EAST MORRISON CREEK EROSION MITIGATION
ENVIRONMENTAL ASSESSMENT
ENVIRONMENTAL STUDY REPORT

Prepared for: **TOWN OF OAKVILLE**

Prepared by: **MONTROSE ENVIRONMENTAL SOLUTIONS CANADA INC.**

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Oakville, Ontario

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Prepared for the Town of Oakville, March 2026

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EXECUTIVE SUMMARY

Introduction and Study Objectives

The study area of East Morrison Creek from Postridge Drive to the Morrison-Wedgewood Diversion Channel was previously identified as a high-priority "long" reach area of concern in the *Town of Oakville 2021 Creek Inventory and Assessment* (Aquafor Beech 2022). Key concerns include bank erosion within the creek, bank, and valley slope stability, failure of erosion control measures, and threats to private property and municipal infrastructure. To address the identified erosion risks within the study area, the Town of Oakville (the Town) is undertaking a Schedule B Municipal Class Environmental Assessment (EA).

The purpose of the study is to develop, evaluate, and recommend preferred alternative solutions for erosion control within Reaches 39 to 45 of East Morrison Creek. Secondary goals include: 1) enhancing local aquatic and riparian ecosystems using natural channel design principles and 'green solutions' where erosion remediation works are required and 2) ensuring the project addresses social and stakeholder interests including feedback from Indigenous stakeholders, residents, and park users. To achieve these goals, the following project objectives were developed, which fulfill the EA process:

1. **Existing Conditions and Risk Assessment:** Undertake the analyses required to assess and characterize past and existing conditions for stream morphology, hydrology and hydraulics, aquatic habitat, terrestrial habitat, and Town and Halton Region infrastructure along East Morrison Creek.
2. **Evaluate Alternatives to Meet Project Goals:** Identify and evaluate rehabilitation alternatives that will contribute to the long-term protection of infrastructure and private property while minimizing the effects on the riparian ecosystem and improving aquatic habitat.
3. **Select Preferred Solutions through Municipal Class EA and Consultation Processes:** Select preferred solution(s) following an evaluation of environmental, social, and economic factors that will protect Town and regional infrastructure and utilize 'green solutions,' which emphasize the use of natural materials and natural channel design approaches in combination with engineering techniques to encourage environmentally sustainable solutions, to the degree possible.

Municipal Class EA Process Introduction

The objectives outlined above represent Phases 1 and 2 of the Municipal Class EA process (Ontario Municipal Engineers Association; June 2000, as amended in 2007, 2011, 2015, and 2023), which applies to Schedule B municipal infrastructure improvements, including roads, water, wastewater, and stormwater projects, with the potential for some adverse environmental impacts. The East Morrison Creek EA study proposes works to be undertaken in a watercourse for the purposes of erosion control, which may include bank or slope regrading; relocation, realignment, or channelization of a watercourse; and/or installation of a revetment including soil bioengineering techniques.

Additional optional elements under the EA process—including preliminary design concepts of the preferred alternative solutions (Phase 3) and consultation on the Environmental Study Report (Phase 4)—were included in this study for due diligence, which the Town commonly practices for such projects.

Upon completion of the EA study, and following the 30-day public review period on the Environmental Registry of Ontario (ERO) managed by the Ministry of Environment, Conservation and Parks (MECP), the Town may proceed with implementation of the recommended EA projects, typically within 5 years of study completion, or within 10 years if an EA addendum is issued with an updated site assessment.

Phase 1 – Problems and Opportunities

East Morrison Creek through the study area is considered to be under stress from hydromodification within the urbanized watershed (i.e., hydromodification = increased stormwater runoff to streams), causing excessive erosion through fluvial processes of widening and degradation within the soft shale bedrock and weathered alluvium (i.e., alluvium = loose soil materials within the valley bottom). Historical erosion control measures, such as gabion baskets, have become degraded and dysfunctional, potentially increasing the risks of erosion to adjacent property and infrastructure. The 2021 Town-wide erosion inventory identified 23 erosion sites, including 2 stormwater outfalls, a CSP culvert at a trail and sanitary sewer crossing, 5 pedestrian bridges, 6 trail encroachments, and a range of valley slope related risks to upland properties, some of which also include risks to trails. These sites were reassessed as part of this EA study and one additional site was identified (i.e., ES-24, upstream of ES-4) involving another valley slope related risk to upland private properties.

A risk assessment methodology was applied which provided a relative score (out of 100) using practical field criteria to evaluate the probability and consequences of the erosion hazard at each site. A risk score threshold of 50 out of 100 from the field assessment was used to identify higher risk sites for consideration of mitigation solutions through the EA study. The degree of risk at many identified sites was considered to be relatively low in the short to intermediate term (i.e., risk score <50), and as such direct interventions immediately following the EA were not deemed necessary. The EA alternative solutions and design requirements were adapted to address several specific problem sites (i.e., higher risk score >50), mostly at the downstream end of the study area, rather than the reach long solution that was initially proposed through the previous study in 2021. As such, 12 of the highest priority erosion sites were identified for inclusion in the EA evaluation.

Phase 2 – Identification and Evaluation of Alternative Solutions

The following five alternative solutions were developed for erosion mitigation within the East Morrison Creek study area.

- **Alternative 1 – Do Nothing:** Do nothing must be considered as part of Municipal Class EA process. Regular monitoring may be recommended where, for example, other alternatives have extensive environmental impacts and/or are not economically feasible.
- **Alternative 2 – Continuous Monitoring:** Detailed study of erosion site for up to 5 years including annual topographic surveys for accurate measurement of erosion rates. In cases where detailed studies identify higher risk sites, an addendum to the EA study may be submitted within 5 years of the initial EA report to allow for additional mitigation works (i.e., Alternative 2 sites may be subsequently "bumped up" to Alternative 3 or 4).

- **Alternative 3 – Selective Works:** Localized channel bed and/or bank work to address erosion issues at the site, with emphasis on "green solutions" where feasible (see section below). Importance is placed on minimizing the impacts (spatial and temporal) of the selected alternatives on the natural environment. Bank protection examples range from "hard" approaches such as armourstone and boulder revetments to "soft" approaches such as bank regrading and bioengineering. A distinct intermediate approach for shale bedrock channels in the Town is the use of "flagstone" buttresses which are a "green solution" that utilize vegetation and platy limestone similar to natural materials.
- **Alternative 4 – Reach-Scale Channel Engineering:** Channel realignment or design over longer lengths of the creek using a balance of "hard" erosion control and "soft" restoration approaches, with emphasis on "green solutions" where feasible (see section below). Depending on constraints and risks, this alternative may vary with the degree of channel hardening to control erosion:
    - **Stable Channel Engineering** – This alternative option primarily applies "hard" channel engineering approaches for erosion control (e.g., armourstone, riprap, boulder, rock buttresses), but may incorporate some environmentally sensitive materials and geomorphically referenced features in the channel (e.g., riffles).
    - **Natural Channel Design (NCD)** – This alternative option consists of constructing a new channel that is intended to mimic natural channel features—such as riffles and pools—typically using stone materials similar to native alluvium (e.g., typically rounded, or platy in limestone bedrock systems), but still with a high priority for channel stabilization combining both "hard" and "soft" approaches.
- **Alternative 5 – Removal of Risk:** Removal of infrastructure or property from erosion hazard zone, which may include easements and/or land acquisitions.

Alternative Evaluation Criteria

Criteria were developed to evaluate the alternative solutions based on the following categories: physical and natural environment, technical and engineering, social and cultural environment, and economic criteria (**Table A**).

TABLE A Summary of Evaluation Criteria

Criteria	Description
Physical / Natural Environment Criteria (25%)	
Management of Existing Erosion Risks	Effectiveness of the alternative to manage or mitigate erosion risks, both existing and ongoing, relative to the level of urgency.
Impacts to Aquatic and/or Terrestrial Habitat	Potential to provide greater improvements to aquatic and terrestrial species and habitat, while also considering potential construction impacts relative to existing condition.
Climate Change Adaptation/Resiliency	Relative potential to provide additional hydrological and ecological resiliency, through physical, hydrological, and ecological redundancy for buffering extreme events and seasonal climate shifts. Ability to improve geomorphic stability and natural components of watercourse function.

Criteria	Description
Technical and Engineering Criteria (25%)	
Technical Feasibility	Constructability and construction access. Ability to limit impacts to existing infrastructure (e.g., sewers, watermains, gas, roads), including the feasibility of not intervening.
Approvability	Acceptability of agencies, community members and stakeholders. More easily approved with less project complexity, considering permitting/coordination requirements with community members and stakeholders, etc.
Green Solutions	Potential to employ green solutions, such as bioengineering, plantings, natural channel and other "soft" erosion mitigation approaches.
Social / Cultural Environment Criteria (25%)	
Community Disruption and Recreational Impacts	Compatibility of proposed works with adjacent properties (i.e., removal or addition of features which reduces utility for neighbouring lands scores lower). Less or limited disruption to surrounding community and residents (e.g., access and use of park/trails).
Landowner and Public Acceptance	Ability to be accepted by landowners and community including First Nations and Indigenous consultation. This includes acceptance of impacts to trees.
Archaeological Impacts	Ability to protect built heritage resources, cultural heritage landscapes, and archaeological resources.
Economic Criteria (25%)	
Construction and Capital Costs	Relative measure of initial costs to install/construct the proposed works.
Maintenance Costs	Relative measure of the ongoing maintenance costs in the creek.
Life Cycle Costs	Relative measure of the lifespan of erosion mitigation works or existing assets.

Climate Change and Green Solutions

Climate change adaptation/resiliency and the use of "green solutions" were also considered and integrated into the relevant criteria under the evaluation categories. Climate change and green solutions were integrated into the physical/natural environment and technical/engineering categories, respectively. The climate change criteria was included in the physical/natural environment category as it focuses on the ability to adapt to, and be resilient to a changed hydrological flow regime and accompanied geomorphic response due to climate change. The green solutions criteria focuses on the potential to employ bioengineering, plantings, and natural channel design approaches; therefore, it was included under the technical/engineering category. Local works are typically "harder" erosion controls, while reach-scale works generally allow for "softer" bioengineering and natural channel design approaches, although the two approaches are not mutually exclusive and can be integrated together on a continuum. The removal of risk alternative was considered to be the greenest solution as it consists of allowing erosion to continue and/or restoring natural stream processes, including natural erosion, by removing risks from the channel and corridor. However, removal risk tends to be less acceptable due to its extremely high cost and/or significant impacts to local residents due to moving infrastructure and/or expropriating private property. Monitoring was considered as somewhat "green" as it limits negative environmental impacts of doing work if not immediately necessary.

Another consideration associated with climate change and green solutions is Impacts to Aquatic and/or Terrestrial Habitat, which has been included as a separate criterion, whereby smaller construction "footprints" and fewer tree removals would be considered "greener" solutions and potentially better for climate change resiliency if mature vegetation can be maintained. While it is noted that each of these evaluation criteria are relevant to the

promotion of green solutions, the labelled “green solutions” criterion is focused on the potential value of specific design methods for erosion protection.

