.3.23 of the City's Official Plan, "Mississauga will have regard for the maintenance of the long term ecological integrity of the Natural Heritage System in all decisions".

Natural Areas Survey (NAS)

A Natural Areas Survey was completed by the City of Mississauga in 2019 describing the natural features surrounding Sawmill Creek. The NAS describes Sawmill Creek as an engineered feature with a water quantity control structure present as well as a Type 2 fishery. It is designated as a Significant Natural Area with five delineated vegetation communities, 194 floral and 37 faunal species documented for the site. The site is described as in poor condition with extensive disturbance and non-native species present throughout. Disturbances include garbage, ad-hoc trails, soil compaction and extensive erosion. In total, 93 non-native species are found within the study area including some that are highly invasive such as garlic mustard (*Alliaria petiolata*), winged spindle tree (*Euonymus alatus*), wild chervil (*Anthriscus sylvestris*), Japanese barberry (*Berberis thunbergii*), common reed grass (*Phragmites australis*), Tartarian honeysuckle (*Lonicera tatarica*), goutweed (*Aegopodium podagraria*), giant hogweed (*Heracleum mantegazzianum*) and common buckthorn (*Rhamnus cathartica*). Despite the abundance of non-native species, the area contains two Species at Risk, 13 CVC Fauna Species of Conservation Concern, and 22 CVC Flora Species of Conservation Concern.

2. Natural Environment Existing Conditions

ERI staff conducted various site investigations during the 2020 field season to identify aquatic and terrestrial habitats and features present within the study area. Incidental wildlife observations were collected during all site visits. Dates and locations of specific surveys are shown in **Table 2-1.**

Table 2-1 – Field Survey Summary

Field Investigation	Protocol	Date	Observer
Aquatic Habitat Assessment	Modified OSAP 2013	October 29, 2020	K. Keele
Ecological Land Classification	Lee et. al (2008)	June 16 & & July 6, 2020	J. Piette K. Keele J. Krist
Vascular Flora and Fauna Inventory	Systematic search by ELC polygon	June 16, 2020 & July 6 2020	K. Keele J. Piette J. Krist
Breeding Bird Survey	OBBA 2001	June 19, 2020 & July 6, 2020	K. Keele

2.1 Aquatic Habitat Assessment

2.1.1 Background

Sawmill Creek is a permanent water body which originates in the southern part of Mississauga and flows in a southeasterly direction before joining the Credit River and flowing into Lake Ontario. Sawmill Creek is identified as a Type 2 Fishery. Fish surveys conducted within Sawmill creek since the 1980's have identified no fish catch records and demonstrate no fish community population is present within the creek. There are several theories behind this including, historically having dried out during droughts, an energy dissipator at the mouth of Sawmill Creek impeding fish movement, discharge of contaminants and habitat destruction due to construction and erosion, periods of high flows washing fish downstream and numerous impediments to fish passage not allowing fish to move upstream again. The downstream Credit River has a strong fish community (G&S, 1995). CVC has classified Sawmill creek as a warmwater thermal regime (CVC, 2012). CVC has conducted recent (2006-2011) fish community surveys for Sawmill Creek in proximity to the study area and found brook stickleback (*Culaea inconstans*), creek chub (*Semotilus atromaculatus*), fathead minnow (*Pimephales promelas*), and pumpkinseed (*Lepomis gibbosus*) to be present within the watercourse.

2.1.2 Methods

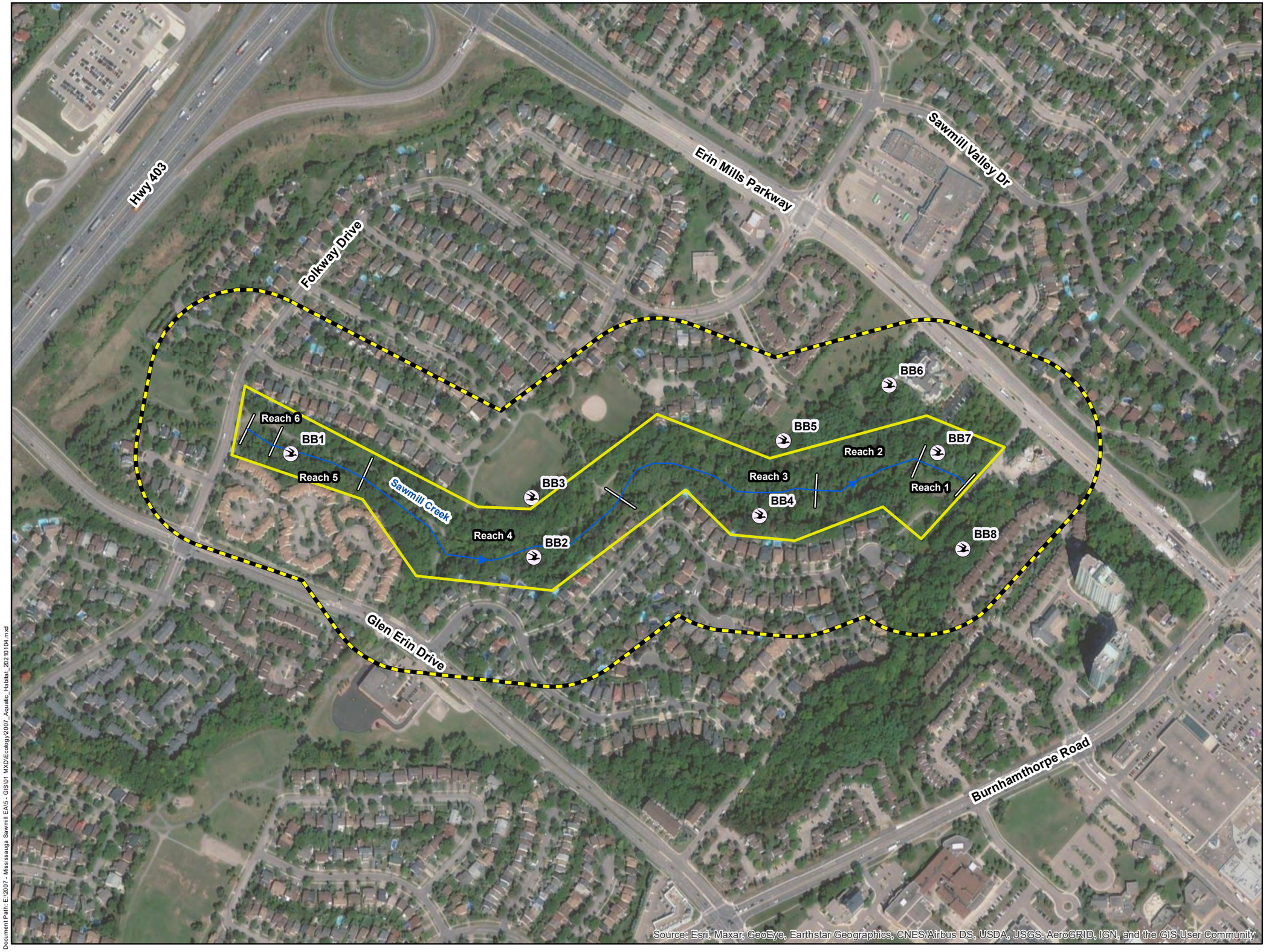
A detailed aquatic habitat assessment was conducted on October 29th, 2020 to characterize the aquatic habitat features within the study area. The entire 1030 m of Sawmill Creek between Folkway Drive and Erin Mills Parkway was assessed, and detailed notes and photos were recorded. The creek was divided into 6 assessment reaches based on similar aquatic habitat and channel morphology, as shown in **Figure 4**. It should be noted, these assessment reaches are identical to those in the geomorphic assessment. No fish community assessment was completed as part of this assessment.

The following information was documented during the aquatic habitat assessment:

- Substrate type and composition;
- Riparian and aquatic vegetation;
- Potential fish habitat or presence of fish;
- Bank stability;
- In-stream habitat and cover;
- Water quality measurements;
- Adjacent lands (vegetation community type, riparian habitat, cover, land use, etc.); and
- Channel morphology.

Sawmill Creek Erosion Control Project

Figure 4
Ecological Studies



Legend

- Study Area
- Study Area 120 m Buffer
- Breeding Bird Survey Station
- Reach 1 (67 m)
- Reach 2 (136 m)
- Reach 3 (277 m)
- Reach 4 (389 m)
- Reach 5 (119 m)
- Reach 6 (40 m)

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Meters

NAD 1983 UTM 17N	1:4,500
Project: 2007 Sawmill Creek Erosion Control Date: 2021/01	N W E S

Data Sources: Ecosystem Recovery Inc., 2021, City of Mississauga Natural Areas Survey (2018)

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2.1.3 Results

Reach 1

This reach begins at a double cell concrete outfall and extends 64 m upstream. The watercourse is surrounded by deciduous forest on both sides of the watercourse. Gabion baskets line the edges of the creek. However, several portions have failed, leading to exposed filter cloth and deposits of angular rock into the watercourse. Portions of the creek bank are also lined with armourstone, some of which have moved and are within the creek channel. Both banks have large areas of erosion and exposed tree roots. The substrate of the watercourse is dominated by gravel with the second dominate of angular cobble. The occasional boulder is present, and areas of sand deposits were occasionally observed. Woody debris and detritus were observed in the channel. Attached algae is abundant in the channel and slimes/crusts are present. No other algae or aquatic macrophytes were observed. At the time of the assessment, water was flowing clear with no turbidity. The wetted width of the channel ranged between 2.05 – 4.07 m and depth ranged between 14 - 78 cm. Velocity was measured at multiple locations throughout the reach and the results ranged between 0.14 - 0.33 m/sec. Both banks were slightly unstable. Shoreline cover ranged between 60-90% and canopy coverage ranged between 75-100 %. Seasonal obstructions are present to fish passage, including poured concrete in the channel and armourstone. No fishing pressure was observed within this channel.

Reach 2

Reach 2 is 147 m in length and has high (up to 2.2 m) near-vertical channel banks, both of which are considered unstable and have experienced high levels of erosion. The areas of erosion have exposed roots and clay banks with sandy loam on the top horizontal layer. The eroded material has moved to form small islands of sand, gravel and cobble within the stream. One island which has formed is 15 m x 5 m and is oblong in shape. Multiple channels have formed in many places due to the deposited material in the channel. Previously installed gabion baskets have failed along the right side of the creek and an armourstone wall has moved, with armourstone now found within the channel. At the time of assessment, the water in the channel was flowing clear with no turbidity. Multiple large logjams are present in the channel, which are likely barriers to fish passage. The substrate of the watercourse is dominated by gravel, followed by angular cobble originating from the displaced and broken gabion baskets. Areas of clay substrate and small areas of sediment/sand deposits are also present within the channel. Woody debris and detritus are present within the channel and garbage was observed occasionally. Attached algae and slimes/crusts are present. The wetted width of the channel ranged between 0.47 - 1.95 m. Depths ranged between 14 – 105 cm, the hydraulic head between 0 - 3 cm and flow velocity between 0.45 - 0 0.87 m/sec. The surrounding habitat of the watercourse is deciduous forest on both banks. Shoreline cover ranged between 30-60% and canopy cover between 50-75%. No fishing pressure was observed within this channel.

Reach 3

Reach 3 is approximately 285 m in length and is bound on the upstream side by a pedestrian bridge crossing. The surrounding habitat of the watercourse is deciduous forest with a dense understory. The channel banks within the reach were previously lined with bank protection and stability measures, including armourstone and gabion baskets. These have now failed in many parts of the reach causing angular rock and armourstone to be deposited within the channel. The channel banks had large areas of logjams, which were observed in multiple areas in the channel, creating barriers to fish movement. The creeks banks were unstable, with large areas of erosion and undercutting between 45 - 117 cm in depth. Riffles, runs and deep pools were observed. Portions of the channel were braided, with one small drop in the channel profile causing a waterfall feature. Woody debris was present, and detritus was abundant within the channel. Filaments and attached algae were observed, but all other algae and aquatic macrophytes were absent from the watercourse. The wetted width of the channel was 0.80 - 1.55 m, while the bankfull width ranged from 1.4 to 3.9 m. The hydraulic head varied between 0 -1.5 cm and the flow velocity ranged between 0.91

– 1.39 m/sec. The water was flowing clear within this reach at the time of assessment. No fishing pressure was observed within this channel.

Reach 4

Reach 4 is 381 m in length. It is surrounded by deciduous forest and is within proximity to a walking pedestrian trail. At the bridge crossing on the downstream limit of the reach, concrete blocks have been added to the bridge footings to temporarily reduce flow velocity and maintain erosion issues under the bridge. Other bank stabilization measures include failing gabion baskets found throughout the reach and failing weir structures including armourstone and bricks within the channel. The banks of the watercourse are unstable, with large areas of erosion and undercutting of banks (8 - 75 cm). As a result of the ongoing erosion issues, exposed roots and islands of angular stone have formed. Small areas of sediment and sand deposits are intermittent within the channel. Under a second bridge further upstream within the reach, a concrete pad was installed with a 40 cm height drop, presenting a barrier to fish passage. Other features found within the channel include small waterfall features, deep pools and small riffles. The wetted width of the channel ranges between 1.78 – 5.7 m, with water depths of 13 – 99 cm in one particularly deep pool. The substrate of the creek is dominated by cobble, followed by gravel. Clay is also present in the channel as well as the occasional boulder. Woody debris and detritus were abundant. The shoreline cover ranged between 60 - 90% and canopy cover ranges between 60-90%. Flow velocity was measured within the channel and ranged between 0.19 – 0.74 m/sec with the hydraulic head ranging between 0 - 2 cm. Only filaments, attached algae and slimes/crust were observed within the reach; all other algae and aquatic macrophytes were absent. No fishing pressure was observed within this channel.

Reach 5

This reach is 120 m in length and is surrounded by deciduous forest. The reach contains small meanders, and the banks, though slightly unstable, are significantly more stable in comparison to the downstream reaches. There is exposed soil on the creek banks and minor areas of erosion, which have caused 6 – 11 cm of undercutting. Channel hardening has been established in the form of gabion baskets on the creek banks. These were in stable and functioning condition. Silt socks were also observed at one location resting on the shoreline, which at the time of assessment, were not serving a purpose. A small gravel island has formed (6 m x 2 m in size) and occasional small sand bars were also observed within the creek. This reach contained riffles and shallow pools, but overall was uniform in shape. The occasional tree has fallen across the channel but is not impacting flow or fish passage. Shoreline cover ranged between 60-90% and canopy cover between 50 - 75%. The wetted width of the channel was relatively uniform, ranging between 3.76 – 3.9 m, with water depths ranging between 7 – 28 cm. The dominate substrate is gravel, followed by cobble. Both woody debris and detritus, as well as filaments, attached algae and slimes/crusts were present within the channel. The water's velocity was measured to be between 0.08 – 0.48 m/sec, with the hydraulic head varying from 0 - 1.5 cm. The only seasonal fish passage obstruction present was the concrete weir at the downstream limits of the reach, and no other fishing pressure was observed. No sources of pollution were noted, but iron staining in one section of the creek was observed.

Reach 6

Reach 6 is the shortest length of the assessed reaches for Sawmill Creek with a total length of 37 m. The reach consists of a concrete-lined channel extending downstream from the four-cell stormwater outlet located under Folkway Drive. It is surrounded by deciduous forest and residential properties. The concrete channel is trapezoidal in shape and has low water depths within it. Sediment deposition over time has occurred within this channel as the north side of the channel has filled in and created an island with shrubs, trees and ground vegetation establishment forcing the flow to the south side of the channel. Directly downstream of the four concrete culverts under Folkway Drive, the concrete stormwater outlet splits flow and herbaceous vegetation has established on the north bank. Th concrete lined channel has no other substrate and attached algae and slimes/crust are present on the concrete. Water velocities were only observed on the south side of the channel ranging from 0.43 - 0.5 m/sec with a hydraulic head of 1 and 2 cm respectively. On the north side of the channel, the water was stagnant. Shoreline cover ranged between 30 – 60 % and canopy cover ranged between 50 – 75 %. A minnow was observed in the pool directly

downstream of the culverts, which is unique as no other minnows were observed in any reach during this assessment. A piece of a minnow trap was observed near this area, which may explain the minnow's origins as a release by the public.
Representative aquatic photographs can be seen in **Appendix A**.

2.2 Water Quality

2.2.1 Methods

Water quality and flow monitoring measurements were performed within each reach of the study area on October 29th, 2020. Water quality was monitored using a Horiba U-52 multiparameter meter, which measures pH, conductivity, dissolved oxygen (DO), oxidation reduction potential (ORP), turbidity, temperature, salinity, and total dissolved solids (TDS). Results of the water quality monitoring are presented in **Table 2-2.**

2.2.2 Results

Table 2-2. Water Quality Parameters of Sawmill Creek by Reach.

	Temperature °C	pH	ORP (mV)	Conductivity (mS/cm)	Turbidity (NTU)	Dissolved Oxygen (mg/L)	Total Dissolved Solids (ppm)
Reach 1	10.01	6.76	241	0.518	-	92	-
Reach 2	10.19	7.45	239	0.512	-	78.2	-
Reach 3	9.93	7.84	233	0.53	-	82	-
Reach 4	10.83	7.94	239	0.523	-	76	-
Reach 5	11.36	8.14	228	0.551	-	75.6	-
Reach 6	11.61	8.15	231	0.581	-	73.2	-

2.3 Terrestrial Environment

2.3.1 Vegetation Communities & Plants

2.3.1.1 *Background*

Prior to completing field investigations, a review of existing information was completed to gain an understanding of site conditions within the study area. Background information reviewed included information obtained from the sources outlined in **Table 1-1** above.

The City of Mississauga's Official Plan delineates this section of Sawmill Creek as a Significant Natural Area and Natural Green Space. A small section near the intersection of Burnhamthorpe Road W and Erin Mills Parkway is classified as a linkage area. NAS has delineated five ELC communities within the study area.

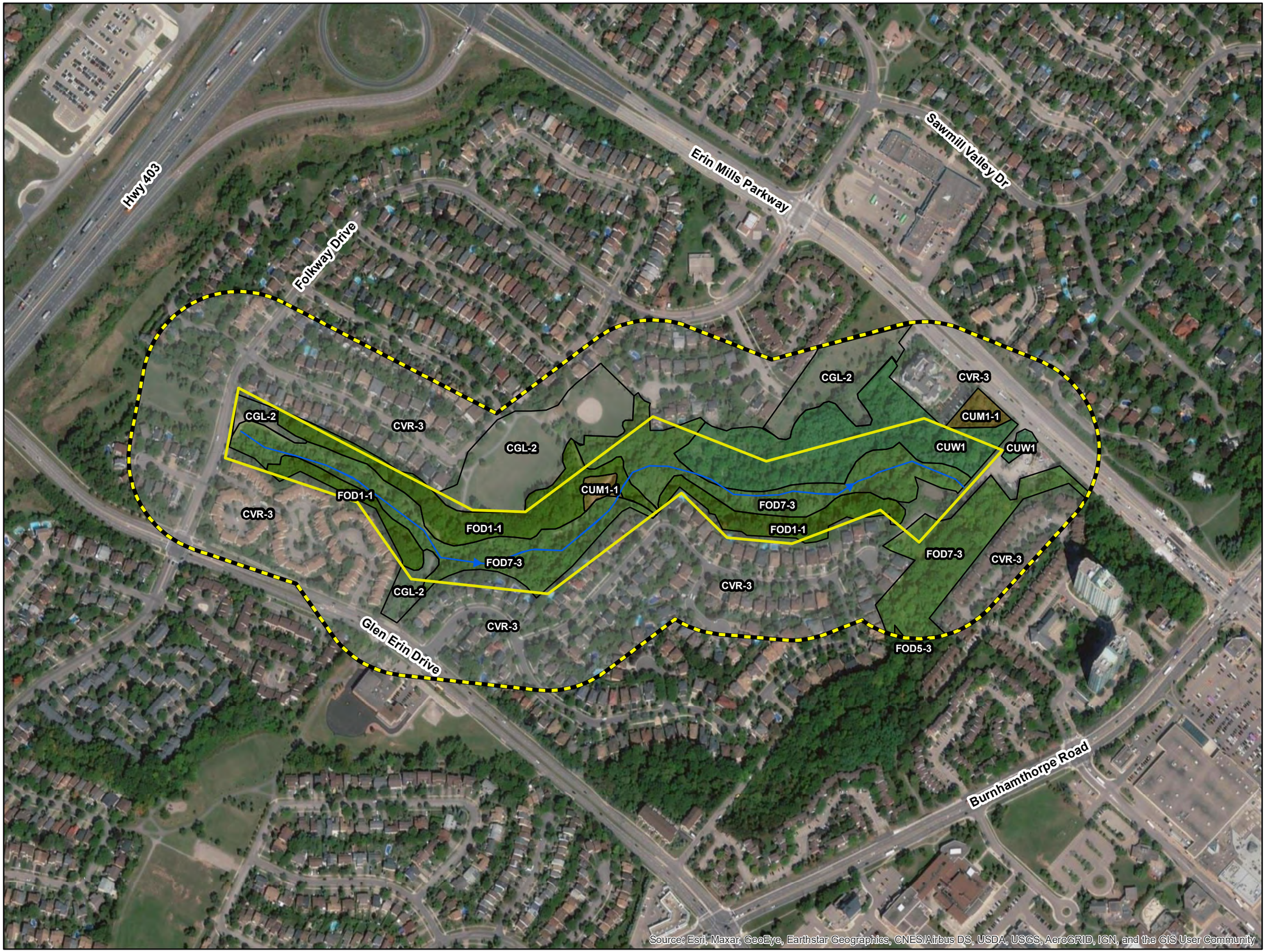
2.3.1.2 *Methods*

Ecological Land Classification (ELC) & Plants

Vegetation communities were characterized and mapped using the Ecological Land Classification (ELC) system for southern Ontario (Lee et. al., 1998) during two site visits on June 16 and July 6, 2020. Existing ELC data from the City of Mississauga Natural Areas Survey (2019) was confirmed and updated where necessary. Data recorded for each vegetation community included species composition, dominance and uncommon species or features. In addition, incidental wildlife observations were recorded throughout all site visits. ELC communities are shown on **Figure 5.**

Sawmill Creek Erosion Control Project

Figure 5
Ecological Land Classification



Legend

- Study Area
- Study Area 120 m Buffer
- Watercourse

ELC

- CGL-2: Parkland
- CVR-3: Residential
- CUM1-1: Mineral Cultural Meadow
- CUW1: Mineral Cultural Woodland
- FOD1-1: Dry-Fresh Red Oak Deciduous Forest
- FOD5-3: Dry-Fresh Sugar Maple - Oak Deciduous Forest
- FOD7-3: Fresh-Moist Willow Lowland

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0 55 110 220
Meters

NAD 1983 UTM 17N	1:4,500
Project: 2007 Sawmill Creek Erosion Control Date: 2021/01	N W E S

Data Sources: Ecosystem Recovery Inc., 2021, City of Mississauga Natural Areas Survey (2018)

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Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

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Floristic Quality Indicators

A series of Floristic Quality Indicators were calculated for each community including: the calculation of the mean Coefficient of Conservatism (CC), the Floristic Quality Index (FQI) and the Weediness Index.

Coefficient of Conservatism (CC) - These values range from 0 (low) to 10 (high) and are based on species tolerance of disturbance and fidelity to a specific habitat.

- **0 – 3:** Species found in a wide variety of communities, including disturbed sites;
- **4 – 6:** Species associated with a specific community but tolerate moderate disturbance;
- **7 – 8:** Species associated with a community in an advanced successional stage, tolerant of minor disturbances; and
- **9 – 10:** Species with a high degree of fidelity to a narrow range of ecological parameters.

Floristic Quality Index - The floristic quality (FQI) of an area is demonstrated through the mean value of CC. For instance, an old field or grazed woodlot would likely have a low mean CC as these habitats are dominated by opportunistic species that may occur on a wide range of site conditions and are tolerant of disturbance. A bog, prairie or intact forest would likely have a higher CC due to the specific habitat requirements of many of the species and general absence of disturbance. Largely, a community with an FQI of 1 - 19 should be considered to be of low vegetative quality; communities with an FQI of 20 - 35 should be considered to have a high vegetative quality and communities with an FQI above 35 should be considered of "Natural Area" quality.

Weediness Index - The Weediness Index calculates the potential invasiveness of non-native plants, and when used in combination with the percentage of non-native plants can be used as an indicator of disturbance. Values ranging from -1 (low) to -3 (high) have been assigned to most non-native species in Ontario based on the potential impact each species can have in natural areas: **-1:** Little or no impact on natural areas (most non-native plants fall into this category), **-2:** Occasional impacts on natural areas, generally infrequent or localized. **-3:** Major potential impacts on natural areas.

2.3.1.3 *Results*

Six vegetation communities were delineated by ERI ecologists; a cultural woodland, a willow lowland deciduous forest, a red oak deciduous forest, and a sugar maple oak deciduous forest. All of the delineated communities within the study area are considered contiguous, spanning approximately 14 ha in size, and are at various stages of succession. A total of 101 species were observed within the study area during ERI field investigations. Of these, 57 were native and 44 were non-native species. The total FQI value of the study area was 27.68. All communities within the study area are considered common in Ontario. The following presents a description of each of the delineated communities. A full list of species can be found in **Appendix B**. Representative photographs can be found in **Appendix C**. Ecological features identified by reach are illustrated in **Figure 6.**

CGL_2: Parkland

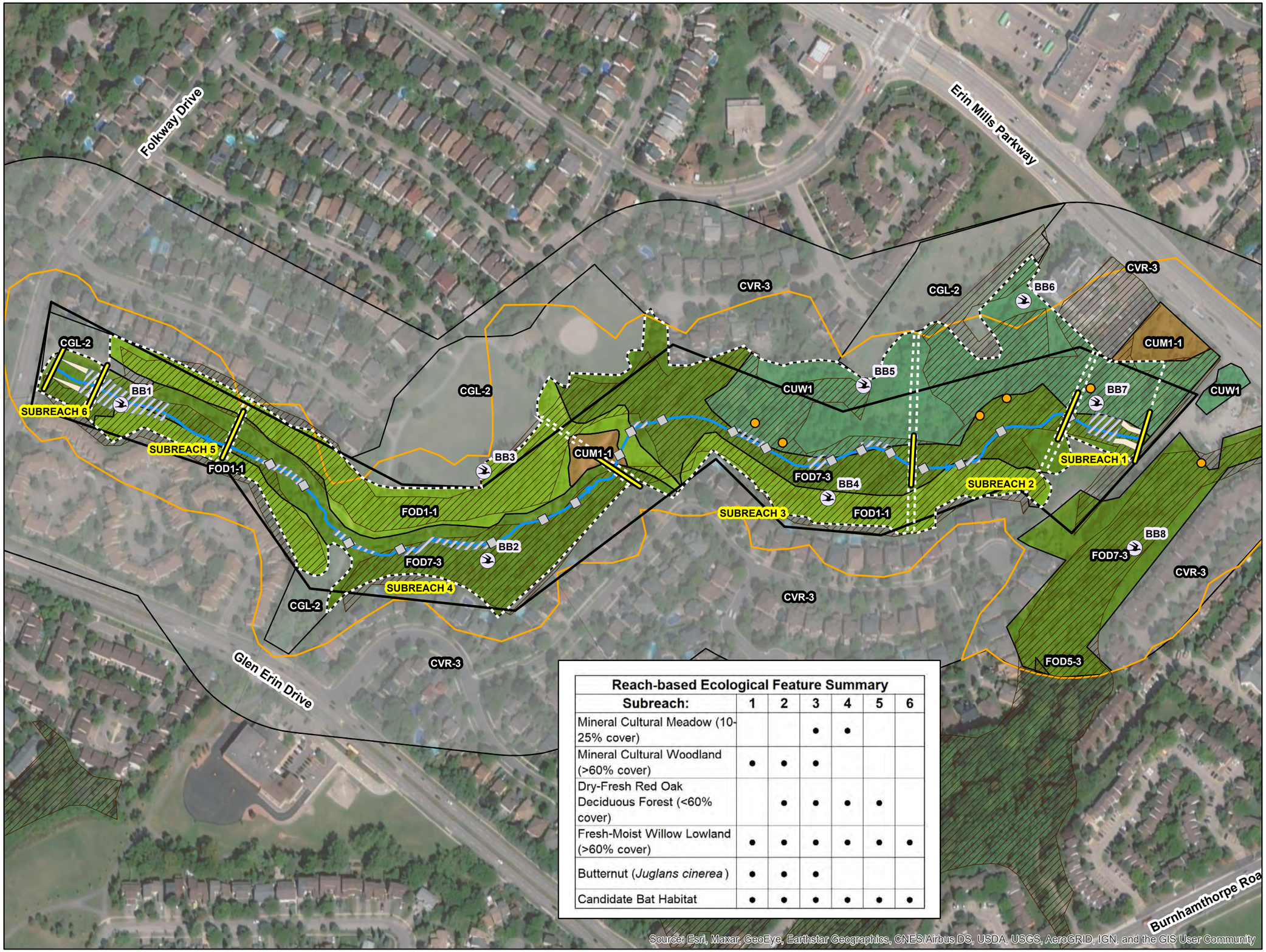
Arbour Green Park is an open manicured park with a baseball diamond, soccer field and arboretum with a variety of native planted trees. This park has all manicured grassland and maintained parks that are heavily used by the public with sporadic planted trees. They offer little natural habitat for wildlife and wildlife typically found within these settings are generalist species. Tree species found within this community are common to an urban landscape and found within the neighboring ELC communities.

CUW1: Mineral Cultural Woodland

This community is located along the north edge of Sawmill Creek. Species observed within the canopy and sub-canopy included sugar maple (*Acer saccharum*), red oak (*Quercus rubra*), white ash (*Fraxinus americana*), red pine (*Pinus resinosa*), white pine (*Pinus strobus*), silver maple (*Acer saccharinum*), trembling aspen (*Populus tremuloides*), butternut (*Juglans cinerea*), tamarack (*Larix laricina*) and blue spruce (*Picea pungens*). The shrub layer included winged burning bush, alternate-leaved dogwood (*Cornus alternifolia*), Tartarian honeysuckle, choke cherry (*Prunus virginiana*), and American red raspberry (*Rubus*

Sawmill Creek Erosion Control Project

Figure 6
Ecological Features



Reach-based Ecological Feature Summary

Subreach:	1	2	3	4	5	6
Mineral Cultural Meadow (10-25% cover)			•	•		
Mineral Cultural Woodland (>60% cover)	•	•	•			
Dry-Fresh Red Oak Deciduous Forest (<60% cover)		•	•	•	•	
Fresh-Moist Willow Lowland (>60% cover)	•	•	•	•	•	•
Butternut (*Juglans cinerea*)	•	•	•			
Candidate Bat Habitat	•	•	•	•	•	•

Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Legend

- Study Area
- Watercourse
- Aquatic Reach Break
- Reach Boundary
- Butternut Location (Juglans cinerea)
- Breeding Bird Survey Location
- CVC Regulation Limit
- Wooded Area (MNRF)
- Weir (Grade Control Structure)
- Gabion-lined Channel
- Concrete Lined Channel

ELC

- CGL-2: Parkland
- CVR-3: Residential
- CUM1-1: Mineral Cultural Meadow
- CUW1: Mineral Cultural Woodland
- FOD1-1: Dry-Fresh Red Oak Deciduous Forest
- FOD5-3: Dry-Fresh Sugar Maple - Oak Deciduous Forest
- FOD7-3: Fresh-Moist Willow Lowland

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0 37.5 75 150
Meters

NAD 1983 UTM 17N	1:3,000
Project: 2007 Sawmill Creek Erosion Control Date: 2021/04	N W E S

Data Sources: Ecosystem Recovery Inc., 2021, City of Mississauga Natural Areas Survey (2018)

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idaeus). The ground cover layer consisted of common plantain (Plantago major), eastern daisy fleabane (*Erigeron annuus*), several species of goldenrod (*Solidago spp.*), cleavers (*Galium aparine*), common heal-all (*Prunella vulgaris*), smooth brome (*Bromus inermis*) and common reed grass.

A total of 63 plant species were identified in this community, including 32 native and 31 non-native species. The FQI for this community was calculated to be 17.68 with an average coefficient of conservatism of 3.13.

CVR-3: Residential

Multiple residential land types exist surrounding Sawmill Creek and include low density residential and single family residential. These properties are manicured lawns with sporadic trees, many non-native and offer little wildlife habitat. Typical tree species found within this area includes Norway maple, red oak, black walnut, white ash, eastern white cedar (*Thuja occidentalis*), Norway spruce, blue spruce, sugar maple (*Acer saccharum*), honey locust (*Gleditsia triacanthos f. inermis*). Many ornamental plants are found within the gardens of these residential neighbourhoods.

FOD1-1: Dry-Fresh Oak Deciduous Forest

This community is located adjacent to the FOD7-3 community along Sawmill Creek. Species observed within the canopy included red oak, American basswood (*Tilia americana*), black cherry (*Prunus serotina*), and shagbark hickory (*Carya ovata*). The subcanopy consisted of sugar maple, American basswood, American elm (*Ulmus americana*), and Manitoba maple (*Acer negundo*). The shrub layer was dominated by winged burning bush, European spindle tree *(Euonomus europea*), common buckthorn and Tartarian honeysuckle. Species within the herbaceous layer consisted of garlic mustard, Canada goldenrod (*Solidago canadensis*), riverbank grape (*Vitis riparia*), and aster species (*Symphyotrichum spp*). A small cultural meadow inclusion is located along the southeast edge of this community.

A total of 55 species were documented in this community, 29 of which were native and 26 were non-native. The FQI was calculated to be 15.60 with an average coefficient of conservatism of 2.90.

FOD5-3: Dry-Fresh Sugar Maple-Oak Deciduous Forest

This community is located on the southeast side of Sawmill Creek, closest to Burnhamthorpe Road West. Only a small portion of the community falls within the study area, therefore it was not fully investigated. The canopy was dominated by sugar maple, red oak and American beech (*Fagus grandifolia*). The subcanopy was dominated by basswood, black walnut (*Juglans nigra*), and white ash. The shrub layer consisted of alternate-leaved dogwood, common buckthorn, and choke cherry. Species observed within the herbaceous layer included wild carrot (*Daucus carota*), garlic mustard, zig-zag goldenrod (*Solidago flexicaulis*), enchanter's nightshade (*Circaea canadensis*), and false solomon's seal (*Maianthemum canadensis*).

A total of 48 plant species were documented, of which were 31 native and 17 were non-native. The FQI was calculated to be 21.37 with an average coefficient of conservatism of 3.84.

FOD7-3: Fresh-Moist Willow Lowland Deciduous Forest

This community type is the dominant community found within the study area and is located along most of the floodplain of Sawmill Creek. Species observed within the canopy included crack willow (*Salix fragilis*), black walnut, Manitoba maple, and red oak. The subcanopy contained Norway maple (*Acer plantanoides*), American elm, and amur maple (*Acer ginnala*). The shrub layer included winged burning bush, common buckthorn, riverbank grape, and Tartarian honeysuckle. Herbaceous species observed included garlic mustard, Canada goldenrod, and enchanter's nightshade.

A total of 59 plant species, including 34 native species and 25 non-native were observed. The FQI for this community was calculated to be 17.15, with an average coefficient of conservatism of 2.94.

2.3.2 Birds

2.3.2.1 *Background Review*

A desktop review was conducted using OBBA records from a 10x10 km square that overlaps with the study area (Square 17PJ06). eBird records from Mississauga – Sawmill Valley and nearby Shalebank Hollow Park, as well as iNaturalist records within a 1 km radius of the study area, were also included.

In total, 182 bird species were identified in the background review. This included the following 5 SAR and 6 SOCC; barn swallow (*Hirundo rustica*) (THR), bank swallow (*Riparia riparia*) (THR), bobolink (*Dolicholynx oryzivorus*) (THR), chimney swift (*Chaetura pelagica*) (THR), eastern meadowlark (*Sturnella magna*) (THR), Canada warbler (*Cardellina canadensis*) (SC), common nighthawk (*Chordeiles minor*) (SC), eastern wood-pewee (*Contopus virens*) (SC), rusty blackbird (*Euphagus carolinus*) (SC), short-eared owl (*Asio flammeus*) (SC), and wood thrush (*Hylocichla mustelina*) (SC). A list of potential bird species is found in **Appendix D**.

2.3.2.2 *Methods*

Breeding bird surveys occurred over the course of two rounds separated by at least ten days, between sunrise and 10 am according to the Ontario Breeding Bird Atlas protocols (OBBA, 2001). Eight stations were selected in the study area and at each station a 10-minute point count was conducted for both visual and audible documentation of species presence including the highest level of breeding evidence exhibited for each species recorded. Incidental observations were also recorded during travel between stations, as well as during all other field surveys on site for the duration of the project. The point count locations are shown on **Figure 4.**

2.3.2.3 *Results*

Surveys were conducted on June 19th and July 6th, 2020. In total, 31 bird species were observed by ERI. None of the observed species were classified as SAR or SCC, with the majority being considered common and widespread throughout Ontario. The results of the breeding bird survey are found in **Appendix E**.

2.3.3 Reptiles and Amphibians

2.3.3.1 *Background*

A desktop review was conducted to identify amphibian and reptile species likely to be present within the study area. Records were obtained for a 10 km x 10 km square from the Ontario Reptile and Amphibian Atlas (17PJ02) in addition to records obtained from iNaturalist within a 1 km radius of the site.

In total, 25 reptile and amphibian species were identified in the background review as potentially occurring within the study area. This included two SAR; jefferson salamander (*Ambystoma jeffersonianum*) (END) and blanding's turtle (*Emydoidea blandingii*) (THR), and three SOCC species; snapping turtle (*Chelydra serpentina*) (SC), eastern ribbonsnake (*Thamnophis sauritis*) (SC), and northern map turtle (*Graptemys geographica*).

The Natural Area Survey (2019) documented one green frog within the study area; however, no habitat features existed within the site. It also reported Sawmill Creek as being an important movement corridor for amphibians between breeding and non-breeding habitat.

2.3.3.2 *Methods*

No amphibian call or reptile surveys were conducted as a part of this EA, however, all incidental observations were recorded.

2.3.3.3 *Results*

One Dekay's brownsnake (*Storeria dekayi*) was observed on the paved pedestrian trail. No other reptiles or amphibians were observed by ERI during field investigations. Sawmill Creek could support amphibian and reptile movement between upstream and downstream portions of Sawmill Creek; however, several large drops along the creek would make travel difficult for species.

A complete list of species identified in the background review is provided in **Appendix F.**

2.3.4 Insects

2.3.4.1 *Background*

A desktop review was conducted to identify insect species records within the vicinity of the study area. Records were obtained for a 10 km x 10 km square from the Ontario Butterfly Atlas (17PJ02) and within a 1 km radius of the study area from iNaturalist.

In total, 122 insect species were identified as part of the background review, including one SCC species, monarch (*Danaus plexippus*) (SC).

2.3.4.2 *Methods*

Insect-specific surveys were not conducted as a part of this study. However, all incidental observations during field visits were recorded.

2.3.4.3 *Results*

During ERI field investigation, a total of six insect species were observed. All of the species were observed from the trail and are considered common and widespread in Ontario. These included monarch, ebony jewelwing (*Calopteryx maculata*), eastern tiger swallowtail (*Papilo glaucus*), red admiral (*Vanessa atalanta*), gypsy moth (*Lymantria dispar*), and tent caterpillar (*Malacosoma americanum*).

For a full list of insect species identified during the background review and observed by ERI, see **Appendix G.**

2.3.5 Mammals

2.3.5.1 *Background*

A desktop review was conducted to identify mammal species likely to nest, breed, or forage within the study area. The Mammal Atlas of the Ontario was used to identify species records within the general vicinity of the Sawmill Creek study area. Mammal records reported to iNaturalist within a 1 km radius of the study area also contributed to the background review.

In total, 47 mammal species were identified during the background review, including four SAR and one SCC; little brown myotis (*Myotis lucifugus*) (END), eastern small-footed myotis (*Myotis leibii*) (END), northern myotis (*Myotis septentrionalis*) (END), tricolored bat (*Perimyotis subflavus*) (END), and woodland vole (*Microtus pinetorum*) (SC).

2.3.5.2 *Methods*

No mammal-specific field assessments have been completed to date for this project; however, incidental observations of all species observed were recorded. It is anticipated for a cavity tree assessment to be completed during the detailed design phase of the project.

2.3.5.3 *Results*

Wildlife observations were collected during each site visit in addition to the breeding bird and aquatic habitat assessment. Incidental faunal species observations are included in the bird and mammal tables found in Attachment H.

3. Assessment of Significance

This section analyzes the significance and sensitivity of natural features to determine opportunities and constraints to be considered for creek restoration. Natural features that are sensitive to disturbance are identified based on rare or significant features or the functions/processes and/or policies prohibiting development or alteration within them.

3.1 Watercourses and Fish Habitat

Sawmill Creek is a permanent water body, which flows south easterly eventually joining the Credit River downstream of the study area. It is a type 2 fishery and a warmwater watercourse. A low population fish community exists within Sawmill Creek due to many fish passage barriers and high flow velocities that exist within the creek. No fish community assessment was required as part of this study, but an aquatic habitat assessment was performed which identified poor fish habitat and many barriers to fish passage existing in the channel including log jams, concrete in the channel, weirs with large drops and failed bank hardening structures (armourstone, gabion baskets, concrete) which limits passage.

The study area has riffles, pools, bank overhang, bank hardening, flow structure installed (weirs) and multiple pedestrian bridge crossings. Gravel and sand islands have formed periodically within the channel. High rates of bank erosion occur, predominately in the downstream reaches. Wood debris and cover are sporadic and not abundant. Overall, the system has limited in-stream vegetation, little diversity of habitat, uniformity and poorly sorted substrate, little cover for fish species and poor water quality.

The current system would benefit from habitat enhancement designed to improve fish habitat, remove barriers to fish movement, naturalize the stream corridor, and provide flood and erosion protection. This alteration would have a positive effect within the study area and contribute to improvement for the watershed. To improve fish habitat, addition of in-stream cover such as woody debris and aquatic vegetation would provide enhancement. As well, creation riffle/run/pool features, removal of fish barriers and a more naturalized channel alignment would enhance conditions. Riparian plantings would help stabilize the banks of the creek and provide shade and cover for fish.

3.2 Identified Natural Heritage Features

The Sawmill Creek study area is part of the City of Mississauga Green System which is comprised of the Natural Heritage System (NHS), Urban Forests, Natural Hazard Lands and Parks and Open Spaces (City of Mississauga, 2019). The City of Mississauga Official Plan (OP) (2019) identifies the study area as a Significant Natural Area which is part of the greater NHS, including natural areas (e.g., meadows, fish and wildlife habitats), woodlands, wetlands and valley and watercourse corridors. The OP defines Significant Natural Areas as areas that meet one or more of the following criteria:

a) provincially or regional significant Life Science Areas of Natural and Scientific Interest (ANSI);
b) environmentally sensitive or significant areas;
c) habitat of threatened species or endangered species;
d) fish habitat;
e) significant wildlife habitat;
f) significant woodlands;
g) significant wetlands; and
h) significant valleylands.

The OP defines significant woodlands as those that meet one or more of the following criteria:

- woodlands, excluding cultural savannahs, greater than or equal to 4 hectares;
- woodlands, excluding cultural woodlands and cultural savannahs, greater than or equal to two hectares and less than four hectares;
- any woodland greater than 0.5 hectares that: supports old growth trees (greater than or equal to 100 years old);
- supports a significant linkage function as determined through an Environmental Impact Study approved by the City in consultation with the appropriate conservation authority;
- is located within 100 meters of another Significant Natural Area supporting a significant ecological relationship between the two features;
- is located within 30 meters of a watercourse or significant wetland; or
- supports significant species or communities.

The woodlands within the Sawmill Creek study area are within 30 m of a watercourse, provide a wildlife linkage function and are greater than 4 ha, and therefore are considered significant. Construction activity and site alteration within or adjacent to a Significant Natural Area would be permitted unless all reasonable alternatives have been considered and any negative impacts have been minimized. Any negative impact that cannot be avoided would need to be mitigated through restoration and enhancement to the greatest extent possible

3.3 Habitat for Threatened and Endangered Species

A habitat screening was completed to determine the potential occurrence of SAR within the study area. For this screening, SAR are defined as species that are listed as either Threatened (THR) or Endangered (END) under the Endangered Species Act (*ESA)*. Individual species, as well as their habitat, are protected in Ontario. Species listed as Special Concern (SC) under the *ESA* receive protection under the Provincial Policy Statement (PPS) and their habitat is considered Significant Wildlife Habitat (SWH). Species listed under *SARA* are only protected on federal land, as part of projects that are otherwise being permitted by a federal agency. This includes aquatic SAR; however, no aquatic SAR have been identified within the study area. SARA also requires consideration for any migratory bird listed on Schedule 1 where critical habitat has been identified; however, should the species also be listed under *ESA* and provides equal or greater protection, the *ESA* take precedence.

ERI conducted a background review to create a list of potential SAR within the study area and surrounding landscape to supplement existing information known for the study area. This list was developed using multiple background resources including:

- Ontario Breeding Bird Atlas (Bird Studies Canada, 2009).
- Reptiles and Amphibians of Ontario Atlas (Ontario Nature, 2018).
- Species at Risk in Ontario List – Online Tool (MNRF, 2020).
- Natural Heritage Information Centre (Natural Heritage Areas application) (MNRF, 2020).
- Atlas of the Mammals of Ontario (Dobbyn, 1994).
- DFO online aquatic SAR Mapping tool (DFO, 2020).
- Ontario Butterfly Atlas (MacNaughton et al., 2017).

Once the list was compiled, a screening exercise was completed to determine the presence of suitable habitat for each SAR identified as potentially occurring within the study area, based on known preferred habitat characteristics for each species.

Full SAR screening results are provided in **Attachment I**.

Twenty-two SAR species were identified as potentially occurring within the study area during the background review. This number was refined to the following species based on habitat assessments, targeted wildlife surveys and ELC surveys and are discussed below.

Confirmed SAR

Butternut (END) – In Ontario, Butternut usually grows alone or in small groups in deciduous forests. It prefers moist, well-drained soil and is often found along streams. It is also found on well-drained gravel sites and rarely on dry rocky soil (MNRF 2014d). Seven butternuts were located within the study area during field surveys.

It is currently not anticipated butternut will require removal to accommodate proposed works; however, this is to be confirmed through the selection of the preferred alternative. A butternut health assessment may be required for those specimens located near the preferred alternative.

Candidate SAR

None of the species identified below were observed by ERI during field investigations; however, suitable habitat conditions were observed within the study area and/or species-specific surveys were not conducted to confirm presence. A tree inventory and cavity tree assessment may be required at detailed design.

Eastern small-footed bat, END - This species could be associated with any forested community where suitable roosting (i.e. cavity trees, houses, abandoned buildings, barns, etc.) habitat is available in the Study area.

Little brown myotis, END - This species could be associated with any forested community where suitable roosting (i.e. cavity trees, houses, abandoned buildings, barns, etc.) habitat is available in the Study area.

Northern (long-eared) myotis, END - This species could be associated with any forested community where suitable roosting (i.e. cavity trees, houses, abandoned buildings, barns, etc.) habitat is available in the Study area.

Tri-colored bat, END - This species can be found in a variety of forested habitats and could be using leaf clusters for roosting, where present, within the Study area.

3.4 Significant Wildlife Habitat

Significant Wildlife Habitat (SWH) is identified under Section 2.3 of the PPS as areas where plants, animals and other organisms live and find adequate amounts of food, water, shelter and space needed to sustain their populations. Specific wildlife habitats of concern may include areas where species concentrate at a vulnerable point in their annual or life cycle, or areas which are important to migratory species. Wildlife habitat is considered significant where it is ecologically important in terms of features, functions, representation or amount, and contributing to the quality and diversity of an identifiable geographic area or Natural Heritage System.

Defining wildlife habitat significance for Ecoregion 6E, in which the subject property is located, is described in the Significant Wildlife Habitat Technical Guide (SWHTG) Addendum (MNRF, 2015b). SWH is protected under the Ontario Provincial Policy Statement (OMMAH 2014) and is divided into four broad categories as follows:

- Seasonal concentration areas.
- Rare vegetation communities or specialized habitats for wildlife.
- Habitats of species of conservation concern, excluding the habitats of endangered and threatened species.
- Animal movement corridors.

After conducting site visits, the study area was evaluated for suitable geographic criteria and habitat characteristics for each candidate Significant Wildlife Habitat, as outlined in the SWHTG.

A summary of the SWH screening results is provided in the following sections and the detailed analysis is provided in **Appendix J.**

Candidate Significant Wildlife Habitat

The SWH screening found that the criteria for candidate SWH were met for the 2 categories listed below. These habitats are considered candidate as species-specific surveys were either not conducted, were not completed at the appropriate time of year or observations of the species did not confirm the use of these habitats (i.e., bird flyovers).

- **Bat Maternity Colonies** - study area contained deciduous forest with several mature snags suitable for bat maternity colonies. However, bat-specific surveys were not conducted by ERI.
- **Special Concern and Rare Wildlife Species:** candidate habitat for eastern ribbonsnake is located within Sawmill Creek.

Confirmed Significant Wildlife Habitat

The SWH screening found that the criteria for confirmed SWH were met for the following category:

- **Special Concern and Rare Wildlife Species: Birds –** Monarch was observed incidentally during site visits. Common milkweed was recorded in several vegetation communities within the study area.

4. Constraints and Opportunities

The portion of Sawmill creek within the study area is located within an identified Significant Natural Area and as such any disturbance or encroachment outside of the proposed limits of work should be avoided or minimized where feasible. In general, it is not anticipated for the proposed creek works along Sawmill Creek to impact the form and function of the Significant Natural Area provided appropriate mitigation measures are implemented.

Regarding the natural environment the following should be considered when selecting the preferred alternative:

Butternut – Several butternuts were observed along Sawmill Creek. Consideration should be made in the preservations of these specimens were feasible when selecting the preferred alternative.

SAR Bats - Bat species are afforded protection under the *ESA* (2007). Suitable bat habitat (cavity / snag trees) was observed within the study area. Additional bat cavity tree surveys may be required at detailed design should the proposed alternative result in tree removal. Overall, tree removals will be avoided or minimized, where feasible, to avoid potential impacts on bat habitat and contravene the Act.

Locally Rare Species – Consideration should be given to the relocation of locally rare vegetation where feasible, or the inclusion of the species into proposed seed mixes. Four locally rare vegetation species were recorded within the study area and should be avoided where possible. These include red pine, field thistle, summer grape and Philadelphia fleabane.