Selection of Preferred Alternatives

Based on the evaluation of alternatives, Alternative 3 (selective works) was selected as the preferred solution for 6 erosion sites (E4/E24, E5/E6/E7, and E11) and Alternative 2 (continuous monitoring) was selected for the other 6 erosion sites (E9, E10, and E17, and E14, E15, and E16). Site locations are presented in **Figure 13**. Preliminary functional designs were prepared for the 6 sites where selective works was the preferred alternative (see attached drawings). These sites were grouped into 3 project areas with local channel remediation and erosion control works. Given the proximity of projects E4/E24 and E5/E6/E7, implementation of these projects concurrently would provide some of the advantages of reach-scale channel engineering as discussed for Alternative 4. Proposed selective works and continuous monitoring project sites are outlined in **Table B** along with estimated costs for implementation. The selected alternatives will allow for the application of ‘green solutions’ which include the use of natural materials / natural channel design approaches in combination with engineering techniques to encourage environmentally sustainable solutions.

Consultation

The public and agency consultation and Indigenous engagement requirements for a Schedule B project under the Municipal Class EA process were followed throughout the project, including:

- Notice of Study Commencement was distributed on December 18, 2023, to inform the public, Indigenous communities, and applicable agencies that the Class EA is being undertaken.
- Outreach to utility companies through the circulation of a letter outlining the project and requesting infrastructure information.
- Public Information Centres held on September 17, 2024, and June 11, 2025, to present information and solicit feedback from the public. A Notice of Public Information Centre (PIC) was circulated prior to each of these events. The first PIC outlined the EA process and presented background information, existing conditions, and potential alternative solutions. The second PIC discussed the evaluation of alternatives, selection of preferred alternative, and the preliminary function designs and cost estimates for erosion mitigation works.
- Conservation Halton (CH) was engaged at the onset of the project including an initial meeting and site walk on September 13, 2023. Consultation occurred throughout different stages of the project and documents were provided for review and comment. A second pre-consultation meeting was held on June 18, 2025, to review the site characterization and erosion risk assessment, evaluation of alternatives, and proposed solutions. CH reviewed and provided comments on the draft ESR.
- Following the notice of engagement, the Stage 1 archaeological report and PIC materials were supplied to Six Nations of the Grand River. Six Nations also reviewed and provided comments on the draft ESR. No responses have been received from the other Indigenous communities notified.

Implementation and Environmental Assessment Requirements

This study was undertaken as a Schedule B project under the Municipal Class Environmental Assessment process, the East Morrison Creek Erosion Mitigation EA, including Phases 1 and 2 of the planning and design process that were addressed in this study. Building on Phase 2, preliminary design concepts have been developed based on the preferred alternative solutions and the EA project reporting files have been compiled into an Environmental Study Report (ESR). The ESR and preliminary function design report provide recommendations for detailed design, approvals, and implementation. With the completion of Phases 1 and 2, and submission of the final approved ESR, implementation of the preferred alternatives can proceed under Phase 5 of the Municipal Class EA process.

Implementation of the recommended preferred alterative solutions, starting with advancement of the preliminary functional designs to detailed design and approval, is based on a 5 to 10 year timeline that would commence after the final ESR posting and the public review process is complete (Phase 5). A summary of the proposed EA erosion mitigation projects for East Morrison Creek are presented in **Table B** and **Figure 13**. Typically, the proposed projects should be completed within the first 5 years after the EA is completed, or may be completed 5-10 years later with an EA addendum updating the existing conditions and confirming alternative solutions. For the three high-priority erosion mitigation projects identified in the East Morrison Creek EA study—E4/E24, E5/E6/E7, and E11—it is recommended these sites be completed concurrently given their similar level risk and urgency, and given the environmental and economic advantages of mobilizing one contractor to the site to complete the works under a single construction contract.

Six erosion sites have been identified for continuous monitoring under Alternative 2, including sites E9, E10, E14, E15, E16, and E17. Under the EA recommendations, the Town is to proceed with the development and implementation of a 5-year detailed monitoring program, including annual topographic surveys for accurate measurement of erosion rates (e.g., laser scanning) and monumented photographs repeated yearly. At the end of the 5-year program under Alternative 2, a detailed monitoring and erosion hazard assessment study is to be prepared to reassess the level of risk and urgency of each erosion site. A risk probability trigger for intervention has been proposed based on an estimated time to contact of less than 25 years (i.e., estimated time for creek to expose and damage infrastructure and/or property based on erosion rates and distance). This threshold reflects the potential for ongoing erosion to impact critical infrastructures or properties within the 25 year timeframe. If this threshold is triggered for any of the Alternative 2 sites, the Town may choose to file an EA addendum and proceed with additional erosion mitigation designs within 5 years of filing the EA addendum. All additional works for Alternative 2 sites should be implemented within the 10-year expiry period of the initial filing of the EA study.

Of the remaining 12 lower priority sites not advanced through the EA, it is expected that these sites will be included in the regular Town-wide watercourse monitoring program reviewed on a 5-year cycle, with the next monitoring event scheduled in 2026.

TABLE B Proposed Alternatives and Cost Estimates

Erosion Site(s)	Preferred Alternative	Description	Estimated Cost
E4 & E24	**Alternative 3** Selective Works [(1)]	Channel realignment away from toe of slope and replacement of gabion baskets with armourstone wall.	$1,800,000
E5, E6, & E7	**Alternative 3** Selective Works [(1)]	E5: Removal of gabion baskets and channel realignment. E6: Erosion protection downstream of outfall. E7: Channel realignment and vegetated flagstone buttress at toe of slope.	$1,300,000
E11	**Alternative 3** Selective Works	Install slip liner and headwalls/wingwalls to reinforce culvert. Stabilize channel upstream and downstream.	$400,000
E9, E10, E14, E15, E16, E17	**Alternative 2** Continuous Monitoring	Continuous monitoring including annual topographic surveys to measure erosion rates, monumented photos, and reporting for 5 years. [(2)]	$300,000
		Total	**$3,800,000**

Notes:

1) Implementing project E4 & E24 concurrently with project E5, E6, E7 will provide some advantages similar to reach-scale channel engineering as discussed for Alternative 4

2) May require EA addendum after 5 years if detailed erosion hazard assessment triggers an intervention recommendation, with additional erosion mitigation works identified prior to the 10-year expiry of the initial EA study.

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1 INTRODUCTION

Montrose Environmental Solutions Canada Inc. (Montrose) is pleased to submit this Environmental Study Report (ESR) documenting Phases 1, 2, and 3 of the study including review of background information and data gaps, confirmation of project goals and objectives, assessment of existing conditions, development and evaluation of alternative solutions, and the selection of the preferred alternatives and preliminary designs.

The study area of East Morrison Creek (Figure 1) was identified as a high-priority "long" reach area of concern in the *Town of Oakville 2021 Creek Inventory and Assessment* (Aquafor Beech 2022). The purpose of the study is to develop, evaluate, and recommend preferred alternatives for erosion control within Reaches 39 to 45 of East Morrison Creek and will be completed through four main tasks:

- Task A: Phase 1 Services, Problem Definition (Appendix A)
- Task B: Phase 2 Services, Development and Review of Options
- Task C: Phase 3 Services, Preferred Alternatives Selection and Preliminary Design
- Task D: Phase 4 Services, Preparation of Environmental Study Report

Montrose is undertaking the necessary technical studies to accurately define the problems, support the development and evaluation of alternative solutions, produce conceptual designs, and complete the necessary consultations with regulatory agencies, Indigenous groups, and the public. The key technical studies include analysis of the geomorphology, hydraulics, and ecological systems within the study area. Assessments include areas potentially impacted by construction and consideration of geotechnical slope stability and flood reduction. An archaeological screening and Stage 1 archaeological assessment have been completed.

The Town has also reviewed a long list of potential structural and non-structural alternatives, which Montrose has refined to address the site-specific conditions on East Morrison Creek. Of particular importance, the plan aims to better evaluate the degree of short-term and long-term risks across the study area. It is expected that the degree of risk at many identified sites may be relatively low in the short to intermediate term (i.e., not urgent), and as such direct interventions immediately following the Environmental Assessment (EA) may not be the highest priority for capital investments by the Town. While some sites may require more immediate action, other management strategies can be recommended within the EA process that involve 5-year monitoring programs and EA addendums to confirm the urgency of works within the 10-year expiry of the initial EA study.

Of the 23 erosion sites identified in the 2021 inventory and assessment study (Aquafor Beech 2022), initial screening undertaken at the outset of the current assignment identified four primary erosion sites of concern within the study area based on their apparent risk to infrastructure or property; these include Site 4 (slope adjacent to residential properties), Site 11 (trail crossing and corrugated steel pipe (CSP) culvert where there is also a sanitary sewer main mapped), and Site 6 and Site 7 (eroded outfall and slope adjacent to parking lot, respectively). The remaining sites consist of a range of valley slope related risks, trail encroachments, pedestrian bridges, and one additional stormwater outfall.

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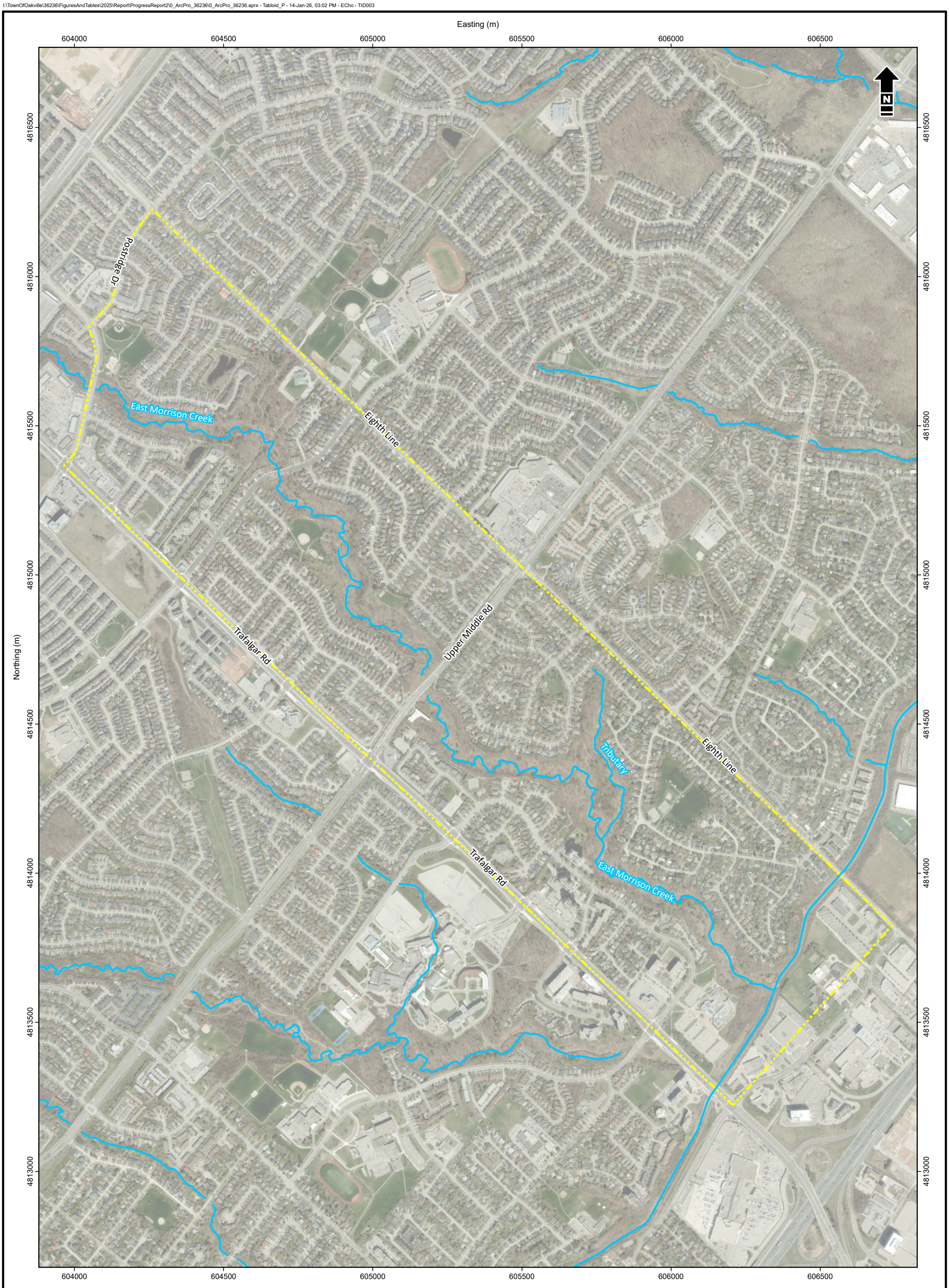

Study Limits

Watercourse

1:12,000 metres

120 0 120 240

NAD 1983 CSRS UTM Zone 17N

Imagery (2023) World Imagery: Peel Region, Town of Oakville, Vantor

MONTROSE ENVIRONMENTAL

Town of Oakville

East Morrison Creek Erosion Mitigation Environmental Assessment

Study Area

Date:	Project:	Submitter:	Reviewer:
January 2026	36236	A. Yates	P. Campbell

Figure 1

1.1 Environmental Assessment Process

1.1.1 Ontario's Environmental Assessment Act

The East Morrison Creek Erosion Mitigation Environmental Assessment Project is subject to the provisions of Ontario's *Environmental Assessment Act* (Government of Ontario 2010). The Act requires that an EA 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 impacts 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 EA 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*.

1.1.2 Municipal Class Environmental Assessment

The East Morrison Creek Erosion Mitigation Environmental Assessment Project falls under the Class 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, 2015, and 2023).

Figure 2 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, including Public Information Centre (PIC) events.

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 ESR, 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.

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 ESR.

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 erosion control, which may include:

- Bank or slope regrading
- Relocation, realignment, or channelization of watercourse
- Revetment including soil bioengineering techniques

For Schedule B projects, Phase 5 Implementation may proceed after completion of Phases 1 and 2, but the proponent may decide to undertake optional elements of Phases 3 and 4 for due diligence purposes. Subsequent to Phase 2 for the East Morrison Creek EA, preliminary design concepts have been developed based on the preferred alternative solutions (optional Phase 3), and the EA project reporting files have been compiled into a ESR (optional Phase 4). For changes in site conditions, including prescribed follow-up assessments recommended under the EA, the Town may issue EA addendums within a 5 year period, typically, to allow for implementation of all projects within 10 years of the initial EA study.

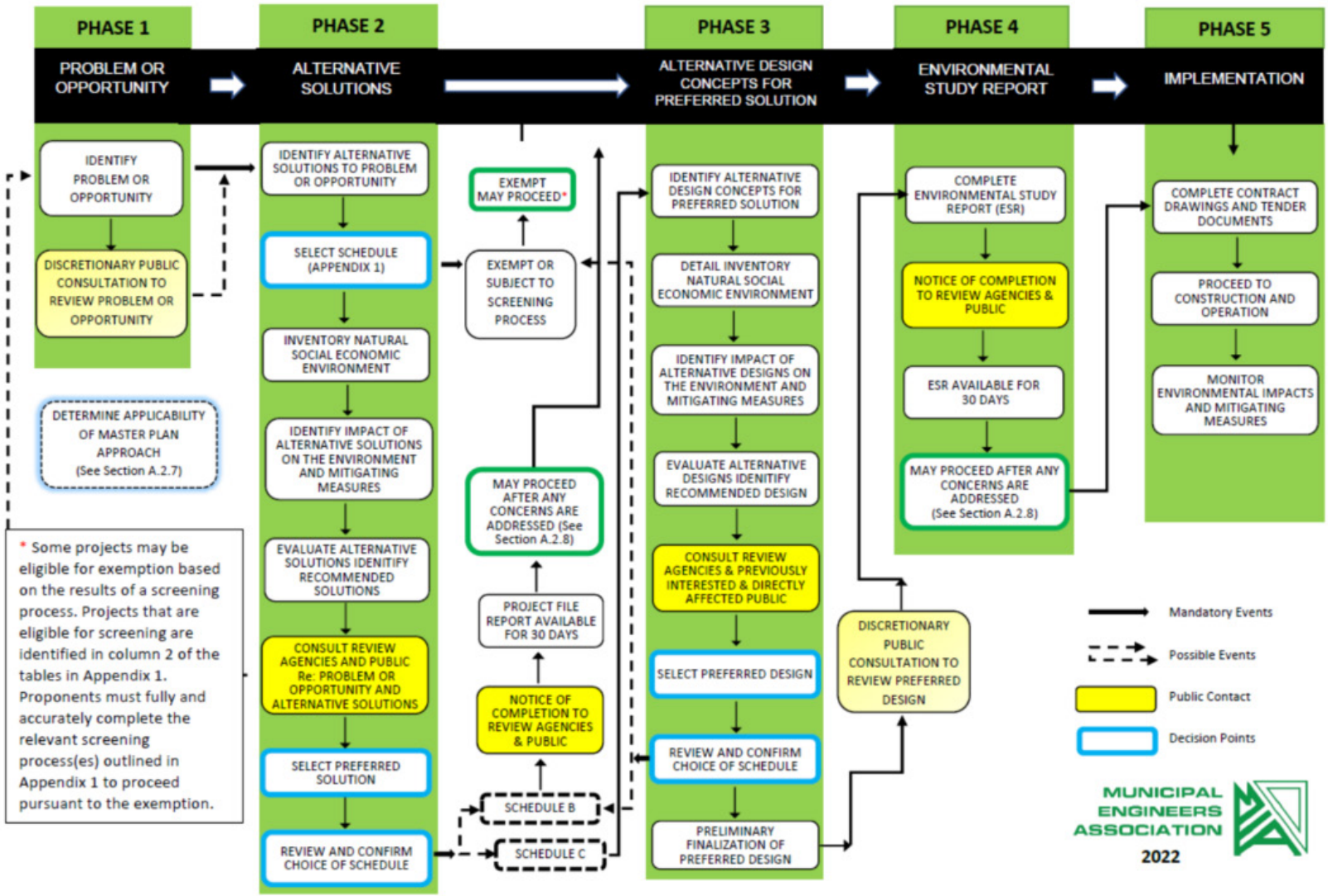

FIGURE 2 Municipal Class EA Process (MEA 2023)

1.2 Background

Stream erosion has been routinely assessed within the Town of Oakville and documented in a series of reports. A summary of key background information pertaining to the erosion mitigation EA for East Morrison Creek is summarized below.

1.2.1 Town-Wide Creek Inventory and Assessment Studies

The Town of Oakville has been monitoring watercourses and infrastructure conditions since 2001 to manage impacts of urbanization on stream erosion and maintain stream infrastructure assets. Most recently, Aquafor Beech completed the 2021 Creek Inventory and Assessment Study. The 2021 study was an update to the 2015 Creek Inventory Assessment Study and 2017 Scoped Update completed by Aquafor Beech and built off previous studies completed in 2008, 2006, and 2001.

As part of the 2021 study, East Morrison Creek was assessed from the Morrison-Wedgewood Diversion Channel to Dundas Street East (Reaches 39 to 45a). Reach 45a is upstream of Postridge Drive and is not included in the current study. Reaches 39 to 45 of East Morrison Creek (current study area) were identified as the first priority "long" reach area of concern in the 2015 study.

Munn's Creek Reaches 33 to 35 were prioritized in the 2017 update but were subsequently addressed through the Munn's Creek Erosion Mitigation EA Study. East Morrison Creek Reaches 39 to 45 returned to first priority in the 2021 inventory. Through the area of concern East Morrison flow through a well defined valley with frequent valley wall contacts. The subject reaches are considered to be under stress from hydromodification within the urbanized watershed, causing excessive erosion through fluvial processes of widening and degradation within the soft shale bedrock and weathered alluvium. With historical erosion control measures in place to protect properties, trails, pedestrian bridges, and other infrastructure, many of the existing protection measures have become degraded and dysfunctional (e.g., gabion baskets, riprap), potentially increasing the risks of erosion on adjacent property and resources. A total of 23 erosion sites were identified in the 2021 inventory study, including 2 stormwater outfalls, about 8 trail encroachments and pedestrian bridges, and a range of valley slope related risks to upland properties. Erosion sites were scored based on eight erosion hazard criteria: risk type, distance to risk, site length and height, erodibility, erosion potential (stress), riparian habitat, and aquatic habitat conditions. Appendix B provides the scoring for each criterion. Erosion site scores are provided in Table 1.

An EA was recommended for Reaches 39 to 45 of East Morrison Creek to address erosion issues within these reaches. The 2021 report also recommended that a geotechnical investigation, slope stability analysis, and risk assessment be completed as part of the EA to assess risks to recreational trails and private properties located at the top of the valley slope. Recommendations for restoration included replacement of about 1 km of bank treatments, two storm sewer outfalls, and two to three pedestrian bridges with wider span.

TABLE 1 2021 Erosion Site Scores (Aquafor Beech 2022)

Erosion Site	Score								
	Risk Type	Distance to Risk	Site Length	Site Height	Erodibility	Erosion Potential (stress)	Riparian Quality	Aquatic Habitat Quality	Total Score
E1	35	16	3	2	8	5	1	3	73
E2	35	8	2	2	8	1	3	2	61
E3	35	12	3	3	6	5	3	2	69
E4	25	16	2	5	8	5	3	3	67
E5	35	8	3	3	8	5	3	2	67
E6	45	16	2	4	6	5	3	3	84
E7	25	8	2	5	6	5	3	1	55
E8	35	16	3	2	8	5	3	1	73
E9	25	8	2	5	6	5	1	3	55
E10	25	16	4	5	8	5	1	2	66
E11	35	20	3	3	8	4	1	2	76
E12	45	16	1	3	6	5	3	3	82
E13	35	20	2	2	8	5	3	4	79
E14	35	12	2	4	8	5	1	1	68
E15	35	12	2	4	8	5	3	3	72
E16	35	12	2	4	6	5	3	3	70
E17	25	8	2	4	6	5	3	3	56
E18	35	16	2	4	8	3	3	4	75
E19	35	16	3	4	8	3	3	3	75
E20	35	20	1	2	8	3	3	2	74
E21	35	20	1	2	8	3	3	3	75
E22	35	12	3	4	8	4	1	2	69
E23	35	8	2	4	8	3	3	1	64

1.2.2 Hydrology and Hydraulics

Conservation Halton (CH) provided a HEC-RAS model of base conditions on East Morrison Creek. The model includes associated files and a memorandum titled *Morrison-Wedgewood Floodplain Mapping Documentation for Use of Modelling* dated July 22, 2020 (Conservation Halton 2020).

The HEC-RAS model includes Morrison Creek from Dundas Street East to the confluence with the Morrison-Wedgewood Diversion Channel. Within the study area, between Upper Middle Road East and the confluence, there are approximately 34 existing cross-sections, based on CH's 2018 LiDAR data.

The peak flows used in the HEC-RAS model are based on a Morrison Hershfield (MH 2020) hydrologic study. The hydrology study encompassed East Wedgewood Creek, West Wedgewood Creek, East Morison Creek, West Morison Creek, and Munn's Creek. The hydrological modelling was performed using Visual OTTHYMO 5 software. East Morrison represents a catchment area of 678 ha and is broken into 7.8 ha to 73.2 ha subcatchments within the hydrologic model. The land use within the catchment is primarily medium-density residential, with scattered rural land use in the upstream reaches. Peak flow rates for the 1:2-year through regional storm events are modelled and input into the HEC-RAS model at three flow change locations within the study area. The flow rates within the study area are shown in Table 2.