Restoration & invasive Species Management - An opportunity exists within our study area limits to improve the overall native species composition through the removal of invasive and non-native species and replacement with native tree, shrubs and herbaceous species along Sawmill Creek. There is also an opportunity to improve fish passage through the removal of debris within Sawmill Creek

5. General Best Management Practices

The mitigation measures described below are general in nature and appropriate for the evaluation of alternatives for the MCEA project components. Detailed assessments and recommendations should be provided once the preferred alternative has been selected.

Natural Feature Identification & Protection

Identifying and protecting natural heritage features is an important component in the design process and for the execution of a successful construction project. Limiting potential impacts to the defined work area and minimizing disturbances should be considered where possible. It is recommended that heavy-duty Erosion and Sediment Control (ESC) and Tree Protection Fencing (TPZ) be installed to clearly delineate the limits of work and to protect the surrounding natural features. Inspection of the TPZ and ESC should be done at regular intervals and after a rainfall. Any deficiencies would be repaired.

Peripheral Vegetation Protection

During construction adjacent to Significant Natural Areas, heavy equipment could damage peripheral vegetation from dust, contact, excavation and/or soil compaction. Dust coated vegetation can lead to a reduction in photosynthesis, and an increase in susceptibility to disease which could lead to species loss. All efforts should be made to protection edge vegetation through use of a combination of fencing and dust suppressants. Dust suppressants should be applied to those areas which generate large amounts of dust. Restrict earth movement immediately adjacent to woodlands or water features during periods of high dust generation.

In-Water Work

To minimize disturbance during critical periods, construction for in-water works must be restricted to a period between March 15th and July 15th of any given year. This timing window will allow for all possible species to complete their spawning without construction disturbance. Where feasible, in-water work should be conducted under low flow conditions to further reduce the risk to fish and fish habitat and to increase the likelihood that the in-water work area can be effectively isolated.

Controlled Construction Vehicle Access

Construction vehicle access should be limited to areas outside of the drip-line of the trees being preserved to prevent/minimize soil compaction and damage to Significant Natural Areas. Where feasible, existing trails and paths should be used as access points. Details on the locations of these areas should be determined at detailed design.

Construction Vehicle Re-fueling Stations

Re-fueling stations should be located within a centralized location a minimum of 30 m from Significant Natural Areas, and watercourses. An emergency response kit should be made available at each re-fueling station in case of a spill. All site construction personnel should be appropriately trained in handling a potential spill and have WHMIS Training. All chemical transfer/maintenance should be conducted within the refueling station areas.

Damage to Rooting Zones During Removals

During grading and construction in areas immediately adjacent to the Significant Natural Area, roots may be damaged by machinery and soils may be compacted, affecting the trees ability to grow. To address potential root damage, root pruning of adjacent trees during grading and excavation may be required and should be completed through communication with a certified arborist. Additionally, to avoid compaction of soils, tree protection zones around trees should be established and fenced using ESC.

Timing Restrictions

To limit disturbance to resident wildlife and significant species during their various life cycle processes, construction related activities should be completed outside of known sensitive periods. Construction should be limited to the daylight hours (i.e. 7 am to 7 pm) in order to reduce the amount of noise disturbance. In addition, vegetation removal should occur outside of the breeding bird period of April 1st to August 31st to avoid contravention of the *MBCA* through incidental take and should also occur outside of the bat maternity roosting period of April 1 to October 1 to avoid impact to SAR bats.

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Appendix A
Aquatic Habitat Photolog

Aquatic Habitat Assessment: October 29, 2020



Photo #1 (Reach 1): Photo of box culverts at the south end of the study area.



Photo #2 (Reach 1): Upstream view of failing concrete weir north of the box culverts.



Photo #3 (Reach 1): View of clay and gravel substrate.



Photo #4 (Reach 2): Upstream view eroded creek wall exposing clay.



Photo #5 (Reach 2): View of large log jam, also acting as a barrier to fish movement.

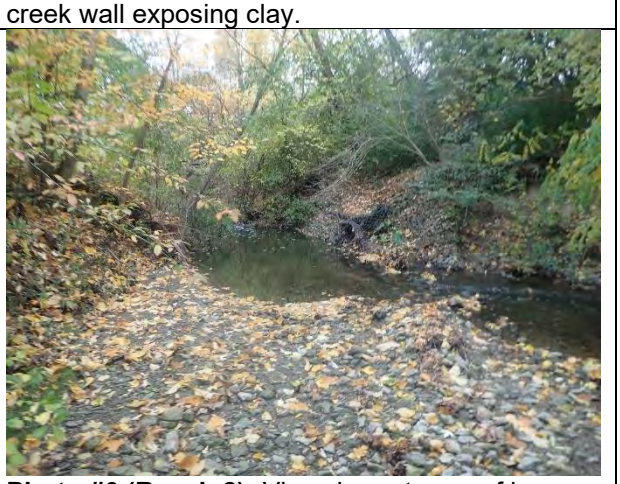


Photo #6 (Reach 2): View downstream of large log jam. Failed gabion baskets line the banks of the creek.



Photo #7 (Reach 2): View of clay, gravel, and cobble substrate.



Photo #8 (Reach 2): Downstream view of cobble deposition bars north of the eroded creek wall.



Photo #9 (Reach 3): Upstream view of wide section of creek. Water velocity in this section was low, near stagnant at the time of assessment.



Photo #10 (Reach 3): View of uprooted trees and undercutting on both banks. The substrate consists of clay and gravel.



Photo #11 (Reach 3): Downstream view of scour pool with open gabion baskets and on the left bank.



Photo #12 (Reach 3): View of gravel and cobble substrate with clumps of filamentous algae.



Photo #13 (Reach 3): Uptream view of riffle with armourstone on right bank.



Photo #14 (Reach 3): Upstream view facing pedestrian crossing. Exposed roots and undercutting are seen on the right bank.



Photo #15 (Reach 3): Downstream view of run with cobble substrate.



Photo #16 (Reach 3): Upstream view of riffle and pedestrian bridge.



Photo #17 (Reach 4): View of additional concrete blocks added to armour the bridge foundations on the south side of the pedestrian bridge.



Photo #18 (Reach 4): Upstream view of splash pad associated with gabion weir.



Photo #19 (Reach 4): Upstream view of riffle with a tree having exposed roots caused by erosion..



Photo #20 (Reach 4): Large pool directly downstream of failing weir.



Photo #21 (Reach 4): Failed concrete structure underneath pedestrian bridge.



Photo #22 (Reach 4): Close-up view of failed concrete access structure.



Photo #23 (Reach 4): Downstream view from pedestrian bridge showing cobble bar on the right bank.



Photo #24 (Reach 4): Second failed concrete structure within the creek



Photo #25 (Reach 5): Upstream view of vegetated gravel bars in the centre of the creek channel.



Photo #26 (Reach 5): Upstream view of run with an old oil sock on the left bank.



Photo #27 (Reach 5): Downstream view of small riffle. The banks consist of shrubs and low-lying vegetation.



Photo #28 (Reach 6): Upstream view of concrete bank leading to box culverts at the north end of the study area.



Photo #29 (Reach 6): Upstream view of concrete flow diversion barriers in front of concrete box culverts.



Photo #30 (Reach 6): Downstream view of pool between box culverts and flow diversion barriers.



Photo #31 (Reach 6): Downstream view on east side of channel showing vegetation growing between sloped concrete bank and the creek.

Appendix B
Vegetation Species

Vegetation Species

COMMON NAME	BOTANICAL NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	INVASIVE SPECIES ONTARIO	PROVINCIAL RANK	ESA STATUS	COSEWIC STATUS (2016-08-19)	SARA STATUS (2016-08-19)	GLOBAL RANK	REGIONAL STATUS 7E - CAROLINIAN ZONE - 2017	LOCAL STATUS PEEL	NAS Survey	STUDY AREA	CUW1	FOD7-3	FOD1-1	FOD5-3
	Reference																	
FERNS & ALLIES	**PTERIDOPHYTES**																	
Wood Fern Family	**Dryopteridaceae**																	
Northwestern Lady Fern	*Athyrium filix-femina*										C		x					
Spinulose Wood Fern	*Dryopteris carthusiana*	5	-3			S5				G5	C	X	x					
Crested Wood Fern	*Dryopteris cristata*	7	-5			S5				G5	U	X	x					
Evergreen Wood Fern	*Dryopteris intermedia*	5	0			S5				G5	C	X	x					
Marginal Wood Fern	*Dryopteris marginalis*	5	3			S5				G5	C	X	x					
Western Oak Fern	*Gymnocarpium dryopteris*	7	3			S5				G5	U	X	x					
Ostrich Fern	*Matteuccia struthiopteris*	5	0			S5				G5	C	X	x					
Sensitive Fern	*Onoclea sensibilis*	4	-3			S5				G5	C	X	x					
Christmas Fern	*Polystichum acrostichoides*	5	3			S5				G5	C	X	x					
Horsetail Family	**Equisetaceae**																	
Field Horsetail	*Equisetum arvense*	0	0			S5				G5	C	X	x					
Common Scouring-rush	*Equisetum hyemale*	2	0			S5				G5T5	C	X	x					
Common Scouring-rush	*Equisetum hyemale ssp. affine*												x					
Marsh Horsetail	*Equisetum palustre*	10	-3			S5				G5	R	RL	x					
Meadow Horsetail	*Equisetum pratense*	8	-3			S5				G5	R	RL	x					
Adder's Tongue Family	**Ophioglossaceae**																	
Rattlesnake Fern	*Botrychium virginianum*	5	3			S5				G5	C	X	x					
Royal Fern Family	**Osmundaceae**																	
Interrupted Fern	*Osmunda claytoniana*	7	-1			S5				G5	C	RL	x					
Royal Fern	*Osmunda regalis*	7	-5			S5				G5	C	L	x					
Maidenhair Fern Family	**Pteridaceae**																	
Northern Maidenhair Fern	*Adiantum pedatum*	7	3			S5				G5	C	X	x					
Marsh Fern Family	**Thelypteridaceae**																	
Eastern Marsh Fern	*Thelypteris palustris*	5	-3			S5				G5	C	X	x					
CONIFERS	**GYMNOSPERMS**																	
Cedar Family	**Cupressaceae**																	
Eastern Red Cedar	*Juniperus virginiana*	4	3			S5				G5	C	L	x					
Red Cedar	*Juniperus virginiana var. virginiana*	4	3			S5				G5T5				x				x
Eastern White Cedar	*Thuja occidentalis*	4	-3			S5				G5	C	X	x					
Pine Family	**Pinaceae**																	
Tamarack	*Larix laricina*	7	-3			S5				G5	U	X	x	x	x			
Norway Spruce	*Picea abies*		5	-1		SNA				G5	IX	I	x	x		x	x	x
White Spruce	*Picea glauca*	6	3			S5				G5	U	L	x	x				x
Blue Spruce	*Picea pungens*		3			SNA				G5	IR		x	x	x	x	x	
Jack Pine	*Pinus banksiana*	5	3			S5				G5	IR	I	x					
Austrian Pine	*Pinus nigra*		5	-1		SNA				GNR	IR		x					
Red Pine	*Pinus resinosa*	8	3			S5				G5	R	RL	x	x	x	x		
Eastern White Pine	*Pinus strobus*	4	3			S5				G5	C	X	x	x	x	x		x

COMMON NAME	BOTANICAL NAME	COEFFICIENT OF CONSERVATISM	WETNESS INDEX	WEEDINESS INDEX	INVASIVE SPECIES ONTARIO	PROVINCIAL RANK	ESA STATUS	COSEWIC STATUS (2016-08-19)	SARA STATUS (2016-08-19)	GLOBAL RANK	REGIONAL STATUS 7E - CAROLINIAN ZONE - 2017	LOCAL STATUS PEEL	NAS Survey	STUDY AREA	CUW1	FOD7-3	FOD1-1	FOD5-3
Scots Pine	*Pinus sylvestris*		3	-3	2	SNA				GNR	IX	I	x					
Eastern Hemlock	*Tsuga canadensis*	7	3			S5				G5	C	X	x					
Yew Family	**Taxaceae**																	
Canada Yew	*Taxus canadensis*	7	3			S4				G5	U	X	x	x				x
DICOTS	**DICOTYLEDONS**																	
Maple Family	**Aceraceae**																	
Hedge Maple	*Acer campestre*		5			SNA				GNR	IR		x					
Freeman's Maple	*Acer X freemanii*	6	-5			SNA				GNA	hyb		x	x			x	x
Amur Maple	*Acer ginnala*		5	-2	4	SNA				G--TNR			x	x		x		
Manitoba Maple	*Acer negundo*	0	0		1	S5				G5	C	X	x	x		x	x	
Norway Maple	*Acer platanoides*		5	-3	2	SNA				GNR	IU	I	x	x	x	x	x	
Red Maple	*Acer rubrum*	4	0			S5				G5	C	X	x					
Silver Maple	*Acer saccharinum*	5	-3			S5				G5	C	X	x	x	x	x		x
Sugar Maple	*Acer saccharum*	4	3			S5				G5	C	X	x	x	x	x	x	x
Mountain Maple	*Acer spicatum*	6	3			S5				G5	U	X	x					
Freeman's Maple	*Acer X freemanii*	6	-5			SNA				GNA	hyb		x					
Sumac or Cashew Family	**Anacardiaceae**																	
Staghorn Sumac	*Rhus typhina*	1	3			S5				G5	C	X	x	x	x	x	x	x
Carrot or Parsley Family	**Apiaceae**																	
Bishop's Goutweed	*Aegopodium podagraria*		0	-3	1	SNA				GNR	IU	I	x	x			x	
Woodland Chervil	*Anthriscus sylvestris*		5	-2		SNA				GNR	IR	I	x					
Spotted Water-hemlock	*Cicuta maculata*	6	-5			S5				G5	C	X	x	x			x	
Poison Hemlock	*Conium maculatum*		-3	-1		SNA?				G5	IR	I	x					
Canadian Honewort	*Cryptotaenia canadensis*	5	0			S5				G5	C	X	x					
Wild Carrot	*Daucus carota*		5	-2		SNA				GNR	IC	I	x	x	x	x	x	x
Giant Hogweed	*Heracleum mantegazzianum*		0		1	SNA				GNR	IR	RL	x					
Cow-parsnip	*Heracleum maximum*	3	-3			S5				G5	U		x					
Woolly Sweet-cicely	*Osmorhiza claytonii*	5	0			S5				G5	C	X	x					
Erect Hedge-parsley	*Torilis japonica*		3	-3		SNA				GNR	IX	I	x					
Dogbane Family	**Apocynaceae**																	
Spreading Dogbane	*Apocynum androsaemifolium*	3	5			S5				G5	C	X	x					
Indian Hemp	*Apocynum cannabinum*	3	0			S5				G--T5?	C	X	x					
Common Periwinkle	*Vinca minor*		5	-2	2	SNA				GNR	IX	I	x	x	x			
Duchman's-pipe Family	**Aristolochiaceae**																	
Wild Ginger	*Asarum canadense*	6	5			S5				G5	C	X	x					
Milkweed Family	**Asclepiadaceae**																	
Common Milkweed	*Asclepias syriaca*	0	5			S5				G5	C	X	x	x		x	x	
European Swallow-wort	*Vincetoxicum rossicum*		5	-3	1	SNA				GNR	IX	I	x					
Aster Family	**Asteraceae**																	
Common Yarrow	*Achillea millefolium*		3	-1		SE				G5	IX	I	x					
Common Ragweed	*Ambrosia artemisiifolia*	0	3			S5				G5	C		x	x	x	x	x	
Perennial Ragweed	*Ambrosia psilostachya*	0	0	-1		SNA				G5	IR	X		x	x		x	

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Western Pearly Everlasting	*Anaphalis margaritacea*	3	3			S5				G5	R		x					
Common Burdock	*Arctium minus*		3	-2		SNA				GNR	IC		x	x	x	x	x	x
Common Mugwort	*Artemisia vulgaris*		5	-1	4	SNA				GU	IX		x					
Aster species	*Symphyotrichum sp.*													x	x	x		
Heart-leaved Aster	*Symphyotrichum cordifolium*	5	5			S5				G5	C		x					
Heath Aster	*Symphyotrichum ericoides*	4	3			S5				G5	C		x					
Smooth Blue Aster	*Symphyotrichum laeve*	7	3			S5				G5	C		x					
White Panicled Aster	*Symphyotrichum lanceolatum*	3	-3			S5				G5	C		x					
Calico Aster	*Symphyotrichum lateriflorum*	3	0			S5				G5	C	X	x					
Large-leaved Aster	*Eurybia macrophylla*	5	5			S5				G5	C		x					
New England Aster	*Symphyotrichum novae-angliae*	2	-3			S5				G5	C		x	x	x			
Oldfield Aster	*Symphyotrichum pilosum*		3			S5				G5T5	C		x					
Purple-stemmed Aster	*Symphyotrichum puniceum*										C		x					
Nodding Beggar-ticks	*Bidens cernua*	2	-5			S5				G5	C		x					
Devil's Beggar-ticks	*Bidens frondosa*	3	-3			S5				G5	C		x					
Chicory	*Cichorium intybus*		5	-1		SNA				GNR	IC	I	x	x		x	x	x
Canada Thistle	*Cirsium arvense*		3	-1	1	SNA				GNR	IC		x	x	x	x		
Field Thistle	*Cirsium discolor*	9	5			S3				G5	R			x		x		
Bull Thistle	*Cirsium vulgare*		3	-1		SNA				GNR	IC		x	x	x	x	x	
Eastern Daisy Fleabane	*Erigeron annuus*	0	3			S5				G5	C		x	x	x	x	x	
Philadelphia Fleabane	*Erigeron philadelphicus*	1	-3			S5				G5	C	RL	x	x	x	x		
Rough Fleabane	*Erigeron strigosus*	4	3			S5				G5	C		x					
Boneset	*Eupatorium perfoliatum*	2	-3			S5				G5	C	X	x					
White Snakeroot	*Ageratina altissima*										C		x					
Spotted Joe-pye-weed	*Eutrochium maculatum*	3	-5			S5				G5	C	X	x					
Grass-leaved Goldenrod	*Euthamia graminifolia*	2	0			S5				G5	C		x					
Elecampane	*Inula helenium*		3	-2	4	SNA				GNR	IU		x					
Tall Blue Lettuce	*Lactuca biennis*	6	0			S5				G5	U		x					
Prickly Lettuce	*Lactuca serriola*		3	-1		SNA				GNR	IC	I	x					
Nipplewort	*Lapsana communis*		3	-2	4	SNA				GNR	IX		x					
Black-eyed Susan	*Rudbeckia hirta*	0	3			S5				G5	C	X	x					
Brown-eyed Susan	*Rudbeckia triloba*		3	-1		SNA				G5	IX	RL	x					
Goldenrod Species	*Solidago sp.*													x	x	x	x	x
Tall Goldenrod	*Solidago altissima*	1	3			S5				G5	C	X	x	x	x	x	x	x
Wreath Goldenrod	*Solidago caesia*	5	3			S5				G5	C	X	x					
Canada Goldenrod	*Solidago canadensis var. canadensis*	1	3			S5				G5	C	X		x	x	x	x	x
Zig-zag Goldenrod	*Solidago flexicaulis*	6	3			S5				G5	C	X	x	x				x
Giant Goldenrod	*Solidago gigantea*	4	-3			S5				G5	C	X	x					
Early Goldenrod	*Solidago juncea*	3	5			S5				G5	C	X	x					
Round-leaved Goldenrod	*Solidago patula*	8	-5			S4				G5	C	RL	x					
Wrinkle-leaf Goldenrod	*Solidago rugosa*										C		x					
Bog Goldenrod	*Solidago uliginosa*	9	-5			S5				G4G5	R	RL	x					
Field Sow-thistle	*Sonchus arvensis*										IC		x	x			x	

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Field Sow-thistle	*Sonchus arvensis ssp. arvensis*		3	-1		SNA				GNRTNR	IC	I	x					
Common Sow-thistle	*Sonchus oleraceus*		3	-1		SNA				GNR	IX	I	x					
Rock Dandelion	*Taraxacum erythrospermum*		5	-1		SNA				GNR	IX	I		x	x		x	
Common Dandelion	*Taraxacum officinale*		3	-2		SNA				G5	IC	I	x	x	x	x	x	x
Yellow Salsify	*Tragopogon dubius*		5	-1		SNA				GNR	IC	I	x					
Jack go to bed at noon	*Tragopogon pratensis*		5	-1		SNA				GNR	IX	I	x					
Coltsfoot	*Tussilago farfara*		3	-2		SNA				GNR	IC	I	x	x	x	x		
Touch-me-not Family	**Balsaminaceae**																	
Jewelweed	*Impatiens capensis*	4	-3			S5				G5	C	X	x	x		x		
Barberry Family	**Berberidaceae**																	
Oregon-grape	*Berberis aquifolium*		5	-1		SNA				G5	IR	X	x					
Japanese Barberry	*Berberis thunbergii*		4	-3	3	SNA				GNR	IX	L	x					
Blue Cohosh	*Caulophyllum thalictroides*	6	5			S5				G5	X		x					
May-apple	*Podophyllum peltatum*	5	3			S5				G5	C	I	x					
Birch Family	**Betulaceae**																	
Yellow Birch	*Betula alleghaniensis*	6	0			S5				G5	C		x					
Paper Birch	*Betula papyrifera*	2	2			S5				G5	C		x					
Blue Beech	*Carpinus caroliniana*										C		x					
Beaked Hazelnut	*Corylus cornuta*	5	5			S5				G5	U		x					
Ironwood	*Ostrya virginiana*	4	4			S5				G5	C		x	x			x	
Bignonia Family	**Bignoniaceae**																	
Northern Catalpa	*Catalpa speciosa*		3	-1		SNA				G4?	IR		x					
Borage Family	**Boraginaceae**																	
Hound's-tongue	*Cynoglossum officinale*		5	-1		SNA				GNR	IU		x					
Viper's Bugloss	*Echium vulgare*		5	-2		SNA				GNR	IC		x					
Virginia Stickweed	*Hackelia virginiana*	5	1			S5				G5	C	I	x					
European Stoneseed	*Lithospermum officinale*		5	-1		SNA				GNR	IU	I	x					
Forget-me-not species	*Myosotis sp.*												x					
Bay Forget-me-not	*Myosotis laxa*	6	-5			S5				G5	C	I	x					
True Forget-me-not	*Myosotis scorpioides*		-5	-1	4	SNA				G5	IX		x					
Mustard Family	**Brassicaceae**																	
Garlic Mustard	*Alliaria petiolata*		0	-3	1	SNA				GNR	IC	I	x	x	x	x	x	x
Garden Yellowrocket	*Barbarea vulgaris*		0	-1	3	SNA				GNR	IC		x					
Wild Turnip	*Brassica rapa*		5	-1		SNA				GNR	IR	I	x					
Cut-leaved Toothwort	*Cardamine concatenata*	6	3			S5				G5	C	RL	x					
Dame's Rocket	*Hesperis matronalis*		5	-3	1	SNA				G4G5	IC	X	x					
Field Pepperweed	*Lepidium campestre*		5	-1		SNA				GNR	IC	I		x				x
Marsh Yellow-cress	*Rorippa palustris*										C		x					
Bellflower Family	**Lobelia**																	
Creeping Bellflower	*Campanula rapunculoides*		5	-2	4	SNA				GNR	IU	I	x					
Indian Tobacco	*Lobelia inflata*	3	4			S5				G5	C	X	x					
Great Blue Lobelia	*Lobelia siphilitica*	6	-4			S5				G5	C	X	x					
Hemp Family	**Cannabaceae**																	
Japanese Hop	*Humulus japonicus*		3	-1	3	SNA				GNR	IR	I	x					

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Honeysuckle Family	**Caprifoliaceae**																	
Northern Bush Honeysuckle	*Diervilla lonicera*	5	5			S5				G5	C	X	x					
American Fly Honeysuckle	*Lonicera canadensis*	6	3			S5				G5	C	X	x					
Limber Honeysuckle	*Lonicera dioica*	5	3			S5				G5	C	X	x					
Douglas Honeysuckle	*Lonicera dioica*												x					
Amur Honeysuckle	*Lonicera maackii*		5	-2	1	SNA				GNR	IR		x					
Morrow's Honeysuckle	*Lonicera morrowii*		5	-1	1	SNA				GNR	IR	I	x					
Tartarian Honeysuckle	*Lonicera tatarica*		3	-3	1	SNA				GNR	IC	I	x	x	x	x	x	x
Showy Fly Honeysuckle	*Lonicera X bella*		5	-3		hyb				GNA	hyb	I	x					
Red Elderberry	*Sambucus racemosa*	5	2		4	S5				G5	C	X	x					
Snowberry	*Symphoricarpos albus*	7	4		4	S5				G5		L	x					
Viburnum species	*Viburnum sp.*													x			x	
Maple-leaved Viburnum	*Viburnum acerifolium*	6	5			S5				G5	C	X	x					
Wayfaring-tree	*Viburnum lantana*		5	-1		SNA				GNR	IX	I	x					
Nannyberry	*Viburnum lentago*	4	-1			S5				G5	C	X	x					
European Cranberrybush	*Viburnum opulus*		0	-1		SNA				G5		I	x					
Pink Family	**Caryophyllaceae**																	
Common Mouse-ear Chickweed	*Cerastium fontanum*		3	-1		SNA				GNR	IC	I	x					
Deptford Pink	*Dianthus armeria*		5	-1		SNA				GNR	IC	I	x					
Longleaf Starwort	*Stellaria longifolia*	2	-4			S5				G5	C	RL	x					
Staff-tree Family	**Celastraceae**																	
Winged Spindle Tree	*Euonymus alatus*		5	-1	3	SNA				GNR	IR	I		x	x	x	x	
European Spindle Tree	*Euonymus europaeus*		5	-1		SNA				GNR	IR	I		x	x	x	x	
Winter Creeper	*Euonymus fortunei*		5	-1		SNA				GNR	IR		x					
Running Strawberry-bush	*Euonymus obovatus*	6	5			S4				G5	C	X	x					
Goosefoot Family	**Chenopodiaceae**																	
Lamb's Quarters	*Chenopodium album*					SNA				G5	IC		x					
Oak-leaved Goosefoot	*Chenopodium glaucum*												x					
Morning-glory Family	**Convolvulaceae**																	
Field Bindweed	*Convolvulus arvensis*		5	-1	3	SNA				GNR	IC	I	x					
Dogwood Family	**Cornaceae**																	
Alternate-leaved Dogwood	*Cornus alternifolia*	6	5			S5				G5	C	X	x	x	x			x
Silky Dogwood	*Cornus amomum*	5	-4			S5				G5		L		x		x		
Gray Dogwood	*Cornus racemosa*	2	-2			S5				G5	C	X	x					
Round-leaved Dogwood	*Cornus rugosa*	6	5			S5				G5	C	X	x					
Gourd Family	**Cucurbitaceae**																	
Wild Cucumber	*Echinocystis lobata*	3	-2			S5				G5	C	X	x					
One-seeded Bur-cucumber	*Sicyos angulatus*	5	-2			S4S5				G5	U	RL	x					
Teasel Family	**Dipsacaceae**																	
Fuller's Teasel	*Dipsacus fullonum*		5	-1	3	SNA				GNR	IC	I	x	x	x		x	x
Oleaster Family	**Elaeagnaceae**																	
Russian Olive	*Elaeagnus angustifolia*		4	-1	3	SNA				GNR	IU	I	x					

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Autumn Olive	*Elaeagnus umbellata*		3	-3	1	SNA				GNR	IU		x					
Spurge Family	**Euphorbiaceae**																	
Three-seeded Mercury	*Acalypha rhomboidea*	0	3			S5				G5	C	X	x					
Pea Family	**Fabaceae**																	
Hog Peanut	*Amphicarpaea bracteata*	4	0			S5				G5	C	X	x					
Groundnut	*Apios americana*	6	-3			S5				G5	C	RL	x					
Canadian Tick-trefoil	*Desmodium canadense*	5	1			S4				G5	C	L	x					
Pointed-leaved Tick-trefoil	*Desmodium glutinosum*	6	5			S4				G5	U	L	x					
Honey Locust	*Gleditsia triacanthos*	3	0			S2?				G5	R	I	x					
Bird's-foot Trefoil	*Lotus corniculatus*		1	-2	2	SNA				GNR	IC	I	x	x	x			
Black Medick	*Medicago lupulina*		1	-1	4	SNA				GNR	IC	I	x	x			x	
Alfalfa	*Medicago sativa ssp. sativa*		5	-1	4	SNA				GNRTNR	IC	I	x					
Yellow Sweet-clover	*Melilotus officinalis*		3	-1		SNA				GNR	IC	I	x					
Black Locust	*Robinia pseudoacacia*		4	-3	2	SNA				G5	IC	I		x	x	x		x
Rabbit-foot Clover	*Trifolium arvense*		5	-1	4	SNA				GNR	IX	I	x					
Alsike Clover	*Trifolium hybridum*		1	-1		SNA				GNR	IC	I		x	x	x		
Red Clover	*Trifolium pratense*		2	-2	4	SNA				GNR	IC	I	x					
White Clover	*Trifolium repens*		2	-1	4	SNA				GNR	IC	I	x					
Cow Vetch	*Vicia cracca*		5	-1	2	SNA				GNR	IX	I	x	x	x			
Beech Family	**Fagaceae**																	
American Beech	*Fagus grandifolia*	6	3			S4				G5	C	X	x	x			x	x
White Oak	*Quercus alba*	6	3			S5				G5	C	X	x					
Bur Oak	*Quercus macrocarpa*	5	1			S5				G5	C	X	x					
Pin Oak	*Quercus palustris*	9	-3			S4				G5	C		x					
English Oak	*Quercus robur*					SNA				GNR	IR		x					
Red Oak	*Quercus rubra*	6	3			S5				G5	C	X	x	x	x		x	x
Geranium Family	**Geraniaceae**																	
Spotted Geranium	*Geranium maculatum*	6	3			S5				G5	C	X	x					
Herb-robert	*Geranium robertianum*		5	-2		S5				G5	C	I	x					
Currant Family	**Grossulariaceae**																	
Currant sp.	*Ribes sp.*												x					
American Black Currant	*Ribes americanum*	4	-3			S5				G5	C	X	x					
Eastern Prickly Gooseberry	*Ribes cynosbati*	4	5			S5				G5	C	X	x					
Red Currant	*Ribes rubrum*		5	-2		SNA				G4G5	IX	I	x					
Swamp Red Currant	*Ribes triste*	6	-5			S5				G5	U	X	x					
St. John's-wort Family	**Guttiferae**																	
Common St. John's-wort	*Hypericum perforatum*		5	-3	4	SNA				GNR	IC	I	x	x				x
Spotted St. John's-wort	*Hypericum punctatum*	5	-1			S5				G5	C	RL	x					
Witch-hazel Family	**Hamamelidaceae**																	
Witch-hazel	*Hamamelis virginiana*	6	3			S4S5				G5	C	X	x					
Buckeye Family	**Hippocastanaceae**																	
Horse Chestnut	*Aesculus hippocastanum*		5	-1	3	SNA				GNR	IR	I	x					
Water-leaf Family	**Hydrophyllaceae**																	
Virginia Water-leaf	*Hydrophyllum virginianum*	6	-2			S5				G5	C	X	x					

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Walnut Family	**Juglandaceae**																	
Bitternut Hickory	*Carya cordiformis*	6	0			S5				G5	C	X	x					
Bitternut Hickory	*Carya cordiformis*	6	0			S5				G5	C	X	x	x	x			
Shagbark Hickory	*Carya ovata*	6	3			S5				G5	C	X	x	x			x	
Butternut	*Juglans cinerea*	6	2			S2?	END	END	END	G4	U	X	x	x	x	x		
Black Walnut	*Juglans nigra*	5	3			S4?				G5	C	X	x	x	x	x	x	x
Mint Family	**Lamiaceae**																	
Ground Ivy	*Glechoma hederacea*		5	-2	4	SNA				GNR	IC	I	x					
Common Motherwort	*Leonurus cardiaca*										IC		x					
Common Motherwort	*Leonurus cardiaca ssp. cardiaca*		5	-2		SNA				GNRTNR		I	x					
American Water-horehound	*Lycopus americanus*	4	-5			S5				G5	C	X	x					
European Water-horehound	*Lycopus europaeus*		-5	-2	3	SNA				GNR	IU	I	x					
American Wild Mint	*Mentha arvensis*	3	-3			S5				G5	C	X		x		x	x	
Catnip	*Nepeta cataria*		1	-2	4	SNA				GNR	IC	I	x					
Common Heal-all	*Prunella vulgaris ssp. vulgaris*		0	-1		SNA				G5TU	IR			x	x		x	
Lance Heal-all	*Prunella vulgaris ssp. lanceolata*	5	5			S5				G5T5	C	X	x					
Laurel Family	**Lauraceae**																	
Northern Spicebush	*Lindera benzoin*	6	-2			S4				G5	C	RL	x					
Loosestrife Family	**Lythraceae**																	
Purple Loosestrife	*Lythrum salicaria*		-5	-3	1	SNA				G5	IC	I	x					
Mallow Family	**Malvaceae**																	
Common Mallow	*Malva neglecta*		5	-1		SNA				GNR	IC	I	x					
Moonseed Family	**Menispermaceae**																	
Common Moonseed	*Menispermum canadense*	7	0			S4				G5	C	L	x					
Mulberry Family	**Moraceae**																	
White Mulberry	*Morus alba*		0	-3	1	SNA				GNR	IC	I	x					
Olive Family	**Oleaceae**																	
Green-stem Forsythia	*Forsythia viridissima*					SNA				GNR	IR	I	x					
White Ash	*Fraxinus americana*	4	3			S4				G5	C	X	x	x	x	x	x	x
Black Ash	*Fraxinus nigra*	7	-4			S4				G5	C	X	x					
Green Ash	*Fraxinus pennsylvanica*	3	-3			S4				G5	C	X	x	x				x
European Privet	*Ligustrum vulgare*		1	-2	4	SNA				GNR	IX	I	x					
Japanese Tree Lilac	*Syringa reticulata*										IR		x					
Evening-primrose Family	**Onagraceae**																	
Canada Enchanter's Nightshade	*Circaea canadensis*	3	3			S5				G5	C	X	x	x		x	x	x
Common Lilac	*Syringa vulgaris*		5	-2	2	SNA				GNR	IX	I	x					
Evening-primrose Family	**Onagraceae**																	
Canada Enchanter's Nightshade	*Circaea canadensis*	3	3			S5				G5	C	X	x					
Hairy Willow-herb	*Epilobium ciliatum*										C		x					

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Purple-veined Willow-herb	*Epilobium coloratum*	3	-5			S5				G5	C	RL	x					
Great Hairy Willow-herb	*Epilobium hirsutum*		-4	-2		SNA				GNR	IU	I	x					
Northern Evening-primrose	*Oenothera parviflora*	1	3			S5				G5	C	X	x					
Broom-rape Family	**Orobanchaceae**																	
Beechdrops	*Epifagus virginiana*	6	5			S5				G5	C	X	x					
One-flowered Broom-rape	*Orobanche uniflora*	8	5			S4				G5	R	RL	x					
Wood Sorrel Family	**Oxalidaceae**																	
Slender Yellow Wood-sorrel	*Oxalis dillenii*	0	3			S5?				G5	U	X	x					
Common Yellow Oxalis	*Oxalis stricta*	0	3			S5				G5	C	X	x	x	x	x	x	x
Poppy Family	**Papaveraceae**																	
Celandine	*Chelidonium majus*		5	-3		SNA				GNR	IU	I	x					
Bloodroot	*Sanguinaria canadensis*	5	4			S5				G5	C	X	x					
Lopseed Family	**Phrymaceae**																	
American Lopseed	*Phryma leptostachya*	6	5			S4S5				G5	C	X	x					
Plantain Family	**Plantaginaceae**																	
English Plantain	*Plantago lanceolata*		0	-1		SNA				G5	IC	I	x	x			x	
Common Plantain	*Plantago major*		-1	-1		SNA				G5	IC	I	x	x	x	x	x	x
Rugel's Plaintain	*Plantago rugelii*	1	0			S5				G5	C	X	x					
Smartweed Family	**Polygonaceae**																	
Leathery Knotweed	*Polygonum achoreum*	0	5			S5				G5	R	X	x					
Prostrate Knotweed	*Polygonum aviculare*		1	-1		SNA				GNR		I	x					
Curlytop Smartweed	*Persicaria lapathifolia*	2	-4			S5				G5	C	X	x					
Pennsylvania Smartweed	*Persicaria pensylvanica*	3	-4			S5				G5	C	RL	x					
Lady's-thumb	*Persicaria maculosa*		-3	-1		SNA				G3G5	IC	I	x					
Curly-leaf Dock	*Rumex crispus*		-1	-2		SNA				GNR	IC	I	x	x	x	x	x	x
Bitter Dock	*Rumex obtusifolius*		-3	-1		SNA				GNR	IX	I	x					
Purslane Family	**Portulacaceae**																	
Virginia Spring Beauty	*Claytonia virginica*	5	3			S5				G5	C	X	x					
Primrose Family	**Primulaceae**																	
Fringed Loosestrife	*Lysimachia ciliata*	4	-3			S5				G5	C	X	x					
Creeping Jenny	*Lysimachia nummularia*		-4	-3	2	SNA				GNR	IC	I	x	x	x	x		
Star-flower	*Trientalis borealis*	6	-1			S5				G5	C	X	x					
Buttercup Family	**Ranunculaceae**																	
White Baneberry	*Actaea pachypoda*	6	5			S5				G5	C	X	x					
Red Baneberry	*Actaea rubra*	5	5			S5				G5	C	X	x					
Canada Anemone	*Anemone canadensis*	3	-3			S5				G5	C	X	x	x		x		x
Round-lobed Hepatica	*Anemone americana*	6	5			S5				G5	C	RL	x					
Wood Anemone	*Anemone quinquefolia*										C		x					
Wood Anemone	*Anemone quinquefolia var. quinquefolia*	7	0			S5				G5T5		X	x					
Virginia Anemone	*Anemone virginiana*										C		x					
Tall Thimbleweed	*Anemone virginiana var. virginiana*	4	5			S5				G5T5	C	X	x					
Wild Columbine	*Aquilegia canadensis*	5	1			S5				G5	C	X	x					

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Yellow Marsh-marigold	*Caltha palustris*	5	-5			S5				G5	C	X	x					
Virginia Virgin's-bower	*Clematis virginiana*	3	0			S5				G5	C	X	x					
Littleleaf Buttercup	*Ranunculus abortivus*	2	-2			S5				G5	C	X	x					
Tall Buttercup	*Ranunculus acris*		-2	-2		SNA				G5	IC	I	x	x	x	x	x	
Hooked Buttercup	*Ranunculus recurvatus*										C		x					
Creeping Buttercup	*Ranunculus repens*		-1	-1	3	SNA				GNR	IX	I	x					
Early Meadow-rue	*Thalictrum dioicum*	5	2			S5				G5	C	X	x					
Tall Meadow-rue	*Thalictrum pubescens*	5	-2			S5				G5	C	X	x					
Buckthorn Family	**Rhamnaceae**																	
Common Buckthorn	*Rhamnus cathartica*		3	-3	1	SNA				GNR	IC	I	x	x	x	x	x	x
Rose Family	**Rosaceae**																	
Tall Hairy Agrimony	*Agrimonia gryposepala*	2	2			S5				G5	C	X	x					
Saskatoon Berry	*Amelanchier alnifolia*	8	2			S4?				G5		RL	x					
Downy Serviceberry	*Amelanchier arborea*	5	3			S5				G5	C	X	x					
Hawthorn species	*Crataegus sp.*	4	5										x	x	x		x	
English Hawthorn	*Crataegus monogyna*		5	-1	3	SNA				G5	IU	I	x					
Dotted Hawthorn	*Crataegus punctata*	4	5			S5				G5	C	X	x					
Fleshy Hawthorn	*Crataegus succulenta*	4	5			S5				G5	C	RL	x					
Woodland Strawberry	*Fragaria vesca*										U		x	x	x		x	
Woodland Strawberry	*Fragaria vesca ssp. americana*	4	4			S5				G5T5	U	X	x					
Wild Strawberry	*Fragaria virginiana*	2	1			S5				G5	C	X	x					
Avens species	*Geum sp.*												x	x	x		x	
Yellow Avens	*Geum aleppicum*	2	-1			S5				G5	C	X	x					
White Avens	*Geum canadense*	3	0			S5				G5	C	X	x	x	x	x	x	x
Wood Avens	*Geum urbanum*		5	-1		SNA				G5	IX	I	x					
Common Apple	*Malus pumila*		5	-1		SNA				G5	IC	I	x	x	x		x	
Silvery Cinquefoil	*Potentilla argentea*		3	-2		SNA				GNR	IX	I	x					
Norwegian Cinquefoil	*Potentilla norvegica*	0	0			S5				G5	C	I	x					
Rough-fruited Cinquefoil	*Potentilla recta*		5	-2		SNA				GNR	IC	I	x	x	x			
Old-field Cinquefoil	*Potentilla simplex*	3	4			S5				G5	C	X	x					
Purple Leaf Sand Cherry	*Prunus x cistena*												x	x			x	x
Sweet Cherry	*Prunus avium*		5	-2	4	SNA				GNR	IR	I	x	x	x		x	
Canada Plum	*Prunus nigra*	4	4			S4				G4G5	U	X	x					
Pin Cherry	*Prunus pensylvanica*	3	4			S5				G5	C	X	x					
Black Cherry	*Prunus serotina*	3	3			S5				G5	C	X	x	x			x	x
Choke Cherry	*Prunus virginiana*	2	1			S5				G5	C	X	x	x	x	x	x	x
Common Pear	*Pyrus communis*		5	-1		SNA				G5	IU	I	x					
Dog Rose	*Rosa canina*		5	-1		SNA				GNR	IX	I	x					
Multiflora Rose	*Rosa multiflora*		3	-3	1	SNA				GNR	IC	I	x	x		x	x	x
Common Blackberry	*Rubus allegheniensis*	2	2			S5				G5	C	X	x	x				x
American Red Raspberry	*Rubus idaeus*	0	-2			SNA				G5			x	x	x	x	x	
Black Raspberry	*Rubus occidentalis*	2	5			S5				G5	C	X	x	x		x		
Purple Flowering Raspberry	*Rubus odoratus*	3	5			S5				G5	C	X	x					
False Spiraea	*Sorbaria sorbifolia*		5	-1	3	SNA				G5	IR	I	x					

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European Mountain-ash	*Sorbus aucuparia*		5	-2	4	SNA				G5	IX	I	x					
Northern Mountain-ash	*Sorbus decora*	8	3			S5				G5	R		x					
Meadow-sweet sp.	*Spiraea sp.*												x					
Japanese Meadow-sweet	*Spiraea japonica*		5	-1		SNA				G5	IR	I	x					
Madder Family	**Rubiaceae**																	
Bedstraw species	*Galium sp.*													x	x		x	
Cleavers	*Galium aparine*	4	3			S5				G5	C	L	x	x	x	x		
Smooth Bedstraw	*Galium mollugo*		5	-2	2	SNA				GNR	IU	I	x					
Fragrant Bedstraw	*Galium triflorum*	4	2			S5				G5	C	X	x					
Willow Family	**Salicaceae**																	
Balsam Poplar	*Populus balsamifera*	4	-3			S5				G5	U	X	x					
Eastern Cottonwood	*Populus deltoides*										C		x					
Large-tooth Aspen	*Populus grandidentata*	5	3			S5				G5	C	X	x					
Trembling Aspen	*Populus tremuloides*	2	0			S5				G5	C	X	x	x	x			
Crack Willow	*Salix fragilis*		-1	-3	3	SE				GNR	IC	I	x	x		x		
Willow species	*Salix sp.*													x	x	x		
White Willow	*Salix alba*		-3	-2	3	SNA				G5	IX	I	x					
Peach-leaved Willow	*Salix amygdaloides*	6	-3			S5				G5	C	L	x					
Bebb's Willow	*Salix bebbiana*	4	-4			S5				G5	C	X	x					
Missouri River Willow	*Salix eriocephala*	4	-3			S5				G5	C	X	x					
Crack Willow	*Salix fragilis*		-1	-3	3	SE				GNR	IC	I	x					
Shining Willow	*Salix lucida*	5	-4			S5				G5	U	L	x					
Hybrid Crack Willow	*Salix X rubens*		-4	-3		hyb				HYB	hyb		x					
Saxifrage Family	**Saxifragaceae**																	
Heartleaf Foamflower	*Tiarella cordifolia*	6	1			S5				G5	C	X	x					
Figwort Family	**Scrophulariaceae**																	
Butter-and-eggs	*Linaria vulgaris*		5	-1	4	SNA				GNR	IC	I	x					
Common Mullein	*Verbascum thapsus*		5	-2		SNA				GNR	IC	I	x					
Common Gypsyweed	*Veronica officinalis*		5	-2		SNA				G5	IX	I	x					
Ailanthus Family	**Simaroubaceae**																	
Tree-of-heaven	*Ailanthus altissima*		5	-1	2	SNA				GNR	IR	I	x					
Nightshade Family	**Solanaceae**																	
Bittersweet Nightshade	*Solanum dulcamara*		0	-2	3	SNA				GNR	IC	I	x	x		x		
Linden Family	**Tiliaceae**																	
American Basswood	*Tilia americana*	4	3			S5				G5	C	X	x	x		x		x
Elm Family	**Ulmaceae**																	
Common Hackberry	*Celtis occidentalis*	8	1			S4				G5	C		x					
American Elm	*Ulmus americana*	3	-2			S5				G5	C	X	x	x	x	x	x	x
Siberian Elm	*Ulmus pumila*		5	-1	2	SNA				GNR	IX	I	x	x				x
Slippery Elm	*Ulmus rubra*	6	0			S5				G5	C	X	x					
Nettle Family	**Urticaceae**																	
Smallspike False Nettle	*Boehmeria cylindrica*	4	-5			S5				G5	C	X	x					
Canadian Wood Nettle	*Laportea canadensis*	6	-3			S5				G5	C	X	x					
Canadian Clearweed	*Pilea pumila*	5	-3			S5				G5	C	X	x					

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Stinging Nettle	*Urtica dioica ssp. dioica*		-1	-1	3	SNA				G5T5?	IR	X		x	x	x		x
California Nettle	*Urtica dioica ssp. gracilis*	2	-1			S5				G5T5	C	X	x					
Vervain Family	**Verbenaceae**																	
Blue Vervain	*Verbena hastata*	4	-4			S5				G5	C	X	x					
White Vervain	*Verbena urticifolia*	4	-1			S5				G5	C	X	x					
Violet Family	**Violaceae**																	
Violet sp.	*Viola sp.*												x					
Canadian White Violet	*Viola canadensis*	6	5			S5				G5	U	X	x					
Marsh Blue Violet	*Viola cucullata*	5	-5			S5				G5	C	L	x					
Downy Yellow Violet	*Viola pubescens*	5	4			S5				G5	C	X	x					
Woolly Blue Violet	*Viola sororia*	4	1			S5				G5	C	X	x	x		x		
Grape Family	**Vitaceae**																	
Thicket-creeper	*Parthenocissus vitacea*	3	3			S5				G5	C	X	x					
Virginia Creeper	*Parthenocissus quinquefolia*	6	1			S4?				G5	U		x	x	x	x	x	x
Summer Grape	*Vitis aestivalis*	7	3			S4				G5	C	RL		x			x	
Riverbank Grape	*Vitis riparia*	0	-2			S5				G5	C	X	x	x	x	x	x	x
MONOCOTS	**MONOCOTYLEDONS**																	
Water-plantain Family	**Alismataceae**																	
Common Water-plantain	*Alisma plantago-aquatica*	3	-5			S5				G5		X	x					
Asparagus Family	**Asparagaceae**																	
Hosta species	*Hosta sp.*													x			x	
Arum Family	**Araceae**																	
Jack-in-the-pulpit	*Arisaema triphyllum*	5	-2			S5				G5	C	X	x					
Skunk Cabbage	*Symplocarpus foetidus*	7	-5			S5				G5	C	RL	x					
Sedge Family	**Cyperaceae**																	
Sedge species	*Carex sp.*												x					
Bebb's Sedge	*Carex bebbii*	3	-5			S5				G5	C	X	x					
Eastern Woodland Sedge	*Carex blanda*	3	0			S5				G5?	C	X	x					
Thin-leaved Sedge	*Carex cephaloidea*	6	2			S5				G5	U	RL	x					
Fibrous Rooted Sedge	*Carex communis*	6	5			S5				G5	C	X	x					
Fringed Sedge	*Carex crinita*	6	-4			S5				G5	C	X	x					
Dewey's Sedge	*Carex deweyana*	6	4			S5				G5	C	X	x					
Slender Looseflower Sedge	*Carex gracilescens*	7	5			S4				G5?	U	PRL	x					
Graceful Sedge	*Carex gracillima*	4	3			S5				G5	C	X	x					
Greater Bladder Sedge	*Carex intumescens*	6	-4			S5				G5	C	X	x					
Lake Sedge	*Carex lacustris*	5	-5			S5				G5	C	X	x					
Nerveless Woodland Sedge	*Carex leptonervia*	5	0			S4				G4	U	L	x					
Pennsylvania Sedge	*Carex pensylvanica*	5	5			S5				G5	C	X	x	x	x			x
Retrorse Sedge	*Carex retrorsa*	5	-5			S5				G5	C	X	x			x		
Broad-leaved Sedge	*Carex platyphylla*	7	5			S5				G5	U	X	x					
Retrorse Sedge	*Carex retrorsa*	5	-5			S5				G5	C	X	x					
Rosy Sedge	*Carex rosea*	5	5			S5				G5	C	X	x					
Pointed Broom Sedge	*Carex scoparia*	5	-3			S5				G5	U	RL	x					

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Spiked Sedge	*Carex spicata*		5	-1		SNA				GNR	IC	X	x					
Awl-fruited Sedge	*Carex stipata*	3	-5			S5				G5	C	X	x					
Quill Sedge	*Carex tenera*	4	-1			S5				G5	C	X	x					
Northwest Territory Sedge	*Carex utriculata*	7	-5			S5				G5	R	L	x					
Fox Sedge	*Carex vulpinoidea*	3	-5			S5				G5	C	X	x					
Green Bulrush	*Scirpus atrovirens*	3	-5			S5				G5?	C	X	x					
Rush Family	**Juncaceae**																	
Toad Rush	*Juncus bufonius*	1	-4			S5				GNR	C	X	x					
Dudley's Rush	*Juncus dudleyi*	1	0			S5				G5	C	X	x					
Path Rush	*Juncus tenuis*	0	0			S5				G5	C	X	x					
Duckweed Family	**Lemnaceae**																	
Lesser Duckweed	*Lemna minor*	2	-5			S5				G5	C	X	x					
Lily Family	**Liliaceae**																	
Wild Leek	*Allium tricoccum*	7	2			S4				G5		X	x					
European Lily-of-the-valley	*Convallaria majalis*		5	-2	3	SNA				G5	IX	I	x	x			x	
Yellow Trout-lily	*Erythronium americanum*	5	5			S5				G5	C	X	x					
Orange Day-lily	*Hemerocallis fulva*		5	-3		SNA				GNA	IU	I	x					
Michigan Lily	*Lilium michiganense*	7	-1			S5				G5	C	X	x					
Canada Mayflower	*Maianthemum canadense*	5	0			S5				G5	C	X	x					
Large False Solomon's Seal	*Maianthemum racemosum*	4	3			S5				G5	C	X	x					
Starry False Solomon's Seal	*Maianthemum stellatum*	6	1			S5				G5	C	X	x					
Large False Solomon's Seal	*Maianthemum racemosum*	4	3			S5				G5	C	X	x	x	x			x
Eurasian Solomon's Seal	*Polygonatum multiflorum*			-1		SNA				GNR	IR			x	x			
Hairy Solomon's Seal	*Polygonatum pubescens*	5	5			S5				G5	C	X	x					
Red Trillium	*Trillium erectum*	6	1			S5				G5	C	X	x	x				x
White Trillium	*Trillium grandiflorum*	5	5			S5				G5	C	X	x					
Orchid Family	**Orchidaceae**																	
Broadleaf Helleborine	*Epipactis helleborine*		5	-2		SNA				GNR	IC	I	x					
Grass Family	**Poaceae**																	
Creeping Bent Grass	*Agrostis stolonifera*	0	-3			SNA				G5	IC	X	x					
Big Bluestem	*Andropogon gerardii*	7	1			S4				G5	C	RL	x					
Smooth Brome	*Bromus inermis*		5	-3	4	SNA				G5TNR	IC	I	x	x	x			
Orchard Grass	*Dactylis glomerata*		3	-1	3	SNA				GNR	IC	I	x					
Hairy Crabgrass	*Digitaria sanguinalis*		3	-1		SNA				G5	IC	I	x					
Eastern Bottle-brush Grass	*Elymus hystrix*	5	5			S5				G5	C	X	x					
Quack Grass	*Elymus repens*		3	-3	3	SNA				GNR	IC	I	x					
River-bank Wild Rye	*Elymus riparius*	7	-3			S4?				G5	U	RL	x					
Virginia Wild Rye	*Elymus virginicus*										C		x					
Virginia Wild Rye	*Elymus virginicus var. virginicus*	5	-2			S5				G5T5	C	X	x					
Red Fescue	*Festuca rubra*										IC		x					
Red Fescue	*Festuca rubra ssp. rubra*		1	-1		SNA				G5T5	IC	X	x					

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American Manna Grass	*Glyceria grandis*	5	-5			S4S5				G5	U	X	x					
Fowl Manna Grass	*Glyceria striata*	3	-5			S5				G5	C	X	x					
Common Barley	*Hordeum vulgare*		5	-1		SNA				GNR	IR	I	x					
Rice Cut Grass	*Leersia oryzoides*	3	-5			S5				G5	C	X	x					
White Cut Grass	*Leersia virginica*	6	-3			S4				G5	C	RL	x					
Amur Silver Grass	*Miscanthus sacchariflorus*		5	-1		SNA				GNR	IX	I	x					
Woodland Muhly	*Muhlenbergia sylvatica*	9	-3			S2				G5	R	PRL	x					
Reed Canary Grass	*Phalaris arundinacea*	0	-4			S5				G5	C	X	x					
Timothy	*Phleum pratense*		3	-1		SNA				GNR	IC	I	x					
Common Reed	*Phragmites australis*	0	-4		1	SNA				G5T5		X	x	x	x	x		
Annual Blue Grass	*Poa annua*		1	-2		SNA				GNR	IC	I	x					
Wood Blue Grass	*Poa nemoralis*		0	-1		SNA				G5	IX	I	x					
Fowl Blue Grass	*Poa palustris*	5	-4			S5				G5	C	X	x					
Kentucky Blue Grass	*Poa pratensis ssp. pratensis*	0	1		2	S5				G5T	IC	X	x					
Catbrier Family	**Smilacaceae**																	
Smooth Carrion Flower	*Smilax herbacea*	5	0			S4				G5	C	X	x					
Cattail Family	**Typhaceae**																	
Narrow-leaved Cattail	*Typha angustifolia*	3	-5			SNA				G5	IC	X	x					
Broad-leaved Cattail	*Typha latifolia*	3	-5			S5				G5	C	X	x					
Glaucous Cattail	*Typha X glauca*	3	-5			SNA				GNA	hyb	X	x					
											Total entries:		417	114	69	63	63	50

FLORISTIC SUMMARY & ASSESSMENT		STUDY AREA		CUW1		FOD7-3		FOD1-1		FOD5-3	
Species Diversity											
Total Species:		**101**		**63**		**59**		**55**		**48**	
Native Species:		57	56.44%	32	50.79%	34	57.63%	29	52.73%	31	64.58%
Exotic Species		44	43.56%	31	49.21%	25	42.37%	26	47.27%	17	35.42%
Total Taxa in Region (List Region, Source)		10000		10000		10000		10000		10000	
% Regional Taxa Recorded		1.01%		0.63%		0.59%		0.55%		0.48%	
Regionally Significant Species		3		2		2		1		0	
S1-S3 Species		2		1		2		0		0	
S4 Species		5		1		1		3		4	
S5 Species		43		24		27		20		24	
Co-efficient of Conservatism and Floral Quality Index											
Co-efficient of Conservatism (CC) (average)		**3.67**		**3.13**		**2.94**		**2.90**		**3.84**	
CC 0 to 3	*lowest sensitivity*	25	43.86%	16	50.00%	19	55.88%	17	58.62%	13	41.94%
CC 4 to 6	*moderate sensitivity*	27	47.37%	14	43.75%	13	38.24%	11	37.93%	17	54.84%
CC 7 to 8	*high sensitivity*	4	7.02%	2	6.25%	1	2.94%	1	3.45%	1	3.23%
CC 9 to 10	*highest sensitivity*	1	1.75%	0	0.00%	1	2.94%	0	0.00%	0	0.00%
Floral Quality Index (FQI)		**27.68**		**17.68**		**17.15**		**15.60**		**21.37**	
Presence of Weedy & Invasive Species											
mean weediness		**-1.80**		**-1.77**		**-1.96**		**-1.73**		**-1.94**	
weediness = -1	*low potential invasiveness*	20	45.45%	14	45.16%	9	36.00%	13	50.00%	7	41.18%
weediness = -2	*moderate potential invasiveness*	13	29.55%	10	32.26%	8	32.00%	7	26.92%	4	23.53%
weediness = -3	*high potential invasiveness*	11	25.00%	7	22.58%	8	32.00%	6	23.08%	6	35.29%
Presence of Wetland Species											
average wetness value		**1.85**		**1.94**		**1.42**		**2.09**		**2.13**	
upland		25	24.75%	15	23.81%	10	16.95%	13	23.64%	9	18.75%
facultative upland		37	36.63%	24	38.10%	25	42.37%	23	41.82%	25	52.08%
facultative		21	20.79%	13	20.63%	12	20.34%	12	21.82%	8	16.67%
facultative wetland		15	14.85%	10	15.87%	12	20.34%	5	9.09%	5	10.42%

Appendix C
Terrestrial Photolog

Site Visits to Sawmill Creek, May – July 2020



Start of the multi-use trail at Folkway Drive facing west.