TABLE 2 Peak Flows Rates

Location	1:2 year	1:5 year	1:10 year	1:25 year	1:50 Year	1:100 year	Regional
Downstream of Upper Middle Road East (Section 2227.4)	10.68	21.91	25.77	33.26	39.07	45.73	55.56
Confluence with Northern Tributary (Section 1331.4)	9.7	18.68	24.57	31.16	36.6	42.59	55.68
West of Hillview Crescent (Section 969.4)	10.99	19.17	26.86	34.27	39.95	46.22	62.47

As part of the planned works, Montrose will update and add new sections to the base HEC-RAS model to represent existing conditions for a basis of comparison (BOC) scenario. Montrose conducted two in field surveys on October 23 to 27, 2023, and November 30, 2023, collecting a total of 1,414 survey points. The BOC model will form the foundation of analysis.

1.2.3 Existing Infrastructure

Based on review of Town mapping of existing infrastructure and information provided by the region and utilities, existing infrastructure within the creek valley includes:

- Sanitary sewer crossing on tributary to East Morrison Creek: The Town confirmed by email that the sanitary sewer crossing of the tributary to East Morrison Creek is active, per communication with Halton Region, and provided the design drawing of the sanitary sewer crossing. The sanitary sewer crossing coincides with erosion site E11 (see drawing in Appendix C). The sewer was constructed in 1977 above a CSP at the creek crossing, with a depth of cover of approximately 1.5 m. Design drawings are provided in Appendix C. Based on mapping from the region, no other regional assets (water mains, sanitary mains, laterals, and maintenance holes) are present within the creek valley.

- Gas pipeline: A TransCanada gas pipeline at runs through the valley north of Glenashton Drive. TransCanada confirmed they cannot provide depth of cover information. However, the crossing location is not flagged as a high-risk erosion site.
- Road crossing infrastructure: stormwater infrastructure (such as outfalls), pedestrian crossings, trails, existing erosion protection are mapped within the creek valley. Major road crossings include Upper Middle Road, Glenashton Drive, and Postridge Drive. The downstream extent of the study area is bounded by the Morrison-Wedgewood Diversion Channel.

1.3 Indigenous Engagement

For EA projects, the Town has legal duties to consult with Indigenous communities whose rights may be impacted. The project study area is located in Treaty 13a, 1805 Mississaugas, within the traditional territory and claim of the Mississaugas of the Credit, and within the 1701 Nanfan Deed. In the Ontario Ministry of Environment, Conservation, and Parks (MECP) acknowledgement of the project Notice of Commencement, two impacted communities are identified. MECP provides a reference document "A Proponent's Introduction to the Delegation of Procedural Aspects of consultation with Aboriginal Communities" to communicate expectations with respect to consultation with Indigenous communities (See Section 4.2). Two additional Indigenous communities have been identified by the Town based on previous EA projects. As such, the Town of Oakville has identified that outreach, engagement and/or consultation for this project is required with:

- Mississaugas of the New Credit First Nation (identified by MECP)
- Six Nations of the Grand River (identified by MECP)
- Haudenosaunee Confederacy Chiefs Council
- Métis Nations of Ontario

With the intent to engage and/or consult with interested Indigenous communities impacted by the project, an Indigenous Engagement Plan has been developed to guide the principles and process for completion of the EA study and to meet the expectations of MECP.

1.3.1 Indigenous Engagement Plan

For meaningful Indigenous Engagement, the study must be guided by principles that emphasize inclusion and equity, accountability and transparency, as well as building trust and partnerships where there are expressions of interest. The following proposed principals are proposed to guide the Indigenous Engagement process for the subject EA study:

- Where appropriate, provide meaningful opportunities to participate in key issues and solve shared problems
- Encourage two-way dialogue with the Town when it makes the most sense
- Listen and report back to Indigenous community representatives about the outcomes of the process

There are several project-specific tools that will be used within a range of established strategies, including informing, consulting, involving, and collaborating with interested Indigenous communities (Table 3). These tools are further outlined in a project-specific Indigenous Engagement Plan in Table 4. Additional engagement activities may be incorporated into the plan, with acceptance by Town, based on the Indigenous community responses and expressions of interest to be consulted.

TABLE 3 Proposed Strategies and Tools for Indigenous Engagement

Engagement Strategies*	Description	Proposed Tools for Indigenous Engagement and/or Consultation
Inform	Project information provided to Indigenous communities at selected stages to help them understand the project	• Emails to Indigenous community contacts • Website updates • Public Information Centres
Consult	Feedback gathered based on information given that is to be considered in decision making processes	Informing plus: • Engagement meetings with interested Indigenous community representatives
Involve	Actively work with Indigenous representatives to ensure concerns and preferred outcomes are well understood and accounted for at each stage of the project	Consulting plus: • Community events, field participation, and/or employment opportunities where appropriate and relevant
Collaborate	When Indigenous communities are invited to be partners in decision making processes through consensus	Consulting plus: • Technical workshop meetings with interested Indigenous community representatives • Distribution of project reports to Indigenous communities, with written comment responses addressed and recorded in consultation records within the ESR

*Note: The level of engagement to be identified based on interest expressed by the Indigenous community.

TABLE 4 Project-Specific Indigenous Engagement Plan

Indigenous Engagement Plan	Project Work Plan Phase	Indigenous Engagement Tools
Gathering, Sharing, and Learning Phase	Notice of Commencement	• Email Notice of Commencement (December 2023)
	Phase 1 Problem Definition	• Email invitation to review project draft Stage 1 archaeological assessment (June 2025)
	Phase 2 Development and Review of Alternatives	• Email Notice of Public Information Centre #1 (September 2024) • Incorporate responses in project progress reporting • Community specific information meetings with representatives may be held with expressions of interest that call for consultation
Consultation on EA Study and Preferred Alternative Phase*	Phase 3 Preferred Alternative Selection and Preliminary Design	• Email Notice of Public Information Centre #2 (May 2025) • Community specific information meetings with representatives may be held with expressions of interest that call for consultation • Incorporate responses and/or meetings in project progress reporting
	Phase 4 Preparation of the Environmental Study Report	• Email invitations to review draft ESR and draft Preliminary Design Reports • Incorporate responses and/or meetings in final ESR for public review and MECP approval • Email Notice of Project Completion

*Note: Future study phases of detailed design, construction, and monitoring are expected to occur after the EA study is completed, with opportunities for interested Indigenous communities to continue engagement with the project(s).

It is important the outreach to the identified Indigenous communities happens early in the project to give the best opportunities for engagement and/or consultation. If responses from Indigenous communities impacted by the EA study or future phase of the project are received later in the study process, efforts may be made to fulfill the intent of the engagement plan and MECP requirements, not substantively delaying urgent works that may pose risks to public health and safety, while also ensuring the community's comments and concerns are sufficiently addressed. The status of the outreach and/or engagement with Indigenous communities is further addressed in Section 4.3.6.

2 PHASE 1 – PROBLEMS AND OPPORTUNTIES

2.1 ISSUES ASSESSMENT AND PROBLEM CONFIRMATION

The goals and objectives of the study have been confirmed through Phase 1 of the study, including review of background information and data and based on discussions with Town staff during the project kickoff meeting and site walk in September 2023. The primary and secondary goals of the study have been identified as follows:

- Primary Goal 1: to address the identified erosion risk within the study area by completing a Schedule B Municipal Class EA. The purpose of the study is to develop, evaluate, and recommend preferred alternative solutions for erosion control within Reaches 39 to 45 of East Morrison Creek.
- Secondary Goal 2: to enhance local aquatic and riparian ecosystems using natural channel design principles and 'green solutions' where erosion remediation works are required.
- Secondary Goal 3: to ensure the project addresses social and stakeholder requirements, including Indigenous stakeholders, residents, park users.

To achieve the above goals, the following three objectives have been discussed with the Town, which fulfill the Municipal Class EA process:

- Project Objective 1 - Existing Conditions and Risk Assessment: undertake the analyses required to assess and characterize past and existing conditions for stream morphology, hydrology and hydraulics, aquatic habitat, terrestrial habitat, and Town and Halton Region infrastructure along East Morrison Creek.
- Project Objective 2 - Evaluate Alternatives to Meet Project Goals: identify and evaluate rehabilitation alternatives that will contribute to the long-term protection of infrastructure and private property while minimizing the effects on the riparian ecosystem and improving aquatic habitat.
- Project Objective 3 - Select Preferred Solutions through Municipal Class EA and Consultation Processes: select preferred solution(s) following an evaluation of environmental, social, and economic factors that will protect Town and regional infrastructure and utilize 'green solutions' where possible.

2.1.1 Discussion of Key Issues

As described in Section 1, the study area of East Morrison Creek has been identified as a high-priority "long" reach area of concern in the Aquafor Beech (2022) study. A total of 23 erosion sites were identified in the 2021 inventory study, including 2 stormwater outfalls, a CSP culvert at trail and sanitary sewer crossing, 5 pedestrian bridges,

6 trail encroachments, and a range of valley slope related risks to upland properties (some of which also include risks to trails). The Town has also provided a long list of potential structural and non-structural alternatives.

Montrose will refine the list of alternatives to address the site-specific conditions on East Morrison Creek. Of particular importance, the study aims to better evaluate the degree of short-term and long-term risks across the study area. It was expected that the degree of risk at many identified sites may be relatively low in the short to intermediate term (i.e., not urgent), and as such direct interventions immediately following the EA may not be the highest priority capital investment for the Town. While some sites may require more immediate action, other management strategies, such as a continuous monitoring EA alternative, can be recommended within the EA process that involve 5-year monitoring programs and EA addendums to confirm the urgency of works within the 10-year expiry of the original EA study.

Initial screening undertaken at the outset of the current assignment identified three primary erosion sites of concern within the study area based on their apparent risk to infrastructure; these include Site 4 (slope adjacent to residential properties) and Sites 6 and 7 (eroded outfall and slope adjacent to parking lot, respectively).

The subsequent background review and field program have supported the initial screening, and based on this work the study team anticipate that the number and extent of sites to be considered by the EA is likely to be less than the Aquafor Beech erosion inventory. As such, the design requirements may be adapted to address several specific problem sites, mostly at downstream end of the study area, rather than the reach long solution that was initially proposed through the previous study.

2.2 Opportunities

Undertaking the EA process for erosion mitigation studies highlights the importance of considering multiple alternatives and evaluating the positive and negative effects to the environment, including social and economic factors.

The opportunities identified for the East Morrison Creek Erosion Mitigation EA study are summarized in the following list and are explored further in Phase 2 of the study (Section 4).

- Opportunity to evaluate local, reach long, and removal risk alternative solutions.
- Opportunity to address erosion issues within the East Morrison Creek study area, including mitigation of risk and protection of infrastructure and/or private property.
- Opportunity to restore or enhance riparian and aquatic habitats.
- Opportunity for education of public and landowners about stream corridor management and encroachment issues.

3 EXISTING CONDITIONS

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

3.1 Physiography, Geology, and Topography

The physiography and surficial geology of an area in which a stream corridor is situated provide an overview of the influences that determine channel landforms and sediment supply. The surficial geology of the southern Ontario region is shaped by a legacy of bedrock erosion and sediment deposition, following continental glaciations over geological timescales and post glacial incision by fluvial processes over the last 10,000 years. The resulting stream and river drainage networks, including their sediments and slope profiles, are conditioned by this glacial and post glacial history.