View of the trailhead at Folkway Drive, facing east.



View of the FOD7-3 community at the trailhead adjacent to Folkway Drive.



The majority of the creek within the study area is bordered by the FOD7-3 community.



The FOD1-1 community covers the west side of the study area, north of the multi-use trail.



View of the FOD1-1 community on the northwest side of the study area.



View of the bridge connecting the multi-use trail to Rainbow Crescent.



View of the bridge on the east end of the study area, within the CUW1 community.



CUW1 at the southeast end of the study area.



FOD7-3 community at the southeast edge of the study area.



FOD5-3 community overhanging the creek, north of Forster Terrace neighbourhood.



View of the FOD5-3 community.

Appendix D
Bird Species

Bird Species

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Peel	PIF	OBBA	NHIC	eBird	iNaturalist	LIO	ERI Observations
Accipitridae	**Hawks, Kites, Eagles & Allies**												
Accipiter cooperii	Cooper's Hawk	S4				Level 3 Forest		PROB		x			
Accipiter gentilis	Northern Goshawk	S4				Level 2 Forest		CONF					
Accipiter striatus	Sharp-shinned Hawk	S5				Level 2 Forest		CONF		x			
Buteo jamaicensis	Red-tailed Hawk	S5						CONF		x			x
Buteo lineatus	Red-shouldered Hawk	S4B			SC	Level 1 Forest		PROB					
Buteo platypterus	Broad-winged Hawk	S5B				Level 2 Forest		PROB					
Circus cyaneus	Northern Harrier	S4B						PROB					
Alaudidae	**Larks**												
Eremophila alpestris	Horned Lark	S5B				Level 3 Open Country		POSS					
Alcedinidae	**Kingfishers**												
Megaceryle alcyon	Belted Kingfisher	S4B/S5B								x			
Apodidae	**Swifts**												
Chaetura pelagica	Chimney Swift	S4B/S4N	THR	THR	THR			POSS		x			
Anatidae	**Ducks, Geese & Swans**												
Aix sponsa	Wood Duck	S5				Level 4 Forest		CONF		x			
Anas platyrhynchos	Mallard	S5						CONF		x	x		x
Anas strepera	Gadwall	S4				Level 2 Marsh				x			
Branta canadensis	Canada Goose	S5						CONF		x			
Cygnus buccinator	Trumpeter Swan	S4								x			
Cygnus olor	Mute Swan	SNA								x			
Lophodytes cucullatus	Hooded Merganser	S5B, S5N				Level 4 Forest		CONF		x			
Branta bernicla	Brant	S4N								x			
Ardeidae	**Herons and Bitterns**												
Ardea herodias	Great Blue Heron	S4						CONF		x			
Botaurus lentiginosus	American Bittern	S4B				Level 1 Marsh		PROB					
Butorides virescens	Green Heron	S4B				Level 4 Marsh		PROB					
Bombycillidae	**Waxwings**												
Bombycilla cedrorum	Cedar Waxwing	S5B						POSS		x			x
Caprimulgidae	**Nightjars**												
Chordeiles minor	Common Nighthawk	S4B	SC	SC	THR	Level 1 Open Country		PROB					
Cardinalidae	**Cardinals, Grosbeaks & Allies**												
Cardinalis cardinalis	Northern Cardinal	S5						CONF		x			x
Passerina cyanea	Indigo Bunting	S4B						POSS		x			
Pheucticus ludovicianus	Rose-breasted Grosbeak	S4B						POSS		x			

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Peel	PIF	OBBA	NHIC	eBird	iNaturalist	LIO	ERI Observations
Piranga olivacea	Scarlet Tanager	S4B				Level 2 Forest		CONF					x
Cathartidae	**Vultures**												
Cathartes aura	Turkey Vulture	S5B				Level 3 Forest		PROB		x			
Certhiidae	**Creepers**												
Certhia americana	Brown Creeper	S5B				Level 2 Forest				x			
Charadriidae	**Plovers**												
Charadrius vociferus	Killdeer	S5B/S5N						PROB		x			x
Columbidae	**Pigeons & Doves**												
Columba livia	Rock Pigeon	SNA						CONF		x			
Zenaida macroura	Mourning Dove	S5						CONF		x			x
Corvidae	**Crows & Jays**												
Corvus brachyrhynchos	American Crow	S5B/S4N						CONF		x			x
Cyanpcitta cristata	Blue Jay	S5						CONF		x	x		x
Cuculidae	**Cuckoo & Anis**												
Coccyzus erythropthalmus	Black-billed Cuckoo	S5B				Level 2 Forest	RD	POSS					
Emberizidae	**New World Sparrows & Allies**												
Junco hyemalis	Dark-eyed Junco	S5B								x			
Melospiza georgiana	Swamp Sparrow	S5B				Level 2 Marsh		POSS		x			
Melospiza lincolnii	Lincoln's Sparrow	S5B								x			
Melospiza melodia	Song Sparrow	S5B/S4N						CONF		x			x
Passerculus sandwichensis	Savannah Sparrow	S4B				Level 1 Open Country		CONF		x			
Pipilo erythrophthalmus	Eastern Towhee	S4B				Level 2 Forest		PROB		x			
Pooecetes gramineus	Vesper Sparrow	S4B				Level 3 Open Country		PROB					
Spizella pallida	Clay-colored Sparrow	S4B						PROB					
Spizella passerina	Chipping Sparrow	S5B/S4N						CONF		x			
Zonotrichia albicollis	White-throated Sparrow	S5B						PROB		x			
Zonotrichia leucophrys	White-crowned Sparrow	S4B								x			
Spizella pusilla	Field Sparrow	S4B				Level 3 Open Country		CONF		x			x
Falconidae	**Carcaras & Falcons**												
Falco sparverius	American Kestrel	S4				Level 2 Open Country		POSS		x			
Fringillidae	**Finches & Allies**												
Haemorhous mexicanus	House Finch	SNA						CONF		x			
Haemorhous purpureus	Purple Finch	S4B				Level 2 Forest		PROB					
Spinus tritis	American Goldfinch	S5B/S4N				Level 3 Open Country		CONF		x	x		x
Hirundinidae	**Swallows**												
Hirundo rustica	Barn Swallow	S4B	THR	THR	THR	Level 4 Open Country		PROB					

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Peel	PIF	OBBA	NHIC	eBird	iNaturalist	LIO	ERI Observations
Riparia riparia	Bank Swallow	S4B	THR	THR	THR	Level 2 Open Country		POSS					
Stelgidopteryx serripennis	Northern Rough-winged Swallow	S4B				Level 2 Open Country				x			
Tachycineta bicolor	Tree Swallow	S4B						CONF					
Icteridae	**New World Blackbird**												
Agelaius phoeniceus	Red-winged Blackbird	S4/S5						CONF		x			x
Dolichonyx oryzivorus	Bobolink	S4B	THR	THR	THR	Level 2 Open Country	RD	CONF					
Euphagus carolinus	Rusty Blackbird	S4B	SC	SC	SC					x			
Icterus galbula	Baltimore Oriole	S4B						CONF		x			x
Molothrus ater	Brown-headed Cowbird	S4B						PROB		x	x		x
Quiscalus quiscula	Common Grackle	S5B/S4N						CONF		x			x
Sturnella magna	Eastern Meadowlark	S4B	THR	THR	THR	Level 3 Open Country		CONF					
Laridae	**Gulls, Terns & Skimmers**												
Larus argentatus	Herring Gull	S5B,S5N								x			
Larus delawarensis	Ring-billed Gull	S5B/S4N								x	x		x
Mimidae	**Mockingbirds, Thrashers & Allies**												
Dumetella carolinsis	Gray Catbird	S4B				Level 4 Forest		PROB		x			x
Mimus polyglottos	Northern Mockingbird	S4				Level 1 Open Country		PROB		x			
Toxostoma rufum	Brown Thrasher	S4B				Level 1 Open Country		PROB					x
Paridae	**Chickadees and Titmice**												
Poecile atricapillus	Black-capped Chickadee	S5				Level 4 Forest		CONF		x			x
Baeolophus bicolor	Tufted Titmouse	S4				Level 3 Forest							x
Parulidae	**Wood Warblers**												
Cardellina canadensis	Canada Warbler	S4B	SC	THR	THR	Level 1 Forest	RD	POSS		x			
Cardellina pusilla	Wilson's Warbler	S4B								x			
Geothlypis philadelphia	Mourning Warbler	S4B				Level 2 Forest		PROB					x
Geothylupis trichas	Common Yellowthroat	S5B						POSS		x			
Mniotilta varia	Black-and-white Warbler	S5B				Level 3 Forest		POSS		x			
Oreothlypis celata	Orange-crowned Warbler	S4B								x			
Oreothlypis ruficapilla	Nashville Warbler	S5B				Level 1 Forest		PROB		x			
Parkesia noveboracensis	Northern Waterthrush	S5B				Level 2 Forest		CONF		x			
Seiurus aurocapilla	Ovenbird	S4B				Level 4 Forest		PROB		x			
Setophaga americana	Northern Parula	S4B								x			
Setophaga caerulescens	Black-throated Blue Warbler	S5B						POSS		x			
Setophaga castanea	Bay-breasted Warbler	S5B								x			
Setophaga coronata	Yellow Rumped Warbler	S5B								x			

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Peel	PIF	OBBA	NHIC	eBird	iNaturalist	LIO	ERI Observations
Setophaga fusca	Blackburnian Warbler	S5B				Level 1 Forest		PROB		x			
Setophaga magnolia	Magnolia Warbler	S5B				Level 1 Forest		POSS		x			
Setophaga pensylvanica	Chestnut-sided warbler	S5B				Level 1 Forest		POSS		x			
Setophaga petechai	Yellow Warbler	S5B						CONF		x			
Setophaga pinus	Pine Warbler	S5B				Level 2 Forest		PROB		x			
Setophaga ruticilla	American Redstart	S5B				Level 2 Forest		POSS		x			
Setophaga tigrina	Cape May Warbler	S5B					RD			x			
Setophaga virens	Black-throated Green Warbler	S5B				Level 1 Forest		PROB		x			
Vermivora cyanoptera	Blue-winged Warbler	S4B				Level 1 Forest		PROB					
Passeridae	**Sparrows**												
Passer domesticus	House Sparrow	SNA						CONF		x			x
Phalacrocoracidae	**Cormorants**												
Phalacrocorax auritus	Double-crested Cormorant	S5B								x			
Phasianidae	**Patridges, Grouse, Turkeys**												
Meleagris gallopavo	Wild Turkey	S5						CONF			x		
Bonasa umbellus	Ruffed Grouse	S4				Level 3 Forest		CONF					
Picidae	**Woodpeckers**												
Colaptes auratus	Northern Flicker	S4B						CONF		x			x
Dryocopus pileatus	Pileated Woodpecker	S5				Level 2 Forest		PROB		x			
Leuconotopicus villosus	Hairy Woodpecker	S5						CONF		x			
Melanerpes carolinus	Red-bellied Woodpecker	S4				Level 3 Forest				x			
Picoides pubescens	Downy Woodpecker	S5						CONF		x			x
Picoides villosus	Hairy Woodpecker	S5						CONF		x			
Sphyrapicus varius	Yellow-bellied Sapsucker	S5B				Level 2 Forest							x
Podicipedidae	**Grebes**												
Podilymbus podiceps	Pied-billed Grebe	S4B,S4N				Level 2 Marsh		CONF					
Polioptilidae	**Gnatcatchers**												
Polioptila caerulea	Blue-gray Gnatcatcher	S4B				Level 3 Forest				x			
Rallidae	**Railes, Gallinules & Coots**												
Fulica americana	American Coot	S4B				Level 1 Marsh		POSS					
Gallinula chloropus	Common Gallinule	S4B						POSS					
Porzana carolina	Sora	S4B				Level 1 Marsh		CONF					
Rallus limicola	Virginia Rail	S5B				Level 1 Marsh		CONF					
Regulidae	**Kinglets**												
Regulus calendula	Ruby-crowned Kinglet	S4B				Level 4 Forest				x			x
Regulus satrapa	Golden-crowned Kinglet	S5B				Level 2 Forest		CONF		x			
Scolopacidae	**Sandpipers, Phalaropes &Allies**												

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Peel	PIF	OBBA	NHIC	eBird	iNaturalist	LIO	ERI Observations
Actitis macularius	Spotted Sandpiper	S5				Level 3 Open Country		POSS		x			
Scolopax minor	American Woodcock	S4B				Level 4 Forest		PROB					
Tringa solitaria	Solitary Sandpiper	S4B								x			
Sittidae	**Nutchatches**												
Sitta canadensis	Red-breasted Nuthatch	S5				Level 3 Forest		CONF		x			x
Sitta carolinensis	White-breasted Nuthatch	S5						POSS		x			
Stercorariidae	**Skuas**												
Asio flammeus	Short-eared Owl	S2N,S4B	SC	SC	SC			PROB					
Asio otus	Long-eared Owl	S4				Level 1 Forest	RD	POSS					
Bubo virginianus	Great Horned Owl	S5						CONF					
Sturnidae	**Starlings**												
Sturnus vulgaris	European Starling	SNA						CONF		x	x		x
Trochillidae	**Hummingbirds**												
Archilochus colubris	Ruby-throated Hummingbird	S5B				Level 3 Forest		PROB		x			
Troglodytidae	**Wrens**												
Cistothorus palustris	Marsh Wren	S4B				Level 3 Marsh		POSS					
Thyrothorus ludovicianus	Carolina Wren	S4				Level 3 Forest				x			
Troglodytes aedon	House Wren	S5B						CONF		x			
Troglodytes hiemalis	Winter Wren	S5B				Level 3 Forest		PROB		x			
Turdidae	**Thrushes**												
Catharus fuscescens	Veery	S4B				Level 3 Forest		PROB					
Catharus guttatus	Hermit Thrush	S5B								x			
Catharus ustulatus	Swainson's Thrush	S4B								x			
Hylocichla mustelina	Wood Thrush	S4B	SC	THR	THR	Level 4 Forest	RD	CONF					
Sialia sialis	Eastern Bluebird	S5B				Level 1 Open Country		CONF					
Turdus migratorius	American Robin	S5B						CONF		x	x		x
Tyrannidae	**Tyrant Flycatchers**												
Contopus virens	Eastern Wood-pewee	S4B	SC	SC	SC			PROB		x			
Empidonax alnorum	Alder Flycatcher	S5B				Level 3 Forest		POSS					
Empidonax flaviventris	Yellow-bellied Flycatcher	S5B								x			
Empidonax minimus	Least Flycatcher	S4B						PROB		x			x
Empidonax traillii	Willow Flycatcher	S5B						POSS		x			
Myiarchus crinitus	Great Crested Flycatcher	S4B						POSS		x			x
Sayornis phoebe	Eastern Phoebe	S5B/S4N				Level 3 Forest		CONF		x			
Tyrannus tyrannus	Eastern Kingbird	S4B				Level 3 Open Country		CONF		x			
Vireonidae	**Vireos**												
Vireo gilvus	Warbling Vireo	S5B						POSS		x			
Vireo olivaceus	Red-eyed Vireo	S5B						POSS		x			x

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Peel	PIF	OBBA	NHIC	eBird	iNaturalist	LIO	ERI Observations
Vireo solitarius	Blue-headed Vireo	S5B				Level 3 Forest		PROB		x			
Total:	182							111	0	102	8	0	33

Appendix E
Breeding Bird Survey

Sawmill Breeding Bird Survey #1 - June 19, 2020 (1/2)

Breeding Bird Survey Station	Common Name	Scientific Name	Notes
Station 1	Northern Cardinal	Cardinalis cardinalis	2 males calling
7:30 am	American Goldfinch	Spinus tristis	2 calling
	Mallard	Anas platyrhynchos	Calling
	American Robin	Turdus migratorius	2 males calling
	Red-breasted Nuthatch	Sitta canadensis	Calling
	European Starling	Sturnus vulgaris	2 fighting, 1 with food
	Gray Catbird	Dumetella carolinensis	Hiding in bushes, calling
	Song Sparrow	Melospiza melodia	Visual
	Baltimore Oriole	Icterus galbula	Female foraging
	Tufted Titmouse	Baeolophus bicolor	Calling
Station 2	House Sparrow	Passer domesticus	3 calling by houses
7:45 am	Northern Cardinal	Cardinalis cardinalis	1 agitated nesting male foraging in tree, 1 female
	Black-capped Chickadee	Poecile atricapillus	Calling
	American Robin	Turdus migratorius	Male running on ground
	Common Grackle	Quiscalus quiscula	Flying overhead
	Northern Flicker	Colaptes auratus	Flying overhead
	Red-eyed Vireo	Vireo olivaceus	Calling
	Yellow-bellied Sapsucker	Sphyrapicus varius	Calling
	European Starling	Sturnus vulgaris	Calling
Station 3	Cedar Waxwing	Bombycilla cedrorum	3 flying overhead
8:00 am	Song Sparrow	Melospiza melodia	2 calling
	House Sparrow	Passer domesticus	10+ calling
	Black-capped Chickadee	Poecile atricapillus	2 calling, one male visual
	Northern Cardinal	Cardinalis cardinalis	2 calling
	European Starling	Sturnus vulgaris	4 fighting
	American Goldfinch	Spinus tristis	6 flying overhead
	Blue Jay	Cyanocitta cristata	Calling
	Ring-Billed Gull	Larus delawarensis	Multiple flying overhead
	Field Sparrow	Spizella pusilla	Calling
	American Crow	Corvus brachyrhynchos	Flying in distance
	Red-winged Blackbird	Agelaius phoeniceus	1 male calling, visual

Breeding Bird Survey Station	Common Name	Scientific Name	Notes
Station 4	Blue Jay	Cyanocitta cristata	2 calling
8:20 am			
	Black-capped Chickadee	Poecile atricapillus	3 calling, 1 male, 2 females
	Northern Cardinal	Cardinalis cardinalis	2 calling
	Baltimore Oriole	Icterus galbula	1 calling
	American Robin	Turdus migratorius	1 male, flying to tree
	Red-eyed Vireo	Vireo olivaceus	Calling
	Song Sparrow	Melospiza melodia	Calling
	Brown Thrasher	Toxostoma rufum	Calling
Station 5	Northern Cardinal	Cardinalis cardinalis	Calling in distance
8:35 am	Black-Capped Chickadee	Poecile atricapillus	
	Field Sparrow	Spizella pusilla	Calling
	Song Sparrow	Melospiza melodia	Calling
	American Goldfinch	Spinus tristis	2 flying, calling (male and female)
	American Robin	Turdus migratorius	Calling
	Catbird	#N/A	Calling
	European Starling	Sturnus vulgaris	1 agitated, flying male
Station 6	American Crow	Corvus brachyrhynchos	2 calling, fighting and playing
8:50 am	Northern Cardinal	Cardinalis cardinalis	2 calling in distance
	European Starling	Sturnus vulgaris	4 flying overhead
	American Goldfinch	Spinus tristis	3 flying overhead
	Blue Jay	Cyanocitta cristata	Flying, calling
	Cedar Waxwing	Bombycilla cedrorum	2 at top of tree
	Black-Capped Chickadee	Poecile atricapillus	Calling
	Brown-headed Cowbird	Molothrus ater	Male, visual
	Song Sparrow	Melospiza melodia	Calling
	House Sparrow	Passer domesticus	3 calling
Station 7	Blue Jay	Cyanocitta cristata	3 calling
9:15 am	American Robin	Turdus migratorius	3 calling
	Northern Cardinal	Cardinalis cardinalis	3 males calling, one female
	American Crow	Corvus brachyrhynchos	Calling

Breeding Bird Survey Station	Common Name	Scientific Name	Notes
	American Goldfinch	Spinus tristis	3 flying
	Black-Capped Chickadee	Poecile atricapillus	Calling
	Downy Woodpecker	Picoides pubescens	Calling, visual in tree
	Song Sparrow	Melospiza melodia	Calling
Station 8	American Crow	Corvus brachyrhynchos	3 calling
9:25 am	Northern Cardinal	Cardinalis cardinalis	Calling in distance
	American Goldfinch	Spinus tristis	
	American Robin	Turdus migratorius	Calling in distance

Sawmill Breeding Bird Survey #2 - July 6, 2020 (2/2)

Breeding Bird Survey Station	Common Name	Scientific Name	Notes
Station 1	Northern Cardinal	*Cardinalis cardinalis*	Calling
7:00 am - 7:10 am	Black-capped Chickadee	*Poecile atricapillus*	Calling
	Gray Catbird	*Dumetella carolinensis*	Calling
	American Goldfinch	*Spinus tristis*	Calling
	Blue Jay	*Cyanocitta cristata*	Calling
	European Starling	*Sturnus vulgaris*	Calling
	Ruby-crowned Kinglet	*Regulus calendula*	Calling
	Downy Woodpecker	*Picoides pubescens*	Calling
	Cedar Waxwing	*Bombycilla cedrorum*	Flying overhead
Station 2	Downy Woodpecker	*Picoides pubescens*	Calling, visible male
7:35 am - 7:45 am	American Robin	*Turdus migratorius*	Calling
	American Goldfinch	*Spinus tristis*	Flying overhead
	Northern Cardinal	*Cardinalis cardinalis*	Calling
	Black-capped Chickadee	*Poecile atricapillus*	5 calling, 2 flying
	Red-tailed Hawk	*Buteo jamaicensis*	Calling
	Red-eyed Vireo	*Vireo olivaceus*	Calling
	Mourning Dove	*Zenaida macroura*	Calling
	Ring-billed Gull	*Larus delawarensis*	Calling in the distance
Station 3	American Robin	*Turdus migratorius*	Calling
7:50 am - 8:00 am	Song Sparrow	*Melospiza melodia*	Calling
	Northern Cardinal	*Cardinalis cardinalis*	Calling
	American Goldfinch	*Spinus tristis*	Flying overhead

Breeding Bird Survey Station	Common Name	Scientific Name	Notes
	Common Grackle	*Quiscalus quiscula*	Flying
	Cedar Waxwing	*Bombycilla cedrorum*	Flying overhead
	Downy Woodpecker	*Picoides pubescens*	Calling
	Black-capped Chickadee	*Poecile atricapillus*	Calling
	Gray Catbird	*Dumetella carolinensis*	Calling
	Red-eyed Vireo	*Vireo olivaceus*	Calling / visual male
	American Robin	*Turdus migratorius*	Calling
	Least Flycatcher	*Empidonax minimus*	Calling
	European Starling	*Sturnus vulgaris*	Calling
	Mourning Warbler	*Geothlypis philadelphia*	Calling
	Scarlet Tanager	*Piranga olivacea*	Calling
	Killdeer	*Charadrius vociferus*	Calling
Station 4	Northern Cardinal	*Cardinalis cardinalis*	Calling
8:05 am - 8:15 am	Black-capped Chickadee	*Poecile atricapillus*	Calling
	Downy Woodpecker	*Picoides pubescens*	Calling and agitated
	American Goldfinch	*Spinus tristis*	Calling
	Mourning Dove	*Zenaida macroura*	Calling
	House Sparrow	*Passer domesticus*	Calling
	American Robin	*Turdus migratorius*	Calling
	Baltimore Oriole	*Icterus galbula*	Calling
	Gray Catbird	*Dumetella carolinensis*	Calling
Station 5	Gray Catbird	*Dumetella carolinensis*	Pair
8:25 am - 8:35 am	American Robin	*Turdus migratorius*	Flying
	Common Grackle	*Quiscalus quiscula*	Calling / visual
	Blue Jay	*Cyanocitta cristata*	Calling
	Northern Cardinal	*Cardinalis cardinalis*	Calling
	House Sparrow	*Passer domesticus*	Calling
	Downy Woodpecker	*Picoides pubescens*	Calling
	Ring-billed Gull	*Larus delawarensis*	Flying in the distance
	European Starling	*Sturnus vulgaris*	Flying overhead
	Blue Jay	*Cyanocitta cristata*	Calling
	Song Sparrow	*Melospiza melodia*	Calling
	Black-capped Chickadee	*Poecile atricapillus*	Calling

Breeding Bird Survey Station	Common Name	Scientific Name	Notes
Station 6	Black-capped Chickadee	*Poecile atricapillus*	Calling / visual
9:15 am - 9:25 am	American Crow	*Corvus brachyrhynchos*	Calling
	Northern Cardinal	*Cardinalis cardinalis*	Calling
	American Goldfinch	*Spinus tristis*	Flying
Station 7	Northern Cardinal	*Cardinalis cardinalis*	Calling
8:44 am- 8:54 am	Cedar Waxwing	*Bombycilla cedrorum*	Calling
	Black-capped Chickadee	*Poecile atricapillus*	Calling
	Gray Catbird	*Dumetella carolinensis*	Calling
	Song Sparrow	*Melospiza melodia*	Calling
	American Robin	*Turdus migratorius*	Calling / visual
	American Goldfinch	*Spinus tristis*	Flying overhead
	Great Crested Flycatcher	*Myiarchus crinitus*	Calling
	Red-eyed Vireo	*Vireo olivaceus*	Calling
Station 8	American Goldfinch	*Spinus tristis*	Calling
9:00 am- 9:10 am	Northern Cardinal	*Cardinalis cardinalis*	Calling
	Downy Woodpecker	*Picoides pubescens*	Calling
	Gray Catbird	*Dumetella carolinensis*	Calling in the distance
	Black-capped Chickadee	*Poecile atricapillus*	Calling
	American Robin	*Turdus migratorius*	Calling
	American Crow	*Corvus brachyrhynchos*	Calling

Appendix F
Amphibian and Reptile Species

Reptile and Amphibian Species

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC	ORAA	iNaturalist	LIO	ERI Observations
Cryptodeira	**Turtles**										
Chelydra serpentina	Snapping Turtle	S3	SC	SC	SC			x			
Chrysemys picta marginata	Midland Painted Turtle	S4						x			
Emydoidea blandingii	Blanding's Turtle	S3	THR	END	THR			x			
Graptemys geographica	Northern Map Turtle	S3	SC	SC	SC			x			
Trachemys scripta elegans	Red-eared Slider	SNA						x			
Squamata	**Snakes**										
Lampropeltis triangulum	Milksnake	S4		SC	SC			x			
Nerodia sipedon sipedon	Northern Watersnake	S5						x			
Storeria dekayi	DeKay's Brownsnake	S5						x	x		x
Storeria occipitomaculata	Red-bellied snake	S5						x			
Thamnophis sauritus	Eastern Ribbonsnake	S4	SC	SC	SC			x			
Thamnophis sirtalis sirtalis	Eastern Gartersnake	S5						x			
Caudata	**Salamanders**										
Ambystoma jeffersonianum	Jefferson Salamander	S2	END	END	END			x			
Ambystoma laterale	Blue-spotted Salamander	S4						x			
Ambystoma maculatum	Spotted Salamander	S4						x			
Necturus maculosus	Mudpuppy	S4						x			
Notophthalmus viridescens viridescens	Red-spotted Newt	S5						x			
Plethodon cinereus	Eastern Red-backed Salamander	S5						x	x		
Anura	**Frogs and Toads**										
Anaxyrus americanus	American Toad	S5						x			
Hyla versicolor	Gray Treefrog	S5						x			
Lithobates catesbeianus	American Bullfrog	S4						x			
Lithobates clamitans	Green Frog	S5						x			
Lithobates pipiens	Northern Leopard Frog	S5						x			
Lithobates sylvaticus	Wood Frog	S5						x			
Pseudacris crucifer	Spring Peeper	S5						x			
Pseudacris trisetaria pop. 1	Western Chorus Frog (Great Lakes / St. Lawrence - Canadian Shield population)	S3		THR	THR			x			
					Total	**0**	**0**	**25**	**2**	**0**	**1**

Appendix H
Mammal Species

Mammal Species

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC	Mammal Atlas	iNaturalist	ERI Observations
Artiodactyla	**Deer and Bison**									
Odocoileus virginianus	White-tailed Deer	S5						x		x
Carnivora	**Carnivores**									
Canis latrans	Coyote	S5						x		
Canis lupus occidentalis	Northern Gray Wolf	S4						x		
Lynx canadensis	Canada Lynx	S5						x		
Lynx rufus	Bobcat	S4						x		
Mephitis mephitis	Striped Skunk	S5						x		
Mustela erminea	Ermine	S5						x		
Mustela frenata	Long-tailed Weasel	S4						x		
Procyon lotor	Northern Raccoon	S5						x		x
Vulpes vulpes	Red Fox	S5						x		
Chiroptera	**Bats**									
Eptesicus fuscus	Big Brown Bat	S4						x		
Lasionycteris noctivagans	Silver-haired Bat	S4						x		
Lasiurus borealis	Red Bat	S4						x		
Lasiurus cinereus	Hoary Bat	S4						x		
Myotis leibii	Eastern Small-footed Myotis	S2/S3	END					x		
Myotis lucifugus	Little Brown Myotis	S4	END	END	END			x		
Myotis septentrionalis	Northern Myotis	S3	END	END	END			x		
Myotis sodalis	Indiana Myotis	SNA						x		
Perimyotis subflavus	Tricolored Bat	S3	END	END	END			x		
Didelphimorphia	**Oppossums**									
Didelphis virginiana	Virginia Opossum	S4						x		
Lagomorphia	**Rabbits and Hares**									
Lepus europaeus	European Hare	SNA						x		
Sylvilagus floridanus	Eastern Cottontail	S5						x	x	x
Rodentia	**Rodents**									
Castor canadensis	Beaver	S5						x		
Erethizon dorsatum	Porcupine	S5						x		
Glaucomys sabrinus	Northern Flying Squirrel	S5						x		
Marmota monax	Woodchuck	S5						x		
Microtus pennsylvanicus	Meadow Vole	S5						x		
Microtus pinetorum	Woodland Vole	S3?	SC	SC	SC			x		
Mus musculus	House Mouse	SNA						x		
Napaeozapus insignis	Woodland Jumping Mouse	S5						x		
Ondatra zibethicus	Muskrat	S5						x		
Peromyscus leucopus	White-footed Mouse	S5						x		

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC	Mammal Atlas	iNaturalist	ERI Observations
Peromyscus maniculatus	Deer Mouse	S5						x		
Rattus norvegicus	Norway Rat	SNA						x		
Sciurus carolinensis	Grey Squirrel	S5							x	x
Synaptomys cooperi	Southern Bog Lemming	S4						x		
Tamias striatus	Eastern Chipmunk	S5						x	x	x
Tamiasciurus hudsonicus	Red Squirrel	S5						x		x
Zapus hudsonius	Meadow Jumping Mouse	S5						x		
Soricomorpha										
Blarina brevicauda	Northern Short-tailed Shrew	S5							x	
					Total:	0	0	38	4	6

Appendix G
Insect Species

Insect Species

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC	Ontario Butterfly Atlas	iNaturalist	ERI Observations
Coleoptera	**Beetles**	SNR								
Megacyllene robiniae	Longhorned Beetle	SNR							x	
Lilioceris lilii	Leaf Beetle	SNA							x	
Xylocopa virginica	Virginia Carpenter Bee	S4S5							x	
Bombus griseocollis	Brown-belted Bumble Bee	S5							x	
Bombus bimaculatus	Two-spotted Bumble Bee	S5							x	
Bombus impatiens	Common Eastern Bumble Bee	S5							x	
Apis mellifera	European Honey Bee	SNA							x	
Lepidoptera	**Butterflies**									
Catocala ilia	Ilia Underwing	S5						x		
Catocala grynea	Woody Underwing	S5						x		
Catocala relicta	White Underwing Moth	S5						x		
Catocala ultronia	Ultronia Underwing Moth	S5						x		
Catocala blandula	Charming Underwing	S5						x		
Catocala palaeogama	Oldwife Underwing	SNR						x		
Catocala unijuga	Once-married Underwing	S5						x		
Catocala minuta	Little Underwing	SNR						x		
Grammia virgo	Virgin Tiger Moth	S5						x		
Grammia virguncula	Little Virgin Moth	S4?						x		
Cisseps fulvicollis	Yellow-collared Scape Moth	SNR						x		
Clemensia albata	Little White Lichen Moth	SNR						x		
Apantesis phalerata	Harnessed Moth	S4?						x		
Ctenucha virginica	Virginia Ctenucha Moth	S5						x		
Cycnia tenera	Delicate Cycnia	S4						x		
Euchaetes egle	Milkweed Tussock Moth	S4?						x	x	
Halysidota tessellaris	Banded Tussock Moth	S5						x		
Haploa clymene	Clymene Moth	SNR						x		
Haploa confusa	Confused Haploa	S5						x		
Haploa lecontei	LeConte's Haploa	S4?						x		
Hypoprepia fucosa	Painted Lichen Moth	S5						x		
Lophocampa caryae	Hickory Tussock Moth	SNR						x	x	
Lymantria dispar	Gypsy Moth	SNA							x	
Phragmatobia fuliginosa	Ruby Tiger Moth	S4?						x		
Pyrrharctia isabella	Isabella Tiger Moth	S5						x	x	
Spilosoma latipennis	Pink-legged Tiger Moth	SNR						x		
Spilosoma virginica	Virginian Tiger Moth	S5						x		
Protitame virginalis	Virgin Moth	SNR						x		
Thymelicus lineola	European Skipper	SNA						x		
Hylephila phyleus	Fiery Skipper	SNA						x		

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC	Ontario Butterfly Atlas	iNaturalist	ERI Observations
Epargyreus clarus	Silver-spotted Skipper	S4						x		
Thorybes pylades	Northern Cloudywing	S5						x		
Erynnis icelus	Dreamy Duskywing	S5						x		
Erynnis juvenalis	Juvenal's Duskywing	S5						x		
Erynnis baptisiae	Wild Indigo Duskywing	S4						x		
Ancyloxypha numitor	Least Skipper	S5						x		
Polites peckius	Peck's Skipper	S5						x	x	
Polites themistocles	Tawny-edged Skipper	S5						x		
Polites mystic	Long Dash Skipper	S5						x		
Wallengrenia egeremet	Northern Broken-Dash	S5						x		
Pompeius verna	Little Glassywing	S4						x		
Anatrytone logan	Delaware Skipper	S4						x		
Poanes hobomok	Hobomok Skipper	S5						x	x	
Euphyes vestris	Dun Skipper	S5						x		
Malacosoma americana	Eastern Tent Caterpillar Moth	S5						x		
Malacosoma disstria	Forest Tent Caterpillar Moth	S5						x		
Phyllodesma americana	Lappet Moth	S5						x		
Tolype velleda	Large Tolype	SNR						x		
Lycaena phlaeas	American Copper	S5						x		
Lycaena hyllus	Bronze Copper	S5						x		
Satyrium acadica	Acadian Hairstreak	S4						x		
Satyrium edwardsii	Edwards' Hairstreak	S4						x		
Satyrium calanus	Banded Hairstreak	S4						x		
Satyrium caryaevorus	Hickory Hairstreak	S4						x		
Satyrium liparops	Striped Hairstreak	S5						x		
Callophrys niphon	Eastern Pine Elfin	S5						x		
Cupido comyntas	Eastern Tailed Blue	S5						x		
Glaucopsyche lygdamus	Silvery Blue	S5						x		
Celastrina lucia	Northern Spring Azure	S5						x		
Alypia octomaculata	Eight-spotted Forester Moth	S5							x	
Furcula borealis	White Furcula	SNR						x		
Heterocampa guttivitta	Saddled Prominent	SNR						x		
Lochmaeus manteo	Variable Oakleaf Caterpillar Moth	SNR						x		
Macrurocampa marthesia	Mottled Prominent	SNR						x		
Misogada unicolor	Drab Prominent	SNR						x		
Nadata gibbosa	White-spotted Prominent Moth	S5						x		
Schizura unicornis	Unicorn Caterpillar Moth	SNR						x		
Phyciodes cocyta	Northern Crescent	S5						x		
Euphydryas phaeton	Baltimore Checkerspot	S4						x		
Polygonia interrogationis	Question Mark	S5						x	x	
Polygonia comma	Eastern Comma	S5						x		

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC	Ontario Butterfly Atlas	iNaturalist	ERI Observations
Polygonia progne	Gray Comma	S5						x		
Speyeria cybele	Great Spangled Fritillary	S5						x		
Boloria bellona	Meadow Fritillary	S5						x		
Chlosyne nycteis	Silvery Checkerspot	S5						x		
Phyciodes tharos	Pearl Crescent	S4						x		
Nymphalis l-album	Compton Tortoiseshell	S5						x		
Nymphalis antiopa	Mourning Cloak	S5						x	x	
Aglais milberti	Milbert's Tortoiseshell	S5						x		
Vanessa virginiensis	American Lady	S5						x	x	
Vanessa cardui	Painted Lady	S5						x		
Vanessa atalanta	Red Admiral	S5						x	x	
Junonia coenia	Common Buckeye	SNA						x		
Limenitis arthemis astyanax	Red-spotted Purple	S5						x		
Limenitis archippus	Viceroy	S5						x		
Lethe anthedon	Northern Pearly-Eye	S5						x		
Lethe eurydice	Eyed Brown	S5						x		
Lethe appalachia	Appalachian Brown	S4						x		
Megisto cymela	Little Wood-Satyr	S5						x	x	
Coenonympha tullia	Common Ringlet	S5						x		
Cercyonis pegala	Common Wood-Nymph	S5						x		
Danaus plexippus	Monarch	S2N,S4B	SC	END	SC			x	x	
Limenitis arthemis arthemis	White Admiral	S5						x		
Eurytides marcellus	Zebra Swallowtail	SNA						x		
Papilio polyxenes	Black Swallowtail	S5						x	x	
Papilio cresphontes	Giant Swallowtail	S4						x		
Papilio glaucus	Eastern Tiger Swallowtail	S5						x	x	
Papilio canadensis	Canadian Tiger Swallowtail	S5						x		
Pieris rapae	Cabbage White	SNA						x	x	
Colias philodice	Clouded Sulphur	S5						x		
Colias eurytheme	Orange Sulphur	S5						x		
Antheraea polyphemus	Polyphemus Moth	S5						x		
Hyalophora cecropia	Cecropia Moth	S5						x	x	
Paonias excaecata	Blinded Sphinx	S5						x		
Paonias myops	Small-eyed Sphinx	S5						x		
Hemaris thysbe	Hummingbird Clearwing	S5						x		
Eumorpha pandorus	Pandorus Sphinx	S4						x		
Sphecodina abbottii	Abbott's Sphinx	S4						x		
Deidamia inscripta	Lettered Sphinx	SNA						x		
Darapsa myron	Hog Sphinx	SU						x		
Smerinthus jamaicensis	Twin-spotted Sphinx	S5						x		
Hemaris diffinis	Snowberry Clearwing Moth	S4S5						x		

Scientific Name	Common Name	S-RANK	ESA	COSEWIC	SARA	Locally Significant	NHIC	Ontario Butterfly Atlas	iNaturalist	ERI Observations
Yponomeuta cagnagella	Spindle Ermine Moth	SNA							x	
					Total:	0	0	110	25	0

Appendix I

Species at Risk Screening

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Source Identifying Species Record	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Habitat Located within the Study Area	Conclusions/ Recommendations
Amphibians	Jefferson Salamander *Ambystoma jeffersonianum*	END	END Schedule 1	END	ORAA	- Mature deciduous or mixed upland forest containing, or adjacent to, breeding ponds - Terrestrial habitat must include small mammal burrows or rock fissures for over-wintering below the frost line - Breeding ponds are normally ephemeral or vernal woodland pools that dry in late summer - **FOD where permanent or temporary ponds or pools are present**	- Most commonly found within the Niagara Escarpment and Carolinian forest regions	**No** Suitable breeding pools were observed during site investigations	No further action required
Amphibians	Western Chorus Frog (Great Lakes / St. Lawrence - Canadian Shield population) *Pseudacris triseriata*	No Status	THR Schedule 1	THR	ORAA	- Where both terrestrial and aquatic habitats are found in close proximity with seasonally dry temporary ponds devoid of fish - Rarely found in permanent ponds - Terrestrial habitat primarily lowland (marshes or wooded wetlands, low shrubs and grass) with rocks, dead trees, leaves, or in loose soil or animal burrows	- Can be found from Georgian Bay east to Eganville, and from southern Ontario to south of Algonquin Park	**Low Probability** - No suitable breeding pools were observed during site investigations	Nothing further
Plants	Butternut *Juglans cinerea*	END	END Schedule 1	END	ERI	- Deciduous forests with moist, well-drained soil of pH 5.5 to 8; commonly found along streams - Often grows alone in sunny openings and near forest edges - FOD and mature hedgerows	- South of Pembroke to Port Elgin	**Confirmed** Species was observed during field investigations; however, is not in the vicnity of any porposed works	Butternut Health Assessment is to be conducted for species where construction may occur within 50 m. Following Assessment a Notice of Activity may be required
Mammals	Eastern Small-footed Myotis (Eastern Small-footed Bat) *Myotis leibii*	END	N/A	N/A	Ontario Mammal Atlas	- Summer habitat includes rock outcrops, in buildings, under bridges, or in caves, mines or hollow trees - Roosting locations are typically changed every night - Winter hibernation occurs in caves or mines, typically drier and colder than sites selected by other bats	- South of Georgian Bay to Lake Erie and east to the Pembroke area, the Bruce Peninsula, the Espanola area, and Lake Superior Provincial Park	**Candidate** Candidate habitat is found throughout the study area with large trees containing cavities observed during field investigations.	Removal of cavity trees will be avoided where feasible. To be determined at detailed design. Vegetation removal is to occur outside of the maternity roosting period of April 1 to October 15.
Mammals	Little Brown Myotis (Little Brown Bat) *Myotis lucifugus*	END	END Schedule 1	END	Ontario Mammal Atlas	- Large-diameter trees, attics, abandoned buildings, and barns often used for summer colonies - Foraging occurs over water, along waterways, and forest edges, while open areas such as clearcuts or fields are typically avoided - Hibernacula used in winter include mines and caves that are humid and remain above freezing	- All across Ontario; concentrated in southern Ontario	**Candidate** Candidate habitat is found throughout the study area with large trees containing cavities observed during field investigations	Removal of cavity trees will be avoided where feasible. To be determined at detailed design. Vegetation removal is to occur outside of the maternity roosting period of April 1 to October 15.
Mammals	Northern Myotis (Northern Long-eared Bat) *Myotis septentrionalis*	END	END Schedule 1	END	Ontario Mammal Atlas	- Typically within the boreal forest, under loose bark or in the cavities of trees - Foraging occurs over water, along waterways, and forest edges, while open areas such as clearcuts or fields are typically avoided - Overwintering occurs in cold and humid sites such as caves or mines - **FOC, FOM, FOD, SWC, SWM, and SWD where suitable roosting (i.e. cavity trees and trees with loose bark) habitat is available**	- Forested areas in southern Ontario, to the north shore of Lake Superior and occasionally as far north as Moosonee, and west to Lake Nipigon	**Candidate** Candidate habitat is found throughout the study area with large trees containing cavities observed during field investigations	Removal of cavity trees will be avoided where feasible. To be determined at detailed design. Vegetation removal is to occur outside of the maternity roosting period of April 1 to October 15.