The study area is located within the physiographic regions of the Iroquois Plain and the South Slope (Chapman and Putnam 1984). The northern portion of the study area is located within the South Slope which is characterized by low-lying, fine grained, undulating ground moraine and knolls (Thurber 2025).The southern portion of the study area is located within the Iroquois Plain which was formed in the late Pleistocene by Glacial Lake Iroquois and consists of a thin veneer of glacio-lacustrine sand and silty sand over bedrock outcrops.

Surficial geology mapping (OGS 2019) indicates that the northern portion of the study area and valley crests consist of very stiff to hard clay to silt-textured glacial till (Halton Till) derived from glaciolacustrine deposits or shale (OGS 2019). The creek valley and the southern portion of the study area consists primarily of Paleozoic bedrock including red and grey shale of the Queenston Formation. Boreholes advanced within the study area have found surficial materials (topsoil, fill, and/or localized alluvial deposits) underlain by till mantling shale bedrock (Thurber 2025). Bedrock was encountered at depths of 0.4 to 5.3 m below grade in boreholes (Thurber 2025). East Morrison Creek has incised into the shale bedrock which is exposed along the channel bed and banks/valley walls through the study area.

The regional topography slopes southerly towards Lake Ontario. East Morrison Creek is situated within a confined valley setting. Valley walls are approximately 4 to 13 m in height through the study area (Thurber 2025), ranging in steepness and proximity to the channel. East Morrison Creek contacts the valley wall at several locations within the study area.

Additional information on subsurface conditions is provided in the Thurber (2025) report (Appendix D).

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Easting (m)

602000 603000 604000 605000 606000 607000 608000 609000

Northing (m)

4819000 4818000 4817000 4816000 4815000 4814000 4813000 4812000 4811000 4810000

8b
8b
Till Moraines
19
5d
3
5d
South Slope
9b
9
5d
5d
Till Plains (Drumlinized)
East Morrison Creek
5d
3
Shale Plains
Iroquois
Plain
9
19
Sand Plains
9
5d
Sixteen Mile Creek
Lake
Ontario (lac
Ontario)
5d
3
3
5d

N

Study Limits
Watercourse
Boundary between South Slope and Iroquois Plain
Physiographic Landform (OGS MRD228)

Surficial Geology (OGS MRD128)

- 3: Paleozoic bedrock
- 5d: Clay to silt till
- 8b: Fine-grained glaciolacustrine deposits (silt, clay)
- 9: Coarse-grained glaciolacustrine deposits (sand, gravel, minor silt and clay)
- 9b: Coarse-grained glaciolacustrine deposits (sand, gravel)
- 19: Modern alluvial deposits

1:30,000 metres
300 0 300 600
NAD 1983 CSRS UTM Zone 17N

Imagery (2023) World_Imagery: Source: Esri, Vantor, Earthstar Geographics, IGN, and the GIS User CommunityHydrography (2017) Source: Ontario Ministry of Natural Resources and Forestry

MONTROSE ENVIRONMENTAL

Town of Oakville
East Morrison Creek Erosion Mitigation Environmental Assessment

Surficial Geology and Physiography

Date:	Project:	Submitter:	Reviewer:
January 2026	36236	A. Yates	P. Campbell

Figure 3

3.2 Geotechnical Assessment

A geotechnical desktop study and site inspection was completed by Thurber Engineering Ltd. (Thurber) for the study area. The report is provided in Appendix D. The results of this assessment do not constitute update of East Morrison Creek erosion hazard limits for regulatory purposes.

The study area was divided into 100 zones which were assessed for total slope instability risk following MNRF (2002) guidelines. Slope stability figures showing zones and risk classifications are shown in an appendix of the Thurber (2025) report. In total, 65 zones were identified as low risk, 24 as moderate risk, and 11 as high-risk. Moderate and high-risk zones were recommended for additional investigation during detailed design.

The primary mode of instability inferred within the study area is toe erosion from East Morrison Creek causing slope oversteepening. A potential secondary mode of instability is erosion of the valley walls from active table land drainage over the slope face. Recommendations for additional investigations and potential mitigation measures are provided in the Thurber (2025) report.

3.3 Hydraulic Assessment

Building off the modelling of base conditions discussed in Section 1.2.2 and Appendix A, the hydrological flows and hydraulic modelling information for East Morrison Creek were reviewed and updated. The design flow events for the tributary were taken from the *Flood Risk Mapping and Spill Quantification – Morrison-Wedgewood Diversion Channel Volume 1: Hydrologic Modelling Report* by Morrison Hershfield (2020). Per Figure 12 of the report, flow values from reference point 404 were used, where the tributary confluence with the main East Morrison channel is located. Flow values were consistent across each existing and future scenario in the hydrologic study. Tributary flows were added to steady flow scenario 2 within HEC-RAS as this is the scenario noted to be used for regulatory purposes. Reach 6 extends from the newly added tributary to the confluence with the diversion channel.

The flows for the tributary and main channel are summarized in Table 5 below.

TABLE 5 Existing Peak Flows within East Morrison Creek and Tributary

HEC-RAS Reach	River Station	2-year	5-year	10-year	25-year	50-year	100-year	Reg
EMC, Reach 1	5371.4	2.47	4.57	6.33	8.95	10.75	12.64	30.89
EMC, Reach 1	5152.4	2.26	4.41	7.08	8.92	10.69	12.60	31.75
EMC, Reach 1	4525.4	2.28	4.42	6.95	8.94	10.71	12.62	32.13
EMC, Reach 2	3726.4	11.65	18.16	22.77	29.44	34.36	39.95	44.53
EMC, Reach 2	3515.4	12.18	19.20	24.49	32.38	38.65	45.37	51.57
EMC, Reach 2	2518.4	12.74	20.26	26.06	34.52	40.76	47.64	53.40
EMC, Reach 2	2227.4	10.68	21.91	25.77	33.26	39.07	45.73	55.56
EMC, Reach 2 (Upstream of Tributary)	1335	9.70	18.68	24.57	31.16	36.60	42.59	55.68
Tributary	1729	3.70	5.81	7.50	9.73	11.24	12.77	6.53
EMC, Reach 6 (Downstream of Tributary)	1004	10.99	19.17	26.86	34.27	39.95	46.22	62.47

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Easting (m)

604000 604500 605000 605500 606000 606500

Northing (m)

4816500 4816000 4815500 4815000 4814500 4814000 4813500 4813000

N

Postridge Dr

Eighth Line

Trafalgar Rd

Upper Middle Rd

EMC Reach 1

East Morrison Creek

Trib to EMC Reach 1

EMC Reach 2

Tributary EMC-Trib Reach 5

EMC Reach 6

EWC Reach 1

WWC Reach 1

MWDC Reach 1

MWDC Reach 2

MWDC Reach 3

Trib to WMC Reach 1

WMC Reach 1

WMC Reach 2

Munn's Cr Reach 1

4525.4

3726.4

3515.4

2518.4

2227.4

1729

1335

1004

Study Limits

Watercourse

HEC-RAS Sections

1:12,000

metres

120 0 120 240

NAD 1983 CSRS UTM Zone 17N

Imagery (2023) World Imagery: Peel Region, Town of Oakville, VantorHydrography (2017) Source: Ontario Ministry of Natural Resources and Forestry

MONTROSE ENVIRONMENTAL

Town of Oakville

East Morrison Creek Erosion Mitigation Environmental Assessment

HEC-RAS Sections

Date:	Project:	Submitter:	Reviewer:
January 2026	36236	A. Yates	P. Campbell

Figure 4

3.4 Existing Channel Conditions Assessment

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 East Morrison Creek from Postridge Drive to the confluence with the Morrison-Wedgewood Diversion Channel was accomplished through review of historical data, background materials, field assessments, and data analyses. The geomorphic assessment was informed by the geotechnical and hydraulic assessments and a topographic survey of the site. 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.

3.4.1 Historical Assessment

The Stage 1 archaeological assessment (Appendix E) conducted by TMHC Inc. (TMHC) for the East Morrison Creek Mitigation Study area included a review of historical aerial photographs. Map 7 in the TMHC (2023) report includes historic aerials from 1960, 1969, 1995, and 2008. The channel planform could not be distinguished in any of the aerial images due to tree cover within the valley. Changes in land use over time are described below.

In 1960, the area surrounding the study area was predominantly rural and only Upper Middle Road had been constructed. By 1969, the surrounding area remained largely rural; however, residential development had begun near the southern portion of the study area. The Morrison-Wedgewood Diversion Channel at the downstream extent had also been constructed in the 1969 image. Considerable development occurred between 1969 and 1995. By 1995, residential development extended along both sides of the creek valley to Glenaston Drive, which was constructed by this time. Construction was underway around the northern portion of the study area in 1995. By 2008, Postridge Drive and residential developments between Glenaston Drive and Postridge Drive were constructed.

3.4.2 Topographic Survey

As part of the erosion assessment, the channel and corridor of East Morrison Creek within the study area were surveyed on October 23 to 27, 2023, and November 30, 2023. The survey documented existing conditions including the bankfull channel, channel profile, infrastructure (bridges/culverts), floodplain extent, and toe of valley slope. Hydraulic cross-sections were also surveyed throughout the study area from Upper Middle Road to the confluence with the Morrison-Wedgewood Diversion Channel to verify and augment the hydraulic model.

A detailed survey was also completed at each erosion site to confirm the location and extent of erosion sites. Erosion sites are discussed in Section 3.4.6.

3.4.3 Geomorphic Assessment

Montrose completed a geomorphic field assessment of the study area on October 19 and 20, 2023. The purpose of the geomorphic assessment was to characterize channel form and processes and identify erosion hazards within the study area. This included an assessment of erosion sites from the 2021 inventory.

The Rapid Geomorphic Assessment (RGA; MOE 2003) is used to evaluate dominant geomorphic processes. Field observations are evaluated using an indexed rating for channel sensitivity based on aggradation, degradation, channel widening, and lateral adjustment. The combined indices are used to provide an indication of current channel stability, with designations of In Regime, Stressed/Transitional, or In Adjustment. The RGA is applied on a per reach basis (i.e., a defined length of channel with relatively uniform characteristics).

East Morrison Creek is a well defined, meandering channel within a confined valley through the study area. There is a forested riparian corridor within the valley and land use surrounding the valley is predominantly residential. Recreational trails are present within the valley and along the top of valley slope in some areas.

The field assessment included measurements of bankfull dimensions and substrate characterization. Channel banks consisted of clay derived from weathered shale. Exposed shale bedrock was common along the channel bed and lower banks. Bed substrate was generally gravel to cobble-sized platy shale and limestone material. The channel bankfull width varies throughout the study area, ranging from 3 m in the upstream extent to up to 10 m in Reach 39 at the downstream limit. Bankfull depths ranged from 0.3 m in Reach 45 to up to 1.2 m Reach 39. Reach characteristics are summarized in Table 6.

The topographic survey did not extend for the entire length of the East Morrison Creek study area, given that higher priority sites were considered to be concentrated downstream of Upper Middle Road based on an initial screening. To supplement this, the profile was extracted from a LiDAR DEM retrieved from NRCAN (1 m cell resolution, 2022). The detailed field survey was focused on the floodplain in downstream reaches, to also allow for updates to the hydraulic modelling, combined with the 2022 LiDAR DEM for the broader valley and upstream floodplain topography. Throughout the study area, the profile remains fairly uniform, with an average slope for all reaches of 0.98%. The profile does show bed features, including riffles and pools in the lower reaches (Figure 6). The tributary showed increased variability in the profile trend, with an average slope of 2.4%

Reaches within the study area were found to be ‘transitional’ or ‘in adjustment’. RGA scores are shown in Table 7. The dominant process in all reaches was widening with fallen/leaning trees, exposed tree roots, woody debris jams, bank erosion, and outflanked bank protection measures. There were also several valley contacts throughout the study area. Evidence of channel degradation was also common as the channel has down-cut into shale bedrock in many locations. Evidence of downcutting was also observed through the presence of elevated storm sewer outfalls, scour pools, undermined bank protection measures. These results are similar to the conditions observed in the 2021 inventory (Aquafor Beech 2022).

TABLE 6 Reach Characteristics

Reach	Bankfull Width* (m)	Bankfull Depth* (m)	Substrate	Description
R39	8.6 – 10.6 (9.3)	0.75 – 1.2 (0.98)	Gravel to cobble	Over-widened channel with bank erosion, exposed tree roots, and leaning trees. Riffles and pools poorly defined. Minor woody debris. Riprap bank treatment at pedestrian bridge in poor condition. Platy bed substrate.
R40	8.2 – 10.2 (8.9)	0.8 – 1.2 (0.93)	Gravel to cobble (D_{50} = 7.04 cm)	Sinuous channel with tight bends. Erosion at meander bends and valley contacts. Gabion basket toe protection buried in some areas due to slope processes. Narrow gabion basket lined channel at pedestrian bridge is outflanked and has a large downstream scour pool. Exposed bedrock on channel bed and knickpoint observed. Gully in west valley slope. Substrate similar to Reach 39.
R41	8.0 – 8.8 (8.4)	0.8 – 0.6 (0.7)	Gravel to cobble (D_{50} = 2.91 cm)	Bed morphology consists of riffles and shallow pools. Finer bed substrate. Valley contacts. Woody debris jams. Elevated stormwater outfall with downstream scour pool. Exposed pedestrian bridge footing.
R42	6.9 – 7.6 (7.3)	0.7 – 0.8 (0.75)	Gravel to cobble (D_{50} = 9.23 cm)	Fewer channel disturbances compared to downstream. Narrower channel with increased woody debris. Frequent valley contacts. Fine gravel point bars. Well developed pools. Bedrock on lower banks. Failing gabion baskets at stormwater outfall. Scour pool downstream of Upper Middle Road culvert.
R43	6.5 – 8.5 (7.2)	0.85 – 1.0 (0.93)	Sand/silt to gravel	Major woody debris. Frequent valley contacts. Localized bank protection measures common. Gabion baskets undermined and outflanked. Erosion downstream of stormwater outfalls. Well formed pools and poorly formed riffles. Bed substrate reflective of shale weathering. Finer substrate than other reaches.
R44	5.2 – 10 (7.1)	0.75 – 1.0 (0.85)	Gravel to cobble (D_{50} = 8.4 cm)	Bankfull channel width variable; generally, 5.5 to 6.5 m wide but wider at valley contacts. Bedrock in pools and lower banks. Localized erosion control measures. Gabion baskets undermined and outflanked.
R45	3.4 – 6.6 (4.8)	0.3 – 0.8 (0.65)	Sand/silt to gravel, few cobbles (D_{50} = 6.04 cm)	Narrow channel with well defined pools. Few riffles with rounded cobbles likely from till. Valley wall contacts. Split flow upstream of stormwater outfall. Exposed pedestrian bridge footing.
Tributary	~4.0 – 7.0**	~0.5 – 1**	Sand to cobble	Stormwater outfall channel. Steep gradient. Valley contacts. Lots of fallen/leaning trees and woody debris. Groundwater seeps observed. Exposed shale bedrock. Culvert at pedestrian crossing perched. Section of channel lined with gabion baskets near downstream extent. Small debris jam just upstream of confluence with log across channel acting as grade control.

* Range of sampled values provided for each parameter, with the reach average in brackets.

**Values for tributary approximated from topographic information and site photographs.

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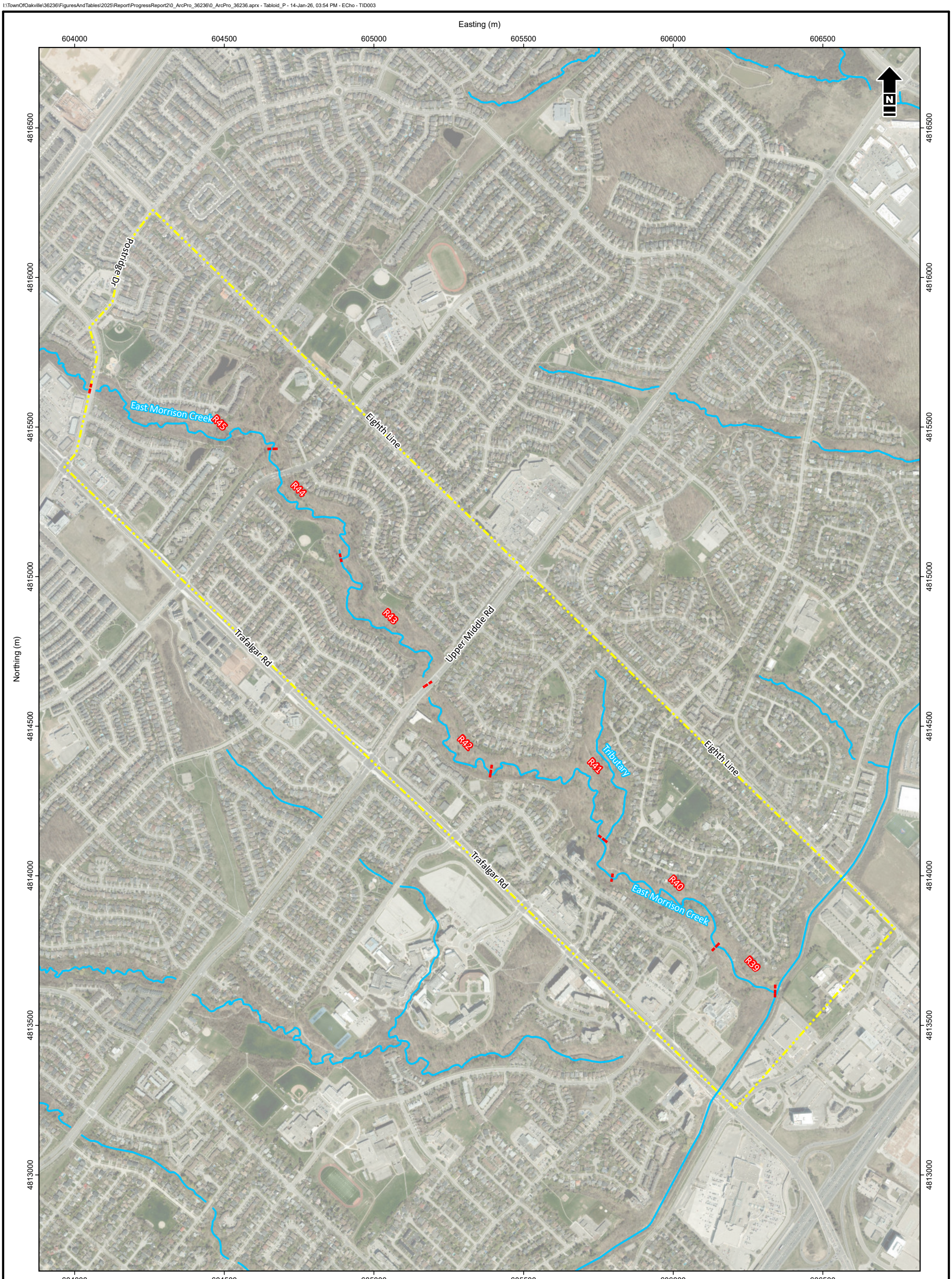


Study Limits
Watercourse
Reach Break

1:12,000
metres
100 0 100 200
NAD 1983 CSRS UTM Zone 17N

Imagery (2023) World Imagery: Peel Region, Town of Oakville, VantorHydrography (2017) Source: Ontario Ministry of Natural Resources and Forestry

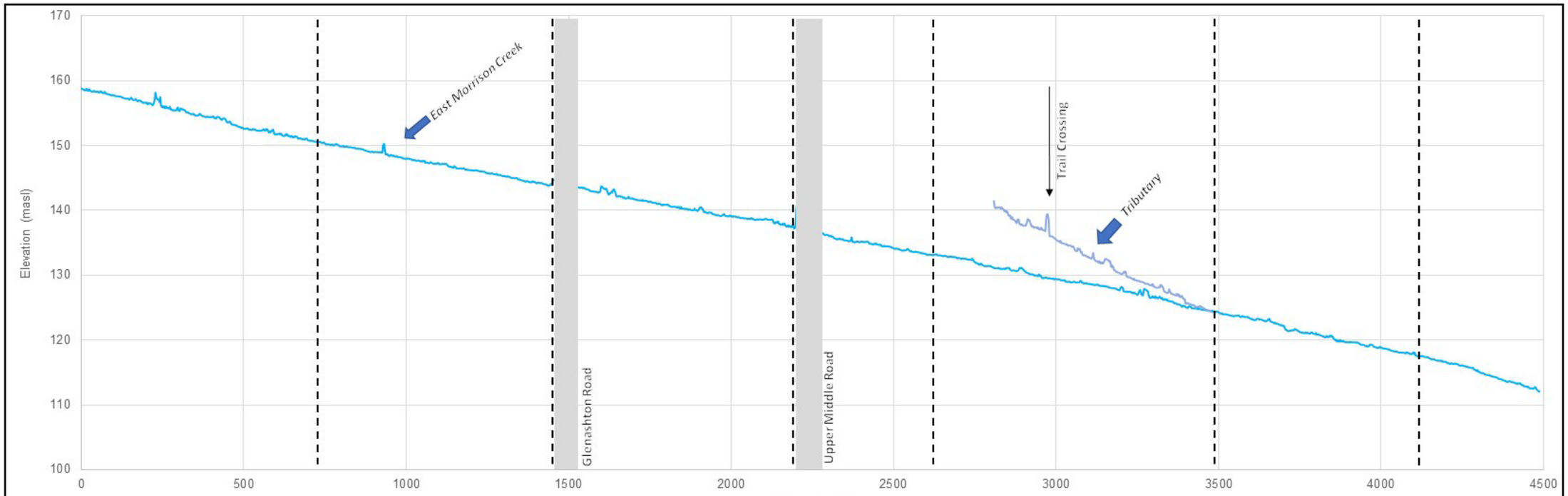
MONTROSE ENVIRONMENTAL

Town of Oakville
East Morrison Creek Erosion Mitigation Environmental Assessment

Geomorphic Reaches

Date:	Project:	Submitter:	Reviewer:
January 2026	36236	A. Yates	P. Campbell

Figure 5



Reach	R45	R44	R43	R42	R41	R40	R39
Reach Length	838 m	603 m	725 m	457 m	900 m	571 m	279 m
Channel Substrate	Sand/Silt to Gravel	Gravel to Cobble	Sand/Silt to Gravel	Gravel to Cobble	Gravel to Cobble	Gravel to Cobble	Gravel to Cobble
Bankfull Width	3.4 – 6.6 m	5.2 – 10.0 m	6.5 – 8.5 m	6.9 – 7.6 m	8.0 – 8.8 m	8.2 – 10.2 m	8.6 – 10.2 m
Bankfull Depth	0.3 – 0.8 m	0.75 – 1.0 m	0.85 – 1.0 m	0.7 – 0.8m	0.6 – 0.8m	0.8 – 1.2 m	0.75 – 1.2 m
Channel Stability	Transitional	Transitional	In Adjustment	Transitional	In Adjustment	In Adjustment	Transitional
Channel Type	Meandering	High Energy	High Energy	High Energy	High Energy	High Energy	High Energy

FIGURE 6 Annotated Bed Profile

TABLE 7 Summary of Rapid Geomorphic Assessment Scores

Reach	Factor Value				Stability Index	Condition	Dominant Process
	Aggradation	Degradation	Widening	Planimetric Adjustment			
R39	0.14	0.14	0.75	0.14	0.29	Transitional	Widening
R40	0.14	0.50	0.88	0.14	0.41	In Adjustment	Widening
R41	0.29	0.50	0.75	0.14	0.42	In Adjustment	Widening
R42	0.29	0.50	0.67	0.14	0.40	Transitional	Widening
R43	0.43	0.44	0.78	0.00	0.41	In Adjustment	Widening
R44	0.29	0.44	0.78	0.00	0.38	Transitional	Widening
R45	0.33	0.33	0.33	0.14	0.27	Transitional	Widening
Tributary	RGA not completed, ephemeral to intermittent flow						

3.4.4 Hydrogeomorphic Conditions

The updated hydraulic model of the study area was used as a basis for the hydrogeomorphic assessment. The results of the assessment are summarized in Table 8 and are discussed below.