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Source Identifying Species Record	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Habitat Located within the Study Area	Conclusions/ Recommendations
Mammals	Tri-colored Bat *Perimyotis subflavus*	END	END Schedule 1	END	Ontario Mammal Atlas	- Day roost and maternity colonies are formed in older forests with large-diameter trees, barns, or other structures - Foraging occurs over water or along streams in a forest - Winter hibernacula include caves and mines	- Southern Ontario north to Sudbury	**Candidate** Candidate habitat is found throughout the study area with large trees containing cavities observed during field investigations	Removal of cavity trees will be avoided where feasible. To be determined at detailed design. Vegetation removal is to occur outside of the maternity roosting period of April 1 to October 15.
Birds	Chimney Swift *Chaetura pelagica*	THR	THR Schedule 1	THR	eBird, OBBA	- Historically included hollow trees - More commonly found in and around urban settlements, including chimneys and other manmade structures - Typically close to water **- TPO, CUM1, MAM, MAS, OAO, SAS1, SAM1, SAF1 adjacent to suitable nesting habitat**	- Southern Ontario north to Timmins	**No** Suitable habitat was not observed	Vegetation removal should occur outside of the breeding bird window (April 1 - August 31)
Birds	Barn Swallow *Hirundo rustica*	THR	THR Schedule 1	THR	OBBA	- Cup-shaped mud nests are built on human-made structures such as open barns, under bridges, and in culverts - Preferably constructed on rough-cut wood surfaces with right angles - Foraging habitat includes grassy fields, pastures, cropland, lake and river shorelines, cottage areas and farmyards, islands, wetlands, and tundra **- TPO, CUM1, MAM, MAS, OAO, SAS1, SAM1, and SAF1, adjacent to suitable nesting structures**	- From southern Ontario north to Hudson Bay	**No** Suitable nesting structures were observed during field investigations	Vegetation removal should occur outside of the breeding bird window (April 1 - August 31)
Birds	Bank Swallow *Riparia riparia*	THR	THR Schedule 1	THR	OBBA	- Requires vertical faces in sand or silt deposits; river and lake banks, active/inactive sand and gravel pits, road cuts, soil stockpiles - Breeding sites are located close to aerial foraging areas such as grasslands, meadows, pastures, and cropland - Large wetlands used for nocturnal roost sites during post-breeding, migration and wintering periods -watercourses with steep banks close to CUM, TPO	- Common across southern Ontario, especially along Lake Erie and Lake Ontario shorelines and the Saugeen River - Sparse population scattered across northern Ontario	**No** Suitable habitat was observed during field investigations	Vegetation removal should occur outside of the breeding bird window (April 1 - August 31)
Birds	Bobolink *Dolichonyx oryzivorus*	THR	THR Schedule 1	THR	OBBA	- Hayfields, pastures, wet prairie, graminoid peatlands, abandoned farm fields dominated by tall grasses, no-till cropland, small-grain fields, restored surface mining sites - Small nests are often built on the ground in dense grasses - Typically not abundant in short-grass prairie, alfalfa, or in row crop monocultures (corn, soybean, wheat) **- TPO, TPS, CUM1, and MAM2**	- Southern Ontario north to James Bay	**No** Suitable habitat was observed during field investigations	Vegetation removal should occur outside of the breeding bird window (April 1 - August 31)
Birds	Eastern Meadowlark *Sturnella magna*	THR	THR Schedule 1	THR	OBBA	- Moderately tall grasslands; prairies, savannahs, pastures and hayfields, alfalfa fields, weedy borders of croplands, roadsides, orchards, airports, overgrown fields - Small trees, shrubs, or fence posts used as elevated song perches **- TPO, TPS, CUM1, CUS, and MAM2**	- Southern Ontario north to Timmins, as well as Lake of the Woods area	**No** Suitable habitat was not observed during field investigations	Vegetation removal should occur outside of the breeding bird window (April 1 - August 31)

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Source Identifying Species Record	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Habitat Located within the Study Area	Conclusions/ Recommendations
Reptiles	Blanding's Turtle (Great Lakes / St. Lawrence population) Emydoidea blandingii	THR	THR Schedule 1	END	ORAA	- Shallow, nutrient-rich habitats; typically large wetlands and shallow lakes with lots of water plants - Nesting occurs in sand, organic soil, gravel, cobblestone, and soil-filled crevices of rock outcrops - Overwintering occurs in pools about 1 metre in depth - SWT2, SWT3, SWD, SWM, MAS2, SAS1, SAM1, where open water is present	- Southern Ontario north to Sudbury, with isolated reports as far north as Timmins	**No** Suitable habitat was not observed during field investigations	No further action required
Birds	Common Nighthawk *Chordeiles minor*	SC	THR Schedule 1	SC	OBBA	- Open areas with little to no ground vegetation; logged or burned areas, rock barrens, peat bogs, lakeshores, dunes, beaches, and mine tailings - Less commonly found in cultivated fields, orchards, mine tailings, and along gravel roads and railways - Nesting habitat is typically open and vegetation free; may include grasslands, pastures, marshes, and riverbanks - May also include mixed and coniferous forests **- SD, BB, RB, CUM, BO, FOM, FOX and FOD with sparsely vegetated openings**	- All of Ontario except for coastal regions of James Bay and Hudson Bay	**No** Suitable habitat was not observed during field investigations	Vegetation removal should occur outside of the breeding bird window (April 1 - August 31)
Birds	Rusty Blackbird *Euphagus carolinus*	SC	SC Schedule 1	SC	eBIrd	- Wet woodlands, swamps, pond edges - Agricultural land is used for foraging - Boreal forest is used for breeding; conifer-dominated forests adjacent to wetlands, peat bogs, sedge meadows, marshes, swamps, and beaver ponds	- Breeding habitat spans Hudson Bay south to Orilia - May be seen in southern Ontario during migration	**No** Suitable habitat was not observed during field investigations	Vegetation removal should occur outside of the breeding bird window (April 1 - August 31)
Birds	Canada Warbler *Cardellina canadensis*	SC	THR Schedule 1	THR	OBBA, eBIrd	- Deciduous or coniferous forests with well-developed, dense shrub layer; commonly wet or in riparian areas - May also include stands regenerating after natural disturbances (ie, logging) **- FOC3, FOC4, FOM6, FOM7, FOM8, FOD6, FOD7, FOD8, FOD9, SWC, SWM and SWD**	- All of Ontario	**No** Suitable habitat was not observed during field investigations	Vegetation removal should occur outside of the breeding bird window (April 1 - August 31)
Birds	Short-eared Owl *Asio flammeus*	SC	SC Schedule 1	SC	OBBA	- Tundra, dense grasslands, peat bogs, marshes, sand-sage concentrations, old pastures, and agricultural fields - Nests are built on the ground	- All of Ontario	**No** Suitable habitat was not observed during field investigations	Vegetation removal should occur outside of the breeding bird window (April 1 - August 31)
Birds	Wood Thrush *Hylocichla mustelina*	SC	THR Schedule 1	THR	OBBA	- Mature deciduous and mixed forests; moist stands of trees with well-developed undergrowth - Tall trees are used for singing perches - Nests are built in live saplings, trees, or shrubs, especially sugar maple or American beech - Preferbly large forest mosaics **- FOD and FOM greater than 1 ha**	- Southern Ontario north to Hearst	**No** **S**uitable habitat was not observed during field investigations	Vegetation removal should occur outside of the breeding bird window (April 1 - August 31)
Birds	Eastern Wood-pewee *Contopus virens*	SC	SC Schedule 1	SC	OBBA, eBIrd	- Mid-canopy layer of forest clearings, edges of deciduous and mixed forests, early successional clearings **- FOC, FOM, FOD, SWD, SWM and CUW**	- Southern Ontario north to Sudbury	**No** Suitable habitat was not observed during field investigations	Vegetation removal should occur outside of the breeding bird window (April 1 - August 31)

Taxonomy	Species	ESA Status	SARA Status	COSEWIC Status	Source Identifying Species Record	Preferred Habitat[1, 2]	Known Species Range[1, 2]	Habitat Located within the Study Area	Conclusions/ Recommendations
Insects	Monarch *Danaus plexippus*	SC	SC Schedule 1	END	Ontario Butterfly Atlas, iNaturalist	- Open or disturbed habitats such as roadsides, fields, wetlands, prairies, and open forests - Trees along the north shore of the Great Lakes are used for roosting before migrating across open water - Caterpillars are confined to meadows and open areas where milkweed grows - **AL, TP, and CUM where milkweed is present**	- South of 50° of latitude	**Confirmed** Species was observed during field investigations	Seed mixes used for restoration purposes should inlcude milkweed.
Reptiles	Northern Map Turtle *Graptemys geographica*	SC	SC Schedule 1	SC	ORAA	- Both lakes and rivers, preferably with slow-moving currents, muddy bottoms, high-quality water, and abundant vegetation - Habitat must contain suitable basking sites such as rocks and deadheads - Hibernation occurs at the bottom of deep, slow-moving sections of river - **OAO, SA** with emergent rocks and fallen trees	- Southern Ontario, primarily on the shores of Georgian Bay, Lake St. Clair, Lake Erie, and Lake Ontario, and along larger rivers including the Thames, Grand, and Ottawa '- Has also been recorded on Manitoulin Island and north of Timmins	**No** Suitable habitat was not observed during field investigations	No further action required
Reptiles	Eastern Ribbonsnake (Great Lakes population; Northern Ribbonsnake) *Thamnophis sauritus*	SC	SC Schedule 1	SC	ORAA	- Marshes, bogs, fens, ponds, lake shorelines, wet meadows, or other wetland habitats with both flowing and standing water - Hibernacula consist of underground burrows or rock crevices; may be well-drained, close to water, or completely submerged. - **FOC, FOM, FOD, SWC, SWM, SWD, MAM, MAS, OAO, SAS, SAM and SAF containing standing or flowing water near year-round**	- Southern Ontario north to Sudbury, including Manitoulin Island	**Candidate** Suitable habitat observed during field investigations in Sawmill Creek; however, no evidence of this species was detected surveys.	Works along the banks should consider the presence of snakes. A widlife observation protocol should be considered in the event a snake is observed within the study area during construction.
Reptiles	Snapping Turtle *Chelydra serpentina*	SC	SC Schedule 1	SC		- Shallow wetland habitats with slow-moving water and soft bottoms; ponds, sloughs, shallow bays, river edges, or slow streams - Nesting occurs on sandy or gravel banks or man-made structures such as roads, dams, and aggregate pites - Overwintering occurs underwater, underneath logs, sticks, or overhanging banks, deep in mud in marshy areas, or underneath floating mats of vegetation. - **OAO, SA near gravelly or sandy areas**	- Primarily southern Ontario north to Timmins; also found near Thunder Bay and Kenora	**No** Suitable habitat was not observed during field investigations	A widlife observation protocol should be considered in the event a turtle be observed within the study area during construction.

Appendix J
Significant Wildlife Habitat Assessment

Table 1. Seasonal Concentration Areas of Animals.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Waterfowl Stopover and Staging Areas (Terrestrial) Rationale: Habitat important for migrating waterfowl.	American Black Duck Wood Duck Green-winged Teal Blue-winged Teal Mallard Northern Shoveler American Wigeon Northern Pintail Gadwall	CUM1 CUT1 • Plus evidence of annual spring flooding from melt water or run-off within these Ecosites.	• Fields with sheet water during Spring (mid March to May). • Field flooding during spring melt and run-off provides important invertebrate foraging habitat for migrating waterfowl. • Agricultural fields with waste grains are commonly used by waterfowl, these are not considered SWH unless they have spring sheet water available [cxlviii]. Information Sources: • Reports and other information available from Conservation Authorities • Sites documented through waterfowl planning processes (eg. EHJV implementation plan). • Field Naturalists Clubs. • Ducks Unlimited Canada . • Natural Heritage Information Center (NHIC) Waterfowl Concentration Area. • Anecdotal information from the landowners, adjacent landowners or local naturalist clubs may be good information in determining occurrence.	• Studies carried out and verified presence of an annual concentration of any listed species, evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • Any mixed aggregations of 100[E] or more individuals required. • SWH MIST [cxlix] Index #7 provides development effects and mitigation measures. • Annual use of habitat is documented from information sources or field studies (annual use can be based on studies or determined by past surveys with species numbers and dates). • The flooded Field Ecosite habitat plus a 100 – 300 m radius, dependant on local site conditions and adjacent land use is the significant wildlife habitat [cxlviii].	ELC codes not present. **SWH type not present.**
Waterfowl Stopover and Staging Areas (Aquatic) Rationale: Important for local and migrant waterfowl populations during the spring or fall migration or both periods combined. Sites identified are usually only one of a few in the eco-district.	Canada Goose Cackling Goose Snow Goose American Black Duck Northern Pintail Northern Shoveler American Wigeon Gadwall Green-winged Teal Blue-winged Teal Hooded Merganser Common Merganser Lesser Scaup Greater Scaup Long-tailed Duck Surf Scoter White-winged Scoter Black Scoter Ring-necked duck Common Goldeneye Bufflehead Redhead Ruddy Duck Red-breasted Merganser Brant Canvasback Ruddy Duck	MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7	• Ponds, marshes, lakes, bays, coastal inlets, and watercourses used during migration. Sewage treatment ponds and storm water ponds do not qualify as a SWH, however a reservoir managed as a large wetland or pond/lake does qualify. • These habitats have an abundant food supply (mostly aquatic invertebrates and vegetation in shallow water). Information Sources: • Environment Canada • Naturalist clubs often are aware of staging / stopover areas. • OMNRF Wetland Evaluations indicate presence of locally and regionally significant waterfowl staging. • Sites documented through waterfowl planning processes (eg. EHJV implementation plan). • Ducks Unlimited projects. • Element occurrence specification by Nature Serve: http://www.natureserve.org • Natural Heritage Information Centre (NHIC) Waterfowl Concentration Area.	Studies carried out and verified presence of: • Aggregations of 100[E] or more of listed species for 7 days[E], results in > 700 waterfowl use days. • Areas with annual staging of ruddy ducks, canvasbacks, and redheads are SWH [cxlix]. • The combined area of the ELC Ecosites and a 100 m radius area is the SWH [cxlviii]. • Wetland area and shorelines associated with sites identified within the SWHTG [cxlviii] Appendix K [cxlix] are significant wildlife habitat. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi]. • Annual Use of Habitat is Documented from Information Sources or Field Studies (Annual can be based on completed studies or determined from past surveys with species numbers and dates recorded). • SWH MIST cxlix Index #7 provides development effects and mitigation measures.	ELC codes not present. **SWH type not present.**
Shorebird Migratory	Greater Yellowlegs Lesser Yellowlegs Marbled Godwit	BBO1 BBO2 BBS1 BBS2	• Shorelines of lakes, rivers and wetlands, including beach areas, bars and seasonally flooded, muddy and un-vegetated shoreline habitats.	Studies confirming: • Presence of 3 or more of listed species and > 1000[E] shorebird use days during spring or fall migration period (shorebird use days are	ELC codes not present. **SWH type not present.**

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Stopover Area Rationale: High quality shorebird stopover habitat is extremely rare and typically has a long history of use.	Hudsonian Godwit Black-bellied Plover American Golden Plover Semipalmated Plover Solitary Sandpiper Spotted Sandpiper Semipalmated Sandpiper Pectoral Sandpiper White-rumped Sandpiper Baird's Sandpiper Least Sandpiper Purple Sandpiper Stilt Sandpiper Short-billed Dowitcher Red-necked Phalarope Whimbrel Ruddy Turnstone Sanderling Dunlin	BBT1 BBT2 SDO1 SDS2 SDT1 MAM1 MAM2 MAM3 MAM4 MAM5	• Great Lakes coastal shorelines, including groynes and other forms of armour rock lakeshores, are extremely important for migratory shorebirds in May to mid-June and early July to October. • Sewage treatment ponds and storm water ponds do not qualify as a SWH. Information Sources: • Western hemisphere shorebird reserve network. • Canadian Wildlife Service (CWS) Ontario Shorebird Survey. • Bird Studies Canada. • Ontario Nature. • Local birders and naturalist clubs. • Natural Heritage Information Centre (NHIC) Shorebird Migratory Concentration Area.	the accumulated number of shorebirds counted per day over the course of the fall or spring migration period). • Whimbrel stop briefly (< 24 hrs) during spring migration, any site with > 100Ⓔ Whimbrel used for 3 years or more is significant. • The area of significant shorebird habitat includes the mapped ELC Shoreline Ecosites plus a 100 m radius area [cxlviii]. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #8 provides development effects and mitigation measures.	
Raptor Wintering Area Rationale: Sites used by multiple species, a high number of individuals and used annually are most significant.	Rough-legged Hawk Red-tailed Hawk Northern Harrier American Kestrel Snowy Owl **Special Concern:** Short-eared Owl Bald Eagle	Hawks / Owls: Combination of ELC Community Series; need to have present one Community Series from each land class Forest: FOD, FOM, FOC. Upland: CUM, CUT, CUS, CUW. Bald Eagle: Forest community Series: FOD, FOM, FOC, SWD, SWM or SWC on shoreline areas adjacent to large rivers or lakes with open water (hunting area).	• The habitat provides a combination of fields and woodlands that provide roosting, foraging and resting habitats for wintering raptors. • Raptor wintering (hawk / owl) sites need to be > 20 ha [cxlviii, cxlix] with a combination of forest and upland. [xvi, xvii, xviii, xix, xx, xxi]. • Least disturbed sites, idle / fallow or lightly grazed field / meadow (> 15 ha) with adjacent woodlands [cxlix]. • Field area of the habitat is to be wind swept with limited snow depth or accumulation. • Eagle sites have open water and large trees and snags available for roosting [cxlix]. Information Sources: • OMNRF Ecologist or Biologist. • Naturalist clubs. • Natural Heritage Information Centre (NHIC) Raptor Winter Concentration Area. • Data from Bird Studies Canada. • Results of Christmas Bird Counts. • Reports and other information available from Conservation Authorities.	Studies confirm the use of these habitats by: • One or more Short-eared Owls or; One of more Bald Eagles or; At least10 individuals and two of the listed hawk / owl species[Ⓔ]. • To be significant a site must be used regularly (3 in 5 years) [cxlix] for a minimum of 20 days by the above number of birds[Ⓔ]. • The habitat area for an Eagle winter site is the Shoreline Forest Ecosites directly adjacent to the prime hunting area[Ⓔ]. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #10 and #11 provides development effects and mitigation measures.	Red-tailed Hawk was observed calling within the study area; however, combination of ELC communities not present. **SWH type not present.**
Bat Hibernacula Rationale: Bat hibernacula are rare	Big Brown Bat Tri-coloured Bat	Bat Hibernacula may be found in these Ecosites: CCR1 CCR2 CCA1	• Hibernacula may be found in caves, mine shafts, underground foundations and Karsts. • Active mine sites should not be considered as SWH. • The locations of bat hibernacula are relatively poorly known. Information Sources	• All sites with confirmed hibernating bats are SWH [Ⓔ]. • The area includes 200 m radius around the entrance of the hibernaculum [cxlviii, ccvii, Ⓔ] for most development types and 1000 m for wind farms [ccv]. • Studies are to be conducted during the peak swarming period (Aug. – Sept.).	**SWH type not present.**

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
habitats in all Ontario landscapes		CCA2 (Note: buildings are not considered to be SWH)	• OMNRF for possible locations and contact for local experts. • Natural Heritage Information Centre (NHIC) Bat Hibernaculum. • Ministry of Northern Development and Mines for location of mine shafts. • Clubs that explore caves (eg. Sierra Club). • University Biology Departments with bat experts.	Surveys should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects" [ccv]. • SWH MIST [cxlix] Index #1 provides development effects and mitigation measures.	
Bat Maternity Colonies Rationale: Known locations of forested bat maternity colonies are extremely rare in all Ontario landscapes.	Big Brown Bat Silver-haired Bat	Maternity colonies considered SWH are found in forested Ecosites. All ELC Ecosites in ELC Community Series: FOD FOM SWD SWM	• Maternity colonies can be found in tree cavities, vegetation and often in buildings [xxii, xxv, xxvi, xxvii, xxxi] (buildings are not considered to be SWH). • Maternity roosts are not found in caves and mines in Ontario [xxii]. • Maternity colonies located in Mature deciduous or mixed forest stands [ccix, ccx, ccv] with > 10 / ha large diameter (> 25 cm dbh) wildlife trees [ccvii]. • Female Bats prefer wildlife tree (snags) in early stages of decay, class 1-3 [ccxiv] or class 1 or 2 [ccxii]. • Silver-haired Bats prefer older mixed or deciduous forest and form maternity colonies in tree cavities and small hollows. Older forest areas with at least 21 snags / ha are preferred [ccx, lxiv]. Information Sources: • OMNRF for possible locations and contact for local experts. • University Biology Departments with bat experts.	• Maternity Colonies with confirmed use by; • > 10 Big Brown Bats[Ⓔ] • > 5 Adult Female Silver haired Bats[Ⓔ]. • The area of the habitat includes the entire woodland or a forest stand ELC Ecosite or an Ecoelement containing the maternity colonies[Ⓔ]. • Evaluation methods for maternity colonies should be conducted following methods outlined in the "Bats and Bat Habitats: Guidelines for Wind Power Projects" [ccv]. • SWH MIST [cxlix] Index #12 provides development effects and mitigation measures.	Cavity trees observed; however, no acoustic monitoring has been completed. **Candidate SWH**
Turtle Wintering Areas Rationale: Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	Midland Painted Turtle **Special Concern:** Northern Map Turtle Snapping Turtle	Snapping and Midland Painted Turtles; ELC Community Classes; SW, MA, OA and SA, ELC Community Series; FEO and BOO Northern Map Turtle; Open Water areas such as deeper rivers or streams and lakes with current can also be used as over-wintering habitat	• For most turtles, wintering areas are in the same general area as their core habitat. Water has to be deep enough not to freeze and have soft mud substrates. • Over-wintering sites are permanent water bodies, large wetlands, and bogs or fens with adequate Dissolved Oxygen [cix, cx, cxi, cxii]. • Man-made ponds such as sewage lagoons or storm water ponds should not be considered SWH. Information Sources: • EIS studies carried out by Conservation Authorities. • Field Naturalists Clubs. • OMNRF Ecologist or Biologist. • Natural Heritage Information Centre (NHIC).	• Presence of 5 over-wintering Midland Painted Turtles is significant[Ⓔ] . • One or more Northern Map Turtle or Snapping Turtle over-wintering within a wetland is significant[Ⓔ]. • The mapped ELC Ecosite area with the over wintering turtles is the SWH. If the hibernation site is within a stream or river, the deep water pool where the turtles are over wintering is the SWH. • Over wintering areas may be identified by searching for congregations (Basking Areas) of turtles on warm, sunny days during the fall (Sept. – Oct.) or spring (Mar– May) [cvii]. • Congregation of turtles is more common where wintering areas are limited and therefore significant [cix, cx, cxi, cxii]. • SWH MIST [cxlix] Index #28 provides development effects and mitigation measures for turtle wintering habitat.	**SWH type not present.**
Reptile Hibernaculum Rationale: Generally sites are the only known sites in the area. Sites with the highest number of individuals are most significant.	**Snakes:** Eastern Gartersnake Northern Watersnake Northern Red-bellied Snake Northern Brown snake Smooth Green Snake Northern Ring-necked Snake **Special Concern:** Milk snake Eastern Ribbonsnake **Lizard:**	For all snakes, habitat may be found in any Ecosite other than very wet ones. Talus, Rock Barren, Crevice, Cave, and Alvar sites may be directly related to these habitats. Observations or congregations of snakes on sunny warm days in the spring or fall is a good indicator.	• For snakes, hibernation takes place in sites located below frost lines in burrows, rock crevices and other natural or naturalized locations. The existence of features that go below frost line; such as rock piles or slopes, old stone fences, and abandoned crumbling foundations assist in identifying candidate SWH. • Areas of broken and fissured rock are particularly valuable since they provide access to subterranean sites below the frost line [xliv, l, li, lii, cxii]. • Wetlands can also be important over-wintering habitat in conifer or shrub swamps and swales, poor fens, or depressions in bedrock terrain with sparse trees or shrubs with sphagnum moss or sedge hummock ground cover. • Five-lined Skink prefer mixed forests with rock outcrop openings providing cover rock overlaying granite bedrock with fissure [cciii].	Studies confirming: • Presence of snake hibernacula used by a minimum of five individuals of a snake sp. or; individuals of two or more snake spp. • Congregations of a minimum of five individuals of a snake sp. or; individuals of two or more snake spp. near potential hibernacula (eg. foundation or rocky slope) on sunny warm days in Spring (Apr / May) and Fall (Sept / Oct)[Ⓔ]. • Note: If there are Special Concern Species present, then site is SWH. • Note: Sites for hibernation possess specific habitat parameters (e.g. temperature, humidity, etc.) and consequently are used annually, often by many of the same individuals of a local population (e.g. strong hibernation site fidelity). Other critical life	**SWH type not present.**

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
	Special Concern: (Southern Shield population): Five-lined Skink	For Five-lined Skink, ELC Community Series of FOD and FOM and Ecosites: FOC1 FOC3	Information Sources: • In spring, local residents or landowners may have observed the emergence of snakes on their property (e.g. old dug wells). • Reports and other information available from Conservation Authorities. • Field Naturalist Clubs. • University herpetologists. • Natural Heritage Information Centre (NHIC). • OMNRF ecologist or biologist may be aware of locations on wintering skinks.	processes (e.g. mating) often take place in close proximity to hibernacula. The feature in which the hibernacula is located plus a 30 m radius area is the SWH(E). • SWH MIST [cxlix] Index #13 provides development effects and mitigation measures for snake hibernacula. • Presence of any active hibernaculum for skink is significant. • SWH MIST [cxlix] Index #37 provides development effects and mitigation measures for Five-linked Skink wintering habitat. •	
Colonially - Nesting Bird Breeding Habitat (Bank and Cliff) Rationale: Historical use and number of colony nests make this habitat signif-icant. An iden-tified colony can be impor-tant to local populations. All swallow population are declining in Ontario.	Cliff Swallow Northern Rough-winged Swallow (this species is not colonial but can be found in Cliff Swallow colonies)	Eroding banks, sandy hills, borrow pits, steep slopes, and sand piles Cliff faces, bridge abutments, silos, barns. Habitat found in the following Ecosites: CUM1 CUT1 CUS1 BLO1 BLS1 BLT1 CLO1 CLS1 CLT1	• Any site or areas with exposed soil banks, undisturbed or naturally eroding that is not a licensed / permitted aggregate area. • Does not include man-made structures (bridges or buildings) or recently (2 years) disturbed soil areas, such as berms, embankments, soil or aggregate stockpiles. • Does not include a licensed / permitted Mineral Aggregate Operation. Information Sources: • Reports and other information available from Conservation Authorities. • Ontario Breeding Bird Atlas. • Bird Studies Canada; NatureCounts http://www.birdscanada.org/birdmon/ • Field Naturalist Clubs.	Studies confirming: • Presence of 1 or more nesting sites with 8 [cxlix] or more cliff swallow pairs and / or rough-winged swallow pairs during the breeding season. • A colony identified as SWH will include a 50 m radius habitat area from the peripheral nests [ccvii]. • Field surveys to observe and count swallow nests are to be completed during the breeding season. Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi]. • SWH MIST [cxlix] Index #4 provides development effects and mitigation measures.	Species not observed during field investigations. **SWH type not present.**
Colonially-Nesting Bird Breeding Habitat (Trees and Shrubs) Rationale: Large colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Great Blue Heron Black-crowned Night Heron Great Egret Green Heron	SWM2 SWM3 SWM5 SWM6 SWD1 SWD2 SWD3 SWD4 SWD5 SWD6 SWD7 FET1	• Nests in live or dead standing trees in wetlands, lakes, islands, and peninsulas. Shrubs and occasionally emergent vegetation may also be used. • Most nests in trees are 11 to 15 m from ground, near the top of the tree. Information Sources: • Ontario Breeding Bird Atlas ccv, colonial nest records. • Ontario Heronry Inventory 1991 available from Bird Studies Canada or NHIC (OMNRF). • Natural Heritage Information Centre (NHIC) Mixed Wader Nesting Colony. • Aerial photographs can help identify large heronries. • Reports and other information available from Conservation Authorities. • MNRF District Offices. • Local Naturalist Clubs.	Studies confirming: • Presence of 5(E) or more active nests of Great Blue Heron or other listed species. • The habitat extends from the edge of the colony and a minimum 300 m radius or extent of the Forest Ecosite containing the colony or any island < 15.0 ha with a colony is the SWH [cc, ccvii]. • Confirmation of active heronries are to be achieved through site visits conducted during the nesting season (April to August) or by evidence such as the presence of fresh guano, dead young and / or eggshells. • SWH MIST [cxlix] Index #5 provides development effects and mitigation measures.	Species not observed during field investigations. **SWH type not present.**

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Colonially-Nesting Bird Breeding Habitat (Ground) Rationale: Colonies are important to local bird population, typically sites are only known colony in area and are used annually.	Herring Gull Great Black-backed Gull Little Gull Ring-billed Gull Common Tern Caspian Tern Brewer's Blackbird	Any rocky island or peninsula (natural or artificial) within a lake or large river (two-lined on a 1;50,000 NTS map). Close proximity to watercourses in open fields or pastures with scattered trees or shrubs (Brewer's Blackbird). MAM1 – 6 MAS1 – 3 CUM CUT CUS	• Nesting colonies of gulls and terns are on islands or peninsulas associated with open water or in marshy areas. • Brewers Blackbird colonies are found loosely on the ground in or in low bushes in close proximity to streams and irrigation ditches within farmlands. Information Sources: • Ontario Breeding Bird Atlas, rare / colonial species records. • Canadian Wildlife Service. • Reports and other information available from Conservation Authorities. • Natural Heritage Information Centre (NHIC) Colonial Waterbird Nesting Area. • MNRF District Offices. • Field Naturalist Clubs.	Studies confirming: • Presence of > 25 active nests for Herring Gulls or Ring-billed Gulls, > 5 active nests for Common Tern or > 2 active nests for Caspian Tern(E). • Presence of 5 or more pairs for Brewer's Blackbird(E). • Any active nesting colony of one or more Little Gull, and Great Black-backed Gull is significant(E). • The edge of the colony and a minimum 150m radius area of habitat, or the extent of the ELC Ecosites containing the colony or any island < 3.0 ha with a colony is the SWH [cc, ccvii]. • Studies would be done during May / June when actively nesting. Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi] • SWH MIST [cxlix] Index #6 provides development effects and mitigation measures.	Species thresholds not observed during breeding bird surveys. **SWH type not present.**
Migratory Butterfly Stopover Areas Rationale: Butterfly stopover areas are extremely rare habitats and are biologically important for butterfly species that migrate south for the winter.	Painted Lady Red Admiral **Special Concern**: Monarch	Combination of ELC Community Series; need to have present one Community Series from each landclass: Field: CUM CUT CUS Forest: FOC FOD FOM CUP Anecdotally, a candidate site for butterfly stopover will have a history of butterflies being observed.	• A butterfly stopover area will be a minimum of 10 ha in size with a combination of field and forest habitat present, and will be located within 5 km of Lake Erie or Lake Ontario [cxlix]. • The habitat is typically a combination of field and forest, and provides the butterflies with a location to rest prior to their long migration south [xxxii, xxxiii, xxxiv, xxxv, xxxvi]. • The habitat should not be disturbed, fields/meadows with an abundance of preferred nectar plants and woodland edge providing shelter are requirements for this habitat [cxlviii, cxlix]. • Staging areas usually provide protection from the elements and are often spits of land or areas with the shortest distance to cross the Great Lakes [xxxvii, xxxviii, xxxix, xl, xli]. Information Sources: • MNRF District Offices. • Natural Heritage Information Centre (NHIC). • Agriculture Canada in Ottawa may have list of butterfly experts. • Field Naturalist Clubs. • Toronto Entomologists Association. • Conservation Authorities.	Studies confirm: • The presence of Monarch Use Days (MUD) during fall migration (Aug / Oct) [xliii]. MUD is based on the number of days a site is used by Monarchs, multiplied by the number of individuals using the site. Numbers of butterflies can range from 100-500 / day [xxxvii], significant variation can occur between years and multiple years of sampling should occur [xl, xlii]. • Observational studies are to be completed and need to be done frequently during the migration period to estimate MUD. • MUD of > 5000 or > 3000 with the presence of Painted Ladies or Red Admiral's is to be considered significant(E). • SWH MIST [cxlix] Index #16 provides development effects and mitigation measures.	Not within 5 km of Lake Ontario. **SWH type not present.**
Landbird Migratory Stopover Rationale: Sites with a high diversity of species as	All migratory songbirds. Canadian Wildlife Service Ontario website: http://www.ec.gc.ca/nature/	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC	• Woodlots > 5 ha (E) in size and within 5 km [iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv, xv] of Lake Erie and Lake Ontario. If woodlands are rare in an area of shoreline, woodland fragments 2 – 5 ha can be considered for this habitat(E). Woodlots need to be > 10 ha (E) in size and within 5 km [iv, v, vi, vii, viii, ix, x, xi, xii, xiii, xiv, xv] of Lake Ontario. • If multiple woodlands are located along the shoreline those Woodlands < 2 km from Lake Ontario are more significant [cxlix].	Studies confirm: • Use of the habitat by > 200 birds / day and with > 35 spp with at least 10 bird spp. recorded on at least 5 different survey dates(E). This abundance and diversity of migrant bird species is considered above average and significant. • Studies should be completed during spring (Mar to May) and fall (Aug to Oct) migration using standardized assessment techniques.	Not within 5km of Lake Ontario. **SWH type not present.**

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
well as high numbers are most significant.	default.asp?lang=En&n=421B7A9D-1 All migrant raptors species: Ontario Ministry of Natural Resources: Fish and Wildlife Conservation Act, 1997. Schedule 7: Specially Protected Birds (Raptors).	SWM SWD	• Sites have a variety of habitats; forest, grassland and wetland complexes [cxlix]. • The largest sites are more significant [cxlix]. • Woodlots and forest fragments are important habitats to migrating birds [ccxviii], these features located along the shore and located within 5 km of Lake Ontario are Candidate SWH [cxlviii]. <u>Information Sources</u>: • Bird Studies Canada. • Ontario Nature. • Local birders and field naturalist clubs. • Ontario Important Bird Areas (IBA) Program.	• Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi]. • SWH MIST [cxlix] Index #9 provides development effects and mitigation measures.	
Deer Yarding Areas <u>Rationale:</u> Winter habitat for deer is considered to be the main limiting factor for northern deer populations. In winter, deer congregate in “yards” to survive severe winter conditions. Deer yards typically have a long history of annual use by deer, yards typically represent 10 – 15% of an areas summer range.	White-tailed Deer	Note: OMNRF to determine this habitat. ELC Community Series providing a thermal cover component for a deer yard would include: FOM FOC SWM SWC Or these ELC Ecosites: CUP2 CUP3 FOD3 CUT	• Deer yarding areas or winter concentration areas (yards) are areas deer move to in response to the onset of winter snow and cold. This is a behavioural response and deer will establish traditional use areas. The yard is composed for two areas referred to as Stratum I and Stratum II. Stratum II covers the entire winter yard area and is usually a mixed or deciduous forest with plenty of browse available for food. Agricultural lands can also be included in this area. Deer move to these areas in early winter and generally, when snow depths reach 20 cm, most of the deer will have moved here. If the snow is light and fluffy, deer may continue to use this area until 30 cm snow depth. In mild winters, deer may remain in the Stratum II area the entire winter. • The Core of a deer yard (Stratum I) is located within the Stratum II area and is critical for deer survival in areas where winters become severe. It is primarily composed of coniferous trees (pine, hemlock, cedar, spruce) with a canopy cover of more than 60% [cxciv]. • OMNRF determines deer yards following methods outlined in “Selected Wildlife and Habitat Features: Inventory Manual” [cxcv]. • Woodlots with high densities of deer due to artificial feeding are not significant [E].	No studies required: • Snow depth and temperature are the greatest influence on deer use of winter yards. Snow depth > 40 cm for more than 60 days in a typical winter are minimum criteria for a deer yard to be considered as SWH [lvi, lvii, lviii, lix, lx, E]. • Deer yards are mapped by OMNRF District offices. Locations of Core or Stratum I and Stratum II deer yards considered significant by OMNRF will be available at local MNRF offices or via Land Information Ontario (LIO). • Field investigations that record deer tracks in winter are done to confirm use (best done from an aircraft). Preferably, this is done over a series of winters to establish the boundary of the Stratum I and Stratum II yard in an “average” winter. MNRF will complete these field investigations [cxcv]. • If a SWH is determined for Deer Wintering Area or if a proposed development is within Stratum II yarding area then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWH MIST [cxlix] Index #2 provides development effects and mitigation measures.	No evidence of deer yarding observed during field investigations. **SWH type not present.**
Deer Winter Congregation Areas <u>Rationale</u>: Deer movement during winter in the southern areas of	White-tailed Deer	All Forested Ecosites with these ELC Community Series; FOC FOM FOD SWC SWM SWD	• Woodlots will typically be > 100 [E] ha in size. Woodlots < 100 ha may be considered as significant based on MNRF studies or assessment. • Deer movement during winter in the southern areas of EcoRegion 6E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands [cxlviii]. • If deer are constrained by snow depth refer to the Deer Yarding Area habitat within Table 1.1 of this Schedule. • Large woodlots > 100 ha and up to 1500 ha are known to be used annually by densities of deer that range from 0.1-1.5 deer / ha [ccxxiv].	Studies confirm: • Deer management is an MNRF responsibility, deer winter congregation areas considered significant will be mapped by MNRF [cxlviii]. • Use of the woodlot by white-tailed deer will be determined by MNRF, all woodlots exceeding the area criteria are significant, unless determined not to be significant by MNRF [E].	**SWH type not present.**

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
EcoRegion 6E are not constrained by snow depth, however deer will annually congregate in large numbers in suitable woodlands to reduce or avoid the impacts of winter conditions [cxlviii].		Conifer plantations much smaller than 50 ha may also be used.	• Woodlots with high densities of deer due to artificial feeding are not significant[E]. Information Sources: • MNRF District Offices. • LIO/NRVIS.	• Studies should be completed during winter (Jan / Feb) when > 20 cm of snow is on the ground using aerial survey techniques [ccxxiv], ground or road surveys or a pellet count deer density survey [ccxxv]. • If a SWH is determined for Deer Wintering Area or if a proposed development is within Stratum II yarding area then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWH MIST [cxlix] Index #2 provides development effects and mitigation measures.	

Table 2. Rare Vegetation Communities.

Rare Vegetation Community	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes	Habitat Description	Detailed Information and Sources	Defining Criteria	Assessment Details
Cliffs and Talus Slopes Rationale: Cliffs and Talus Slopes are extremely rare habitats in Ontario.	Any ELC Ecosite within Community Series: TAO CLO TAS CLS TAT CLT	A Cliff is vertical to near vertical bedrock > 3 m in height. A Talus Slope is rock rubble at the base of a cliff made up of coarse rocky debris.	• Most cliff and talus slopes occur along the Niagara Escarpment. Information Sources: • The Niagara Escarpment Commission has detailed information on location of these habitats. • OMNRF Districts. • Natural Heritage Information Centre (NHIC) has location information available on their website. • Field Naturalist Clubs. • Conservation Authorities.	• Confirm any ELC Vegetation Type for Cliffs or Talus Slopes [lxxviii]. • SWH MIST [cxlix] Index #21 provides development effects and mitigation measures.	**SWH type not present.**
Sand Barren Rationale: Sand barrens are rare in Ontario and support rare species. Most Sand Barrens have been lost due to cottage development and forestry.	ELC Ecosites: SBO1 SBS1 SBT1 Vegetation cover varies from patchy and barren to continuous meadow (SBO1), thicket-like (SBS1), or more closed and treed (SBT1). Tree cover always < or equals to 60%.	Sand Barrens typically are exposed sand, generally sparsely vegetated and caused by lack of moisture, periodic fires and erosion. Usually located within other types of natural habitat such as forest or savannah. Vegetation can vary from patchy and barren to tree covered, but less than 60%.	• A sand barren area > 0.5 ha in size[E]. Information Sources: • OMNRF Districts. • Natural Heritage Information Centre (NHIC) has location information available on their website. • Field Naturalist Clubs. • Conservation Authorities.	• Confirm any ELC Vegetation Type for Sand Barrens [lxxviii]. • Site must not be dominated by exotic or introduced species (< 50% vegetative cover are exotic sp.)[E]. • SWH MIST [cxlix] Index #20 provides development effects and mitigation measures.	**SWH type not present.**

Rare Vegetation Community	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes	Habitat Description	Detailed Information and Sources	Defining Criteria	Assessment Details
Alvar Rationale: Alvars are extremely rare habitats in EcoRegion 6E. Most alvars in Ontario are in EcoRegions 6E and 7E. alvars in 6E are small and highly localized just north of the Palaeozoic-Precambrian contact.	ALO1 ALS1 ALT1 FOC1 FOC2 CUM2 CUS2 CUT2-1 CUW2 Five Alvar Indicator Species: 1) *Carex crawei* 2) *Panicum philadelphicum* 3) *Eleocharis compressa* 4) *Scutellaria parvula* 5) *Trichostema brachiatum* These indicator species are very specific to Alvars within EcoRegion 6E Ⓔ cxlix.	An alvar is typically a level, mostly unfractured calcareous bedrock feature with a mosaic of rock pavements and bedrock overlain by a thin veneer of soil. The hydrology of alvars is complex, with alternating periods of inundation and drought. Vegetation cover varies from sparse lichen-moss associations to grasslands and shrublands and comprising a number of characteristic or indicator plants. Undisturbed alvars can be phyto- and zoogeographically diverse, supporting many uncommon or are relict plant and animals species. Vegetation cover varies from patchy to barren with a less than 60% tree cover lxxviii.	• An Alvar site > 0.5 ha in size lxxv. Information Sources: • Alvars of Ontario (2000). • Federation of Ontario Naturalists lxxvi. • Ontario Nature – Conserving Great Lakes Alvars ccviii. • Natural Heritage Information Centre (NHIC) has location information available on their website. • OMNRF Staff. • Field Naturalist Clubs. • Conservation Authorities.	• Field studies that identify four of the five Ⓔ **Alvar Indicator Species** lxxv, cxlix at a Candidate Alvar site is Significant. • Site must not be dominated by exotic or introduced species (< 50% vegetative cover are exotic sp.). • The alvar must be in excellent condition and fit in with surrounding landscape with few conflicting land uses lxxv. • SWH MIST cxlix Index #17 provides development effects and mitigation measures.	**SWH type not present.**
Old Growth Forest Rationale: Due to historic logging practices, extensive old growth forest is rare in the EcoRegion. Interior habitat provided by old growth forest is required by many wildlife species.	Forest Community Series: FOD FOC FOM SWD SWC SWM	Old Growth forests are characterized by heavy mortality or turnover of overstorey trees resulting in a mosaic of gaps that encourage development of a multi-layered canopy and an abundance of snags and downed woody debris.	• Woodland area 30 ha or greater in size or with at least 10 ha interior habitat assuming 100 m buffer at edge of forest Ⓔ. Information Sources: • OMNRF Forest Resource Inventory mapping. • OMNRF Districts. • Field Naturalist Clubs. • Conservation Authorities. • Sustainable Forestry Licence (SFL) companies will possibly know locations through field operations. • Municipal forestry departments.	Field Studies will determine: • If dominant trees species of the are > 140 years old, then the area containing these trees is Significant Wildlife Habitat cxlviii. • The forested area containing the old growth characteristics will have experienced no recognizable forestry activities cxlviii (cut stumps will not be present). • The area of Forest Ecosites combined or an Ecoelement within an Ecosite that contain the old growth characteristics is the SWH. • Determine ELC vegetation types for the forest area containing the old growth characteristics lxxviii. • SWH MIST cxlix Index #23 provides development effects and mitigation measures.	**SWH type not present.**
Savannah Rationale: Savannahs are extremely rare habitats in Ontario.	TPS1 TPS2 TPW1 TPW2 CUS2	A Savannah is a tallgrass prairie habitat that has tree cover between 25 – 60% lxxix, lxxx, lxxxi, lxxxii, lxxxiii.	• No minimum size to site Ⓔ. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources:	• Field studies confirm one or more of the Savannah indicator species listed in cxlix Appendix N should be present Ⓔ. Note: Savannah plant spp. list from EcoRegion 6E should be used cxlviii. • Area of the ELC Ecosite is the SWH.	**SWH type not present.**

Rare Vegetation Community	Candidate SWH			Confirmed SWH	Study Area
	ELC Ecosite Codes	Habitat Description	Detailed Information and Sources	Defining Criteria	Assessment Details
			• Natural Heritage Information Centre (NHIC) has location data available on their website. • OMNRF Districts. • Field Naturalists Clubs. • Conservation Authorities.	• Site must not be dominated by exotic or introduced species (< 50% vegetation cover are exotic sp.). • SWH MIST [cxlix] Index #18 provides development effects and mitigation measures.	
Tallgrass Prairie Rationale: Tallgrass Prairies are extremely rare habitats in Ontario.	TPO1 TPO2	A Tallgrass Prairie has ground cover dominated by prairie grasses. An open Tallgrass Prairie habitat has < 25% tree cover [lxxix, lxxx, lxxxi, lxxxii, lxxxiii].	• No minimum size to site [E]. Site must be restored or a natural site. Remnant sites such as railway right of ways are not considered to be SWH. Information Sources: • OMNRF Districts. • Natural Heritage Information Centre (NHIC) has location information available on their website. • Field Naturalists Clubs. • Conservation Authorities.	Field studies confirm one or more of the Prairie indicator species listed in [cxlix] Appendix N should be present [E]. Note: Prairie plant spp. list from EcoRegion 6E should be used [cxlviii]. • Area of the ELC Ecosite is the SWH. • Site must not be dominated by exotic or introduced species (< 50% vegetative cover are exotic sp.). • SWH MIST [cxlix] Index #19 provides development effects and mitigation measures.	**SWH type not present.**
Other Rare Vegetation Communities Rationale: Plant communities that often contain rare species which depend on the habitat for survival.	Provincially Rare S1, S2 and S3 vegetation communities are listed in Appendix M of the SWHTG [cxlviii]. Any ELC Ecosite Code that has a possible ELC Vegetation Type that is Provincially Rare is Candidate SWH.	Rare Vegetation Communities may include beaches, fens, forest, marsh, barrens, dunes and swamps.	• ELC Ecosite codes that have the potential to be a rare ELC Vegetation Type as outlined in appendix M [cxlviii]. • The OMNRF/NHIC will have up to date listing for rare vegetation communities. Information Sources: • Natural Heritage Information Centre (NHIC) has location information available on their website. • OMNRF Districts. • Field Naturalists Clubs. • Conservation Authorities.	• Field studies should confirm if an ELC Vegetation Type is a rare vegetation community based on listing within Appendix M of SWHTG [cxlviii]. • Area of the ELC Vegetation Type polygon is the SWH. • SWH MIST [cxlix] Index #37 provides development effects and mitigation measures.	**SWH type not present.**

Table 3. Specialized Habitats of Wildlife considered SWH.