A summary of the hydraulic conditions associated with the 2-year flow event are provided in Table 8. Review of the table indicates that the flow energy (i.e., stream power) of the 2-year flow is relatively high. The shear stresses exerted on the channel bed demonstrate similar trends as the stream power. 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 channel type does not correspond with the meandering planform of East Morrison Creek and is an indicator of high energy conditions within the system. Based on stream power and alluvial floodplain classifications outlined for southern Ontario river systems by Phillips and Desloges (2014, 2015a), the study area of East Morrison Creek is defined as a transitional channel system, with gravel and cobble-lag bed materials incised into bedrock (i.e., semi-alluvial), which is a common expression for higher energy systems in the region (i.e., greater than 60 to 100 W/m^2, BM* classification; Phillips and Desloges 2015b). As such, the high energy meandering condition is reflective of the legacy of incision into the limestone and shale bedrock, and the associated coarse-grained bed materials that are supplied to the channel in sufficient quantities to maintain the channel gradients and relatively high energy of the system.

TABLE 8 Hydrogeomorphic Parameters through East Morrison Creek; 2-year Flow Results

Reach	Station Range	2 Year Flow (m^3/s)	Velocity (m/s) Range (Avg)*	Unit Stream Power (W/m^2) Range (Avg)*	Estimated Stream Type	Shear Stress (N/m^2) Range (Avg)*
39	4.4 – 206	10.99	0.5 – 2.74 (1.65)	1.36 – 289.78 (123.95)	High Energy	2.7 – 105.81 (50.39)
40	215 – 828	10.99	0.95 – 2.63 (1.90)	10.91 – 248.71 (117.36)	High Energy	11.53 – 94.67 (53.79)
41	853 – 1104	10.99	0.66 – 2.32 (1.74)	3.8 – 182.96 (94.74)	High Energy	5.74 – 78.94 (47.01)
42	1812.4 – 2227.4	10.68	1.52 – 2.45 (1.99)	46.9 – 205.3 (121.74)	High Energy	30.93 – 83.77 (58.19)
43	2327.4 – 2979.4	12.18	1.24 – 2.46	17.68 – 82.93	High Energy	21.98 – 203.9

Reach	Station Range	2 Year Flow (m^3/s)	Velocity (m/s) Range (Avg)*	Unit Stream Power (W/m^2) Range (Avg)*	Estimated Stream Type	Shear Stress (N/m^2) Range (Avg)*
			(2.02)	(57.78)		(123.98)
44	3056.4 – 3610.4	12.18	1.15 – 2.61 (2.00)	19.2 – 231.29 (120.12)	High Energy	16.65 – 88.76 (56.76)
45	3637.4 – 3726.4	11.65	1.91 – 2.35 (2.10)	51.25 – 78.81 (62.59)	High Energy	98.12 – 185.4 (132.84)
Tributary	272 - 1729	3.7	0.4 – 2.61 (1.85)	0.58 – 242.91 (128.33)	High Energy	1.44 – 93.08 (59.30)

* Range of sampled values provided for each parameter, with the reach average in brackets.

3.4.5 Erosion Hazards

Natural watercourses are dynamic features that change configuration and position within a floodplain by means of erosion, meander evolution, and lateral migration processes. When meanders adjust in size and position, the associated erosion and depositional processes can cause damage to structures, property and infrastructure. For this reason, when development is contemplated near a watercourse, it is desirable to designate a corridor, or setback, that is projected to contain all the natural meander and migration tendencies of the channel. Outside of this corridor, it is assumed that private property and structures will be safe from the erosion potential of the watercourse. The corridor is delineated by the erosion hazard limits.

Guidelines presented in *Technical Guide, River & Stream Systems: Erosion Hazard Limit* (MNR 2002), in accordance with the PPS 5.2.2b (MMAH 2024), as well as the *Belt Width Delineation Procedure* (PARISH 2004) were eviewed. The Technical Guide (MNR 2002) treats confined and unconfined systems differently when defining the erosion hazard limits for a watercourse. Unconfined systems are those with no limits or controls on the spatial occupation of the floodplain by a watercourse, typically associated with no discernable valley slope, allowing the channel to migrate freely. Confined systems are those systems in which meander bends are adjacent to valley walls within the reach, and meander tendencies are limited by the walls. It is also possible to have a partially confined system where meander bends are adjacent to a valley wall on only one side that restricts migration, with the other side allowing for free migration of the channel in the floodplain, for example.

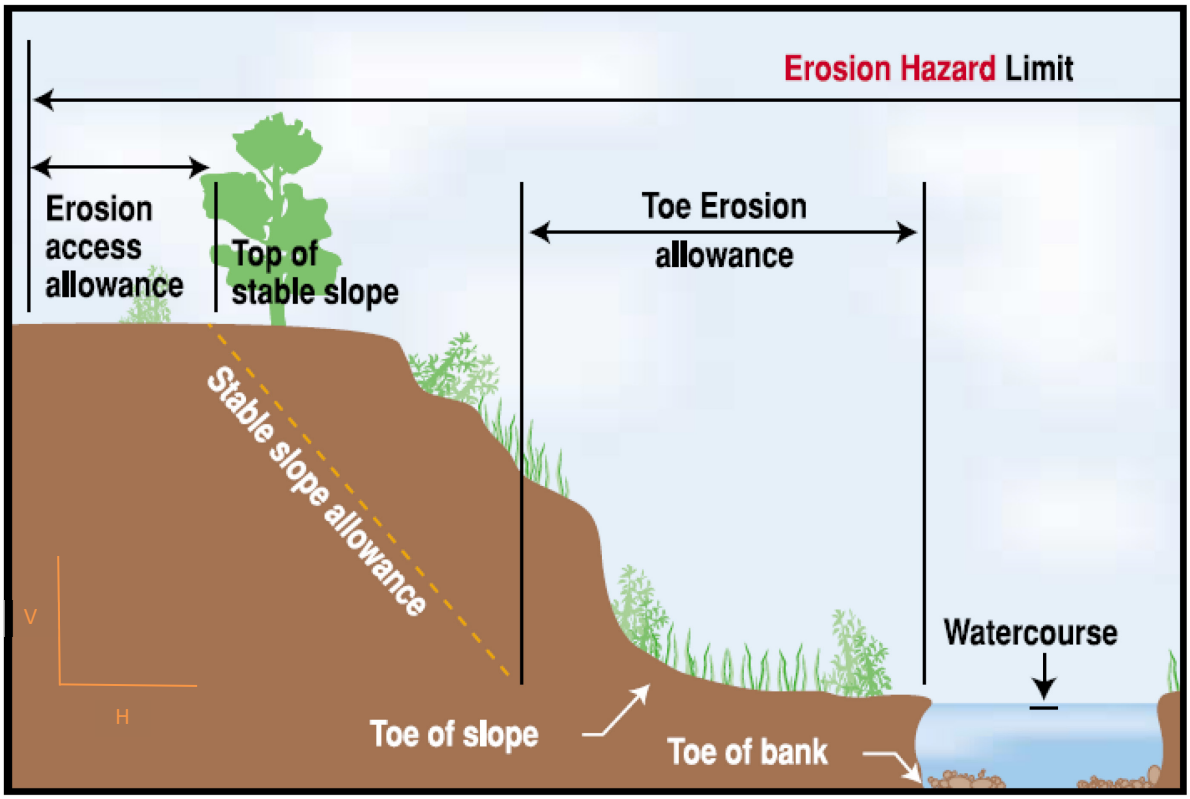


FIGURE 7 Confined System Erosion Hazard Limit where Toe of Valley Slope is Located less than 15 m from the Watercourse (MNR 2002)

East Morrison Creek is a confined system (Figure 7) situated within an existing valley that limits channel migration. The erosion hazard limit for a confined system is determined by (MNR 2002):

1) the staked top of slope if the existing slope is 3H:1V or greater

2) the projected long-term stable top of slope if the existing slope is less than 3H:1V

3) through geotechnical analysis

Applicable toe erosion allowance and erosion access allowance are added to determine the erosion hazard limit. Note that a 3H:1V is considered very conservative for a shale bedrock system; however, the stable slope will vary with the thickness of the overburden.

Figure 8 shows the approximate erosion hazard limit for the study area. The toe and top of slope were delineated based on CH LiDAR (2018) and used to determine the estimated 3H:1V long-term stable top of slope. Note that the offset shown is based on a reach-scale sampling of the long-term stable slope offset and is likely to vary by +/- 10 m. The stable top of slope is presented strictly for the purpose of informing the scale of the erosion issues for the purposes of the EA and the evaluation alternatives and is not intended to delineate the erosion hazard for regulatory purposes. Slopes through the study area are generally steeper than 3H:1V; therefore, the estimated top of stable slope is based on the projected long-term stable slope and extends beyond the existing slope crest. Some of the upland properties are estimated to be within the estimate long-term stable slope erosion hazard, which is why some erosion sites have been identified with risks to private properties.

Engineering and channel design may reduce erosion risk, but such works may require ongoing maintenance and may not reduce erosion hazard limits (i.e., erosion protection works are not counted as “credit” for decreasing the extent of the long-term erosion hazard, even if the risks may be provisionally mitigated). Managing risks within the erosion hazard zone may require collaboration between the Town and private landowners to mitigate future problems and maintenance of erosion protection works. The Town is expected to be responsible for erosion hazards which are fully, or predominantly within the Town owned and/or operated property limits and for risk receivers which are the jurisdictional asset management mandate of the Town (i.e., pathways, pedestrian bridges, transportation facilities, storm sewers, erosion control structures etc.). Notably, within the Town of Oakville, all water and sanitary wastewater infrastructure is owned and operated by the Region of Halton. Refer to Section 4.7 for specific discussion.