Specialized Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Waterfowl Nesting Area Rationale: Important to local waterfowl populations, sites with greatest number of species and highest number of individuals are significant.	American Black Duck Northern Pintail Northern Shoveler Gadwall Blue-winged Teal Green-winged Teal Wood Duck Hooded Merganser Mallard	All upland habitats located adjacent to these wetland ELC Ecosites are Candidate SWH: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 MAM1 MAM2 MAM3 MAM4	• A waterfowl nesting area extends 120 m [cxlix] from a wetland (> 0.5 ha) or a wetland (> 0.5 ha) and any small wetlands (0.5 ha) within 120m or a cluster of 3 or more small (< 0.5 ha) wetlands within 120 m of each individual wetland where waterfowl nesting is known to occur [cxlix]. • Upland areas should be at least 120 m wide so that predators such as racoons, skunks, and foxes have difficulty finding nests. • Wood Ducks and Hooded Mergansers utilize large diameter trees (40 cm dbh) in woodlands for cavity nest sites. Information Sources: • Ducks Unlimited staff may know the locations of particularly productive nesting sites.	Studies confirmed: • Presence of 3 or more nesting pairs for listed species excluding Mallards[E], or; • Presence of 10 or more nesting pairs for listed species including Mallards[E]. • Any active nesting site of an American Black Duck is considered significant. • Nesting studies should be completed during the spring breeding season (April - June). • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi].	**SWH type not present.**

Specialized Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
		MAM5 MAM6 SWT1 SWT2 SWD1 SWD2 SWD3 SWD4 **Note: includes adjacency to Provincially Significant Wetlands.**	• OMNRF Wetland Evaluations for indication of significant waterfowl nesting habitat. • Reports and other information available from Conservation Authorities.	• A field study confirming waterfowl nesting habitat will determine the boundary of the waterfowl nesting habitat for the SWH, this may be greater or less than 120 m [cxlviii] from the wetland and will provide enough habitat for waterfowl to successfully nest. • SWH MIST [cxlix] Index #25 provides development effects and mitigation measures.	
Bald Eagle and Osprey Nesting, Foraging and Perching Habitat Rationale: Nest sites are fairly uncommon in EcoRegion 6E and are used annually by these species. Many suitable nesting locations may be lost due to increasing shoreline development pressures and scarcity of habitat.	Osprey **Special Concern:** Bald Eagle	ELC Forest Community Series: FOD FOM FOC SWD SWM SWC Directly adjacent to riparian areas – rivers, lakes, ponds and wetlands.	• Nests are associated with lakes, ponds, rivers or wetlands along forested shorelines, islands, or on structures over water. • Osprey nests are usually at the top a tree whereas Bald Eagle nests are typically in super canopy trees in a notch within the tree's canopy. • Nests located on man-made objects are not to be included as SWH (e.g. telephone poles and constructed nesting platforms). Information Sources: • Natural Heritage Information Centre (NHIC) compiles all known nesting sites for Bald Eagles in Ontario. • MNRF values information (LIO/NRVIS) will list known nesting locations. Note: data from NRVIS is provided as a point and does not represent all the habitat. • Nature Counts, Ontario Nest Records Scheme data. • OMNRF District. • Check the Ontario Breeding Bird Atlas [ccv] or Rare Breeding Birds in Ontario for species documented. • Reports and other information available from Conservation Authorities. • Field Naturalists Clubs.	Studies confirm the use of these nests by: • One or more active Osprey or Bald Eagle nests in an area [cxlviii]. • Some species have more than one nest in a given area and priority is given to the primary nest with alternate nests included within the area of the SWH. • For an Osprey, the active nest and a 300 m radius around the nest or the contiguous woodland stand is the SWH [ccvii], maintaining undisturbed shorelines with large trees within this area is important [cxlviii]. • For a Bald Eagle the active nest and a 400 - 800 m radius around the nest is the SWH [cvi, ccvii]. Area of the habitat from 400 - 800m is dependant on site lines from the nest to the development and inclusion of perching and foraging habitat [cvi]. • To be significant a site must be used annually. When found inactive, the site must be known to be inactive for equal or > 3 years or suspected of not being used for > 5 years before being considered not significant [ccvii]. • Observational studies to determine nest site use, perching sites and foraging areas need to be done from early March to mid August. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #26 provides development effects and mitigation measures.	No evidence of Bald Eagle or Osprey Nests or sightings were observed during breeding bird survey or other site visits. **SWH type not present.**
Woodland Raptor Nesting Habitat Rationale: Nests sites for these species are rarely	Northern Goshawk Cooper's Hawk Sharp-shinned Hawk Red-shouldered Hawk Barred Owl	May be found in all forested ELC Ecosites. May also be found in: SWC SWM SWD	• All natural or conifer plantation woodland / forest stands > 30 ha with > 10 ha of interior habitat [lxxxviii, lxxxix, xc, xci, xciii, xciv, xcv, xcvi, cxxxiii]. Interior habitat determined with a 200 m buffer [cxlviii]. • Stick nests found in a variety of intermediate-aged to mature conifer, deciduous or mixed forests within tops or crotches of trees. Species such as Coopers hawk nest along forest edges sometimes on peninsulas or small off-shore islands.	Studies confirm: • Presence of 1 or more active nests from species list is considered significant [cxlviii]. • Red-shouldered Hawk and Northern Goshawk – A 400 m radius around the nest or 28 ha area of habitat is the SWH [ccvii] (the 28 ha habitat area	Forest habitat found within the study area, but not large enough (< 30 ha) to support Woodland Raptor Nesting. No raptor or nests of the outlined

Specialized Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
identified; these area sensitive habitats are often used annually by these species.	Broad-winged Hawk	CUP3	• In disturbed sites, nests may be used again, or a new nest will be in close proximity to old nest. Information Sources: • OMNRF Districts. • Check the Ontario Breeding Bird Atlas [ccv] or Rare Breeding Birds in Ontario for species documented. • Check data from Bird Studies Canada. • Reports and other information available from Conservation Authorities.	would be applied where optimal habitat is irregularly shaped around the nest). • Barred Owl – A 200 m radius around the nest is the SWH [ccvii]. • Broad-winged Hawk and Coopers Hawk – A 100 m radius around the nest is the SWH [ccvii]. • Sharp-Shinned Hawk – A 50 m radius around the nest is the SWH [ccvii]. • Conduct field investigations from early March to end of May. The use of call broadcasts can help in locating territorial (courting / nesting) raptors and facilitate the discovery of nests by narrowing down the search area. • SWH MIST [cxlix] Index #27 provides development effects and mitigation measures.	species were observed during breeding bird survey or incidentally. **SWH type not present.**
Turtle Nesting Areas Rationale: These habitats are rare and when identified will often be the only breeding site for local populations for turtles.	Midland Painted Turtle **Special Concern:** Northern Map Turtle Snapping Turtle	Exposed mineral soil (sand or gravel) areas adjacent (< 100 m) [cxlviii] or within the following ELC Ecosites: MAS1 MAS2 MAS3 SAS1 SAM1 SAF1 BOO1 FEO1	• Best nesting habitat for turtles are close to water and away from roads and sites less prone to loss of eggs by predation from skunks, raccoons, or other animals. • For an area to function as a turtle-nesting area, it must provide sand and gravel that turtles are able to dig in and are located in open, sunny areas. Nesting areas on the sides of municipal or provincial road embankments and shoulders are not SWH. • Sand and gravel beaches adjacent to undisturbed shallow weedy areas of marshes, lakes and rivers are most frequently used. Information Sources: • Use Ontario Soil Survey reports and maps to help find suitable substrate for nesting turtles (well-drained sands and fine gravels). • Check the Ontario Herpetofaunal Summary Atlas records or other similar atlases for uncommon turtles; location information may help to find potential nesting habitat for them. • Natural Heritage Information Centre (NHIC). • Field Naturalist Clubs.	Studies confirm: • Presence of 5 or more nesting Midland Painted Turtles[E]. • One or more Northern Map Turtles or Snapping Turtle nesting is a SWH[E]. • The area or collection of sites within an area of exposed mineral soils where the turtles nest, plus a radius of 30 – 100 m around the nesting area dependant on slope, riparian vegetation and adjacent land use in the SWH [cxlviii]. • Travel routes from wetland to nesting area are to be considered within the SWH as part of the 30 – 100 m area of habitat [cxlix]. • Field investigations should be conducted in prime nesting season typically late spring to early summer. Observational studies observing the turtles nesting is a recommended method. • SWH MIST [cxlix] Index #28 provides development effects and mitigation measures for turtle nesting habitat.	**SWH type not present.**
Seeps and Springs Rationale: Seeps / Springs are typical of headwater areas and are often at the source of coldwater streams.	Wild Turkey Ruffed Grouse Spruce Grouse White-tailed Deer Salamander spp.	Seeps / Springs are areas where ground water comes to the surface. Often they are found within headwater areas within forested habitats. Any forested Ecosite within the headwater areas of a stream could have seeps / springs.	• Any forested area (with < 25 % meadow / field / pasture) within headwaters of a stream or river system [cxvii, cxlix]. • Seeps and springs are important feeding and drinking areas especially in the winter will typically support a variety of plant and animal species [cxix, cxx, cxxi, cxxii, cxiii, cxiv]. Information Sources: • Topographical Map. • Thermography. • Hydrological surveys conducted by Conservation Authorities and MOE. • Field Naturalists Clubs and landowners.	Field Studies confirm: • Presence of a site with 2 or more[E] seeps / springs should be considered SWH. • The area of an ELC Forest Ecosite or an Ecoelement within Ecosite containing the seeps / springs is the SWH. The protection of the recharge area considering the slope, vegetation, height of trees and groundwater condition need to be considered in delineation the habitat [cxlviii]. • SWH MIST [cxlix] Index #30 provides development effects and mitigation measures.	None observed during field investigations. **SWH type not present.**

Specialized Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
			• Municipalities and Conservation Authorities may have drainage maps and headwater areas mapped.		
Amphibian Breeding Habitat (Woodland) Rationale: These habitats are extremely important to amphibian biodiversity within a landscape and often represent the only breeding habitat for local amphibian populations.	Eastern Newt Blue-spotted Salamander Spotted Salamander Gray Treefrog Spring Peeper Western Chorus Frog Wood Frog	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD Breeding pools within the woodland or shortest distance from forest habitat are more significant because they are more likely to be used due to educed risk to migrating amphibians.	• Presence of a wetland, pond or woodland pool (including vernal pools) > 500 m^2 (about 25 m diameter) [ccvii] within or adjacent (within 120 m) to a woodland (no minimum size) [clxxxii, lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx]. Some small wetlands may not be mapped and may be important breeding pools for amphibians. • Woodlands with permanent ponds or those containing water in most years until mid-July are more likely to be used as breeding habitat [cxlviii]. Information Sources: • Ontario Herpetofaunal Summary Atlas (or other similar atlases) for records. • Local landowners may also provide assistance as they may hear spring-time choruses of amphibians on their property. • OMNRF Districts and wetland evaluations. • Field Naturalist Clubs. • Canadian Wildlife Service Amphibian Road Call Survey. • Ontario Vernal Pool Association: http://www.ontariovernalpools.org	Studies confirm: • Presence of breeding population of 1 or more of the listed newt / salamander species or 2 or more of the listed frog species with at least 20 individuals (adults or eggs masses) [lxxi] or 2 or more of the listed frog species with Call Level Codes of 3Ⓔ. • A combination of observational study and call count surveys [cviii] will be required during the spring (March-June) when amphibians are concentrated around suitable breeding habitat within or near the woodland / wetlands. • The habitat is the wetland area plus a 230 m radius of woodland area [lxiii, lxv, lxvi, lxvii, lxviii, lxix, lxx, lxxi]. If a wetland area is adjacent to a woodland, a travel corridor connecting the wetland to the woodland is to be included in the habitat. • SWH MIST [cxlix] Index #14 provides development effects and mitigation measures.	None observed during field investigations. **SWH type not present.**
Amphibian Breeding Habitat (Wetland) Rationale: Wetlands supporting breeding for these amphibian species are extremely important and fairly rare within Central Ontario landscapes.	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	ELC Community Classes SW, MA, FE, BO, OA and SA. Typically these Wetland Ecosites will be isolated (> 120 m) from Woodland Ecosites, however larger wetlands containing predominantly aquatic species (e.g. Bull Frog) maybe adjacent to woodlands.	• Wetlands > 500 m^2 (about 25 m diameter) [ccvii], supporting high species diversity are significant; some small or ephemeral habitats may not be identified on MNRF mapping and could be important amphibian breeding habitats [clxxxii]. • Presence of shrubs and logs increase significance of pond for some amphibian species because of available structure for calling, foraging, escape and concealment from predators. • Bullfrogs require permanent water bodies with abundant emergent vegetation. Information Sources: • Ontario Herpetofaunal Summary Atlas (or other similar atlases). • Canadian Wildlife Service Amphibian Road Surveys and Backyard Amphibian Call Count. • OMNRF Districts and wetland evaluations. • Reports and other information available from Conservation Authorities.	Studies confirm: • Presence of breeding population of 1 or more of the listed newt / salamander species or 2 or more of the listed frog / toad species with at least 20 individuals (adults or eggs masses) [lxxi] or 2 or more of the listed frog / toad species with Call Level Codes of 3Ⓔ. or; Wetland with confirmed breeding Bullfrogs are significantⒺ. • The ELC Ecosite Wetland area and the shoreline are the SWH. • A combination of observational study and call count surveys [cviii] will be required during the spring (March - June) when amphibians are concentrated around suitable breeding habitat within or near the wetlands. • If a SWH is determined for Amphibian Breeding Habitat (Wetlands) then Movement Corridors are to be considered as outlined in Table 1.4.1 of this Schedule. • SWH MIST [cxlix] Index #15 provides development effects and mitigation measure	None observed during field investigations. **SWH type not present.**

Specialized Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite Codes	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Woodland Area-Sensitive Bird Breeding Habitat Rationale: Large, natural blocks of mature woodland habitat within the settled areas of Southern Ontario are important habitats for area sensitive interior forest song birds.	Yellow-bellied Sapsucker Red-breasted Nuthatch Veery Blue-headed Vireo Northern Parula Black-throated Green Warbler, Blackburnian Warbler Black-throated Blue Warbler Ovenbird Scarlet Tanager **Special Concern**: Cerulean Warbler Canada Warbler	All Ecosites associated with these ELC Community Series; FOC FOM FOD SWC SWM SWD	• Habitats where interior forest breeding birds are breeding, typically large mature (> 60 yrs old) forest stands or woodlots > 30 ha [cv, cxxxi, cxxxii, cxxxiii, cxxxiv, cxxxv, cxxxvi, cxxxvii, cxxxviii, cxxxix, cxl, cxli, cxlii, cxliii, cxliv, cxlv, cxlvi, cl, cli, clii, cliii, cliv, clv, clvi, clvii, clviii, clix]. • Interior forest habitat is at least 200 m from forest edge habitat [clxiv]. Information Sources: • Local birder clubs. • Canadian Wildlife Service (CWS) for the location of forest bird monitoring. • Bird Studies Canada conducted a 3-year study of 287 woodlands to determine the effects of forest fragmentation on forest birds and to determine what forests were of greatest value to interior species. • Reports and other information available from Conservation Authorities.	Studies confirm: • Presence of nesting or breeding pairs of 3 or more of the listed wildlife species [E]. • Note: any site with breeding Cerulean Warblers or Canada Warblers is to be considered SWH [E]. • Conduct field investigations in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi]. • SWH MIST [cxlix] Index #34 provides development effects and mitigation measures.	Forest habitat present within the study area but is not large enough (< 30 ha) to support Woodland Area Sensitive Breeding Birds. **SWH type not present.**

Table 4. Habitats of Species of Conservation Concern considered SWH.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Marsh Breeding Bird Habitat Rationale: Wetlands for these bird species are typically productive and fairly rare in Southern Ontario landscapes.	American Bittern Virginia Rail Sora Common Moorhen American Coot Pied-billed Grebe Marsh Wren Sedge Wren Common Loon Green Heron Trumpeter Swan **Special Concern:** Black Tern Yellow Rail	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 SAS1 SAM1 SAF1 FEO1 BOO1 For Green Heron: All SW, MA and CUM1 sites.	• Nesting occurs in wetlands. • All wetland habitat is to be considered as long as there is shallow water with emergent aquatic vegetation present [cxxiv]. • For Green Heron, habitat is at the edge of water such as sluggish streams, ponds and marshes sheltered by shrubs and trees. Less frequently, it many be found in upland shrubs or forest a considerable distance from water. Information Source: • OMNRF District and wetland evaluations. • Field Naturalists Clubs. • Natural Heritage Information Centre (NHIC) Records. • Reports and other information available from Conservation Authorities. • Ontario Breeding Bird Atlas.	Studies confirm: • Presence of 5 or more nesting pairs of Sedge Wren or Marsh Wren **or** 1 pair of Sandhill Cranes **or** breeding by any combination of 5 or more of the listed species [E]. • Note: any wetland with breeding of 1 or more Black Terns, Trumpeter Swan, Green Heron or Yellow Rail is SWH [E]. • Area of the ELC Ecosite is the SWH. • Breeding surveys should be done May / June when these species are actively nesting in wetland habitats. • Evaluation methods to follow “Bird and Bird Habitats: Guidelines for Wind Power Projects” [ccxi]. • SWH MIST [cxlix] Index #35 provides development effects and mitigation measures.	ELC communities not present. **SWH type not present.**
Open Country Bird Breeding Habitat Rationale: This wildlife habitat is declining throughout Ontario and North	Upland Sandpiper Grasshopper Sparrow Vesper Sparrow Northern Harrier Savannah Sparrow	CUM1 CUM2	• Large grassland areas (includes natural and cultural fields and meadows > 30 ha [clx, clxi, clxiii, clxiv, clxv, clxvi, clxvii, clxviii, clxix]. • Grassland not Class 1 or 2 agricultural lands, and not being actively used for farming (e.g. no row cropping or intensive hay or livestock pasturing in the last 5 years) [E].	Field Studies confirm: • Presence of nesting or breeding of 2 or more of the listed species [E]. • A field with 1 or more breeding Short-eared Owls is to be considered SWH.	ELC communities not present. **SWH type not present.**

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
America. Species such as the Upland Sandpiper have declined significantly the past 40 years based on CWS (2004) trend records.	**Special Concern:** Short-eared Owl		• Grassland sites considered significant should have a history of longevity, either abandoned fields, mature hayfields and pasturelands that are at least 5 years or older. • The Indicator bird species are area sensitive requiring larger grassland areas than the common grassland species. Information Sources: • Agricultural land classification maps, Ministry of Agriculture. • Local Bird Clubs. • Ontario Breeding Bird Atlas. • Reports and other information available from Conservation Authorities.	• The area of SWH is the contiguous ELC Ecosite field areas. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #32 provides development effects and mitigation measures.	
Shrub / Early Successional Bird Breeding Habitat Rationale: This wildlife habitat is declining throughout Ontario and North America. The Brown Thrasher has declined significantly over the past 40 years based on CWS (2004) trend records.	Indicator Spp: Brown Thrasher Clay-coloured Sparrow Common Spp: Field Sparrow Black-billed Cuckoo Eastern Towhee Willow Flycatcher **Special Concern:** Yellow-breasted Chat Golden-winged Warbler	CUT1 CUT2 CUS1 CUS2 CUW1 CUW2 Patches of Shrub Ecosites can be complexed into a larger habitat for some bird species.	• Large field areas succeeding to shrub and thicket habitats > 10 ha [clxiv] in size. • Shrub land or early successional fields, not class 1 or 2 agricultural lands, not being actively used for farming (e.g. no row-cropping, haying or live-stock pasturing in the last 5 years) [E]. • Shrub thicket habitats (> 10 ha) are most likely to support and sustain a diversity of these species [clxxiii]. • Shrub and thicket habitat sites considered significant should have a history of longevity, either abandoned fields or pasturelands. Information Sources: • Agricultural land classifications maps, Ministry of Agriculture. • Local Bird Clubs. • Ontario Breeding Bird Atlas. • Reports and other information available from Conservation Authorities.	Field Studies confirm: • Presence of nesting or breeding of 1 of the indicator species and at least 2 of the common species [E]. • A habitat with breeding Yellow-breasted Chat or Golden-winged Warbler is to be considered as SWH [E]. • The area of the SWH is the contiguous ELC Ecosite field / thicket area. • Conduct field investigations of the most likely areas in spring and early summer when birds are singing and defending their territories. • Evaluation methods to follow "Bird and Bird Habitats: Guidelines for Wind Power Projects" [ccxi]. • SWH MIST [cxlix] Index #33 provides development effects and mitigation measures.	Size of communities does not meet requirements. **SWH type not present.**
Terrestrial Crayfish Rationale: Terrestrial Crayfish are only found within SW Ontario in Canada and their habitats are very rare [ccii].	Chimney or Digger Crayfish (*Fallicambarus fodiens*) Devil Crayfish or Meadow Crayfish (*Cambarus diogenes*)	MAM1 MAM2 MAM3 MAM4 MAM5 MAM6 MAS1 MAS2 MAS3 SWD SWT SWM CUM1 with inclusions of above Meadow Marsh Ecosites can be used by terrestrial crayfish.	• Wet meadow and edges of shallow marshes (no minimum size) should be surveyed for terrestrial crayfish. • Constructs burrows in marshes, mudflats, meadows, the ground cannot be too moist. Can often be found far from water. • Both species are semi-terrestrial burrower which spends most of its life within burrows consisting of a network of tunnels. Usually the soil is not too moist so that the tunnel is well formed. Information Sources: • Information sources from "Conservation Status of Freshwater Crayfishes" by Dr. Premek Hamr for the WWF and CNF March 1998.	Studies Confirm: • Presence of 1 or more individuals of species listed or their chimneys (burrows) in suitable meadow marsh, swamp or moist terrestrial sites [cci]. • Area of ELC Ecosite or an Ecoelement area of meadow marsh or swamp within the larger Ecosite area is the SWH. • Surveys should be done in April to August in temporary or permanent water. Note the presence of burrows or chimneys are often the only indicator of presence, observance or collection of individuals in very difficult [cci]. • SWH MIST [cxlix] Index #36 provides development effects and mitigation measures.	ELC communities not observed. **SWH type not present.**
Special Concern and Rare Wildlife Species Rationale: These species are quite rare or have experienced significant	All Special Concern and Provincially Rare (S1-S3, SH) plant and animal species. Lists of these species are tracked by the Natural Heritage	All plant and animal element occurrences (EO) within a 1 or 10 km grid. Older element occurrences were recorded prior to GPS being available, therefore location information may lack accuracy.	• When an element occurrence is identified within a 1 or 10 km grid for a Special Concern or Provincially Rare species; linking candidate habitat on the site needs to be completed to ELC Ecosites [lxxviii]. Information Sources:	Studies Confirm : • Assessment / inventory of the site for the identified Special Concern or rare species needs to be completed during the time of the year when the species is present or easily identifiable.	Monarch was observed. **Confirmed.**

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
population declines in Ontario.	Information Centre (NHIC).		• Natural Heritage Information Centre (NHIC) will have Special Concern and Provincially Rare (S1-S3, SH) species list with element occurrences data. • NHIC Website "Get Information" – http://nhic.mnr.gov.on.ca • Ontario Breeding Bird Atlas. • Expert advice should be sought as many of the rare spp. have little information available about their requirements.	• The area of the habitat to the finest ELC scale that protects the habitat form and function is the SWH, this must be delineated through detailed field studies. The habitat needs to be easily mapped and cover an important life stage component for a species e.g. specific nesting habitat for foraging habitat. • SWH MIST [cxlix] Index #37 provides development effects and mitigation measures.	

Table 5. Animal Movement Corridors.

Wildlife Habitat	Wildlife Species	Candidate SWH		Confirmed SWH	Study Area
		ELC Ecosite	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
Amphibian Movement Corridors Rationale: Movement corridors for amphibians moving from their terrestrial habitat to breeding habitat can be extremely important for local populations.	Eastern Newt American Toad Spotted Salamander Four-toed Salamander Blue-spotted Salamander Gray Treefrog Western Chorus Frog Northern Leopard Frog Pickerel Frog Green Frog Mink Frog Bullfrog	Corridors may be found in all Ecosites associated with water. Corridors will be determined based on identifying the significant breeding habitat for these species in Table 1.1.	• Movement corridors between breeding habitat and summer habitat [clxxiv, clxxv, clxxvi, clxxvii, clxxviii, clxxix, clxxx, clxxxi]. • Movement corridors must be determined when Amphibian breeding habitat is confirmed as SWH from Table 1.2.2 (Amphibian Breeding Habitat –Wetland) of this Schedule [E]. Information Sources: • MNRF District Office. • Natural Heritage Information Centre (NHIC). • Reports and other information available from Conservation Authorities. • Field Naturalist Clubs.	• Field Studies must be conducted at the time of year when species are expected to be migrating or entering breeding sites. • Corridors should consist of native vegetation, with several layers of vegetation. Corridors unbroken by roads, waterways or bodies, and undeveloped areas are most significant [cxlix]. • Corridors should have at least 15 m of vegetation on both sides of waterway [cxlix] or be up to 200 m [cxlix] wide of woodland habitat and with gaps < 20 m [cxlix]. • Shorter corridors are more significant than longer corridors, however amphibians must be able to get to and from their summer and breeding habitat [cxlix]. • SWH MIST [cxlix] Index #40 provides development effects and mitigation measures	Amphibian breeding was not confirmed. **SWH type not present.**
Deer Movement Corridors Rationale: Corridors important for all species to be able to access seasonally important life-cycle habitats or to access new habitat for dispersing individuals by minimizing their vulnerability while traveling.	White-tailed Deer	Corridoes may be found in all forested Ecosites. A Project Proposal in Stratum II Deer Winter Area has potential to contain corridors.	• Movement corridor must be determined when Deer Wintering Habitat is confirmed as SWH from Table 1.1 of this schedule [E]. • A deer wintering habitat identified by the OMNRF as SWH Table 1.1 of this Schedule will have corridors that the deer use during fall migration and spring dispersion [clxxxii, clxxxiii, cxlix, cxciv]. • Corridors typically follow riparian areas, woodlots, areas of physical geography (ravines or ridges). Information Sources: • MNRF District Office. • Natural Heritage Information Center (NHIC). • Reports and other information available from Conservation Authorities. • Field Naturalist Clubs.	• Studies must be conducted at the time of year when deer are migrating or moving to and from winter concentration areas. • Corridors that lead to a deer wintering habitat should be unbroken by roads and residential areas. • Corridors should be at least 200 m wide [cxlix] with gaps < 20 m [cxlix] and if following riparian area with at least 15 m of vegetation on both sides of waterway [cxlix]. Shorter corridors are more significant than longer corridors [cxlix]. • SWM MIST [cxlix] Index #39 provides development effects and mitigation measures.	**SWH type not present.**

Table 6. Significant Wildlife Habitat Exceptions for EcoDistricts within EcoRegion 6E.

EcoDistrict	Wildlife Habitat and Species	Candidate SWH			Confirmed SWH	Study Area
		Ecosite	Habitat Description	Habitat Criteria and Information Sources	Defining Criteria	Assessment Details
6E-14 Rationale: The Bruce Peninsula has an isolated and distinct population of black bears. Maintenance of large woodland tracts with mast-producing tree species is important for bears [clxxxvi, ccxvii].	**Mast Producing Areas** Black Bear	All Forested habitat represented by ELC Community Series: FOM FOD	• Black Bears require forested habitat that provides cover, winter hibernation sites, and mast-producing tree species [clxxv, clxxvii, clxxviii, clxxxix, cxc, cxci, cxcii, cxciii, ccxvii]. • Forested habitats need to be large enough to provide cover and protection for black bears [ccxvii].	• Woodland Ecosites > 30 ha with mast-producing tree species, either soft (cherry) or hard (oak and beech). Information Sources: • Important forest habitat for black bears may be identified by OMNRF.	• All woodlands > 30 ha with a 50% composition of these ELC Vegetation [E] Types are considered significant: FOM1-1 FOM2-1 FOM3-1 FOD1-1 FOD1-2 FOD2-1 FOD2-2 FOD2-3 FOD2-4 FOD4-1 FOD5-2 FOD5-3 FOD5-7 FOD6-5 • SWM MIST [cxlix] Index #3 provides development effects and mitigation measures.	Study area is not located in appropriate habitat. **SWH type not present.**
6E-17 Rationale: Sharp-tailed Grouse only occur on Manitoulin Island in EcoRegion 6E, Leks are an important habitat to maintain their population.	**Lek** Sharp-tailed Grouse	CUM CUS CUT	• The lek or dancing ground consists of bare, grassy or spare shrubland. There is often a hill or rise in topography [ccxix]. • Leks are typically a grassy field / meadow > 15 ha with adjacent shrublands and > 30 ha with adjacent deciduous woodland. Conifer trees within 500 m are not tolerated [ccxix].	• Grasslands (field / meadow) are to be > 15 ha when adjacent to shrubland and > 30 ha when adjacent to deciduous woodland [ccxix]. • Grasslands are to be undisturbed with low intensities of agriculture (light grazing or late haying). • Leks will be used annually if not destroyed by cultivation or invasion by woody plants or tree planting [ccxix]. Information Sources: • OMNRF district office. • Bird watching clubs. • Local landowners. • Ontario Breeding Bird Atlas.	• Studies confirming lek habitat are to be completed from late March to June. • Any site confirmed with Sharp-tailed Grouse courtship activities in considered significant [E]. • The field / meadow ELC Ecosites plus a 200 m radius area with shrub or deciduous woodland is the lek habitat [E]. • SWM MIST [cxlix] Index #32 provides development effects and mitigation measures.	Study area is not located in appropriate habitat. **SWH type not present.**

Appendix E

Archaeological Assessment

Stage 1 Archaeological Assessment
Municipal Class EA
Sawmill Creek Erosion Control
Folkway Drive to Erin Mills Parkway
Part of Lots 32 and 33,
Concession 2 North of Dundas Street
Former Geographic Township of Toronto
Now in the City of Mississauga
Regional Municipality of Peel, Ontario

Submitted to

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and

The Ministry of Heritage, Sport, Tourism and Culture Industries

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Original Report submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries
XX November 2020

Executive Summary

A Stage 1 archaeological assessment was conducted as part of an erosion control Municipal Class Environmental Assessment (MCEA) for Sawmill Creek – Folkway Drive to Erin Mills Parkway – in the City of Mississauga, Ontario. The project area is located within part of Lots 32 and 33, Concession 2 North of Dundas Street, in the former Geographic Township of Toronto, now in the City of Mississauga, Regional Municipality of Peel, Ontario. The project area is roughly 8.89 ha (22 acres) in size and consists of treed green space bisected by trails that are associated with Arbour Green Park, Dunn Park and the Sawmill Creek Valley Trail system. Timmins Martelle Heritage Consultants Inc. (TMHC) was contracted to undertake the assessment, which was conducted in accordance with the provisions of the *Environmental Assessment Act* and *Provincial Policy Statement*. The purpose of the assessment was to determine whether there was potential for the discovery of archaeological resources present within the project area.

The Stage 1 background study included a review of current land use, historic and modern maps, registered archaeological sites and previous archaeological studies, past settlement history for the area and a consideration of topographic and physiographic features, soils and drainage. According to the map-based review and background research, potential for the discovery of archaeological sites is indicated by the proximity (within 300 m) to:

1) a watercourse (Sawmill Creek);
2) previously identified archaeological sites (AjGw-301, P1 and P2);
3) area of early 19th-century settlement; and
4) early historical transportation routes (Erin Mills Parkway and Burnhamthorpe Road West (Rogers Road).

As the project area was in proximity to features signalling archaeological potential, a Stage 1 property inspection was conducted to evaluate the current conditions of the project area and evaluate integrity. The Stage 1 property inspection visually confirmed that portions of the project area have witnessed prior disturbance, primarily relating to paved pathways, footbridges and a culvert (0.32 ha; 4.0%). It also determined that minor portions of the project area contain areas of slope (1.54 ha; 17.0%) and low and wet areas (0.29 ha; 3.0%). A portion of the project area was previous assessed and was not recommended for further work (4.69 ha; 53.0%). The remainder of the project area consists of grassed and wooded areas encompassing Sawmill Creek that are not obviously disturbed and retain archaeological potential (2.03 ha; 23.0%).

Based on the Stage 1 background research and property inspection the following recommendations are made:

1) The grassed and wooded areas within the project area, as shown on Maps 11 and 12 (2.03 ha; 23.0%), are not obviously disturbed and retain archaeological potential. These areas would require Stage 2 survey. As these

lands are non-ploughable, the Stage 2 survey should consist of a standard test pit survey at a 5 m transect interval, in keeping with provincial standards.

2) Portions of the project area, consisting of paved pathways, footbridges and a culvert, have been previously disturbed (0.32 ha; 4.0%) and are considered to no longer retain archaeological potential (Maps 11 and 12). These areas have been photo documented and no further assessment work is required.

3) The low and wet areas (0.29 ha; 3.0%) and areas of slope (1.54 ha; 17.0%) are considered not to retain archaeological potential (Maps 11 and 12). These areas have been photo documented and no further assessment work is required.

4) As an accommodation to the MCFN, it is recommended that Find Spot P2, identified during the 1999 ASI assessment of the Dunn property, be revisited and subject to Stage 2 survey within the limits of the current project area (0.028ha) (Map 12; SD Map 2). The purpose being to relocate the find spot and reassess its significance and CHVI. As these lands are non-ploughable, the Stage 2 survey should consist of a standard test pit survey at a 5 m transect interval, in keeping with provincial standards.

5) As the remainder of the portion of the project area previously assessed by ASI in 1999 meets current MHSTCI standards, no further archaeological assessment is recommended (4.662 ha; 53.0%) (Map 6, SD Map 2).

These recommendations are subject to the conditions laid out in Section 7.0 of this report and to the Ministry of Heritage, Sport, Tourism and Culture Industries review and acceptance of this report into the provincial register.

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Stage 1 Archaeological Assessment
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Folkway Drive to Erin Mills Parkway
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Former Geographic Township of Toronto
Now in the City of Mississauga
Regional Municipality of Peel, Ontario

1.0 PROJECT CONTEXT

1.1 Development Context

1.1.1 Introduction

A Stage 1 archaeological assessment was conducted as part of an erosion control Municipal Class Environmental Assessment (MCEA) for Sawmill Creek – Folkway Drive to Erin Mills Parkway – in the City of Mississauga, Ontario. The project area is located within part of Lots 32 and 33, Concession 2 North of Dundas Street, in the former Geographic Township of Toronto, now in the City of Mississauga, Regional Municipality of Peel, Ontario. The project area is roughly 8.89 ha (22 acres) in size and consists of treed green space bisected by trails that are associated with Arbour Green Park, Dunn Park and the Sawmill Creek Valley Trail system. Timmins Martelle Heritage Consultants Inc. (TMHC) was contracted to undertake the assessment, which was conducted in accordance with the provisions of the *Environmental Assessment Act* and *Provincial Policy Statement*. The purpose of the assessment was to determine whether there was potential for the discovery of archaeological resources present within the project area.

All archaeological assessment activities were performed under the professional archaeological license of Sherri Pearce, M.A. (P316) and in accordance with the 2011 *Standards and Guidelines for Consultant Archaeologists* (MTC 2011). Permission to commence the study was given by Wolfgang Wolter of Ecosystems Recovery Inc.

1.1.2 Purpose and Legislative Context

The *Ontario Heritage Act* makes provisions for the protection and conservation of heritage resources in the Province of Ontario. Heritage concerns are recognized as a matter of provincial interest in Section 2.6.2 of the *Provincial Policy Statement* (PPS) which states:

> *development* and *site alteration* shall not be permitted on lands containing *archaeological resources* or *areas of archaeological potential* unless *significant archaeological resources* have been *conserved*.
>
> In the PPS, the term *conserved* means:
>
> the identification, protection, management and use of *built heritage resources, cultural heritage landscapes* and *archaeological resources* in a manner that ensures their cultural heritage value or interest is retained. This may be achieved by the implementation of recommendations set out in a conservation plan, archaeological assessment and/or heritage impact assessment that has been approved, accepted or adopted by the relevant planning authority and/or decision-maker. Mitigative measures and/or alternative development approaches can be included in these plans and assessments.

Sections 2 (d) and 3.5 of the *Planning Act* stipulate that municipalities shall have regard for their conservation of features of significant architectural, cultural, historical, archaeological or scientific interest. Therefore, the purpose of a Stage 1 background study is to determine if there is potential for archaeological resources to be found on a property for which a change in land use is pending. It is used to determine the need for a Stage 2 field assessment involving the search for archaeological sites. In accordance with *Provincial Policy Statement* 2.6, if sites of further cultural heritage value or interest are found, a strategy (usually avoidance, preservation or excavation) must be put forth for their mitigation.

The *Environmental Assessment Act* also provides for the protection and conservation of the "environment," widely defined to cover "cultural heritage" resources. Section 5(3)(c) of the *Act* stipulates that heritage resources to be affected by a proposed undertaking be identified during the environmental screening process. Within the context of an Environmental Assessment, the purpose of a Stage 1 background study is to determine if the project has potential to negatively impact known or unknown archaeological resources. A Stage 2 assessment establishes if archaeological sites are present within the proposed impact areas, while a Stage 3 assessment evaluates their cultural heritage value. In the case of archaeological resources, potentially detrimental effects to archaeological resources are mitigated through Stage 4 protection and avoidance and/or excavation.

2.0 STAGE 1 BACKGROUND STUDY

2.1 Research Methods and Sources

A Stage 1 overview and background study was conducted to gather information about known and potential cultural heritage resources within the project area. According to the *Standards and Guidelines*, a Stage 1 background study must include a review of:

- an up-to-date listing of sites from the Ontario's Past Portal for 1 km around the property;
- reports of previous archaeological fieldwork within a radius of 50 m around the property;
- topographic maps at 1:10,000 (recent and historical) or the most detailed scale available;
- historic settlement maps (e.g., historical atlas, surveys)
- archaeological management plans or other archaeological potential mapping (when available); and
- commemorative plaques or monuments on or near the property.

For this project, the following activities were carried out to satisfy or exceed the above requirements:

- a database search was completed through the Ministry of Heritage, Sport, Tourism and Culture Industries' (MHSTCI) Past Portal system that compiled a list of registered archaeological sites within 1 km of the project area (completed September 8, 2020);
- a review of known prior archaeological reports for the property and adjacent lands (note: the MHSCTI currently does not keep a publicly accessible record of archaeological assessments carried out in the Province of Ontario, so a complete inventory of prior assessment work nearby is not available);
- Ontario Base Mapping (1:10,000) was reviewed through ArcGIS and mapping layers provided by geographynetwork.ca;
- detailed mapping providing by the client was also reviewed; and,
- a series of historic maps and photographs was reviewed related to post-1800 land settlement.

There are no applicable archaeological management plans for the area. There are two commemorative plaques (signage) or monuments near the project area. They relate to the Dunn family occupation of part of Lot 32, Concession 2 NDS (Images 1 and 2).

Additional sources of information were also consulted, including modern aerial photographs, local history accounts, soils and physiographic data provided by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), and both 1:50,000 (Natural Resources Canada) and finer scale topographic mapping.

When compiled, background information was used to create a summary of the characteristics of the study area, in an effort to evaluate its archaeological potential. The Province of Ontario (MTC 2011 – Section 1.3.1) has defined the criteria that identify archaeological potential as:

- previously identified archaeological sites;
- water sources;
    - primary water sources (lakes, rivers, streams, creeks);
    - secondary water courses (intermittent streams and creeks, springs, marshes, swamps);
    - features indicating past water sources (e.g., glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels indicated by clear dip or swale in topography, shorelines of drained lakes or marshes, cobble beaches);
    - accessible or inaccessible shoreline (e.g., high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh);
- elevated topography (e.g., eskers, drumlins, large knolls, plateaux);
- pockets of well-drained sandy soil, especially near areas of heavy soil or rocky ground;
- distinctive land formations that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases; there may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings;
- resource areas, including:
    - food or medicinal plants (e.g., migratory routes, spawning areas, prairie);
    - scarce raw materials (e.g., quartz, copper, ochre or outcrops of chert);
    - early Euro-Canadian industry (e.g., fur trade, logging, prospecting, mining);
- areas of early 19th-century settlement. These include places of early military or pioneer settlement (e.g., pioneer homesteads, isolated cabins, farmstead complexes), early wharf or dock complexes, pioneer churches and early cemeteries. There may be commemorative markers of their history, such as local, provincial, or federal monuments or heritage parks.
- early historical transportation routes (e.g., trails, passes, roads, railways, portage routes);
- property listed on a municipal register or designated under the *Ontario Heritage Act* or that is a federal, provincial, or municipal historic landmark or site; and
- property that local histories or informants have identified with possible archaeological sites, historical events, activities or occupations.

In Southern Ontario (south of the Canadian Shield), any lands within 300 metres of any of the features listed above are considered to have potential for the discovery of archaeological resources.

Typically, a Stage 1 assessment will determine potential for Indigenous and historic era sites independently. This is due to the fact that lifeways varied considerably during these eras so that criteria used to evaluate potential for each type of site also varies.

It should be noted that some factors can also negate the potential for discovery of intact archaeological deposits. Subsection 1.3.2 of the *Standards and Guidelines* indicates that archaeological potential can be removed in instances where land has been subject to extensive and deep land alterations that have severely damaged the integrity of any archaeological resources. Major disturbances indicating removal of archaeological potential include, but are not limited to:

- quarrying;
- major landscaping involving grading below topsoil;
- building footprints; and
- sewage and infrastructure development.

Some activities (agricultural cultivation, surface landscaping, installation of gravel trails, etc.) may result in minor alterations to the surface topsoil but do not necessarily affect or remove archaeological potential. It is not uncommon for archaeological sites, including structural foundations, subsurface features and burials, to be found intact beneath major surface features like roadways and parking lots. Archaeological potential is, therefore, not removed in cases where there is a chance of deeply buried deposits, as in a developed or urban context or floodplain where modern features or alluvial soils can effectively cap and preserve archaeological resources.

2.2 Project Context: Archaeological Context

2.2.1 Project area: Overview and Physical Setting

The project area is located within part of Lots 32 and 33, Concession 2 North of Dundas Street, in the former Geographic Township of Toronto, now in the City of Mississauga, Regional Municipality of Peel, Ontario (Maps 1 and 2). More specifically, the project area is located between Glen Erin Drive and Erin Mills Parkway within Greenlands Park; it is bound to the north by Folkway Drive and to the south by a dead-end road, formerly Burnhamthorpe Road West or Rogers Road. The project area is roughly 8.89 ha (22 acres) in size and consists of treed green space bisected by trails that are associated with Arbour Green Park, Dunn Park and the Sawmill Creek Valley Trail system. The properties immediately surrounding the project area are characterized by residential development.

The project area falls within the Iroquois Plain and South Slope physiographic regions (Map 3). The Iroquois Plain is a sandy-soiled lowland smoothed with lacustrine deposits formed from glacial Lake Iroquois (Chapman and Putnam 1984:190). It extends around the western part of Lake Ontario from the Niagara River to the Trent River and covers a distance of approximately 306 kilometres varying in width from one to twelve

kilometres (Chapman and Putnam 1984:190). The South Slope essentially parallels the Iroquois Lake Plain and the current Lake Ontario shoreline. The South Slope is the southern slope of the Oak Ridges Moraine and extends from the Niagara Escarpment in the west to the Trent River in the east. The South Slope meets the Moraine at heights of approximately 300 m above sea level and descends southward towards Lake Ontario. The South Slope predominantly consists of shallow shale and till plains. The western portion of the project area is located within the Trafalgar Moraine.

Three soil types are present within the project area, from west to east: Chinguacousy clay loam, Oneida clay loam and bottom land (Map 4). Chinguacousy clay loam is an imperfectly draining soil developed on fine textured shale and limestone till (Hoffman and Richards 1953:28). Oneida clay loam is a well-draining soil developed on fine textured shale and limestone till (Hoffman and Richards 1953:28). Bottom land is an immature soil that shows little horizon differentiation typically with poor drainage (Hoffman and Richards 1953:63).

Sawmill Creek runs through the project area (Map 5). Sawmill Creek originates at Folkway Drive and flows southeast through the project area for a distance of roughly 1100m, ultimately discharging to the Credit River at Dundas Street West. This portion of Sawmill Creek was channelized approximately 40 to 50 years ago, with many banks of the creek lined with gabion baskets.

2.2.2 Summary of Registered or Known Archaeological Sites

According to the Ministry of Heritage, Sport, Tourism and Culture Industries' database there are four registered archaeological sites within 1 km of the project area. Additionally, there are two unregistered isolated find spots (P1 and P2) (ASI 1999). One of the registered sites (AjGw-301) is a 19th-century site discovered during a test pit survey by ASI in 1999. Based on the OASD, the site is located approximately 25 m north of the project area; however, based on the report mapping, the site lies immediately adjacent the project area (SD Map 2; Image 13). AjGw-301 is represented by a total of 116 artifacts recovered from a 15 m x 30 m slope midden located south of a demolished brick building. Based on the artifacts recovered and archival research, the site does not have CHVI and no further assessment was recommended.

Table 1: Registered Archaeological Sites within 1 km of the Project Area

Borden Number	Site Name	Time Period	Affinity	Site Type	Current Development Review Status
AjGw-233	Churchill Meadows 2	Pre-Contact	Aboriginal	Other, camp/campsite	No Further CHVI
AjGw-234	Churchill Meadows 3	Woodland, Early	Aboriginal	findspot	Further CHVI
AjGw-301	Dunn Park	Post-Contact	Euro-Canadian	Other, building, homestead, midden	No Further CHVI
AjGw-535	Iverholme	Post-Contact	Euro-Canadian	house, residential	Further CHVI

2.2.3 Summary of Past Archaeological Investigations Within 50 Metres

During the course of this study it was established that one previous archaeological assessment was conducted within 50 m of the current project area. However, as the Province currently does not maintain and accessible database of archaeological assessment areas *per se*, it is not known if this is a complete listing of all archaeological activity undertaken within 50 m of the project area. The previous assessment is summarized briefly below.

Stage 1 & 2 Archaeological Assessment for the Dunn Property – ASI 1999 (Map 6)

Archaeological Services Inc. (ASI) was contracted by John George Associates on behalf of the City of Mississauga to conduct a Stage 1 and 2 archaeological assessment of the Dunn property. The study area is located west of Erin Mills Parkway and north of Burnhamthorpe Road and overlaps a portion of the current project area (SD Maps 1 & 2). The Stage 1 background study determined that the study area retained archaeological potential and Stage 2 assessment was recommended. The Stage 2 assessment consisted of a test pit survey at 5 m intervals. The Stage 2 assessment documented three archaeological sites: P1, an isolated secondary flake on Onondaga chert; P2, an isolated secondary flake on Onondaga chert; and AjGw-301, a late 19th to 20th century site comprised of a slope midden. AjGw-301, which lies adjacent the current project area, yielded 116 artifacts including architectural debris such as window glass and nails, and domestic debris such as glass container fragments and undecorated refined earthenware ceramics. The absence of ceramic ware types and decoration more characteristic of an early to mid 19th century occupation suggests that the site related to a later occupation. Archival research determined that AjGw-301 was associated with the occupation of the property by the Dunn family, who purchased the property in 1871; it also determined that the first log house relating to the initial settlement of the property would have been located elsewhere on the property. Based on the artifacts recovered and on the archival research, it was determined that AjGw-301 does not have further CHVI and no further work was recommended. Due to the isolated nature of find spot P1, no further work was recommended. Find spot P2 falls within the current project area and due to the isolated nature of the find, no further work was

recommended. However, during the engagement process with the Mississaugas of the Credit First Nation (MCFN) for this project, as an accommodation the MCFN requested that find spot P2 be revisited and be subject to Stage 2 survey within the limits of the current project area, with the intent being to relocate the find spot and reassess its significance and CHVI. The area proposed for reassessment is shown on Map 12. The ASI assessment work is summarized in a report entitled *Stage 1 / 2 Archaeological Assessment of the Dunn Property, Part of Lot 32, Concession 2 N.D.S., Former Township of Toronto, City of Mississauga, Ontario.* (ASI 1999; licensee Ron Williamson; PIF 99-007-152).

2.2.4 Dates of Archaeological Fieldwork

The Stage 1 site inspection was conducted on September 9, 2020 in overcast and warm weather conditions. Jonathan Freeman, M.A. (P274) was the field director for the property inspection.

2.3 Project Context: Historical Context

2.3.1 Indigenous Settlement in the Toronto Area

There is archaeological evidence of Indigenous settlement in Toronto and vicinity since the time of glacial retreat some 12,000 years ago through to the modern era. Our knowledge of past Indigenous land use in the area is incomplete due primarily to a lack of archeological investigation of many areas prior to urban development. Nonetheless, using province-wide and region-specific data, a general model of Indigenous settlement in the area can be proposed. The following paragraphs provide a basic textual summary of the known general cultural trends and archaeological periods and a tabular summary appears in Table 2.

Table 2: Cultural Chronology for Indigenous Settlement in the Toronto Area

Period			Time Range (circa)	Diagnostic Features	Complexes
Paleo	Early		9000 - 8400 B.C.	fluted projectile points	Gainey, Barnes, Crowfield
	Late		8400 - 8000 B.C.	non-fluted and lanceolate points	Holcombe, Hi-Lo, Lanceolate
Archaic	Early		8000 - 6000 B.C.	serrated, notched, bifurcate base points	Nettling, Bifurcate Base Horizon
	Middle		6000 - 2500 B.C.	stemmed, side & corner notched points	Brewerton, Otter Creek, Stanly/Neville
	Late		2000 - 1800 B.C.	narrow points	Lamoka
			1800 - 1500 B.C.	broad points	Genesee, Adder Orchard, Perkiomen
			1500 - 1100 B.C.	small points	Crawford Knoll
	Terminal		1100 - 950 B.C.	first true cemeteries	Hind
Woodland	Early		950 - 400 B.C.	expanding stemmed points, Vinette pottery	Meadowood
	Middle		400 B.C. - A.D. 500	dentate, pseudo-scallop pottery	Saugeen
	Transitional		A.D. 500 - 900	first corn, cord-wrapped stick pottery	Princess Point
	Late		A.D. 900 - 1300	first villages, corn horticulture, longhouses	Glen Meyer, Pickering
			A.D. 1300 - 1400	large villages and houses	Uren, Middleport
			A.D. 1400 - 1650	tribal emergence, territoriality	Neutral Iroquois
Contact		Indigenous	A.D. 1700 - present	treaties, mixture of Indigenous & Settler items	Six Nations/Mississauga/Tutelos
		Settler	A.D. 1796 - present	English goods, homesteads	European settlement, pioneer life

Paleo Period

The first human populations to inhabit the area came to the region between 10,000 and 12,000 years ago, coincident with the end of the last period of glaciation. Climate and environmental conditions were significantly different than they are today; local environs would not have been welcoming to anything but short-term settlement. Termed Paleoindians by archaeologists, Ontario's first peoples would have crossed the landscape in small groups (i.e., bands or family units) searching for food, particularly migratory game species. In this area, caribou may have provided the staple of Paleo peoples diet, supplemented by wild plants, small game and fish. Given the low density of populations on the landscape at this time and their mobile nature, Paleo period sites are small and ephemeral. They are usually identified by the presence of distinctive fluted projectile points, usually manufactured on high quality raw materials, including Onondaga chert from the Niagara Escarpment and Fossil Hill chert from Blue Mountains. Paleo period sites have commonly been found in association with relic glacial lakeshores throughout Ontario.

Archaic Period

Settlement and subsistence patterns changed significantly during the Archaic period as both the landscape and ecosystem adjusted to the retreat of the glaciers. Building on earlier patterns, early Archaic populations continued the mobile lifestyle of their predecessors. Through time and with the development of more resource rich local environments, these groups gradually reduced the size of the territories they exploited on a regular basis. A seasonal pattern of warm season riverine or lakeshore settlements and interior cold weather occupations has been documented in the archaeological record. The large cold-weather mammals that formed the basis of the Paleo period subsistence pattern became extinct or moved northward with the onset of warmer climate conditions. Thus, Archaic populations had a more varied diet, exploiting a range of plant, bird, mammal and fish species. Over time, reliance on specific food resources like fish, deer and nuts became more pronounced and the presence of more hospitable environments and resource abundance led to the expansion of band and family sizes. This is evident in the archaeological record in the form of larger sites and aggregation camps, where several families or bands would come together in times of plenty. The change to more preferable environmental circumstances led to a rise in population density. As a result, Archaic sites are more plentiful than those from the earlier period. Artifacts typical of these occupations include a variety of stemmed and notched projectile points, chipped stone scrapers, ground stone tools (e.g., celts, adzes) and ornaments (e.g., bannerstones, gorgets), bifaces or tool blanks, animal bone (where and when preserved) and waste flakes, a by-product of the tool making process.

Early, Middle and Transitional Woodland Periods

Significant changes in cultural and environmental patterns are witnessed in the Early, Middle and Transitional Woodland periods (ca. 950 B.C. to A.D. 1000). Occupations became increasingly more permanent in this period, culminating in major semi-permanent villages by 1,000 years ago. Archaeologically, one of the most significant changes by Woodland times is the appearance of artifacts manufactured from modeled clay and the emergence of more sedentary villages. The Woodland Period is often defined by the occurrence of pottery, storage facilities and residential areas similar to those that define the early agricultural or Neolithic period in Europe. The earliest pottery was crudely made by the coiling method and early house structures were simple oval enclosures. Both the Early and Middle Woodland sub-periods are characterized by an elaborate burial complex that in some areas in Ontario involved the construction of large burial mounds. Trade in exotic items, including rare stone and shell objects, became common at this time, reflecting interconnections between Ontario populations and those in the Ohio and Mississippi river valleys to the south.

Late Woodland

Beginning circa A.D. 1000 the archaeological record documents the emergence of more substantial, semi-permanent settlements and the adoption of corn horticulture. These developments are most often associated with Iroquoian-speaking populations, the ancestors of the Wendat (Huron), Tionontati (Petun) and Attawandaron (Neutral) nations who were known to have resided in the province at the time of the arrival of the first European explorers and missionaries. Iroquoian villages incorporated a number of longhouses, multi-family dwellings that contained several families related through the female line. Precontact Iroquoian sites may be identified by a predominance of well-made pottery decorated with various simple and geometric motifs, triangular projectile points, clay pipes and ground stone artifacts. Sites post-dating European contact are recognized through the appearance of various items of European manufacture. The latter include materials acquired by trade (e.g., glass beads, copper/brass kettles, iron axes, knives and other metal implements) in addition to the personal items of European visitors and Jesuit missionaries (e.g., finger rings, stoneware, rosaries, and glassware).

The Recent Historic Period

When European explorers and missionaries arrived in Ontario in the 17th century, the Iroquoian nations who had formerly inhabited the Humber and Don River watersheds had left the area, with the Wendat migrating north to the Lake Simcoe environs. By 1650, many Wendat had fled due to the onset of epidemic disease and increasing raids by Five Nations Iroquois groups who had established an increasing presence along Lake Ontario. At least two major Seneca villages were established on the Rouge River later that century. At the same time, Algonquian-speaking populations were utilizing the watershed for hunting and trapping. By the 17th century, the Seneca no longer inhabited the Lake Ontario shores and the Algonquin-speaking Mississaugas began moving southward into the area. It

was the Mississaugas who had settled the area north of Lake Ontario by the time the British arrived in the late 18th century. The Europeans identified the Mississaugas as the Mississaugas of the Credit. The Mississaugas were an Ojibwa people, and by the early 1700s had migrated south and settled in the area around the Etobicoke Creek, Credit River and Burlington Bay. "Mississauga" translates as meaning "River of the North of Many Mouths". European settlement became more intense, causing inland movement of the Mississaugas for harvesting purposes. Land surrenders to the British Colonial government and the Six Nations began.

On August 2nd, 1805, near the mouth of the Credit River, representatives for the British Crown and the Native Mississaugas signed Treaty 13A which surrendered a vast tract of land to the British Crown. Referred to as the "Mississauga Purchase" or the "First Purchase", the Crown acquired over 74,000 acres of land excluding a one mile strip on each side of the Credit River from the waterfront to the base line (modern Eglinton Avenue), and this became known as the Credit Indian Reserve. This tract of land surveyed in 1806, known as the "Old Survey," was named Toronto Township, and opened up the area for settlement (On-line Resource: Heritage Mississauga: History of Mississauga).

Additional treaties were signed between the Mississaugas and the British Crown, allowing the Crown to acquire title to more land. On October 28th, 1818, Treaty 19 – known as the "Second Purchase" – was signed, surrendering over 600,000 acres of land, which included most of today's Region of Peel. This vast area was surveyed and opened for settlement in 1819. Known as the "New Survey", this area was divided into the townships of Toronto, Chinguacousy, Caledon, Albion and Toronto Gore. The Mississaugas signed two other treaties on February 28th, 1820: The "Credit Treaties" 22 and 23. These treaties surrendered much of the Credit Indian Reserve lands set aside in 1805. The Mississaugas relocated in 1847 and settled on the New Credit Reserve at Hagersville near Brantford (On-line Resource: Heritage Mississauga: History of Mississauga).

2.3.2 19th Century and Municipal Settlement

The project area falls within part of Lots 32 and 33, Concession 2 North of Dundas Street, in the former Geographic Township of Toronto, Peel County, now the City of Mississauga, Regional Municipality of Peel, Ontario. A brief discussion of 19th century and municipal settlement in the City of Mississauga is provided below, as a means of providing general context for understanding former land use.

Peel County was created following the termination of the district system (Nassau or Home District) in 1852. It remained as such until 1973 and was comprised of Caledon, Chinguacousy, Albion, Toronto Gore, and Toronto Townships. By 1973, however, the Region of Peel was established, and portions of these townships were dissolved, creating the Municipalities of Brampton, Caledon, and Mississauga. The creation of these aforementioned municipalities changed the township boundaries within the old Peel County as follows: Caledon is comprised of Caledon Township as well as the north part of

Albion and Chinguacousy Townships; Mississauga is comprised of Toronto Township and the southern tip of Toronto Gore Township; and Brampton is comprised of the southern part of Chinguacousy Township and part of Toronto Gore Township.

The project area is located in the southern part of Toronto Township. The Township of Toronto is situated in the southeast of the County of Peel and contained 64,777 acres of assessed land by 1877 (Walker & Miles 1877). The Township is divided into the Old and New Survey. The Old Survey was surveyed in 1806 by Mr. Wilmot, one mile on each side of the Credit River being reserved for the Mississaugas. Consent for any settler to fish had to be provided by the Mississaugas (Walker & Miles 1877:60). The first settler was Colonel Thomas Ingersoll. In 1808, the whole population of Toronto Township consisted of seven families. In 1819, after the war of 1812, the "new" part of the township was surveyed. The greater part of the New Survey was granted to a colony of Irish from the City of New York, which brought a fluctuation of settlers into Toronto Township, and at which time most of the Indigenous reserve land had been sold as they moved to areas along the Saugeen River (Walker & Miles 1877:60).

The Town of Mississauga was created in 1968 and incorporated as a City in 1974 through the amalgamation of the Town of Mississauga and villages of Port Credit and Streetsville, and portions of the townships of Toronto Gore and Trafalgar.

Review of Historic Maps and Imagery

A review of relevant and available historic maps and aerial photography was undertaken to establish former land use, specifically within the portions containing the project area. The 1859 Tremaine Map of Peel County (Map 7) and the 1877 Peel County map (Map 8) depicts the owners or occupants of the project area. On the 1859 map, Joseph Rogers, Frederick Forster and William Forster are shown on Lots 33 and 32. Two structures are depicted on Lot 33, south of the project area. Sawmill Creek is depicted on the map, but in a different alignment than present day. Erin Mills Parkway and Burnhamthorpe Road West (Rogers Road) are depicted as open at this time. Although, Burnhamthorpe Road West does not follow its present day alignment.

On the 1877 map, Richard Dunn is depicted on the southern portion of Lot 32 and Joseph Rogers is depicted on Lot 33. A house and orchard are present on both lots, outside of the project area. Sawmill Creek is present but following a different course than the 1859 map and the present-day alignment. Erin Mills Parkway and Burnhamthorpe Road West (Rogers Road) are still depicted as open and following the same alignment as in the 1859 map. The Dunn family moved to Lot 32 in 1871 and the property has remained in the family up until present day. In 1996, George Dunn donated a portion of his family's property to the City of Mississauga to be retained in park like conditions (City of Mississauga 2020). Dunn Park is located in the southern portion of the project area. Although the original house and barn are no longer standing, cement markers show where the home used to be. Additionally, there is are commemorative signs documenting the history of the Dunn family and their property (Images 1 and 2).

Aerial photos (City of Mississauga 2020; City of Toronto Archives) are available for the area from the 20th century. It should be noted that the City of Mississauga website has labelled the former alignment of Burnhamthorpe Road West as Rogers Road, located between Glen Erin Drive and Erin Mills Parkway. A 1960 aerial photograph (Map 9) shows the project area is located within a rural setting and is comprised of portions of agricultural fields and the Sawmill Creek valley lands. The creek follows its natural course as of this date. A farm complex is shown abutting the southeastern corner of the project area. The 1977 aerial photography shows that Burnhamthorpe Road West follows its current day alignment; however, Rogers Road is still depicted as open as of this time. The 1980 aerial imagery (Map 10) from the City of Mississauga website shows that by this time the area surrounding the project area is being developed with the main residential streets surrounding the project area laid out and houses are being built. Sawmill Creek has been channelized by this time, as it runs in a different course than that shown in the 1960 aerial. Rogers Road is also still present as of this date, bordering the southern limits of the project area. By 1992, Rogers Road no longer connects Glen Erin Drive and Erin Mills Parkway and has been interrupted by residential development to the west of the project area.

3.0 STAGE 1 PROPERTY INSPECTION

As the project area is in proximity to features signalling archaeological potential, a Stage 1 property inspection was conducted to evaluate the current conditions of the project area and evaluate its integrity.

The property inspection was conducted on September 9, 2020 in overcast and warm weather conditions. The weather conditions allowed for good visibility for the inspection of the surface features. The property inspection involved the recording and photo-documentation of the field conditions. As the southern most portion of the project area was previously assessed, which met current MHSTCI standards, this area was exempt from the property inspection.

The project area is comprised of the Greenlands Park lands, mainly consisting of open grassed areas and wooded areas with paved pathways throughout. Some areas of disturbance were noted during the property inspection and include the paved pathways and footbridges (Images 3,4, 6, 7 and 11) and a culvert by Folkway Drive (Image 5). Buried utilities and infrastructure, such as storm or sanitary sewer, lighting (Image 4) and communications (Image 3) were also noted; however, the level and extent of disturbance associated with these can not be assessed visually. The boundaries of the project area are generally characterized by areas of steep slope (Images 8 and 9) and Sawmill Creek flows through the middle of the project area (Image 10). Failing gabion baskets, which is one of the reasons necessitating this project, can be seen in Image 10. Largely, the project area is characterised by open manicured grass and natural wooded areas, which appear undisturbed and would require Stage 2 assessment (Images 11 and 12).

The results of the Stage 1 archaeological assessment, as well as the location and orientation of report photographs, are presented on Maps 11 and 12. Proponent mapping was presented as a digital shapefile, so no attempt was made to present the Stage 2 results on the proponent mapping.

Table 3: Documentary Records

Field Notes and Field Maps	Dated September 9, 2020
Photo Catalogue	24 Digital Photos
Location of Records	Timmins Martelle Heritage Consultants Inc., @ the Museum of Ontario Archaeology, 1600 Attawandaron Road, London, Ontario N6G 3M6

4.0 ANALYSIS AND CONCLUSIONS

As noted in Section 2.1, the Province of Ontario has identified numerous factors that signal the potential of a property to contain archaeological resources. The Stage 1 background study included a review of current land use, historic and modern maps, registered archaeological sites and previous archaeological studies, past settlement history for the area and a consideration of topographic and physiographic features, soils and drainage. According to the map-based review and background research, potential for the discovery of archaeological sites is indicated by the proximity (within 300 m) to:

1) a watercourse (Sawmill Creek);
2) previously identified archaeological sites (AjGw-301, P1 and P2);
3) area of early 19th-century settlement; and
4) early historical transportation routes (Erin Mills Parkway and Burnhamthorpe Road West (Rogers Road).

As the project area was in proximity to features signalling archaeological potential, a Stage 1 property inspection was conducted to evaluate the current conditions of the project area and evaluate integrity. The Stage 1 property inspection visually confirmed that portions of the project area have witnessed prior disturbance, primarily relating to paved pathways, footbridges and a culvert (0.32 ha; 4.0%). It also determined that minor portions of the project area contain areas of slope (1.54 ha; 17.0%) and low and wet areas (0.29 ha; 3.0%). A portion of the project area was previous assessed and was not recommended for further work (4.69 ha; 53.0%). The remainder of the project area consists of grassed and wooded areas encompassing Sawmill Creek that are not obviously disturbed and retain archaeological potential (2.03 ha; 23.0%).

5.0 RECOMMENDATIONS

Based on the Stage 1 background research and property inspection the following recommendations are made:

1) The grassed and wooded areas within the project area, as shown on Maps 11 and 12 (2.03 ha; 23.0%), are not obviously disturbed and retain archaeological potential. These areas would require Stage 2 survey. As these lands are non-ploughable, the Stage 2 survey should consist of a standard test pit survey at a 5 m transect interval, in keeping with provincial standards.

2) Portions of the project area, consisting of paved pathways, footbridges and a culvert, have been previously disturbed (0.32 ha; 4.0%) and are considered to no longer retain archaeological potential (Maps 11 and 12). These areas have been photo documented and no further assessment work is required.

3) The low and wet areas (0.29 ha; 3.0%) and areas of slope (1.54 ha; 17.0%) are considered not to retain archaeological potential (Maps 11 and 12). These areas have been photo documented and no further assessment work is required.

4) As an accommodation to the MCFN, it is recommended that Find Spot P2, identified during the 1999 ASI assessment of the Dunn property, be revisited and subject to Stage 2 survey within the limits of the current project area (0.028ha) (Map 12; SD Map 2). The purpose being to relocate the find spot and reassess its significance and CHVI. As these lands are non-ploughable, the Stage 2 survey should consist of a standard test pit survey at a 5 m transect interval, in keeping with provincial standards.

5) As the remainder of the portion of the project area previously assessed by ASI in 1999 meets current MHSTCI standards, no further archaeological assessment is recommended (4.662 ha; 53.0%) (Map 6, SD Map 2).

These recommendations are subject to the conditions laid out in Section 7.0 of this report and to the Ministry of Heritage, Sport, Tourism and Culture Industries review and acceptance of this report into the provincial register.

6.0 SUMMARY

A Stage 1 archaeological assessment was conducted as part of an erosion control Municipal Class Environmental Assessment (MCEA) for Sawmill Creek – Folkway Drive to Erin Mills Parkway – in the City of Mississauga, Ontario. The project area is located within part of Lots 32 and 33, Concession 2 North of Dundas Street, in the former Geographic Township of Toronto, now in the City of Mississauga, Regional Municipality

of Peel, Ontario. The background research indicated that the project area was in proximity to features signalling archaeological potential and a Stage 1 property inspection was undertaken. The Stage 1 property inspection visually confirmed that portions of the project area have witnessed prior disturbance, primarily relating to paved pathways, footbridges and a culvert (0.32 ha; 4.0%). It also determined that minor portions of the project area contain areas of slope (1.54 ha; 17.0%) and low and wet areas (0.29 ha; 3.0%). A portion of the project area was previous assessed and was not recommended for further work (4.662 ha; 53.0%); however, as an accommodation to the MCFN, Find Spot P2 is recommended for Stage 2 reassessment (0.028ha). The remainder of the project area consisting of grassed and wooded areas encompassing Sawmill Creek are not obviously disturbed and retain archaeological potential and Stage 2 survey is recommended (2.03 ha; 23.0%).

7.0 ADVICE ON COMPLIANCE WITH LEGISLATION

This report is submitted to the Ministry of Heritage, Sport, Tourism and Culture Industries as a condition of licensing in accordance with Part VI of the *Ontario Heritage Act*, R.S.O 1990, c 0.18. The report is reviewed to ensure that it complies with the standards and guidelines that are issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the Project area of a development proposal have been addressed to the satisfaction of the Ministry of Heritage, Sport, Tourism and Culture Industries, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.

It is an offence under Sections 48 and 69 of the *Ontario Heritage Act* for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeology Reports referred to in Section 65.1 of the *Ontario Heritage Act*.

Should previously undocumented (i.e., unknown or deeply buried) archaeological resources be discovered, there may be a new archaeological site and therefore subject to Section 48(1) of the *Ontario Heritage Act*. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed consultant archaeologist to carry out archaeological fieldwork, in compliance with Section 48(1) of the *Ontario Heritage Act*. Further, archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48 (1) of the *Ontario Heritage Act* and may not be altered, or have artifacts removed from them, except by a person holding an archaeological licence.

The *Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33* requires that any person discovering human remains must notify the police or coroner and the

Registrar of Burial Sites, War Graves, Abandoned Cemeteries and Cemetery Closures, Ontario Ministry of Government and Consumer Services. Effective as of January 16, 2016, Nancy Watkins, Senior Policy Analyst, is the new Registrar. Her telephone number is 416 212-7499 and her e-mail address is Nancy.Watkins@ontario.ca.

8.0 BIBLIOGRAPHY

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Walker & Miles
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9.0 IMAGES

Image 1: Commemorative Sign near the Project area (looking southwest)

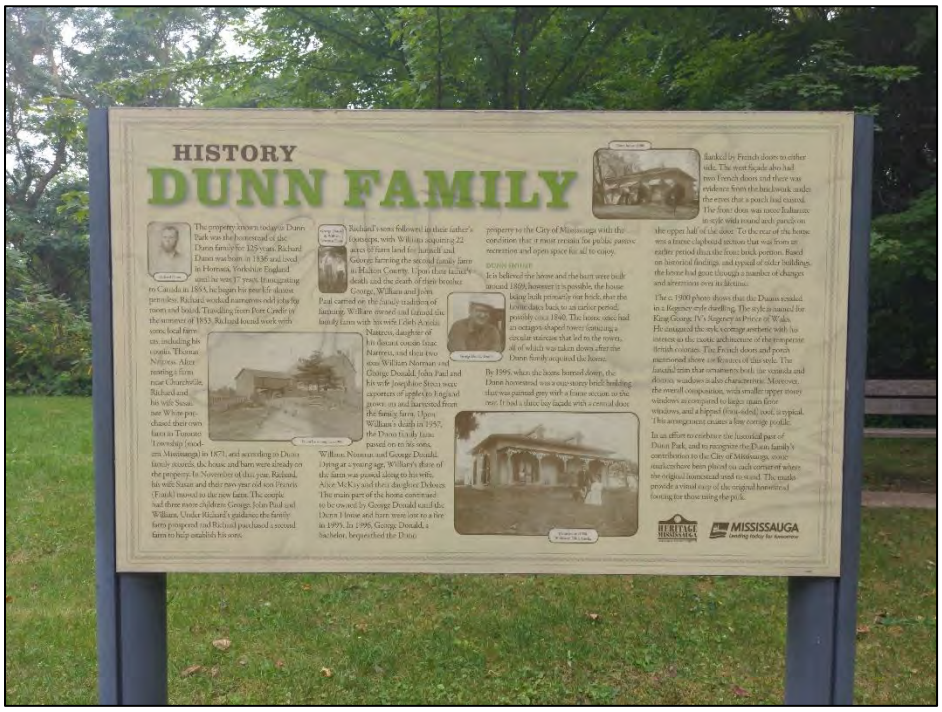


Image 2: Commemorative Sign near the Project area (looking southwest)



Image 3: Grassed and Treed Area by Folkway Drive (looking northeast)



Image 4: Disturbed Area – Paved Walkway and Utilities (looking northwest)



Image 5: Disturbed Area – Culvert by Folkway Drive (looking southwest)



Image 6: Disturbed Area – Damaged Paved Walkway (looking southwest)



Image 7: Disturbed Area – Paved Walkway (looking southeast)



Image 8: Typical Sloped Area (looking northwest)



Image 9: Typical Sloped Area (looking northeast)



Image 10: Low and Wet Area – Sawmill Creek (looking southeast)



Image 11: Typical Grassed Area (looking northwest)



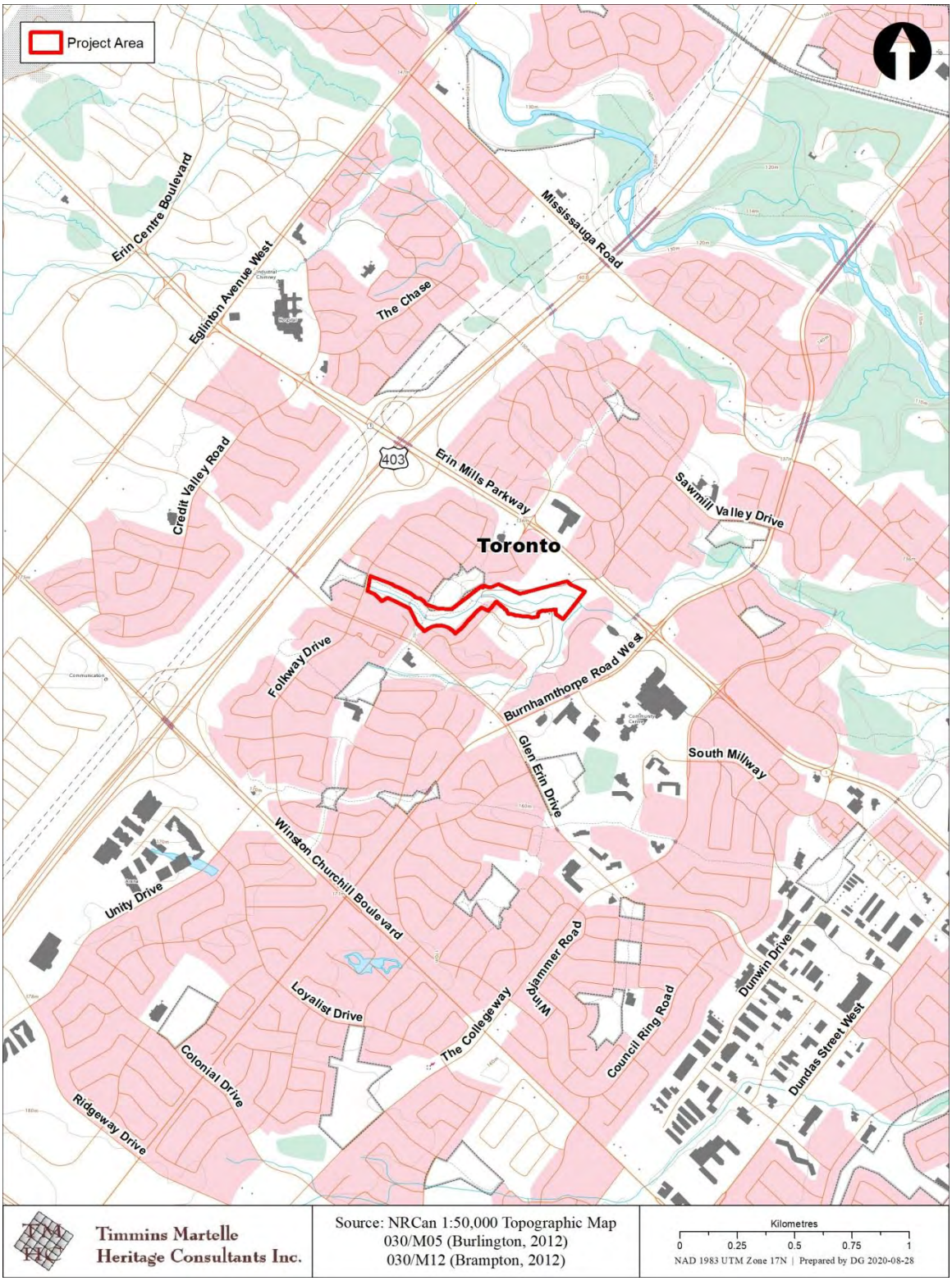
Image 12: Typical Wooded Area (looking southwest)



Image 13: Looking Toward Location of AjGw-301 (looking northeast)



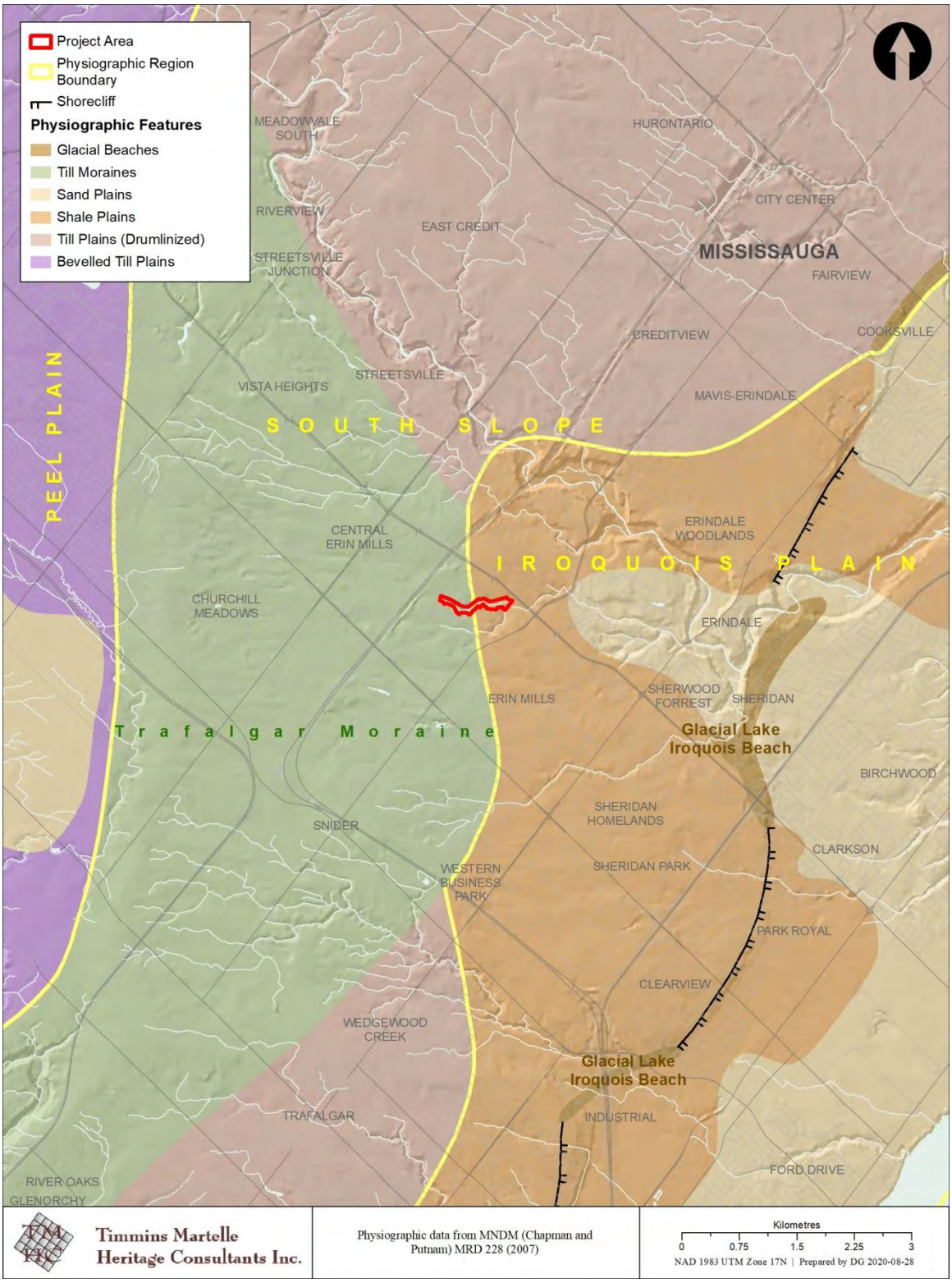
10.0 MAPS



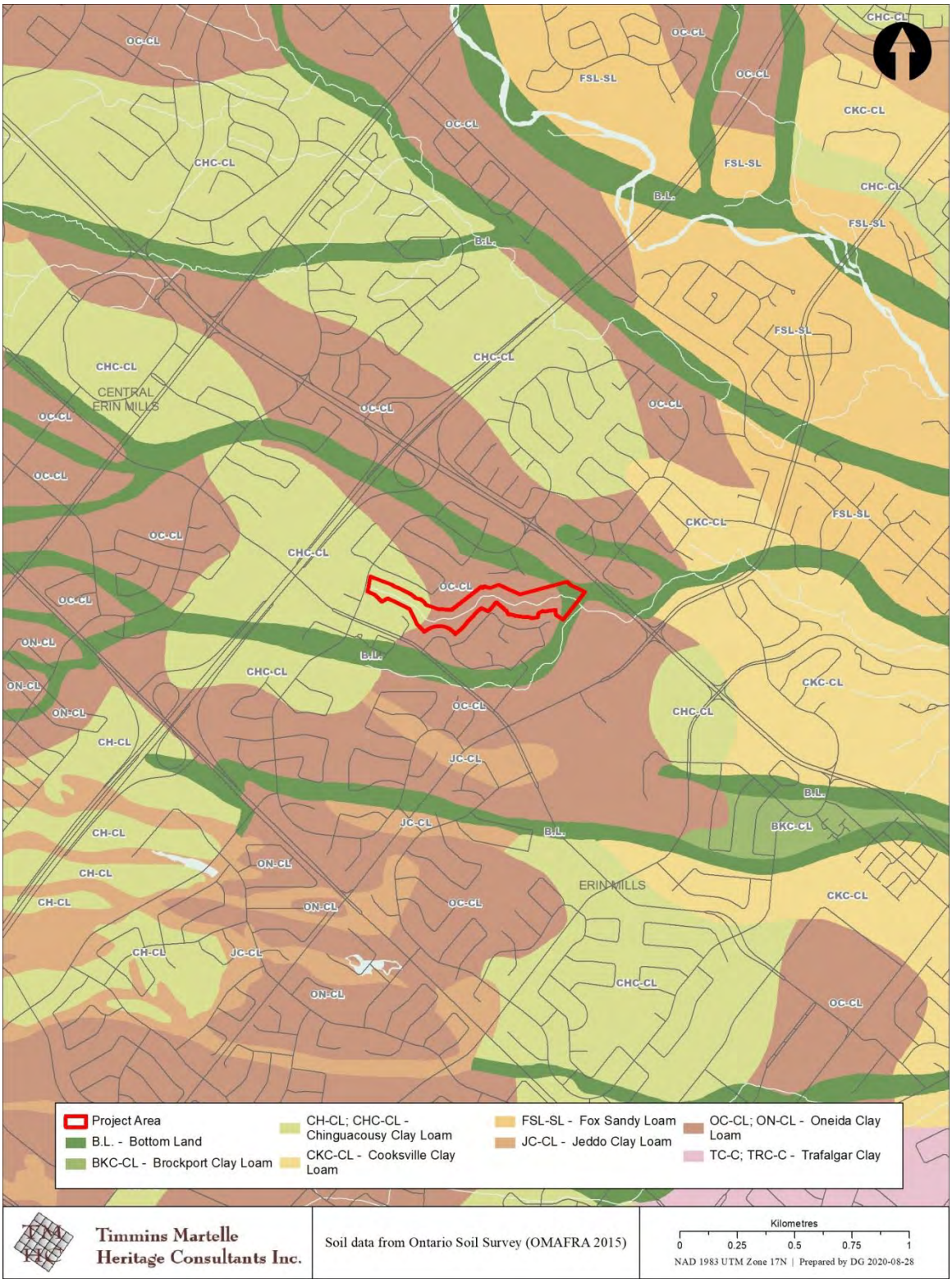
Map 1: Location of the Project Area in the City of Mississauga, ON



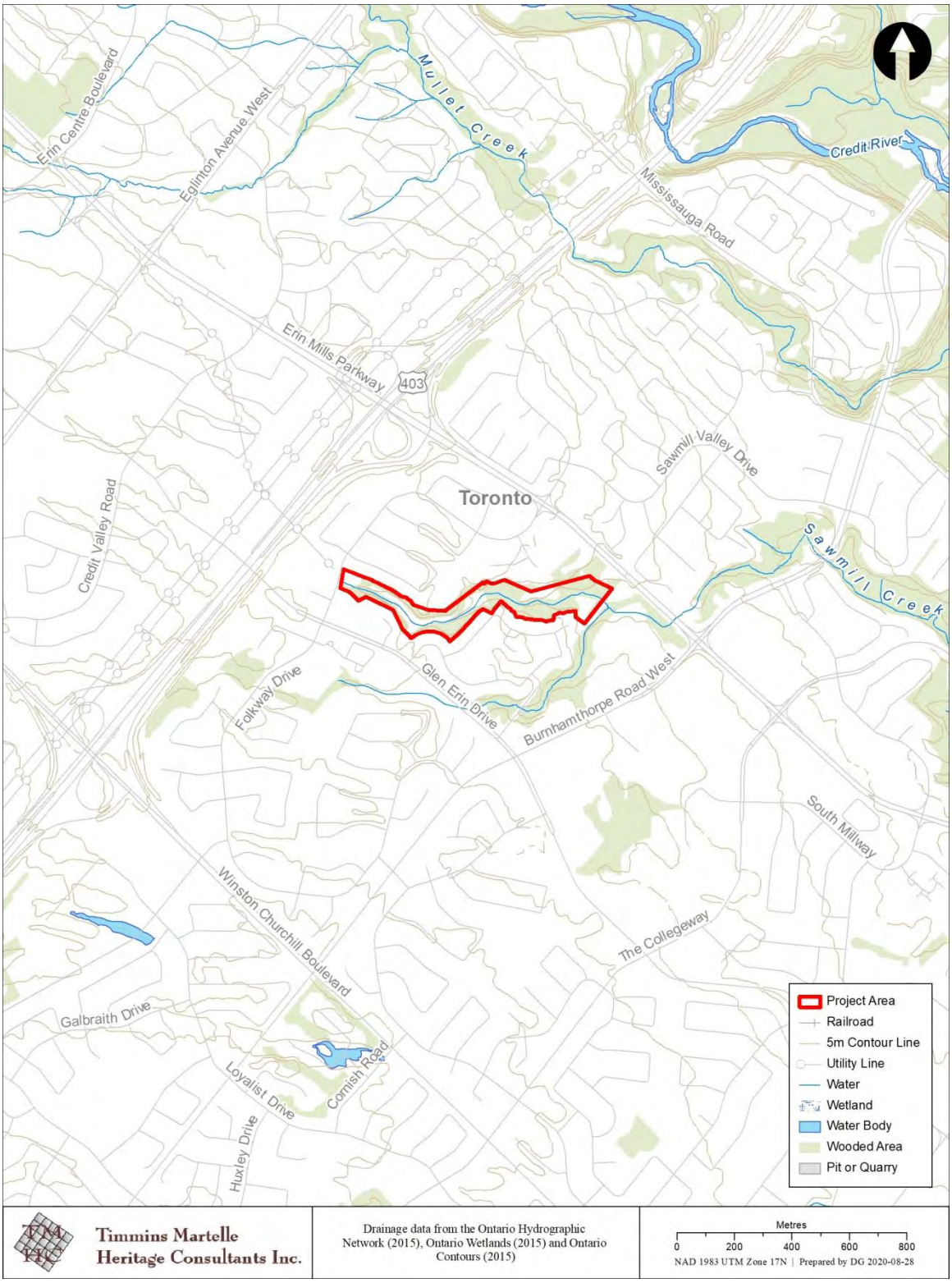
Map 2: Aerial Photograph Showing the Location of the Project Area



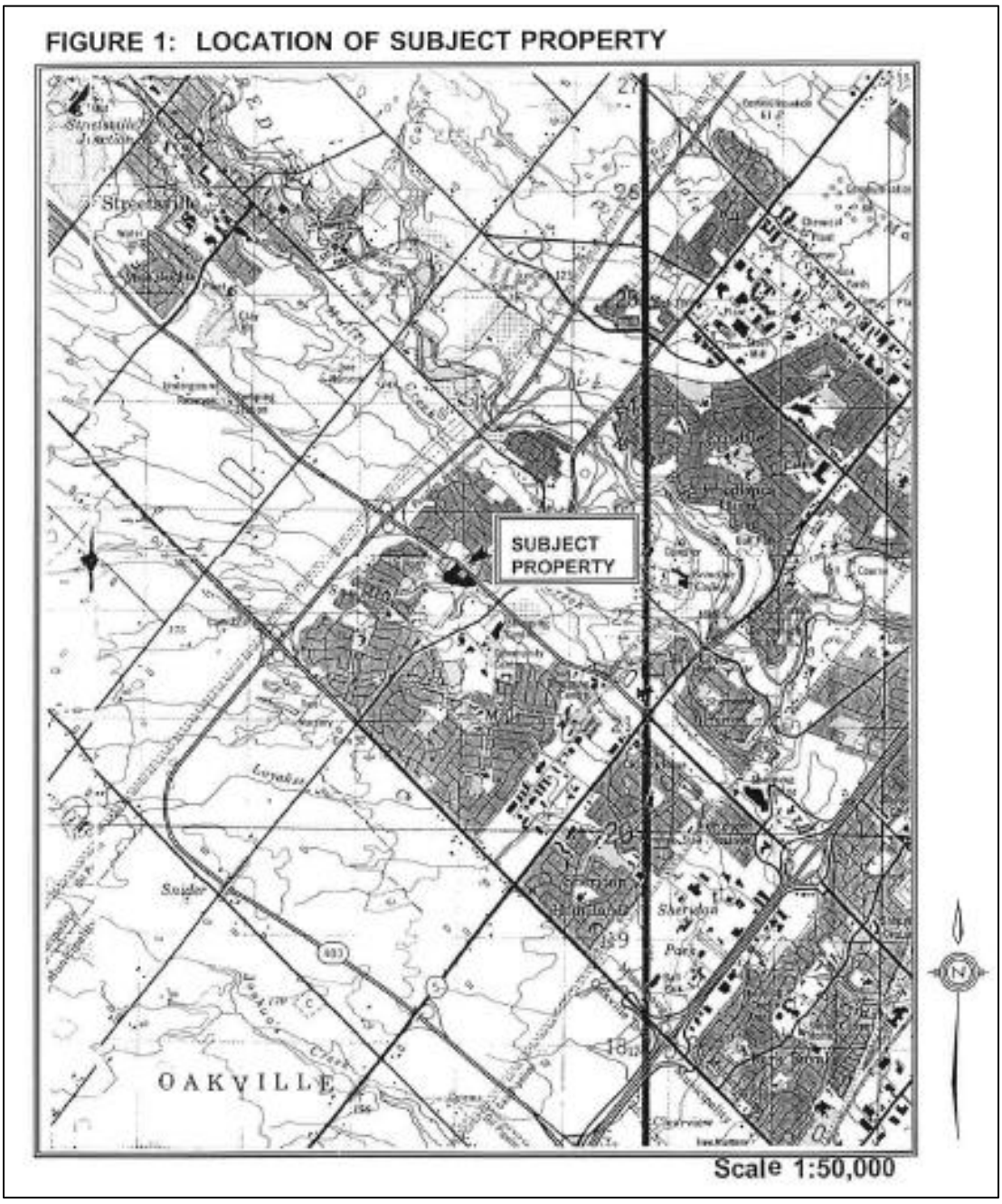
Map 3: Physiography Within the Vicinity of the Project Area



Map 4: Soils Within the Vicinity of the Project Area



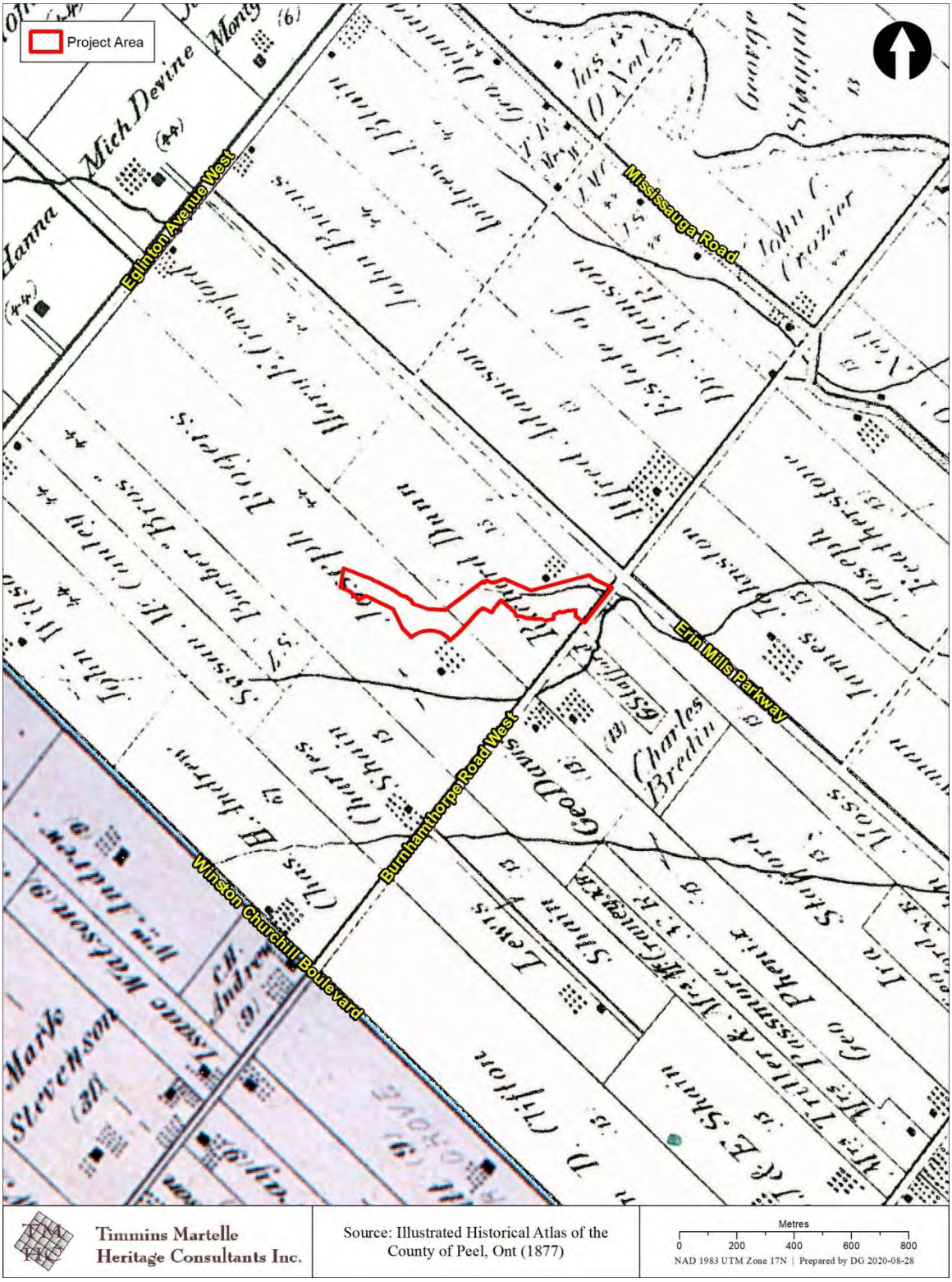
Map 5: Drainage Within the Vicinity of the Project Area



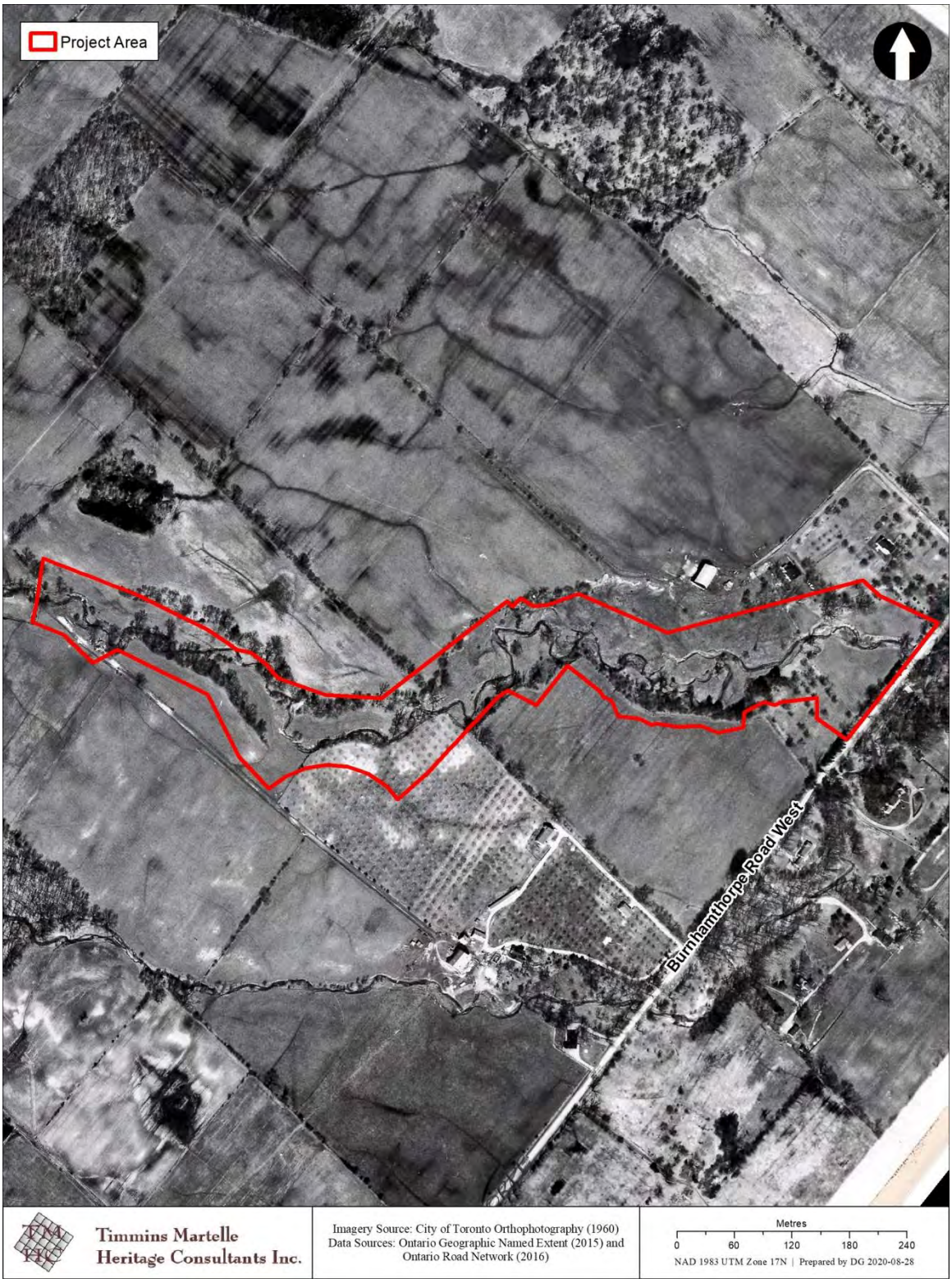
Map 6: ASI Stage 1 & 2 Assessment Area (ASI 1999)



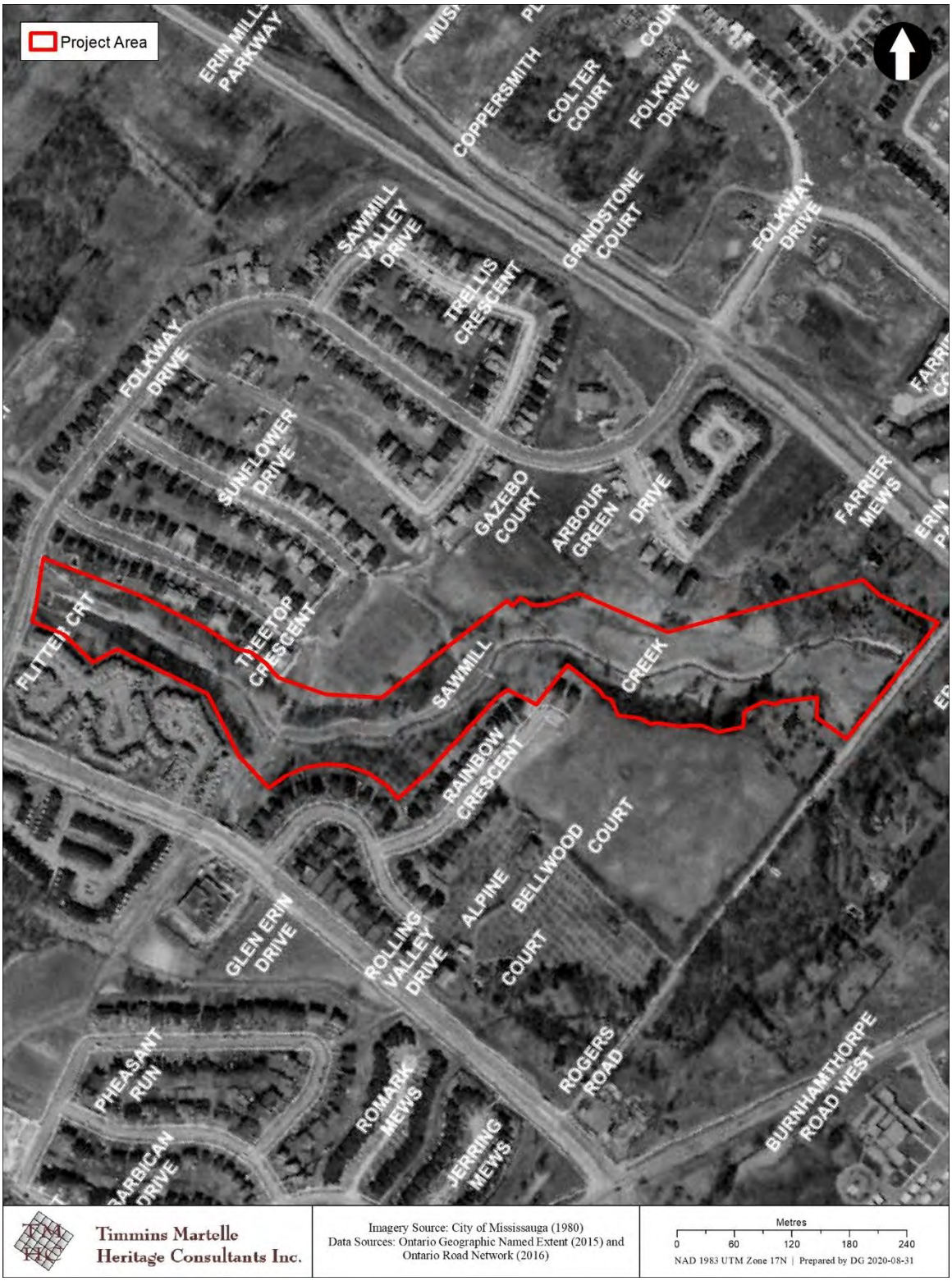
Map 7: Project Area Shown on 1859 Map of Peel County, ON



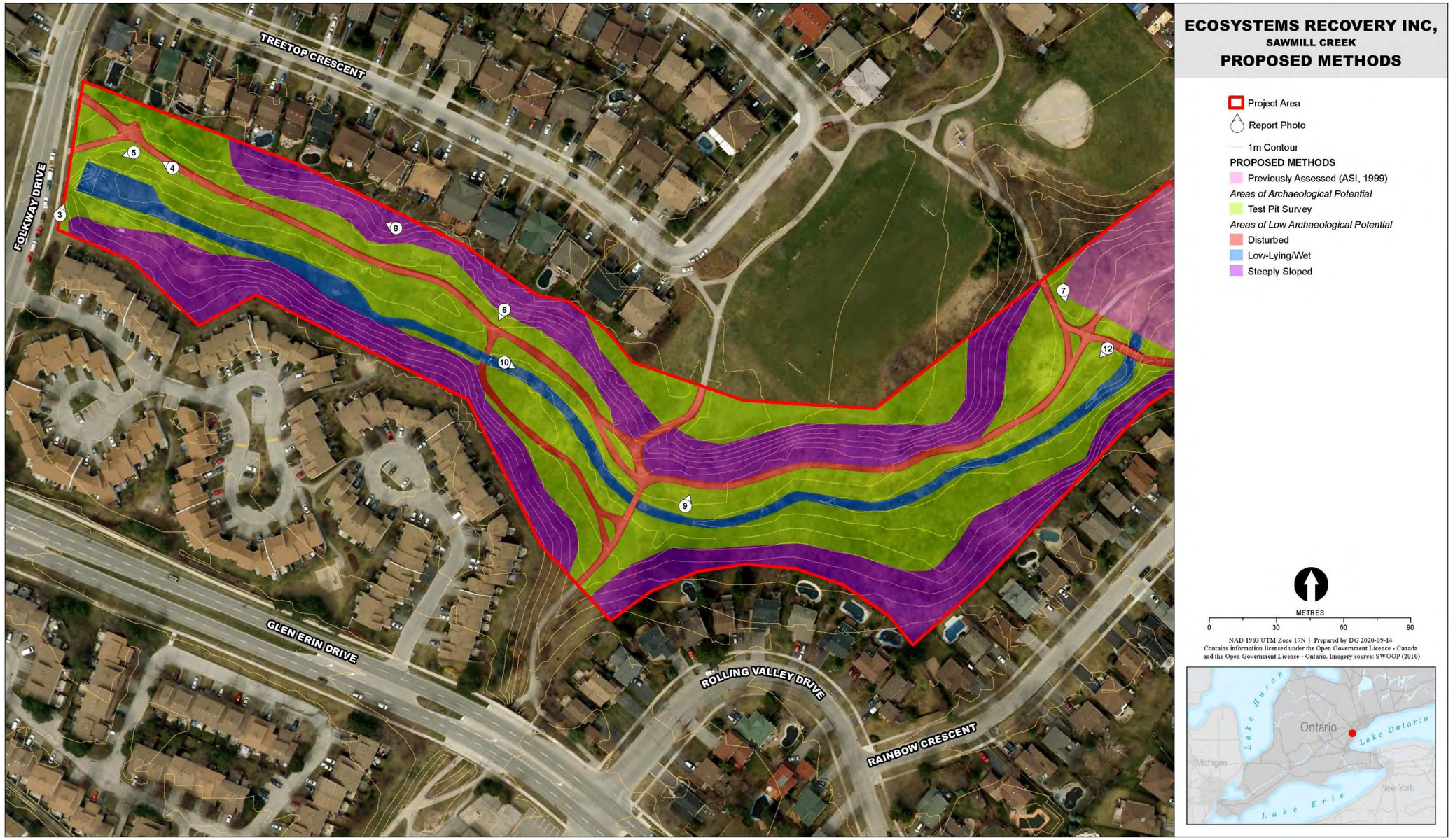
Map 8: Project Area Shown on 1875 Map of Peel County, ON



Map 9: Project Area Shown on a 1960 Aerial Photograph



Map 10: Project Area Shown on a 1980 Aerial Photograph



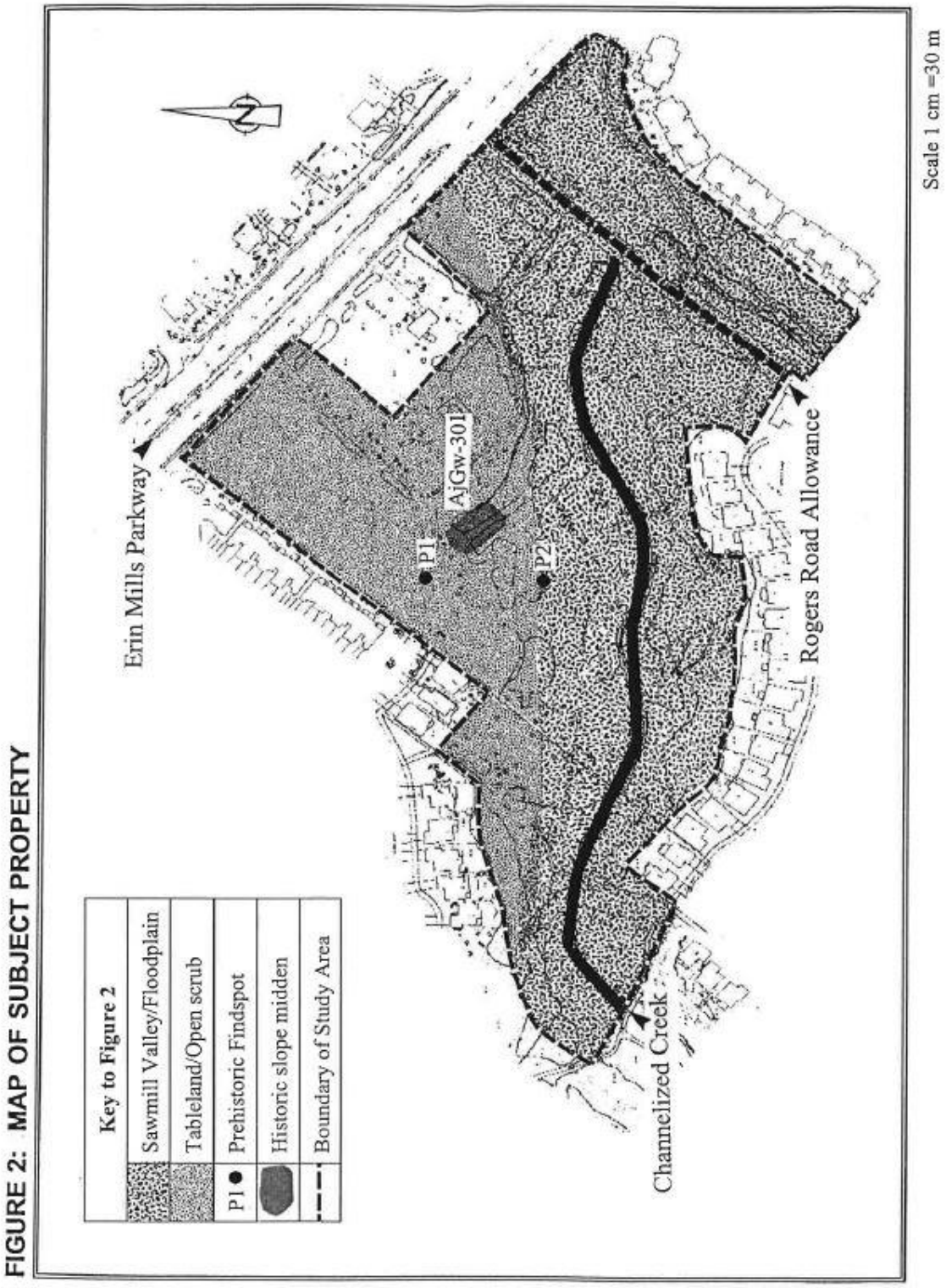
Map 11: Areas of Archaeological Potential – Western Portion



Map 12: Areas of Archaeological Potential – Eastern Portion

Stage 1 Archaeological Assessment
Municipal Class EA
Sawmill Creek Erosion Control
Folkway Drive to Erin Mills Parkway
Part of Lots 32 and 33,
Concession 2 North of Dundas Street
Former Geographic Township of Toronto
Now in the City of Mississauga
Regional Municipality of Peel, Ontario

SUPPLEMENTARY DOCUMENTATION
(to be removed for public circulation of this report)



SD Map 1: Location of Archaeological Sites AjGw-301, P1 and P2 (ASI 1999)



SD Map 2: Previous Assessment and Location of Archaeological Sites AjGw-301 and P2

SUMMARY OF INDIGENOUS CONSULTATION

Prior to initiating the Stage 1 archaeological assessment, and as per the Public Consultation process outlined in the Scope of Work as part of the Environmental Assessment Screening Process for the project, Ecosystems Recovery Inc. practiced due diligence and contacted relevant Indigenous groups regarding the project on July 23, 2020. Contact was via email; a letter and copy of the Notice was also mailed to Chief R. Stacey LaForme of the Mississaugas of the Credit First Nation (MCFN). As there was no follow up response received, and given the timeline for the project, the City and proponent decided to move forward with the field work, which was conducted on September 9, 2020. Following completion of the Stage 1 property inspection, Sherri Pearce of TMHC received an email from the MCFN on September 15, 2020 stating an interest in the project and requesting engagement. As the field work had already been conducted, the MCFN requested to review the draft report and to enter into agreement with the City. A copy of the report was provided to the MCFN on November 9, 2020. After reviewing the report, the MCFN concurred with the overall recommendations outlined in the report. The only exception relating to a portion of the project area that was previously assessed by ASI in 1999. The ASI assessment resulted in the identification of three archaeological locations, one of which, P2, is located within the current project area. As an accommodation the MCFN requested that find spot P2 be revisited and be subject to Stage 2 reassessment within the limits of the current project area, with the intent being to relocate the find spot and reassess its significance and CHVI. In consultation with the proponent and the City of Mississauga, it was decided that the MCFN request be accommodated and as such, the report recommendations were appropriately updated. Provided below is the relevant documentation from the consultation process.

From: Alana Vandersluis
Sent: Thursday, July 23, 2020 11:42 AM
To: fawn.sault@newcreditfirstnation.com
Subject: Sawmill Creek Restoration Environmental Assessment - Notice of Commencement

Dear Fawn Sault,

We are sending this message to you as part of the communication program for the Sawmill Creek Restoration Environmental Assessment project being undertaken by the City of Mississauga. The attachments include a study initiation ad posting and a letter signed by the City of Mississauga project manager.

Thank you.

Alana Vandersluis, EIT
Water Resources Engineering Intern
Cell: (289) 934-0132

Ecosystem Recovery Inc.
80 Courtland Ave. East, Unit 2
Kitchener, Ontario, N2G 2T8
Tel: (519) 621-1500 | Fax: (226) 240-1080
www.ecosystemrecovery.ca

MISSISSAUGA

City of Mississauga
Transportation and Works Department
201 City Centre Drive, Suite 800
MISSISSAUGA, ON L5B 2T4
mississauga.ca

July 23, 2020

Mississauga's of the Credit First Nation
2789 Mississauga Road, R.R. #6
Hagersville, ON
N0A 1H0

Attention: Fawn Sault, Consultation Manager

Re: Notice of Study Commencement: Municipal Class EA Study
Sawmill Creek Erosion Control Project – Folkway Drive to Erin Mills Parkway

The City of Mississauga is undertaking a Schedule 'B' Class Environmental Assessment (Class EA) Study for erosion control and restoration of Sawmill Creek from Folkway Drive to Erin Mills Parkway. For further information, please refer to the attached Notice of Study Commencement.

If you have any questions or comments, or wish to be added or removed from the study mailing list, please contact myself at (905) 615-3200, ext. 3491, or anthony.digiandomenico@mississauga.ca.

Sincerely,

Anthony Di Giandomenico, P.Eng.
Project Manager
Infrastructure Planning and Engineering Services Division
Transportation and Works Department

MISSISSAUGA

mississauga.ca
@citymississauga
facebook.com/citymississauga

CITY OF MISSISSAUGA – NOTICE OF STUDY COMMENCEMENT

Municipal Class Environmental Assessment Study:
Sawmill Creek Erosion Control Project
(Folkway Drive to Erin Mills Parkway)

WHAT?

- The City of Mississauga is undertaking a Schedule B Class Environmental Assessment (Class EA) Study for erosion control and restoration of Sawmill Creek from Folkway Drive to Erin Mills Parkway.



WHY?

- Through its ongoing erosion monitoring program, the City of Mississauga recognizes that this section of Sawmill Creek is a high priority site in need of rehabilitation due to the presence of erosion and risk to infrastructure.

HOW?

- The study will examine the creek and associated natural resources to identify existing erosion problems, potential future risks, and opportunities for restoration and environmental enhancement.
- Through the Class EA process, multiple alternative solutions will be developed and evaluated by the Study Team and refined through public and agency consultation (see below). The Study Team will then select a Preferred Alternative and proceed with design of the recommended works.
- At the end of the study, a Project File documenting the study process will be available for public review.

GET INVOLVED!

- Consultation is an important part of the Class EA process. Public input and comment are invited for incorporation into the planning and design of this project.
- A Public Information Centre (PIC) will be held to present the study findings, the alternative solutions being considered, and to answer any questions you may have. Details regarding the PIC will be advertised publicly as the study progresses.
- If you have any questions or comments regarding the study, wish to provide input on the proposed solutions, or wish to be added or removed from the study mailing list, please contact:

Anthony Di Giandomenico, P.Eng.
Project Manager
City of Mississauga
201 City Centre Dr, Suite 800
Mississauga, ON L5B 2T4
(905) 615-3200, ext. 3491
anthony.digiandomenico@mississauga.ca

Wolfgang Wolter
Consultant Project Manager
Ecosystem Recovery Inc.
80 Courtland Avenue E, Unit 2
Kitchener, ON N2G 2T8
(519) 621-1500
wolfgang.wolter@ecosystemrecovery.ca

COVID-19 Community Engagement Update: While we continue to respond to this pandemic, we are working hard to deliver essential services and projects to keep our City moving and safe. While we can't connect in person at this time, we still want to connect! Opportunities to connect with the Study Team and share your input are noted above.

This notice signals the commencement of the Class EA, a study which will define the problem, identify/evaluate alternative solutions, and determine a preferred design in consultation with regulatory agencies and the public. The study is being undertaken in accordance with the planning and design process for Schedule 'B' projects, as outlined in the "*Municipal Class Environmental Assessment*" document (October 2000, amended in 2015), which is approved under the Ontario *Environmental Assessment Act*.

Personal information is collected under the authority of the Environmental Assessment Act and will be used in the assessment process. With exception of personal information, all comments shall become part of the public records. Questions about this collection should be directed to the Project Manager listed above.

This notice was first issued July 23, 2020.

Sherri Pearce

From: Megan DeVries <Megan.DeVries@mncfn.ca>
Sent: September 15, 2020 3:22 PM
To: Sherri Pearce
Cc: Mark LaForme; Fawn Sault; Archaeology (MHSTCI)
Subject: PIF Notification - Ecosystems Sawmill Creek
Attachments: Pearce - Ecosystems Sawmill Creek.pdf

Follow Up Flag: FollowUp
Flag Status: Flagged

Good afternoon,

Please see the attached letter from the Mississaugas of the Credit First Nation regarding your upcoming archaeological assessment.

Regards,
Megan.

Megan DeVries, M.A.
Archaeological Operations Supervisor

Department of Consultation and Accommodation (DOCA)
Mississaugas of the Credit First Nation (MCFN)
4065 Highway 6 North, Hagersville, ON N0A 1H0
P: 905-768-4260 | M: 289-527-2763
http://www.mncfn.ca

VACATION ALERT: I will be out of the office on vacation September 21 to 25, 2020.

This email and any files transmitted with it are confidential and intended solely for the use of the individual or entity to whom they are addressed. If you are not the intended recipient you are notified that disclosing, copying, distributing or taking any action in reliance on the contents of this information is strictly prohibited. Please note that any views or opinions presented in this email are solely those of the author and do not necessarily represent those of the Mississaugas of the Credit First Nation.

MISSISSAUGAS OF THE CREDIT FIRST NATION

DEPARTMENT OF
CONSULTATION AND ACCOMMODATION

September 14, 2020

Dear Sir/Madam,

I am writing on behalf of the Department of Consultation and Accommodation [DOCA], requesting information on a project within the Mississaugas of the Credit First Nation's [MCFN] treaty territory.

MCFN are an Aboriginal people within the meaning of section 35 of the *Constitution Act, 29182*. We have signed numerous treaties with the Crown, reaffirming our rights as the original owners of the lands in our territory and establishing Treaty rights over the same. Furthermore, we have un-surrendered Aboriginal title to the waters, beds of water, and foreshore within our territory. Our constitutionally protected rights give rise to specific legal obligations and duties which supersede policies and guidelines.

We are an Indigenous community as understood by the United Nations and our rights include those referenced in the United Nations Declaration on the Rights of Indigenous Peoples ("UNDRIP"). Article 11 of UNDRIP states that Indigenous peoples have "the right to maintain, protect and develop the past, present and future manifestations of their cultures, such as archaeological and historical sites, artefacts..." In May, 2016, the Federal Government committed to adopting and implementing UNDRIP; therefore, the rights of Indigenous peoples outlined in it deserve renewed consideration and respect.

These lands have been the territory and home of MCFN and our ancestors for many generations. As such, there is significant potential for archaeological and other cultural resources of our people to be located during the archaeological fieldwork required for projects or development. Such resources are of critical importance to MCFN given the increasing urbanization and development of our territory that effectively whitewashes our past. Without our active participation and monitoring during archaeological fieldwork, our history stands to be lost forever. As the original stewards of these lands – and continuing owners of the waters – we have ongoing obligations to ensure the protection of our cultural and natural resources for future generations. This is our responsibility and our right.

DEPARTMENT OF CONSULTATION AND ACCOMMODATION
Mississaugas of the Credit First Nation
4065 Hwy #6, Hagersville, Ontario N0A 1H0
Phone: (905) 768-4260

DOCA has been notified that in a project information file was submitted to the Ministry of Heritage, Sport, Tourism, and Culture Industries for the following project:

PIF ID	111252
Project Name	Ecosystems Sawmill Creek Stage 1 2020-060
Proponent Identified	Ecosystem Recovery Inc
Municipal Address	n/a
Stage of Assessment	Stage 1
Licensee Name and Number	Sherri Pearce (P316)

Please provide a summary of the history of this project and the current state of its associated environmental and archaeological fieldwork. If it is complete, please provide a summary of the preliminary results, followed by the draft report when available. If it is not yet complete, please provide the anticipated start date of fieldwork.

Please be aware that the development may have impacts on MCFN's treaty and aboriginal rights and MCFN has not been properly consulted on this project. Until a reasonable understanding has been reached between MCFN and the proponent regarding the project and our participation in it to ensure that the fieldwork is conducted in a respectful manner that protects our rights, we are of the opinion that any duty to consult over the project has not been met and all subsequent approvals relating to the project are subject to challenge on this basis.

Finally, we would like to take this opportunity to remind you that MCFN has its own *Standards and Guidelines for Archaeology*, which we expect that will be followed in our Territory. Additionally, DOCA requires that our Field Liaison Representatives participate in all environmental and archaeological fieldwork within the MCFN treaty territory, including Stages 2 through 4. **It is our expectation that no fieldwork will take place without the participation of our FLRs.** MCFN has an Aboriginal and Treaty Right to protect the environmental and our archaeological heritage and our FLRs are our boots on the ground to ensure our interests are protected. MCFN considers it disrespectful to our rights as Indigenous peoples if our natural and cultural heritage is interfered with without our involvement.

It is my hope that in light of the above considerations and with a renewed focus on reconciliation, we can navigate through these issues towards a relationship of respect, partnership, and mutual benefit. **Please provide the requested information by 4pm on October 9, 2020.**

DEPARTMENT OF CONSULTATION AND ACCOMMODATION
Mississaugas of the Credit First Nation
4065 Hwy #6, Hagersville, Ontario N0A 1H0
Phone: (905) 768-4260

Thank you.

Megan DeVries,
Archaeological Operations Supervisor

CC Mark LaForme, MCFN-DOCA (mark.laforme@mncfn.ca)
Ministry of Heritage, Sport, Tourism, and Culture Industries
(archaeology@ontario.ca)

DEPARTMENT OF CONSULTATION AND ACCOMMODATION
Mississaugas of the Credit First Nation
4065 Hwy #6, Hagersville, Ontario N0A 1H0
Phone: (905) 768-4260

Sherri Pearce

From: Sherri Pearce
Sent: September 22, 2020 1:45 PM
To: Megan DeVries
Cc: Fawn Sault; Mark LaForme
Subject: FW: Sawmill Creek Restoration Environmental Assessment - Notice of Commencement
Attachments: Notice of Commencement_Sawmill Creek_final.pdf; 2020-07-23- Letter for MCFN CA- Notice of commencement.pdf

Hi Megan,
I am just following up regarding your letter about the Sawmill Creek Stage 1 assessment. When the project was initiated, we did ask the client if he was planning on engagement. He informed me that they had reached out to interested communities, as per the City's direction, but received no responses or feedback in the interim and that the City wished to proceed with the work. As such, and unfortunately, we have already conducted our site visit; it was completed on September 9th, just prior to receiving your letter. Given that, I was wondering as to how you would like to move forward with this? The City has stated that they are happy to provide you a copy of the report, once it is finalized. Is there anything more we can do at this point and time? Please let me know.

Also, I asked the client to provide me copies of the correspondence, which is below and attached.

Please feel free to contact me to discuss further.
Thanks.
Cheers,
Sherri

Sherri Pearce, M.A.
Project Manager/Staff Archaeologist

Timmins Martelle Heritage Consultants Inc.
Timmins Martelle Heritage Consultants Inc.
@ the Museum of Ontario Archaeology
1600 Attawandaron Road
London, ON N6G 3M6
(519) 641-7222
Fax - (519) 641-7220
* spearce@tmhc.ca
Cell (519) 282-0541

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Please consider the environment before printing this e-mail and/or its attachments.

From: Wolfgang Wolter <wolfgang.wolter@ecosystemrecovery.ca>
Sent: September 22, 2020 11:58 AM
To: Sherri Pearce <spearce@tmhc.ca>
Subject: FW: Sawmill Creek Restoration Environmental Assessment - Notice of Commencement

Hi Sherri

Here is the response we received from MCFN regarding the notice. Attached is what was sent to them. We send an email as well as letter mail.

Email sent to Fawn Sault of the MCFN on July 23, 2020. We received an automated response, copied below:

Aanii,

Please be advised that as a proactive approach to reducing the exposure of COVID-19, the MCFN Chief and Council have implemented a temporary shutdown of all non-essential services. At this point, we will potentially reopen on August 4, 2020 at 8:30.

Please check the MCFN website and social media for further updates.

Miigwetch,

Fawn Sault

Consultation Coordinator

MCFN DOCA

In addition to the email, a letter and copy of the Notice was mailed to Chief R. Stacey LaForme (Department of Consultation and Accomodation, MCFN) at 2789 Mississauga Road, RR#6, Hagersville ON, N0A 1H0.

From: Alana Vandersluis
Sent: Thursday, July 23, 2020 11:42 AM
To: fawn.sault@newcreditfirstnation.com
Subject: Sawmill Creek Restoration Environmental Assessment - Notice of Commencement

Dear Fawn Sault,

We are sending this message to you as part of the communication program for the Sawmill Creek Restoration Environmental Assessment project being undertaken by the City of Mississauga. The attachments include a study initiation ad posting and a letter signed by the City of Mississauga project manager.

Thank you.

Alana Vandersluis, EIT
Water Resources Engineering Intern
Cell: (289) 934-0132

Ecosystem Recovery Inc.
80 Courtland Ave. East, Unit 2
Kitchener, Ontario, N2G 2T8
Tel: (519) 621-1500 | Fax: (226) 240-1080
www.ecosystemrecovery.ca

Sherri Pearce

From: Megan DeVries <Megan.DeVries@mncfn.ca>
Sent: October 1, 2020 3:50 PM
To: Sherri Pearce
Cc: Fawn Sault; Mark LaForme
Subject: RE: Sawmill Creek Restoration Environmental Assessment - Notice of Commencement

Follow Up Flag: Flag for follow up
Flag Status: Flagged

Hi Sherri,

Thank you for the background information. At this point, DOCA will simply request to review the draft report. Do you have a contact at the City? We will provide them with our technical review agreement.

Sincerely,
Megan.

Megan DeVries, M.A.
Archaeological Operations Supervisor

Department of Consultation and Accommodation (DOCA)
Mississaugas of the Credit First Nation (MCFN)
4065 Highway 6 North, Hagersville, ON N0A 1H0
P: 905-768-4260 | M: 289-527-2763
http://www.mncfn.ca

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Sherri Pearce

From: Sherri Pearce
Sent: October 5, 2020 9:57 AM
To: 'Megan DeVries'
Cc: Fawn Sault; Mark LaForme
Subject: RE: Sawmill Creek Restoration Environmental Assessment - Notice of Commencement

Hi Megan,
As per your request, please see below for the City contact for the Sawmill Creek assessment.
We are just finishing up the draft report now. If you could let me know when you have an agreement in place, then I can send you a copy of the report for review. Thanks in advance.
Cheers,
Sherri

Anthony Di Giandomenico P.Eng.
Storm Drainage Engineer, Environmental Services
T 905-615-3200 ext.3491 | M 647-285-8291
anthony.digiandomenico@mississauga.ca

City of Mississauga | Transportation & Works Department
Infrastructure Planning & Engineering Division

Sherri Pearce, M.A.
Project Manager/Staff Archaeologist

Timmins Martelle
Heritage Consultants Inc.

Timmins Martelle Heritage Consultants Inc.
@ the Museum of Ontario Archaeology
1600 Attawandaron Road
London, ON N6G 3M6
(519) 641-7222
Fax - (519) 641-7220
* spearce@tmhc.ca
Cell (519) 282-0541

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From: Sherri Pearce <spearce@tmhc.ca>
Sent: Monday, November 9, 2020 11:59 AM
To: Megan DeVries <Megan.DeVries@mncfn.ca>; Anthony DiGiandomenico <Anthony.DiGiandomenico@mississauga.ca>
Cc: Mark LaForme <Mark.LaForme@mncfn.ca>; Fawn Sault <Fawn.Sault@mncfn.ca>; wolfgang.wolter@ecosystemrecovery.ca
Subject: RE: Sawmill Creek Restoration Environmental Assessment - Notice of Commencement

Hi Megan,
Please find attached our Stage 1 report for your review.
Feel free to contact me if you have any questions or concerns.
Cheers,
Sherri

Sherri Pearce, M.A.
Project Manager/Staff Archaeologist

Timmins Martelle Heritage Consultants Inc.
Timmins Martelle Heritage Consultants Inc.
@ the Museum of Ontario Archaeology
1600 Attawandaron Road
London, ON N6G 3M6
(519) 641-7222
Fax - (519) 641-7220
* spearce@tmhc.ca
Cell (519) 282-0541

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Please consider the environment before printing this e-mail and/or its attachments

From: Adrian Blake <Adrian.Blake@mncfn.ca>
Sent: November 12, 2020 3:19 PM
To: Sherri Pearce <spearce@tmhc.ca>
Cc: Megan DeVries <Megan.DeVries@mncfn.ca>; Mark LaForme <Mark.LaForme@mncfn.ca>
Subject: RE: Sawmill Creek Restoration Environmental Assessment - Notice of Commencement

Good afternoon Sherri,

I'm in the process of reviewing you Stage 1 report for Sawmill Creek. I'm hoping you have a copy of the 1991 Report ASI did for a portion of the current study area. I can't seem to find it in the database, probably due to its age. There also isn't a citation in your bibliography for it but based on the language of your report you have either seen this report or have been in communication with them regarding its contents? It is stated throughout the report that their survey was done in a way that makes it complaint with current Standards and Guidelines. My only concern is with find spot P2, that lies within the current study area. I would like to confirm for myself that the methodology employed in the intensification of this P2 find spot is appropriate to contemporary standards. If you could help me with this issue I expect to be able to finalize my review shortly afterwards.

Thank you for your time,

Adrian Blake, M.S.
Field Archaeologist

Department of Consultation and Accommodation (DOCA)
Mississaugas of the Credit First Nation (MCFN)
4065 Highway 6 North, Hagersville, ON N0A 1H0
M: 905-979-3862
http://www.mncfn.ca

From: Sherri Pearce <spearce@tmhc.ca>
Sent: Thursday, November 12, 2020 3:37 PM
To: Adrian Blake <Adrian.Blake@mncfn.ca>
Cc: Megan DeVries <Megan.DeVries@mncfn.ca>; Mark LaForme <Mark.LaForme@mncfn.ca>
Subject: RE: Sawmill Creek Restoration Environmental Assessment - Notice of Commencement

Hi Adrian,
Thanks for catching that the citation was missing. That was a total oversight on our part. I will fix that in the final version to be submitted. We got a copy of the report directly from ASI. It is attached here for you.
Let me know if there is anything else I can help with.

Cheers,
Sherri

Sherri Pearce, M.A.
Project Manager/Staff Archaeologist

Timmins Martelle Heritage Consultants Inc.

Timmins Martelle Heritage Consultants Inc.
@ the Museum of Ontario Archaeology
1600 Attawandaron Road
London, ON N6G 3M6
(519) 641-7222
Fax - (519) 641-7220
* spearce@tmhc.ca
Cell (519) 282-0541

Sherri Pearce

From: Adrian Blake <Adrian.Blake@mncfn.ca>
Sent: November 13, 2020 11:28 AM
To: Sherri Pearce
Cc: Megan DeVries; Mark LaForme
Subject: RE: Sawmill Creek Restoration Environmental Assessment - Notice of Commencement
Attachments: For TMHC to re survey.png

Follow Up Flag: Follow up
Flag Status: Flagged

Good morning Sherri,

I've gone over everything now for your strategy for the Stage 2 AA at Sawmill Creek. Regarding your assessment of the area you plan on surveying, it looks fine and we currently have no issues with the plan for assessing the portions of the study area that fall outside of the 1999 ASI survey. Regarding ASI's 1999 survey, the only issue I have with it is with the intensification strategy they used at find spot P2. By my calculations their approach examined 40% less soil than would have been examined by a contemporary Option A approach. I don't think it's reasonable for you to find the exact location of P2, but as an accommodation we request you go revisit the approximate area of P2 and conduct some test pitting there at standard 5m intervals. It is a small area and I can't imagine more than 15 test pits will be needed on the flat table land where P2 was located. I've attached a crude map to this email show the approximate area we would like to see this survey take place (the red dot), but I imagine you will use your own cartographers to confirm the approximate location of P2.

Let me know if you have any follow-up questions or comments.

Kind regards,
Adrian Blake, M.S.
Field Archaeologist

Department of Consultation and Accommodation (DOCA)
Mississaugas of the Credit First Nation (MCFN)
4065 Highway 6 North, Hagersville, ON N0A 1H0
M: 905-979-3862
http://www.mncfn.ca



Sherri Pearce

From: Sherri Pearce
Sent: November 19, 2020 10:10 AM
To: Adrian Blake
Cc: Megan DeVries; Mark LaForme
Subject: RE: Sawmill Creek Restoration Environmental Assessment - Notice of Commencement
Attachments: PreviouslyAssessed.jpg; ProposedMethods_Page_2.jpg

Hi Adrian,
We have discussed your request for Stage 2 reassessment of the P2 find spot with the client and the City and the City has agreed to accommodate your request. As such, we will update our report to reflect this. Attached is revised mapping showing the area we propose to survey for P2 and the SD mapping showing where the find spot is, based on our georeferencing. The area we propose is roughly 30m by 15m. Please let me know if this works on your end and then we can finalise the report. Thanks in advance.
Cheers,
Sherri

Sherri Pearce, M.A.
Project Manager/Staff Archaeologist

Timmins Martelle Heritage Consultants Inc.
@ the Museum of Ontario Archaeology
1600 Attawandaron Road
London, ON N6G 3M6
(519) 641-7222
Fax - (519) 641-7220
* spearce@tmhc.ca
Cell (519) 282-0541

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Sherri Pearce

From: Adrian Blake <Adrian.Blake@mncfn.ca>
Sent: November 19, 2020 11:03 AM
To: Sherri Pearce
Cc: Megan DeVries; Mark LaForme
Subject: RE: Sawmill Creek Restoration Environmental Assessment - Notice of Commencement

Sherri,

I've checked over the mapping you provided and it looks like what you are proposing will satisfy our request for accommodation. Ideally, we will have FLR participation when the Stage 2 takes place and will be able to confirm appropriate coverage of the area. Once this is added to the report we will no longer have any concerns with the report or its recommendations.

I appreciate you brining our request to the proponent and look forward to working with you further on this project.

Adrian Blake, M.S.
Field Archaeologist

Department of Consultation and Accommodation (DOCA)
Mississaugas of the Credit First Nation (MCFN)
4065 Highway 6 North, Hagersville, ON N0A 1H0
M: 905-979-3862
http://www.mncfn.ca

Sherri Pearce

From: Sherri Pearce
Sent: November 19, 2020 11:56 AM
To: 'Adrian Blake'
Cc: Megan DeVries; Mark LaForme
Subject: RE: Sawmill Creek Restoration Environmental Assessment - Notice of Commencement

Hi Adrian,
Thanks for getting back to me. We will finalize the report now. Once the report is finalized and approved by the client, I will send both you and Megan a copy for your records.
Cheers,
Sherri

Sherri Pearce, M.A.
Project Manager/Staff Archaeologist

Timmins Martelle Heritage Consultants Inc.
Timmins Martelle Heritage Consultants Inc.
@ the Museum of Ontario Archaeology
1600 Attawandaron Road
London, ON N6G 3M6
(519) 641-7222
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Appendix F

Public Consultation

City of Mississauga
Transportation and Works Department
201 City Centre Drive, Suite 800
MISSISSAUGA, ON L5B 2T4
mississauga.ca

July 23, 2020

[redacted]

Attention: [redacted]

Re: Notice of Study Commencement: Municipal Class EA Study
Sawmill Creek Erosion Control Project – Folkway Drive to Erin Mills Parkway

The City of Mississauga is undertaking a Schedule 'B' Class Environmental Assessment (Class EA) Study for erosion control and restoration of Sawmill Creek from Folkway Drive to Erin Mills Parkway. For further information, please refer to the attached Notice of Study Commencement.

If you have any questions or comments, or wish to be added or removed from the study mailing list, please contact myself at (905) 615-3200, ext. 3491, or anthony.digiandomenico@mississauga.ca.

Sincerely,

Anthony Di Giandomenico, P.Eng.
Project Manager
Infrastructure Planning and Engineering Services Division
Transportation and Works Department

MISSISSAUGA

mississauga.ca
@citymississauga
facebook.com/citymississauga

CITY OF MISSISSAUGA – NOTICE OF STUDY COMMENCEMENT

Municipal Class Environmental Assessment Study: Sawmill Creek Erosion Control Project (Folkway Drive to Erin Mills Parkway)

WHAT?

- The City of Mississauga is undertaking a Schedule B Class Environmental Assessment (Class EA) Study for erosion control and restoration of Sawmill Creek from Folkway Drive to Erin Mills Parkway.



WHY?

- Through its ongoing erosion monitoring program, the City of Mississauga recognizes that this section of Sawmill Creek is a high priority site in need of rehabilitation due to the presence of erosion and risk to infrastructure.

HOW?

- The study will examine the creek and associated natural resources to identify existing erosion problems, potential future risks, and opportunities for restoration and environmental enhancement.
- Through the Class EA process, multiple alternative solutions will be developed and evaluated by the Study Team and refined through public and agency consultation (see below). The Study Team will then select a Preferred Alternative and proceed with design of the recommended works.
- At the end of the study, a Project File documenting the study process will be available for public review.

GET INVOLVED!

- Consultation is an important part of the Class EA process. Public input and comment are invited for incorporation into the planning and design of this project.
- A Public Information Centre (PIC) will be held to present the study findings, the alternative solutions being considered, and to answer any questions you may have. Details regarding the PIC will be advertised publicly as the study progresses.
- If you have any questions or comments regarding the study, wish to provide input on the proposed solutions, or wish to be added or removed from the study mailing list, please contact:

Anthony Di Giandomenico, P.Eng.
Project Manager
City of Mississauga
201 City Centre Dr, Suite 800
Mississauga, ON L5B 2T4
(905) 615-3200, ext. 3491
anthony.digiandomenico@mississauga.ca

Wolfgang Wolter
Consultant Project Manager
Ecosystem Recovery Inc.
80 Courtland Avenue E, Unit 2
Kitchener, ON N2G 2T8
(519) 621-1500
wolfgang.wolter@ecosystemrecovery.ca

COVID-19 Community Engagement Update: While we continue to respond to this pandemic, we are working hard to deliver essential services and projects to keep our City moving and safe. While we can't connect in person at this time, we still want to connect! Opportunities to connect with the Study Team and share your input are noted above.

This notice signals the commencement of the Class EA, a study which will define the problem, identify/evaluate alternative solutions, and determine a preferred design in consultation with regulatory agencies and the public. The study is being undertaken in accordance with the planning and design process for Schedule 'B' projects, as outlined in the *"Municipal Class Environmental Assessment"* document (October 2000, amended in 2015), which is approved under the Ontario *Environmental Assessment Act*.

Personal information is collected under the authority of the Environmental Assessment Act and will be used in the assessment process. With exception of personal information, all comments shall become part of the public records. Questions about this collection should be directed to the Project Manager listed above.

This notice was first issued July 23, 2020.

mississauga.ca
@citymississauga
facebook.com/citymississauga

CITY OF MISSISSAUGA - NOTICE OF ONLINE PUBLIC INFORMATION CENTRE

Municipal Class Environmental Assessment Study
Sawmill Creek Erosion Control Project
Folkway Drive to Erin Mills Parkway

WHAT?

The City of Mississauga has been undertaking a Schedule B Class Environmental Assessment (Class EA) Study for erosion control and restoration of Sawmill Creek from Folkway Drive to Erin Mills Parkway.



WHY?

The City considers this section of Sawmill Creek as a high priority site in need of rehabilitation due to the presence of erosion and risk to infrastructure.

HOW?

Over the last several months, the Study team has carried out various analyses to:

- Characterize the existing conditions of the site
- Complete assessments of the physical nature of the site, the hydrology, hydraulics and geomorphology of the channel, the ecological aspects, social elements and archaeological resources
- Development of alternative solutions to mitigate the impact of erosion and to provide enhancements

The Study findings and alternative solutions are being shared with the public through an Online PIC.

ONLINE PUBLIC INFORMATION CENTRE

Due to the COVID 19 pandemic, the Public Information Centre (PIC) will be held online at the following website:

mississauga.ca/sawmillcreek

The purpose of the PIC is to share information with interested community members, to inform and identify priorities and interests that should be considered in the project planning and execution. The Online PIC will:

- Share information of the existing conditions and site assessments
- Provide summaries of the impacts identified through the assessments
- Present the alternatives developed and their evaluation
- Identify next steps

GET INVOLVED!

Consultation is an important part of the Class EA process. Public input and comment are encouraged to incorporate into the planning and design of the project. The Online PIC and other project details can be found at the above website. If you have any questions or comments regarding the Study, wish to provide input on the proposed alternatives, or wish to be added or removed from the Study mailing list, please contact by April 22, 2021:

Anthony Di Giandomenico, P. Eng.
Project Manager
City of Mississauga
201 City Centre Dr. Suite 800
Mississauga, ON, L5B 2T4
(905) 615-3200 ext. 3491
Anthony.DiGiandomenico@mississauga.ca

Wolfgang Wolter
Consultant Project Manager
Ecosystem Recovery Inc.
80 Courtland Avenue E, Unit 2
Kitchener, ON, N2G 2T8
(519) 621-1500
Wolfgang.wolter@ecosystemrecovery.ca

COVID 19 Community Engagement Update: While we continue to respond to this pandemic, we are working hard to deliver essential services and projects to keep our City moving and safe. While we can't connect in person at this time, we still want to connect! Opportunities to connect with the Study Team and share your input are noted above.

All information will be collected in accordance with the *Freedom of Information and Protection of Privacy Act* (1990). With the exception of personal information, all comments will be included as public input in the Project File Report which will be placed on the public record.

City of Mississauga Sawmill Creek Folkway to Erin Mills, Class EA contact list

Organization	Position	Name	Email	Address	City	Province	Postal Code	Phone
Navigable Waters Protection Program, Transport Canada Marine Office	Regional Manager		NPPONT-PPNONT@tc.gc.ca	100 S Front Street, 1st Floor	Sarnia	ON	N7T 2M4	519-383-1863
Region of Peel	Commissioner of Public Works	Andrew Farr		10 Peel Centre Drive, Suite A and B	Brampton	ON	L6T 4B9	
Ministry of Aboriginal Affairs	Manager, Consultation Unit	Heather Levesque		160 Bloor Street East, 9th Floor	Toronto	ON	M7A 2E6	
Ontario Ministry of the Environment, Conservation and Parks	Environmental Resource Planner & EA Coordinator	Trevor Bell	trevor.bell@ontario.ca	8th, 135 St Clair Ave W	Toronto	ON	M4V 1P5	905-319-9902
MNRF Southern Region Aurora District	District Manager	Brad Allan	brad.allan@ontario.ca	50 Bloomington Road	Aurora	ON	L4G 0L8	905-713-7400
Mississaugas of the Credit First Nation	Department of Consultation and Accommodation	Chief R. Stacey LaForme		2789 Mississauga Rd., R.R.#6	Hagersville	ON	N0A 1H0	
Mississaugas of the Credit First Nation	Consultation Manager	Fawn Sault	fawn.sault@newcreditfirstnation.com	2789 Mississauga Road, RR#6	Hagersville	ON	N0A 1H0	905-768-4260
Fisheries and Oceans Canada	Fish and Fish Habitat Protection Program		FisheriesProtection@dfo-mpo.gc.ca	867 Lakeshore Road	Burlington	ON	L7S 1A1	1-855-852-8320
Credit Valley Conservation	Planning		planning@cvc.ca	1255 Old Derry Road	Mississauga	ON	L5N 6R4	905-670-1615
Credit River Metis Council	Interim President	Robert Bell		350 Rutherford Road South, Plaza II, Suite 305	Brampton	ON	L6W 4N6	
Toronto Indigenous Services Canada			aadnc.infopubs.aandc@canada.ca	655 Bay Street 3rd Floor	Toronto	ON	M5G 2K4	416-973-5282
Ministry of Heritage, Sport, Tourism and Culture Industries	Team Lead - Heritage	Karla Barboza	~~General_Info@mtc.gov.on.ca~~ karla.barboza@ontario.ca	401 Bay Street, Suite 1700	Toronto	ON	M7A 0A7	416-314-7120
Region of Peel	Manager of Infrastructure Programming and Studies			10 Peel Centre Drive, Suite B, 4th Floor	Brampton	ON	L6T 4B9	
Alectra Inc.	Manager, Capital Projects	Patrick Leung	patrick.leung@alectrautilities.com	2185 Derry Road West	Mississauga	ON	L5N 7A6	1-833-253-2872 ext. 24418
	Landowner	[redacted]	[redacted]					
	Landowner	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
Six Nations of the Grand River	Lands and Resources Director	Lonny Bomberry	lonnybomberry@sixnations.ca	2498 Chiefswood Road, P.O. Box 5000	Ohsweken	ON	N0A 1M0	519 753-0665
Haudenosaunee Development Institute			hdi2@bellnet.ca	16 Sunrise Court, Suite 600, P.O. Box 714	Ohsweken	ON	N0A 1M0	519-445-4222

Hand Delivered Notices

Road Name	Address Number
Folkway Drive	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 2676
Rolling Valley Drive	4107, 4111, 4115, 4119, 4123, 4127, 4131, 4135, 4139, 4143, 4147
Rainbow Crescent	2317, 2767, 2773, 2779, 2785, 2791, 2797, 2803, 2809, 2815, 2821, 2827, 2833, 2839, 2845, 2851, 2857, 2863, 2867, 2877, 2883, 2887, 2893, 2897, 2903, 2907, 2913, 2923, 2929
Arbour Green Drive	4086, 4092, 4098
Gazebo Court	2584, 2594, 2600, 2606, 2612
Treetop Crescent	4048, 4052, 4056, 4060, 4064, 4068, 4072, 4076, 4080, 4084, 4086, 4090, 4092, 4096, 4098, 4102, 4104, 4108, 4110, 4116, 4118, 4122, 4124, 4128, 4130, 4134, 4136
Erin Mills Parkway	4046

,

ecosystem recovery inc.
PROFESSIONAL ENGINEERS

Meeting Minutes

80 Courtland Avenue East, Unit 2, Kitchener, ON N2G 2B8
Tel 519.621.1500 ■ Fax 226.240.1080

Project: Sawmill Creek

Proj. No.: 2007

Meeting No.: 3

Meeting Date: November 4, 2020

Meeting Time: 1:00 pm

Note: If any of the contents of this meeting report differ in any respect from your own recollection of the points discussed or decisions reached, please notify us immediately. In the meantime, we will proceed in accordance with the understanding described herein.

Location: Sawmill Creek Study Area (Folkway Drive to Erin Mills Parkway)

Invited: Anthony DiGiandomenico (CoM), Jakub Kilis (CVC), Lori Cook (CVC), George Golding (CVC), Mariëtte Pushkar (ERI), Kierian Keele (ERI) Julia Howett (ERI)

Regrets: Wolfgang Wolter (ERI)

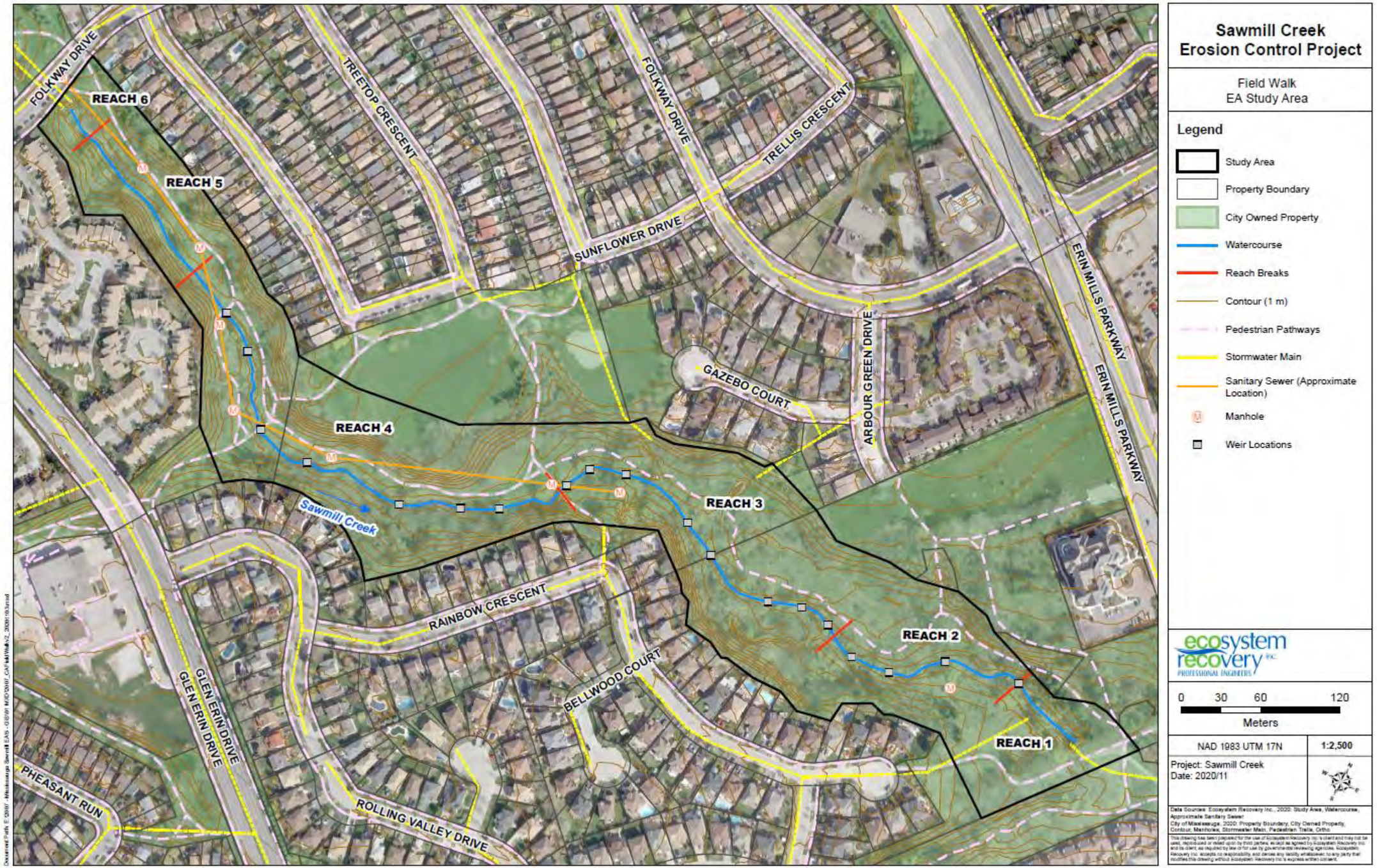
Purpose: Site Walk

Item	Description	Action By
1	**Site Walk & Discussion** • Goals of EA project primarily initiated due to erosion concerns and associated risks to pedestrian bridges, pedestrian pathways, and sanitary and stormwater systems. • Historical photos reveal change in landuse and channel condition/alignment; Sawmill Creek was straightened and engineered through the study area, with majority of works occurring between 1975 and 1977. • Entire drainage network upstream of Folkway Drive has been diverted into stormsewer network; study area is first open water section of channel. • Creek was delineated into six (6) reaches through study area • Ecological assessment findings identified that the habitat is not highly diverse, with many non-native species. SAR butternut were observed within the study area but are unlikely to impact design. A single minnow was observed in the furthest upstream reach during the aquatic habitat assessment. • Overall channel conditions within the study area: • Channel located in wide valley setting; channel confinement varies throughout study area. The channel is generally well connected to the adjacent floodplain in the upstream reaches (Reach 3-5). Downstream, in Reach 2, the channel is incised, generally bound by high, vertical eroded banks. • Trees and shrubs dominate the riparian vegetation surrounding Sawmill Creek. Trees are commonly situated on channel banks, some establishing within the channel cross-section. The accumulation of large woody debris within the channel was observed in the middle and downstream reaches of the channel (Reaches 2-4). Outflanking and bank erosion associated with such debris blockages was common. • Issues identified along Sawmill Creek are largely associated with channel profile grade control weirs and bank erosion control protection (gabions). Structures are not functioning as intended. • Erosion control works were completed in Reach 2 to protect a manhole in ~ 2010. • Nineteen (19) grade control weirs exist through the study area, comprised of gabion baskets (with the exception of one concrete weir). Deterioration and failure of the weir structures has occurred, along with channel bed and bank scour, and outflanking. • The existing HEC RAS model has been updated using topographic survey data; LIDAR data for the area was lacking in quality and was not appropriate for the study.	Info

	• Reaches 1 and 2 are generally considered to be confined from a flood conveyance perspective. • Three (3) pedestrian bridge crossings exist within the study area, including one low-lying crossing. The City has indicated the desire to remove the low-lying pedestrian bridge, which currently contributes to a backwatered state upstream (Reach 5). Erosional concerns were identified in association with the other two pedestrian bridges, which may be due to undersized bridge spans. Maintenance efforts to remediate erosion associated with the pedestrian bridges has occurred previously by the City (~5-6 years ago). Bridge design will likely require a larger bridge span to avoid current erosion issues.	

2.	**Preliminary Alternatives**
	• Alternatives identified need to consider the balance between addressing risks and issues identified, as well as maintaining natural assets (terrestrial features) within the study area. Impacts of the alternatives are to be developed in consideration of existing erosion and flooding conditions, as well as property (public and private), infrastructure, and public safety. Upstream and downstream of the study area do not provide natural fish habitat, and whether the proposed design should incorporate fish passage and habitat should be discussed further.
	• A visual overlay of opportunities and constraints on a reach by reach basis would be beneficial (e.g., high level mapping of terrestrial features or higher quality habitat that should be avoided; identify location of most concerning issues etc.).
	• The EA should consider a planning timeframe of 50 years.
	• The EA should include reference re-use of materials within the study area (e.g., rip-rap from the gabions be used as a base layer for substrate.
	• Do Nothing
	  • Considers the continued deterioration of existing erosion and grade controls through the study area, along with associated continuation of channel bed scour, bank scour, and outflanking of structures and debris blockages.
	  • Potential failure of existing pedestrian bridges due to continued erosion and scour of adjacent channel banks, and deterioration of weir structures beneath bridge crossings.
	• Spot Repairs
	  • Alternative would involve local channel works associated with identified issues, including the removal/replacement of grade control weirs, and removal or replacement of gabion bank protection, where deteriorated or failed
	• Channel Realignment
	  • Holistic channel realignment through the study area, incorporating natural channel design principles and re-establishment of meandering channel type and appropriate channel bed profile.
	• Reach-based Restoration
	  • Alternatives to be developed on a reach by reach basis through the study area, focussing on addressing the issues and concerns identified within the length of channel
		Info

3.	**Next Steps** • CVC to provide pedestrian bridge guidelines • ERI to contact Region regarding whether access to sanitary sewer crossings through the study area is desired and should be incorporated into detailed design • CVC has requested that ERI provide key ecological features mapping per reach to determine which nodes contain the high ecological diverse, or “higher quality” habitat. • ERI to provide mapping for preferred access points on all alternative designs. • CVC to provide preliminary input to alternatives • CVC to review draft of EA report • PIC planned for December – draft boards to be prepared and circulated to City	CVC ERI ERI ERI CVC CVC info


FOLKWAY DRIVE
TREETOP CRESCENT
FOLKWAY DRIVE
TRELLIS CRESCENT
SUNFLOWER DRIVE
ERIN MILLS PARKWAY
GAZEBO COURT
ARBOUR GREEN DRIVE
REACH 6
REACH 5
REACH 4
REACH 3
REACH 2
REACH 1
Sawmill Creek
RAINBOW CRESCENT
BELLWOOD COURT
GLEN ERIN DRIVE
GLEN ERIN DRIVE
PHEASANT RUN
ROLLING VALLEY DRIVE
Sawmill Creek Erosion Control Project
Field Walk
EA Study Area
Legend
Study Area
Property Boundary
City Owned Property
Watercourse
Reach Breaks
Contour (1 m)
Pedestrian Pathways
Stormwater Main
Sanitary Sewer (Approximate Location)
Manhole
Weir Locations
ecosystem recovery inc.
PROFESSIONAL ENGINEERS
0 30 60 120
Meters
NAD 1983 UTM 17N
1:2,500
Project: Sawmill Creek
Date: 2020/11
Data Sources: Ecosystem Recovery Inc., 2020: Study Area, Watercourse, Approximate Sanitary Sewer
City of Mississauga, 2020: Property Boundary, City Owned Property, Contour, Manholes, Stormwater Main, Pedestrian Trails, Ortho

Ministry of Heritage, Sport, Tourism and Culture Industries

Programs and Services Branch
401 Bay Street, Suite 1700
Toronto, ON M7A 0A7
Tel: 613.242.3743

Ministère des Industries du Patrimoine, du Sport, du Tourisme et de la Culture

Direction des programmes et des services
401, rue Bay, Bureau 1700
Toronto, ON M7A 0A7
Tél: 613.242.3743

Ontario

August 5, 2020 EMAIL ONLY

Wolfgang Wolter
Consultant Project Manager
Ecosystem Recovery Inc.
80 Courtland Avenue E, Unit 2
Kitchener, ON N2G 2T8
wolfgang.wolter@ecosystemrecovery.ca

MHSTCI File	**:**	**0011792**
Proponent	**:**	**City of Mississauga**
Subject	**:**	**Notice of Study Commencement**
Project	**:**	**Sawmill Creek Erosion Control Project**
Location	**:**	**City of Mississauga**

Dear Wolfgang Walter:

Thank you for providing the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) with the Notice of Study Commencement for the above-referenced project. MHSTCI's interest in this Environmental Assessment (EA) project relates to its mandate of conserving Ontario's cultural heritage, which includes:

- Archaeological resources, including land and marine;
- Built heritage resources, including bridges and monuments; and,
- Cultural heritage landscapes.

Under the EA process, the proponent is required to determine a project's potential impact on cultural heritage resources.

Project Summary
The City of Mississauga is undertaking a Schedule B Class Environmental Assessment (Class EA) Study for erosion control and restoration of Sawmill Creek from Folkway Drive to Erin Mills Parkway.

Identifying Cultural Heritage Resources
While some cultural heritage resources may have already been formally identified, others may be identified through screening and evaluation. Indigenous communities may have knowledge that can contribute to the identification of cultural heritage resources, and we suggest that any engagement with Indigenous communities includes a discussion about known or potential cultural heritage resources that are of value to these communities. Municipal Heritage Committees, historical societies and other local heritage organizations may also have knowledge that contributes to the identification of cultural heritage resources.

Archaeological Resources
This EA project may impact archaeological resources and should be screened using the MHSTCI *Criteria for Evaluating Archaeological Potential* to determine if an archaeological assessment is needed. MHSTCI archaeological sites data are available at *archaeology@ontario.ca*. If the EA project area exhibits archaeological potential, then an archaeological assessment (AA) should be undertaken by an archaeologist licenced under the *OHA*, who is responsible for submitting the report directly to MHSTCI for review.

Built Heritage and Cultural Heritage Landscapes
The MHSTCI *Criteria for Evaluating Potential for Built Heritage Resources and Cultural Heritage Landscapes* should be completed to help determine whether this EA project may impact cultural heritage resources. If potential or known heritage resources exist, MHSTCI recommends that a Heritage Impact Assessment (HIA), prepared by a qualified consultant, should be completed to assess potential project impacts. Our Ministry's *Info Sheet #5: Heritage Impact Assessments and Conservation Plans* outlines the scope of HIAs. Please send the HIA to MHSTCI for review and make it available to local organizations or individuals who have expressed interest in review.

Environmental Assessment Reporting
All technical cultural heritage studies and their recommendations are to be addressed and incorporated into EA projects. Please advise MHSTCI whether any technical cultural heritage studies will be completed for this EA project, and provide them to MHSTCI before issuing a Notice of Completion or commencing any work on the site. If screening has identified no known or potential cultural heritage resources, or no impacts to these resources, please include the completed checklists and supporting documentation in the EA report or file.

Thank you for consulting MHSTCI on this project and please continue to do so throughout the EA process. If you have any questions or require clarification, do not hesitate to contact me.

Sincerely,

Joseph Harvey
Heritage Planner
joseph.harvey@Ontario.ca

Copied to: Anthony Di Giandomenico, Project Manager, City of Mississauga
Alana Vandersluis, Water Resources Engineering Intern, Ecosystem Recovery Inc.

It is the sole responsibility of proponents to ensure that any information and documentation submitted as part of their EA report or file is accurate. MHSTCI makes no representation or warranty as to the completeness, accuracy or quality of the any checklists, reports or supporting documentation submitted as part of the EA process, and in no way shall MHSTCI be liable for any harm, damages, costs, expenses, losses, claims or actions that may result if any checklists, reports or supporting documents are discovered to be inaccurate, incomplete, misleading or fraudulent.

Please notify MHSTCI if archaeological resources are impacted by EA project work. All activities impacting archaeological resources must cease immediately, and a licensed archaeologist is required to carry out an archaeological assessment in accordance with the *Ontario Heritage Act* and the *Standards and Guidelines for Consultant Archaeologists*.

If human remains are encountered, all activities must cease immediately and the local police as well as the Registrar, Burials of the Ministry of Government and Consumer Services (416-326-8800) must be contacted. In situations where human remains are associated with archaeological resources, MHSTCI should also be notified to ensure that the site is not subject to unlicensed alterations which would be a contravention of the *Ontario Heritage Act*.

Ministry of the Environment, Conservation and Parks

Environmental Assessment Branch

1st Floor
135 St. Clair Avenue W
Toronto ON M4V 1P5
Tel.: 416 314-8001
Fax.: 416 314-8452

Ministère de l'Environnement, de la Protection de la nature et des Parcs

Direction des évaluations environnementales

Rez-de-chaussée
135, avenue St. Clair Ouest
Toronto ON M4V 1P5
Tél. : 416 314-8001
Téléc. : 416 314-8452

Ontario

August 24, 2020

Anthony Di Giandomenico, P.Eng.
Project Manager
City of Mississauga
anthony.digiandomenico@mississauga.ca
BY EMAIL ONLY

Re: **Sawmill Creek Erosion Control Project (Folkway Drive to Erin Mills Parkway)**
City of Mississauga
Schedule B Municipal Class Environmental Assessment
Notice of Study Commencement

Dear Mr. Di Giandomenico,

This letter is in response to the Notice of Commencement for the above noted project. The Ministry of the Environment, Conservation and Parks (MECP) acknowledges that the City of Mississauga has indicated that the study is following the approved environmental planning process for a Schedule B project under the Municipal Engineers Association's Municipal Class Environmental Assessment (Class EA).

The attached "Areas of Interest" document provides guidance regarding the ministry's interests with respect to the Class EA process. Please identify the areas of interest which are applicable to the project and ensure they are addressed. Proponents who address all the applicable areas of interest can minimize potential delays to the project schedule.

The Crown has a legal duty to consult Aboriginal communities when it has knowledge, real or constructive, of the existence or potential existence of an Aboriginal or treaty right and contemplates conduct that may adversely impact that right. Before authorizing this project, the Crown must ensure that its duty to consult has been fulfilled, where such a duty is triggered. Although the duty to consult with Aboriginal peoples is a duty of the Crown, the Crown may delegate procedural aspects of this duty to project proponents while retaining oversight of the consultation process.

The proposed project may have the potential to affect Aboriginal or treaty rights protected under Section 35 of Canada's *Constitution Act* 1982. Where the Crown's duty to consult is triggered in relation to the proposed project**, the MECP is delegating the procedural aspects of rights-based consultation to the proponent through this letter.** The Crown intends to rely on the delegated consultation process in discharging its duty to consult and maintains the right to participate in the consultation process as it sees fit.

Based on information provided to date and the Crown`s preliminary assessment the proponent is required to consult with the following communities who have been identified as potentially affected by the proposed project:

- Mississaugas of the Credit First Nation;
- Six Nations of the Grand River;
- Haudenosaunee Confederacy Chiefs Council; and
- Huron-Wendat Nation, if there are potential archeological impacts

Steps that the proponent may need to take in relation to Aboriginal consultation for the proposed project are outlined in the "Code of Practice for Consultation in Ontario's Environmental Assessment Process".

Additional information related to Ontario's *Environmental Assessment Act* is available online at: www.ontario.ca/environmentalassessments

Please also refer to the attached document "A Proponent's Introduction to the Delegation of Procedural Aspects of consultation with Aboriginal Communities" for further information.

The proponent must contact the Director of Environmental Assessment Branch under the following circumstances subsequent to initial discussions with the communities identified by MECP:

- Aboriginal or treaty rights impacts are identified to you by the communities;
- You have reason to believe that your proposed project may adversely affect an Aboriginal or treaty right;
- Consultation with Indigenous communities or other stakeholders has reached an impasse; or
- A Part II Order request is expected based on impacts to Aboriginal or treaty rights.

The MECP will then assess the extent of any Crown duty to consult for the circumstances and will consider whether additional steps should be taken, including what role you will be asked to play should additional steps and activities be required.

Once the Project File is finalized, the proponent must issue a Notice of Completion providing a minimum 30-day period during which documentation may be reviewed and comment and input can be submitted to the Proponent.

Please ensure that the Notice of Completion advises that outstanding concerns are to be directed to the proponent for a response, and that in the event there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, Part II Order requests on those matters should be addressed in writing to:

Minister Jeff Yurek
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto ON M7A 2J3
minister.mecp@ontario.ca

and

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks

135 St. Clair Ave. W, 1st Floor
Toronto ON, M4V 1P5
EABDirector@ontario.ca

Please note the project cannot proceed until at least 30 days after the end of the public review period provided for in the Notice of Completion.

Further, the project may not proceed after this time if:

- a Part II Order request has been submitted to the ministry regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights; or
- the Director has issued a Notice of Proposed order regarding the project.

The public can request a higher level of assessment on a project if they are concerned about potential adverse impacts to constitutionally protected Aboriginal and treaty rights. In addition, the Minister may issue an order on his or her own initiative within a specified time period. The Director will issue a Notice of Proposed Order to the proponent if the Minister is considering an order for the project within 30 days after the conclusion of the comment period on the Notice of Completion. At this time, the Director may request additional information from the proponent.

Once the requested information has been received, the Minister will have 30 days to make a decision or impose conditions on your project.

A draft copy of the report should be sent to me prior to the filing of the final report, allowing a minimum of 30 days for the ministry's technical reviewers to provide comments.

Please also ensure a copy of the final notice is sent to the ministry's Central Region EA notification email account (eanotification.cregion@ontario.ca) after the draft report is finalized.

Should you or your project team members have any questions regarding the material above, please contact me at trevor.bell@ontario.ca.

Sincerely,



Trevor Bell
Regional Environmental Assessment Coordinator

cc: Tina Dufresne, Manager, Halton Peel District Office, MECP
Agni Papageorgiou, Supervisor, Project Review Unit, MECP
Wolfgang Wolter, Consultant Project Manager, Ecosystem Recovery Inc.

Attachments: Areas of Interest
A Proponent's Introduction to the Delegation of Procedural Aspects of consultation with Aboriginal Communities

AREAS OF INTEREST

It is suggested that you check off each applicable area after you have considered / addressed it.

☐ **Species at Risk**

- The Ministry of the Environment, Conservation and Parks has now assumed responsibility of Ontario's Species at Risk program. For any questions related to subsequent permit requirements, please contact SAROntario@ontario.ca.

☐ **Planning and Policy**

- Ontario has released "A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2019)" which replaces the "Growth Plan for the Greater Golden Horseshoe (2017)". More information, including the Plan, is found here: https://www.placestogrow.ca.

- Parts of the study area may be subject to the A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2019), Oak Ridges Moraine Conservation Plan (2017), Niagara Escarpment Plan (2017), Greenbelt Plan (2017) or Lake Simcoe Protection Plan (2014). Applicable policies should be referenced in the report, and the proponent should describe how the proposed project adheres to the relevant policies in these plans.

- The Provincial Policy Statement (2020) contains policies that protect Ontario's natural heritage and water resources. Applicable policies should be referenced in the report, and the proponent should describe how the proposed project is consistent with these policies.

☐ **Source Water Protection (all projects)**

The *Clean Water Act*, 2006 (CWA) aims to protect existing and future sources of drinking water. To achieve this, several types of vulnerable areas have been delineated around surface water intakes and wellheads for every municipal residential drinking water system that is located in a source protection area. These vulnerable areas are known as a Wellhead Protection Areas (WHPAs) and surface water Intake Protection Zones (IPZs). Other vulnerable areas that have been delineated under the CWA include Highly Vulnerable Aquifers (HVAs), Significant Groundwater Recharge Areas (SGRAs), Event-based modelling areas (EBAs), and Issues Contributing Areas (ICAs). Source protection plans have been developed that include policies to address existing and future risks to sources of municipal drinking water within these vulnerable areas.

Projects that are subject to the Environmental Assessment Act that fall under a Class EA, or one of the Regulations, have the potential to impact sources of drinking water if they occur in designated vulnerable areas or in the vicinity of other at-risk drinking water systems (i.e. systems that are not municipal residential systems). MEA Class EA projects may include activities that, if located in a vulnerable area, could be a threat to sources of drinking water (i.e. have the potential to adversely affect the quality or quantity of drinking water sources) and the activity could therefore be subject to policies in a source protection plan. Where an activity poses a risk to drinking water, policies in the local source protection plan may impact how or where that activity is undertaken. Policies may prohibit certain activities, or they may require risk management measures for these activities. Municipal Official Plans, planning decisions, Class EA projects (where the project includes an activity that is a threat to drinking water) and prescribed instruments must conform with policies that address significant risks to drinking water and must have regard for policies that address moderate or low risks.

- In October 2015, the MEA Parent Class EA document was amended to include reference to the

Clean Water Act (Section A.2.10.6) and indicates that proponents undertaking a Municipal Class EA project must identify early in their process whether a project is or could potentially be occurring with a vulnerable area. **Given this requirement, please include a section in the report on source water protection.**

- The proponent should identify the source protection area and should clearly document how the proximity of the project to sources of drinking water (municipal or other) and any delineated vulnerable areas was considered and assessed. Specifically, the report should discuss whether or not the project is located in a vulnerable area and provide applicable details about the area.

- If located in a vulnerable area, proponents should document whether any project activities are prescribed drinking water threats and thus pose a risk to drinking water (this should be consulted on with the appropriate Source Protection Authority). Where an activity poses a risk to drinking water, the proponent must document and discuss in the report how the project adheres to or has regard to applicable policies in the local source protection plan. This section should then be used to inform and be reflected in other sections of the report, such as the identification of net positive/negative effects of alternatives, mitigation measures, evaluation of alternatives etc.

- While most source protection plans focused on including policies for significant drinking water threats in the WHPAs and IPZs it should be noted that even though source protection plan policies may not apply in HVAs, these are areas where aquifers are sensitive and at risk to impacts and within these areas, activities may impact the quality of sources of drinking water for systems other than municipal residential systems.

- In order to determine if this project is occurring within a vulnerable area, proponents can use this mapping tool: http://www.applications.ene.gov.on.ca/swp/en/index.php.The mapping tool will also provide a link to the appropriate source protection plan in order to identify what policies may be applicable in the vulnerable area.

- For further information on the maps or source protection plan policies which may relate to their project, proponents must contact the appropriate source protection authority. **Please consult with the local source protection authority to discuss potential impacts on drinking water. The contact for this project is Jennifer Stephens at (416) 661-6600 ext 5568 or jstephens@trca.on.ca. Please document the results of that consultation within the report and include all communication documents/correspondence.**

More Information

For more information on the *Clean Water Act*, source protection areas and plans, including specific information on the vulnerable areas and drinking water threats, please refer to Conservation Ontario's website where you will also find links to the local source protection plan/assessment report.

A list of the prescribed drinking water threats can be found in section 1.1 of Ontario Regulation 287/07 made under the *Clean Water Act*. In addition to prescribed drinking water threats, some source protection plans may include policies to address additional "local" threat activities, as approved by the MECP.

Climate Change

Ontario is leading the fight against climate change through the Climate Change Action Plan. Recently released, the plan lays out the specific actions Ontario will take in the next five years to meet its 2020 greenhouse gas reduction targets and establishes the framework necessary to meet its long-term

targets. As a commitment of the action plan, **the province has now finalized a guide, "Considering Climate Change in the Environmental Assessment Process" (Guide).**

The Guide is now a part of the Environmental Assessment program's Guides and Codes of Practice. The Guide sets out the MECP's expectation for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. The guide provides examples, approaches, resources, and references to assist proponents with consideration of climate change in EA. **Proponents should review this Guide in detail.**

- The MECP expects proponents to:

    1. Take into account during the assessment of alternative solutions and alternative designs, the following:
        a. the project's expected production of greenhouse gas emissions and impacts on carbon sinks (climate change mitigation); and
        b. resilience or vulnerability of the undertaking to changing climatic conditions (climate change adaptation).
    2. Include a discrete section in the report detailing how climate change was considered in the EA.

    How climate change is considered can be qualitative or quantitative in nature, and should be scaled to the project's level of environmental effect. In all instances, both a project's impacts on climate change (mitigation) and impacts of climate change on a project (adaptation) should be considered.

- The MECP has also prepared another guide to support provincial land use planning direction related to the completion of energy and emission plans. The "Community Emissions Reduction Planning: A Guide for Municipalities" document is designed to educate stakeholders on the municipal opportunities to reduce energy and greenhouse gas emissions, and to provide guidance on methods and techniques to incorporate consideration of energy and greenhouse gas emissions into municipal activities of all types. We encourage you to review the Guide for information.

Air Quality, Dust and Noise

- If there are sensitive receptors in the surrounding area of this project, an air quality/odour impact assessment will be useful to evaluate alternatives, determine impacts and identify appropriate mitigation measures. The scope of the assessment can be determined based on the potential effects of the proposed alternatives, and typically includes source and receptor characterization and a quantification of local air quality impacts on the sensitive receptors and the environment in the study area. The assessment will compare to all applicable standards or guidelines for all contaminants of concern. **Please contact this office for further consultation on the level of Air Quality Impact Assessment required for this project if not already advised.**

- **If a full Air Quality Impact Assessment is not required for the project, the report should still contain:**

    - A discussion of local air quality including existing activities/sources that significantly impact local air quality and how the project may impact existing conditions;
    - A discussion of the nearby sensitive receptors and the project's potential air quality impacts on present and future sensitive receptors;
    - A discussion of local air quality impacts that could arise from this project during both construction and operation; and

- A discussion of potential mitigation measures.

- As a common practice, “air quality” should be used an evaluation criterion for all road projects.

- Dust and noise control measures should be addressed and included in the construction plans to ensure that nearby residential and other sensitive land uses within the study area are not adversely affected during construction activities.

- The MECP recommends that non-chloride dust-suppressants be applied. For a comprehensive list of fugitive dust prevention and control measures that could be applied, refer to *Cheminfo Services Inc. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities*. report prepared for Environment Canada. March 2005.

- The report should consider the potential impacts of increased noise levels during the operation of the completed project. The proponent should explore all potential measures to mitigate significant noise impacts during the assessment of alternatives.

Ecosystem Protection and Restoration

- Any impacts to ecosystem form and function must be avoided where possible. The report should describe any proposed mitigation measures and how project planning will protect and enhance the local ecosystem.

- All natural heritage features should be identified and described in detail to assess potential impacts and to develop appropriate mitigation measures. The following sensitive environmental features may be located within or adjacent to the study area:

  - Areas of Natural and Scientific Interest (ANSIs)
  - Rare Species of flora or fauna
  - Watercourses
  - Wetlands
  - Woodlots

We recommend consulting with the Ministry of Natural Resources and Forestry (MNRF), Fisheries and Oceans Canada (DFO) and your local conservation authority to determine if special measures or additional studies will be necessary to preserve and protect these sensitive features. In addition, you may consider the provisions of the Rouge Park Management Plan if applicable.

Surface Water

- The report must include enough information to demonstrate that there will be no negative impacts on the natural features or ecological functions of any watercourses within the study area. Measures should be included in the planning and design process to ensure that any impacts to watercourses from construction or operational activities (e.g. spills, erosion, pollution) are mitigated as part of the proposed undertaking.

- Additional stormwater runoff from new pavement can impact receiving watercourses and flood conditions. Quality and quantity control measures to treat stormwater runoff should be considered for all new impervious areas and, where possible, existing surfaces. The ministry’s Stormwater Management Planning and Design Manual (2003) should be referenced in the report and utilized when designing stormwater control methods. **A Stormwater Management Plan should be prepared as part of the Class EA process** that includes:

  - Strategies to address potential water quantity and erosion impacts related to stormwater

draining into streams or other sensitive environmental features, and to ensure that adequate (enhanced) water quality is maintained
    - Watershed information, drainage conditions, and other relevant background information
    - Future drainage conditions, stormwater management options, information on erosion and sediment control during construction, and other details of the proposed works
    - Information on maintenance and monitoring commitments.

- Ontario Regulation 60/08 under the *Ontario Water Resources Act* (OWRA) applies to the Lake Simcoe Basin, which encompasses Lake Simcoe and the lands from which surface water drains into Lake Simcoe. If the proposed sewage treatment plant is listed in Table 1 of the regulation, the report should describe how the proposed project and its mitigation measures are consistent with the requirements of this regulation and the OWRA.

- Any potential approval requirements for surface water taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, except for certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information. Additionally, an Environmental Compliance Approval under the OWRA is required for municipal stormwater management works.

Groundwater

- The status of, and potential impacts to any well water supplies should be addressed. If the project involves groundwater takings or changes to drainage patterns, the quantity and quality of groundwater may be affected due to drawdown effects or the redirection of existing contamination flows. In addition, project activities may infringe on existing wells such that they must be reconstructed or sealed and abandoned. Appropriate information to define existing groundwater conditions should be included in the report.

- If the potential construction or decommissioning of water wells is identified as an issue, the report should refer to Ontario Regulation 903, Wells, under the OWRA.

- Potential impacts to groundwater-dependent natural features should be addressed. Any changes to groundwater flow or quality from groundwater taking may interfere with the ecological processes of streams, wetlands or other surficial features. In addition, discharging contaminated or high volumes of groundwater to these features may have direct impacts on their function. Any potential effects should be identified, and appropriate mitigation measures should be recommended. The level of detail required will be dependent on the significance of the potential impacts.

- Any potential approval requirements for groundwater taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, with the exception of certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information.

Contaminated Soils

- Since the removal or movement of soils may be required, appropriate tests to determine contaminant levels from previous land uses or dumping should be undertaken. If the soils are contaminated, you must determine how and where they are to be disposed of, consistent with

Part XV.1 of the Environmental Protection Act (EPA) and Ontario Regulation 153/04, Records of Site Condition, which details the new requirements related to site assessment and clean up. Please contact the appropriate MECP District Office for further consultation if contaminated sites are present.

- Any current or historical waste disposal sites should be identified in the report. The status of these sites should be determined to confirm whether approval pursuant to Section 46 of the EPA may be required for land uses on former disposal sites.

- The location of any underground storage tanks should be investigated in the report. Measures should be identified to ensure the integrity of these tanks and to ensure an appropriate response in the event of a spill. The ministry's Spills Action Centre must be contacted in such an event.

- The report should identify any underground transmission lines in the study area. The owners should be consulted to avoid impacts to this infrastructure, including potential spills.

Excess Materials Management

- Activities involving the management of excess soil should be completed in accordance with the MECP's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014).

- All waste generated during construction must be disposed of in accordance with ministry requirements

Servicing and Facilities

- Any facility that releases emissions to the atmosphere, discharges contaminants to ground or surface water, provides potable water supplies, or stores, transports or disposes of waste must have an Environmental Compliance Approval (ECA) before it can operate lawfully. Please consult with the Environmental Approvals Access and Service Integration Branch (EAASIB) to determine whether a new or amended ECA will be required for any proposed infrastructure.

- We recommend referring to the ministry's environmental land use planning guides to ensure that any potential land use conflicts are considered when planning for any infrastructure or facilities related to wastewater, pipelines, landfills or industrial uses.

Mitigation and Monitoring

- Contractors must be made aware of all environmental considerations so that all environmental standards and commitments for both construction and operation are met. Mitigation measures should be clearly referenced in the report and regularly monitored during the construction stage of the project. In addition, we encourage proponents to conduct post-construction monitoring to ensure all mitigation measures have been effective and are functioning properly.

- Design and construction reports and plans should be based on a best management approach that centres on the prevention of impacts, protection of the existing environment, and opportunities for rehabilitation and enhancement of any impacted areas.

- The proponent's construction and post-construction monitoring plans must be documented in the report, as outlined in Section A.2.5 and A.4.1 of the MEA Class EA parent document.

Consultation

- The report must demonstrate how the consultation provisions of the Class EA have been fulfilled, including documentation of all stakeholder consultation efforts undertaken during the planning process. This includes a discussion in the SR that identifies concerns that were raised and **describes how they have been addressed by the proponent** throughout the planning process. The Class EA also directs proponents to include copies of comments submitted on the project by interested stakeholders, and the proponent's responses to these comments.

Class EA Process

- The report should provide clear and complete documentation of the planning process in order to allow for transparency in decision-making.

- If this project is a Master Plan: there are several different approaches that can be used to conduct a Master Plan, examples of which are outlined in Appendix 4 of the Class EA. The Master Plan should clearly indicate the selected approach for conducting the plan, by identifying whether the levels of assessment, consultation and documentation are sufficient to fulfill the requirements for Schedule B or C projects. Please note that any Schedule B or C projects identified in the plan would be subject to Part II Order Requests under the *Environmental Assessment Act*, although the plan itself would not be.

- The report must demonstrate how the consultation provisions of the Class EA have been fulfilled, including documentation of all stakeholder consultation efforts undertaken during the planning process. This includes a discussion in the report that identifies concerns that were raised and **describes how they have been addressed by the proponent** throughout the planning process. The Class EA also directs proponents to include copies of comments submitted on the project by interested stakeholders, and the proponent's responses to these comments.

- The Class EA requires the consideration of the effects of each alternative on all aspects of the environment. The report should include a level of detail (e.g. hydrogeological investigations, terrestrial and aquatic assessments) such that all potential impacts can be identified, and appropriate mitigation measures can be developed. Any supporting studies conducted during the Class EA process should be referenced and included as part of the report.

- Please include in the report a list of all subsequent permits or approvals that may be required for the implementation of the preferred alternative, including but not limited to, MECP's PTTW, EASR Registrations and ECAs, conservation authority permits, species at risk permits, and approvals under the *Impact Assessment Act*, 2019.

- Ministry guidelines and other information related to the issues above are available at http://www.ontario.ca/environment-and-energy/environment-and-energy. We encourage you to review all the available guides and to reference any relevant information in the report.

Definitions

The following definitions are specific to this document and may not apply in other contexts:

Aboriginal communities – the First Nation or Métis communities identified by the Crown for the purpose of consultation.

Consultation – the Crown's legal obligation to consult when the Crown has knowledge of an established or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. This is the type of consultation required pursuant to s. 35 of the *Constitution Act, 1982*. Note that this definition does not include consultation with Aboriginal communities for other reasons, such as regulatory requirements.

Crown – the Ontario Crown, acting through a particular ministry or ministries.

Procedural aspects of consultation – those portions of consultation related to the process of consultation, such as notifying an Aboriginal community about a project, providing information about the potential impacts of a project, responding to concerns raised by an Aboriginal community and proposing changes to the project to avoid negative impacts.

Proponent – the person or entity that wants to undertake a project and requires an Ontario Crown decision or approval for the project.

I. Purpose

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that may adversely impact that right. In outlining a framework for the duty to consult, the Supreme Court of Canada has stated that the Crown may delegate procedural aspects of consultation to third parties. This document provides general information about the Ontario Crown's approach to delegation of the procedural aspects of consultation to proponents.

This document is not intended to instruct a proponent about an individual project, and it does not constitute legal advice.

II. Why is it Necessary to Consult with Aboriginal Communities?

The objective of the modern law of Aboriginal and treaty rights is the *reconciliation* of Aboriginal peoples and non-Aboriginal peoples and their respective rights, claims and interests. Consultation is an important component of the reconciliation process.

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. For example, the Crown's duty to consult is triggered when it considers issuing a permit, authorization or approval for a project which has the potential to adversely impact an Aboriginal right, such as the right to hunt, fish, or trap in a particular area.

The scope of consultation required in particular circumstances ranges across a spectrum depending on both the nature of the asserted or established right and the seriousness of the potential adverse impacts on that right.

Depending on the particular circumstances, the Crown may also need to take steps to accommodate the potentially impacted Aboriginal or treaty right. For example, the Crown may be required to avoid or minimize the potential adverse impacts of the project.

III. The Crown's Role and Responsibilities in the Delegated Consultation Process

The Crown has the responsibility for ensuring that the duty to consult, and accommodate where appropriate, is met. However, the Crown may delegate the procedural aspects of consultation to a proponent.

There are different ways in which the Crown may delegate the procedural aspects of consultation to a proponent, including through a letter, a memorandum of understanding, legislation, regulation, policy and codes of practice.

If the Crown decides to delegate procedural aspects of consultation, the Crown will generally:

- Ensure that the delegation of procedural aspects of consultation and the responsibilities of the proponent are clearly communicated to the proponent;
- Identify which Aboriginal communities must be consulted;
- Provide contact information for the Aboriginal communities;
- Revise, as necessary, the list of Aboriginal communities to be consulted as new information becomes available and is assessed by the Crown;
- Assess the scope of consultation owed to the Aboriginal communities;
- Maintain appropriate oversight of the actions taken by the proponent in fulfilling the procedural aspects of consultation;
- Assess the adequacy of consultation that is undertaken and any accommodation that may be required;
- Provide a contact within any responsible ministry in case issues arise that require direction from the Crown; and
- Participate in the consultation process as necessary and as determined by the Crown.

IV. The Proponent's Role and Responsibilities in the Delegated Consultation Process

Where aspects of the consultation process have been delegated to a proponent, the Crown, in meeting its duty to consult, will rely on the proponent's consultation activities and documentation of those activities. The consultation process informs the Crown's decision of whether or not to approve a proposed project or activity.

A proponent's role and responsibilities will vary depending on a variety of factors including the extent of consultation required in the circumstance and the procedural aspects of consultation the Crown has delegated to it. Proponents are often in a better position than the Crown to discuss a project and its potential impacts with Aboriginal communities and to determine ways to avoid or minimize the adverse impacts of a project.

A proponent can raise issues or questions with the Crown at any time during the consultation process. If issues or concerns arise during the consultation that cannot be addressed by the proponent, the proponent should contact the Crown.

a) What might a proponent be required to do in carrying out the procedural aspects of consultation?

Where the Crown delegates procedural aspects of consultation, it is often the proponent's responsibility to provide notice of the proposed project to the identified Aboriginal communities. The notice should indicate that the Crown has delegated the procedural aspects of consultation to the proponent and should include the following information:

- a description of the proposed project or activity;
- mapping;
- proposed timelines;
- details regarding anticipated environmental and other impacts;
- details regarding opportunities to comment; and
- any changes to the proposed project that have been made for seasonal conditions or other factors, where relevant.

Proponents should provide enough information and time to allow Aboriginal communities to provide meaningful feedback regarding the potential impacts of the project. Depending on the nature of consultation required for a project, a proponent also may be required to:

- provide the Crown with copies of any consultation plans prepared and an opportunity to review and comment;
- ensure that any necessary follow-up discussions with Aboriginal communities take place in a timely manner, including to confirm receipt of information, share and update information and to address questions or concerns that may arise;
- as appropriate, discuss with Aboriginal communities potential mitigation measures and/or changes to the project in response to concerns raised by Aboriginal communities;
- use language that is accessible and not overly technical, and translate material into Aboriginal languages where requested or appropriate;
- bear the reasonable costs associated with the consultation process such as, but not limited to, meeting hall rental, meal costs, document translation(s), or to address technical & capacity issues;
- provide the Crown with all the details about potential impacts on established or asserted Aboriginal or treaty rights, how these concerns have been considered and addressed by the proponent and the Aboriginal communities and any steps taken to mitigate the potential impacts;
- provide the Crown with complete and accurate documentation from these meetings and communications; and
- notify the Crown immediately if an Aboriginal community not identified by the Crown approaches the proponent seeking consultation opportunities.

b) What documentation and reporting does the Crown need from the proponent?

Proponents should keep records of all communications with the Aboriginal communities involved in the consultation process and any information provided to these Aboriginal communities.

As the Crown is required to assess the adequacy of consultation, it needs documentation to satisfy itself that the proponent has fulfilled the procedural aspects of consultation delegated to it. The documentation required would typically include:

- the date of meetings, the agendas, any materials distributed, those in attendance and copies of any minutes prepared;
- the description of the proposed project that was shared at the meeting;
- any and all concerns or other feedback provided by the communities;

- any information that was shared by a community in relation to its asserted or established Aboriginal or treaty rights and any potential adverse impacts of the proposed activity, approval or disposition on such rights;
- any proposed project changes or mitigation measures that were discussed, and feedback from Aboriginal communities about the proposed changes and measures;
- any commitments made by the proponent in response to any concerns raised, and feedback from Aboriginal communities on those commitments;
- copies of correspondence to or from Aboriginal communities, and any materials distributed electronically or by mail;
- information regarding any financial assistance provided by the proponent to enable participation by Aboriginal communities in the consultation;
- periodic consultation progress reports or copies of meeting notes if requested by the Crown;
- a summary of how the delegated aspects of consultation were carried out and the results; and
- a summary of issues raised by the Aboriginal communities, how the issues were addressed and any outstanding issues.

In certain circumstances, the Crown may share and discuss the proponent's consultation record with an Aboriginal community to ensure that it is an accurate reflection of the consultation process.

c) Will the Crown require a proponent to provide information about its commercial arrangements with Aboriginal communities?

The Crown may require a proponent to share information about aspects of commercial arrangements between the proponent and Aboriginal communities where the arrangements:

- include elements that are directed at mitigating or otherwise addressing impacts of the project;
- include securing an Aboriginal community's support for the project; or
- may potentially affect the obligations of the Crown to the Aboriginal communities.

The proponent should make every reasonable effort to exempt the Crown from confidentiality provisions in commercial arrangements with Aboriginal communities to the extent necessary to allow this information to be shared with the Crown.

The Crown cannot guarantee that information shared with the Crown will remain confidential. Confidential commercial information should not be provided to the Crown as part of the consultation record if it is not relevant to the duty to consult or otherwise required to be submitted to the Crown as part of the regulatory process.

V. What are the Roles and Responsibilities of Aboriginal Communities' in the Consultation Process?

Like the Crown, Aboriginal communities are expected to engage in consultation in good faith. This includes:

- responding to the consultation notice;
- engaging in the proposed consultation process;
- providing relevant documentation;
- clearly articulating the potential impacts of the proposed project on Aboriginal or treaty rights; and
- discussing ways to mitigates any adverse impacts.

Some Aboriginal communities have developed tools, such as consultation protocols, policies or processes that provide guidance on how they would prefer to be consulted. Although not legally binding, proponents are encouraged to respect these community processes where it is reasonable to do so. Please note that there is no obligation for a proponent to pay a fee to an Aboriginal community in order to enter into a consultation process.

To ensure that the Crown is aware of existing community consultation protocols, proponents should contact the relevant Crown ministry when presented with a consultation protocol by an Aboriginal community or anyone purporting to be a representative of an Aboriginal community.

VI. What if More Than One Provincial Crown Ministry is Involved in Approving a Proponent's Project?

Depending on the project and the required permits or approvals, one or more ministries may delegate procedural aspects of the Crown's duty to consult to the proponent. The proponent may contact individual ministries for guidance related to the delegation of procedural aspects of consultation for ministry-specific permits/approvals required for the project in question. Proponents are encouraged to seek input from all involved Crown ministries sooner rather than later.

MISSISSAUGAS OF THE CREDIT FIRST NATION™

DEPARTMENT OF
CONSULTATION AND ACCOMMODATION

September 14, 2020

Dear Sir/Madam,

I am writing on behalf of the Department of Consultation and Accommodation [DOCA], requesting information on a project within the Mississaugas of the Credit First Nation's [MCFN] treaty territory.

MCFN are an Aboriginal people within the meaning of section 35 of the *Constitution Act, 29182*. We have signed numerous treaties with the Crown, reaffirming our rights as the original owners of the lands in our territory and establishing Treaty rights over the same. Furthermore, we have un-surrendered Aboriginal title to the waters, beds of water, and foreshore within our territory. Our constitutionally protected rights give rise to specific legal obligations and duties which supersede policies and guidelines.

We are an Indigenous community as understood by the United Nations and our rights include those referenced in the United Nations Declaration on the Rights of Indigenous Peoples ("UNDRIP"). Article 11 of UNDRIP states that Indigenous peoples have "the right to maintain, protect and develop the past, present and future manifestations of their cultures, such as archaeological and historical sites, artefacts…" In May, 2016, the Federal Government committed to adopting and implementing UNDRIP; therefore, the rights of Indigenous peoples outlined in it deserve renewed consideration and respect.

These lands have been the territory and home of MCFN and our ancestors for many generations. As such, there is significant potential for archaeological and other cultural resources of our people to be located during the archaeological fieldwork required for projects or development. Such resources are of critical importance to MCFN given the increasing urbanization and development of our territory that effectively whitewashes our past. Without our active participation and monitoring during archaeological fieldwork, our history stands to be lost forever. As the original stewards of these lands – and continuing owners of the waters – we have ongoing obligations to ensure the protection of our cultural and natural resources for future generations. This is our responsibility and our right.

DEPARTMENT OF CONSULTATION AND ACCOMMODATION
Mississaugas of the Credit First Nation
4065 Hwy #6, Hagersville, Ontario N0A 1H0
Phone: (905) 768-4260

DOCA has been notified that in a project information file was submitted to the Ministry of Heritage, Sport, Tourism, and Culture Industries for the following project:

PIF ID	111252
Project Name	Ecosystems Sawmill Creek Stage 1 2020-060
Proponent Identified	Ecosystem Recovery Inc
Municipal Address	n/a
Stage of Assessment	Stage 1
Licensee Name and Number	Sherri Pearce (P316)

Please provide a summary of the history of this project and the current state of its associated environmental and archaeological fieldwork. If it is complete, please provide a summary of the preliminary results, followed by the draft report when available. If it is not yet complete, please provide the anticipated start date of fieldwork.

Please be aware that the development may have impacts on MCFN's treaty and aboriginal rights and MCFN has not been properly consulted on this project. Until a reasonable understanding has been reached between MCFN and the proponent regarding the project and our participation in it to ensure that the fieldwork is conducted in a respectful manner that protects our rights, we are of the opinion that any duty to consult over the project has not been met and all subsequent approvals relating to the project are subject to challenge on this basis.

Finally, we would like to take this opportunity to remind you that MCFN has its own *Standards and Guidelines for Archaeology*, which we expect that will be followed in our Territory. Additionally, DOCA requires that our Field Liaison Representatives participate in all environmental and archaeological fieldwork within the MCFN treaty territory, including Stages 2 through 4. **It is our expectation that no fieldwork will take place without the participation of our FLRs.** MCFN has an Aboriginal and Treaty Right to protect the environmental and our archaeological heritage and our FLRs are our boots on the ground to ensure our interests are protected. MCFN considers it disrespectful to our rights as Indigenous peoples if our natural and cultural heritage is interfered with without our involvement.

It is my hope that in light of the above considerations and with a renewed focus on reconciliation, we can navigate through these issues towards a relationship of respect, partnership, and mutual benefit. **Please provide the requested information by 4pm on October 9, 2020.**

DEPARTMENT OF CONSULTATION AND ACCOMMODATION
Mississaugas of the Credit First Nation
4065 Hwy #6, Hagersville, Ontario N0A 1H0
Phone: (905) 768-4260

Thank you.



Megan DeVries,
Archaeological Operations Supervisor

CC Mark LaForme, MCFN-DOCA (mark.laforme@mncfn.ca)
Ministry of Heritage, Sport, Tourism, and Culture Industries
(archaeology@ontario.ca)

DEPARTMENT OF CONSULTATION AND ACCOMMODATION
Mississaugas of the Credit First Nation
4065 Hwy #6, Hagersville, Ontario N0A 1H0
Phone: (905) 768-4260

City of Mississauga
Municipal Class Environmental Assessment Sawmill Creek Erosion Control Project
Folkway Drive to Erin Mills Parkway
Online Public Information Centre – Comment Form
MARCH 25, 2021

WE WOULD LIKE TO HEAR FROM YOU!

We are interested in hearing any comments or concerns that you may have about this study. Comments and information regarding the study are being collected to assist the City of Mississauga in meeting the requirements of the Environmental Assessment Act. This material will be maintained on file for use during the project and may be included in project documentation. Except for personal information, all comments will become part of the public record.

Comments:

I'm very pleased to see that this work is underway. I have lived in the neighbourhood for almost 40 years and there has been noticable erosion and widening of the creek over the years.

My main concern is to my property as my backyard is at significant risk due to the erosion that's been happening. The creek is getting closer each year and the eroding hill behind our homes has me concerned. I would like to see a full retaining wall built in behind my property (and neighbouring properties) to prevent further erosion and further collapsing of trees.

I'm open to other options but I would like assurance that my property will not be affected by the erosion in future years. I've seen other parts of the creek (east of Erin Mills Pkwy) have had retaining walls put it and am hoping the same can be done here. Alternatives 3 or 4 look like they might address this issue?
Thank you for the opportuntiy to comment and for proactively addressing this issue.

Thank you for your participation. Please submit your comments by APRIL 22, 2021.

Please insert your name and address below and mail or email your completed Comment Form to either contact below.

Anthony Di Giandomenico, P.Eng.
Project Manager
City of Mississauga
201 City Centre Drive, Suite 800
Mississauga, Ontario, L5B 2T8
Phone: 905-615-3200 ext. 3491
Email: anthony.digiandomenico@mississauga.ca

Wolfgang Wolter
Senior Project Manager
Ecosystem Recovery Inc.
80 Courtland Avenue East, Unit 2
Kitchener, Ontario, N2G 2T8
Phone: 519-621-1500
Email: wolfgang.wolter@ecosystemrecovery.ca

Name: [redacted]

Address & Postal Code: [redacted]

E-mail Address: [redacted]

Would you like to be added to the project mailing list? ☑ Yes ☐ No

DISCLAIMER: All information will be collected in accordance with the Freedom of Information and Protection of Privacy Act (1990). With the exception of personal information, all comments will be included as public input in the Project File Report which will be placed on the public record.

From: [redacted]
Sent: 2021/03/31 9:40 AM
To: Anthony DiGiandomenico <Anthony.DiGiandomenico@mississauga.ca>
Subject: Re: Sawmill Valley

Correction:
Folkway-Sawmill Valley to UTM-Burnhamthorpe Trail-Folkway should be Folkway-Sawmill Valley to UTM-Glen Erin Trail-Folkway

From: [redacted]
Sent: Tuesday, March 30, 2021 8:23 PM
To: anthony.digiandomenico@mississauga.ca
Subject: Sawmill Valley

Hi!
I read through the public information on the EA for Sawmill Valley.

I am a cyclist but come November I put the bike away and exercise at the gym weekdays. This past year the gym was closed and I had no wish to buy equipment so I turned to the trails through Mississauga. The long walk was Folkway-Sawmill Valley to UTM-Burnhamthorpe Trail-Folkway; the short walk cut out the loop from Erin Mills to Fifth Line but still used Sawmill Valley.
Thus I claim familiarity with Sawmill Valley trail as I was walking most if not all days of the week.

The city has done a grand job exploiting the natural watercourses feeding Sawmill Valley (Creek?). The surface water drainage paths feeding Sawmill Valley from sub-divisions and roads are
fascinating and the associated trail systems make these waterways more valuable. Indeed the pandemic has proven their worth so I would not wish to see the "do nothing" scenario pursued.

I have formed an impression that a) some residential properties have been built too close to the valley so much so that some are in danger of losing the fence at the bottom of the backyard, indeed
some have already done so and b)too many trees have fallen with potential to block the water flow and c)noxious plants are present.

I would expect the city to undertake a program to plant suitable indigenous species entirely suited to the environment to stabilize the walls of the valley to reduce the rate of backyard and backyard fence loss.
I would hope the city would undertake to eliminate the noxious plant species even those which are indigenous.
Necessarily I would wish to see improvements in the watercourse to ensure that the pedestrian bridges continue to provide safe passage. Incidentally there are two bridges over feeder streams that appear
in good condition yet seem omitted from the catalogue of infrastructure.

I would like to see many of the fallen trees and much brush eliminated but, in a manner that stabilizes the terrain. My impression throughout the length of the trail is that the trees are stressed and a complete
reforestation is desperately needed.
I was disappointed to learn that sewers pass below the stream although I acknowledge that I have seen many manholes along the stream. No doubt it is too late to change any of that infrastructure.

Based on these comments I conclude that I seek option 3 “Full Restoration”.

Regards

[redacted]

PS
I found no link to complete an official comment form

[redacted]

From: [redacted]
Sent: Monday, April 19, 2021 5:55 PM
To: Anthony DiGiandomenico
Subject: Sawmill valley environmental study.

So glad you are doing this study and hopefully restoration. Very concerned by deterioration of trees and vegetation. We have seen fewer birds this spring and have noticed a large area covered with invasive Boston ivy.

City of Mississauga
Municipal Class Environmental Assessment Sawmill Creek Erosion Control Project
Folkway Drive to Erin Mills Parkway
Online Public Information Centre – Comment Form
MARCH 25, 2021

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Comments:

Hello
We are pleased that there will be remediation work on the Sawmill Valley Trail and have the following comments.

1. scope of work - is the assessment inclusive of upstream and downstream impacts of remediation of the creek. did not see a relationship to the broader watershed scheme or I may have missed it.

will the general forest canopy health be addressed as part of the remediation focused on erosion. it would seem to be prudent to include forest health as it appears to be in decline and significantly impacted by aging trees, invasive species, human use and insects and disease.

Maintenace
the frequency of creek inspection and remediation on an operational annual basis will need to be accommodated going forward to minimize damage and extensive capital investments.

Funding will be a source of multiple issues and expect that there will be a lot of push back from political and residential forces unless this can be seen as further protection and safe guarding of health and well being for residents.

thanks for the opportunity to comment.

[redacted]

Thank you for your participation. Please submit your comments by APRIL 22, 2021.

Please insert your name and address below and mail or email your completed Comment Form to either contact below.

Anthony Di Giandomenico, P.Eng.
Project Manager
City of Mississauga
201 City Centre Drive, Suite 800
Mississauga, Ontario, L5B 2T8
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Senior Project Manager
Ecosystem Recovery Inc.
80 Courtland Avenue East, Unit 2
Kitchener, Ontario, N2G 2T8
Phone: 519-621-1500
Email: wolfgang.wolter@ecosystemrecovery.ca

Name: [redacted]

Address & Postal Code: [redacted]

E-mail Address: [redacted]

Would you like to be added to the project mailing list? ☑ Yes ☐ No

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[redacted]

From: [redacted]
Sent: Friday, April 2, 2021 1:28 PM
To: Anthony DiGiandomenico
Subject: Sawmill creek

I would like to see the full restoration to the Sawmill creek between Folkway Dr and Erin Mills Pkwy. I live in this area and use the walkway beside the creek almost daily. I understand the disruptions that will occur but it is necessary and needed.

Regards

[redacted]

City of Mississauga
Municipal Class Environmental Assessment Sawmill Creek Erosion Control Project
Folkway Drive to Erin Mills Parkway
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Comments:

We have lived on Treetop Cres for over 25 years and have noticed the erosion and deterioration over the last couple of years.
Something needs to be done, the last option with 'moderate' cost seems interesting.

Thank you for your participation. Please submit your comments by APRIL 22, 2021.

Please insert your name and address below and mail or email your completed Comment Form to either contact below.

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Phone: 519-621-1500
Email: wolfgang.wolter@ecosystemrecovery.ca

Name: [redacted]

Address & Postal Code: [redacted]

E-mail Address: [redacted]

Would you like to be added to the project mailing list? ☑ Yes ☐ No

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[redacted]

From: [redacted]
Sent: Monday, March 29, 2021 10:34 AM
To: Anthony DiGiandomenico; Wolfgang Wolter
Subject: Sawmill Creek Erosion Control Project

Please add me to the Study mailing list for the above-noted project. I am a resident in this area and would like to be kept up to date on progress.

Thank you

[redacted]

City of Mississauga
Municipal Class Environmental Assessment Sawmill Creek Erosion Control Project
Folkway Drive to Erin Mills Parkway
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WE WOULD LIKE TO HEAR FROM YOU!

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Comments:

My name is [redacted] and i live by Sawmill Creek for the last 16 years.
I have revieved the proposed restoration plans for the Sawmill Creek erosion project and from the presented alternatives, option # 2 (spot repairs) is the only restoration plan that I can support in good faith. I support it because, of all the proposed plans, it will cause the least disturbance to the current natural beauty that spans the length of the creek. It is also the only alternative that protects the existing infrastructural investment such as bridges and pathways from a wasteful and wanton destruction.
Additionally, I think that proposed alternative number # 3 (Full restoration) and alternative #4 (reach based restoration) pose a great risk for significant and irreperable damage to the natural habitat of many local plant and animal species. These alternatives will cause major disturbances/total destruction of the surrounding environment through the removal and replacement of vegetation that will take years, if not decades, to return to its current level. It is also clear that # 3 and #4 would take a significant amount of time and would cause a major disruption to those who use the path along the creek for recreation.

Thank you for your participation. Please submit your comments by APRIL 22, 2021.

Please insert your name and address below and mail or email your completed Comment Form to either contact below.

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Name: [redacted]

Address & Postal Code: [redacted]

E-mail Address: [redacted]

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