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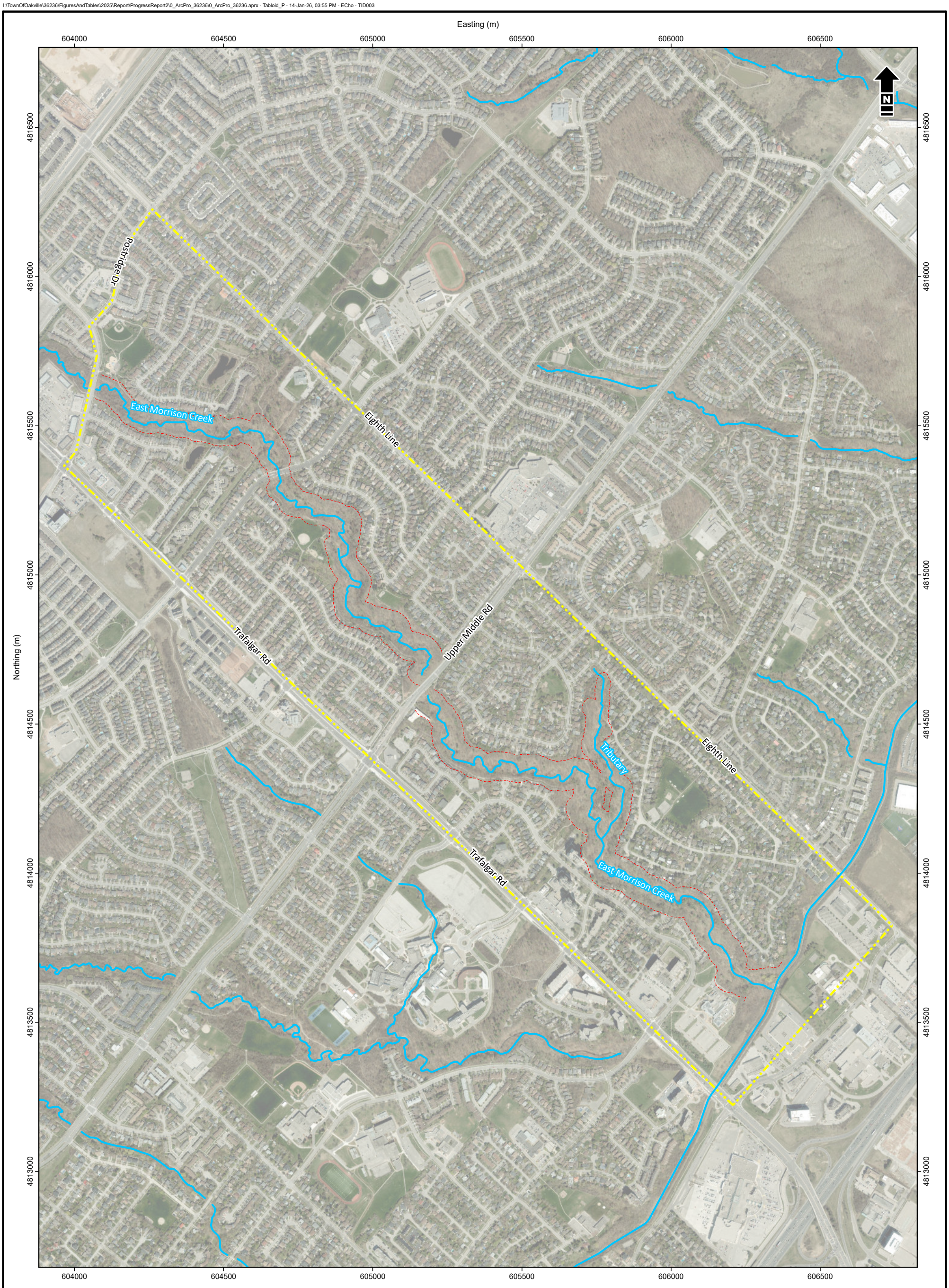

Study Limits
Watercourse
Estimated Stable Top of Slope (3:1)

1:12,000 metres
100 0 100 200
NAD 1983 CSRS UTM Zone 17N

Note: For EA study, does not represent update to regulatory erosion hazard limit.
Reference: Imagery (2023) World Imagery: Peel Region, Town of Oakville, VantorHydrography (2017) Source: Ontario Ministry of Natural Resources and Forestry

MONTROSE ENVIRONMENTAL

Town of Oakville
East Morrison Creek Erosion Mitigation Environmental Assessment

Approximate Erosion Hazard Assessment

Date:	Project:	Submitter:	Reviewer:
January 2026	36236	A. Yates	P. Campbell

Figure 8

3.4.6 Erosion Site Assessment

Erosion sites identified in previous erosion inventories were reassessed as part of this study, along with considerations for the identification of new sites. The location and extent of erosion sites were confirmed during the field assessment. The erosion sites were assessed following the same scoring framework applied in the 2021 inventory (Appendix B). Erosion sites were scored based on eight erosion hazard criteria: type of risk, distance to risk, erosion site length, erosion site height, erosion potential, erodibility, riparian quality and aquatic habitat. These eight criteria can be grouped into three major categories, adding up to a total possible score of 100:

- Consequence of risk (45/100) = type of risk (45 points)
- Probability of risk (45/100) = distance to risk (20 points), site length (5 points), site height (5 points), erodibility (10 points), and erosion potential (5 points)
- Environmental enhancement opportunity (10/100) = riparian quality (5 points) and aquatic habitat conditions (5 points)

The erosion hazard criteria were intended to capture the time until contact is made between the channel and the asset (e.g., trail, outfall, private property) and the impact that would occur (i.e., risk is the product of probability and consequence). Riparian and aquatic habitat quality scoring was intended to reflect that erosion mitigation projects are typically associated with some degree of adverse environmental impacts during construction, which may be appropriate in low-quality habitat but should be avoided unless necessary in a high-quality habitat (i.e., environmental enhancement opportunities). An overall erosion hazard score was generated for each site by summing the score for the eight criteria. The maximum score for each criteria represents the weight of that category in the overall score.

The scoring for risk type from the 2021 inventory framework in Appendix B was revised to include a new risk type for pedestrian bridges with a score of 10 out of 45. Table 9 provides a summary of erosion risk types and their corresponding scores.

TABLE 9 Revised Scoring for Risk Types and their Classification

Risk	Score
Critical Infrastructure	45
Minor Roads/Bridge	35
Private Property/Crossings	25
Secondary Infrastructure	15
Pedestrian Bridges	10
Open Space, Parks, Trails	5
Green Space (no risk)	0

Photographs and descriptions of each erosion site are provided in Appendix F. Erosion site E24 was identified as a new site during the field assessment; it is a valley wall contact with private properties at the top of slope and is located just upstream of erosion site E4. Erosion site scoring is provided in Table 10.

3.4.6.1 Erosion Site Assessment Results

The highest risk sites within the study area are related to critical infrastructure (sanitary sewer at E11) and valley wall contacts with risks to upland private properties. The erosion site scores differ from the 2021 scores. The difference appears to be largely due to differences in the type of risk score, which is the criteria with the largest weight towards the overall score. For the current inventory, stormwater outfalls at erosion sites E6 and E12 were considered secondary infrastructure instead of critical infrastructure as they were not large outfalls. The risk type at E11 was increased to critical infrastructure due to the buried sanitary infrastructure at the culvert. Risks to trails and pedestrian bridges were also considered lower risk than private property. Trails were given a score of 5. Pedestrian bridges were given a score of 10, which falls between secondary infrastructure (15) and trails (5). At sites with multiple risks, the higher risk type was used. For example, many of the valley contacts had a trail at the top of slope with private properties behind and were therefore given a score of 25.

Erosion site E11 was the highest scoring site. There is a CSP through a berm at a trail crossing of the tributary. A sanitary sewer also crosses the tributary at this location above the CSP. At the CSP outlet, the bottom of the culvert was corroded, and flow was undermining the pipe. The outlet was perched and there was a downstream scour pool. Continued erosion to the embankment at the culvert outlet poses a risk to the sanitary sewer above. Based on mapping of the sanitary sewer, the surveyed top of bank at the outlet was 1.88 m from the sewer.

Erosion site locations were compared to the zones and slope instability risk classifications from the Thurber (2025) geotechnical report (Appendix D). The risk classifications for sites where the creek was in contact with the valley slope are provided in Table 10. The slope instability risk at these erosion sites was moderate or high and recommended for further investigation. Note that at some erosion sites, such as E11, valley slope erosion is not the primary risk.

Erosion site E4 had the second highest erosion hazard score from the field assessment. This site is a large valley contact with private properties at the top of slope. It also corresponds to a high-risk slope instability zone, where fence posts appeared to be migrating down slope at properties along Lambeth Road (Thurber 2025). Erosion site E24 is also located within this zone.

Erosion sites E6 and E7 were other high scoring sites. The perched stormwater outfall (E6) is in close proximity to erosion at the toe of valley slope (E7). These sites are located in another high-risk slope instability zone identified by Thurber (2025). Potential impacts at a property on White Oaks Boulevard were observed, including fence posts migrating down slope and separation of the east portion of the parking lot.

High-priority erosion sites with scores of 50/100 and above in Table 10 have been identified for inclusion in the EA evaluation of alternatives. These 12 sites were assessed to be higher risk and require consideration of erosion mitigation opportunities. The high-priority sites are typically located at valley slope contacts (or within the tributary) where private property or critical infrastructure is at risk. For private properties, rear yards, trees, and fences may be at risk. All high-priority erosion sites are located south of Upper Middle Road. Low priority erosion sites (scores below 50/100) will continue to be monitored as part of the Town's regular watercourse monitoring program, with general management recommendation provided as part of the current EA study. These sites are typically in locations where non-critical infrastructure, such as recreational trails, are at risk.

TABLE 10 Erosion Site Scores

Erosion Site	Score									Rank	Slope Instability Risk[1]	Included in EA Evaluation
	Risk Type	Distance to Risk	Site Length	Site Height	Erodibility	Erosion Potential (Stress)	Riparian Quality	Aquatic Habitat Quality	Total Score			
E11	45	16	3	2	6	3	1	3	79	1	Moderate	Yes
E4	25	16	5	5	6	3	3	2	65	2	High	Yes
E6	25	16	4	5	6	3	3	2	64	3	Moderate	Yes
E10	25	16	2	4	4	3	3	3	60	4	High	Yes
E24	25	16	3	5	2	3	3	2	59	5	High	Yes
E7	25	8	2	6	6	3	3	3	56	6	Moderate	Yes
E14	25	8	3	5	6	3	3	1	54	7	Moderate	Yes
E9	25	12	2	4	4	2	3	1	53	8	High	Yes
E16	25	8	3	5	6	2	1	3	53	8	High	Yes
E15	25	8	3	5	6	3	1	2	53	8	High	Yes
E17	25	8	3	4	6	2	1	2	51	11	High	Yes
E5	15	16	3	2	6	3	3	3	51	11	N/A	Yes
E22	25	0	2	4	4	2	3	4	44	13	Moderate	No
E19	25	0	3	5	6	3	1	1	44	13	High	No
E20	10	16	1	2	6	2	3	3	43	15	N/A	No
E21	10	16	1	2	6	2	3	3	43	15	N/A	No
E13	10	16	1	2	6	2	3	3	43	15	N/A	No
E12	15	4	5	4	4	3	3	4	42	18	Moderate	No
E18	5	12	3	5	6	2	3	3	39	19	Moderate	No
E8	5	16	2	2	6	2	3	2	38	20	N/A	No
E23	5	12	2	4	6	2	3	3	37	21	Moderate	No
E1	5	16	3	2	4	2	1	2	35	22	N/A	No
E3	5	12	3	2	6	2	3	1	34	23	N/A	No
E2	5	0	2	3	6	3	3	4	26	24	N/A	No

Note: (1) Existing slope instability risk classification from Thurber (2025)

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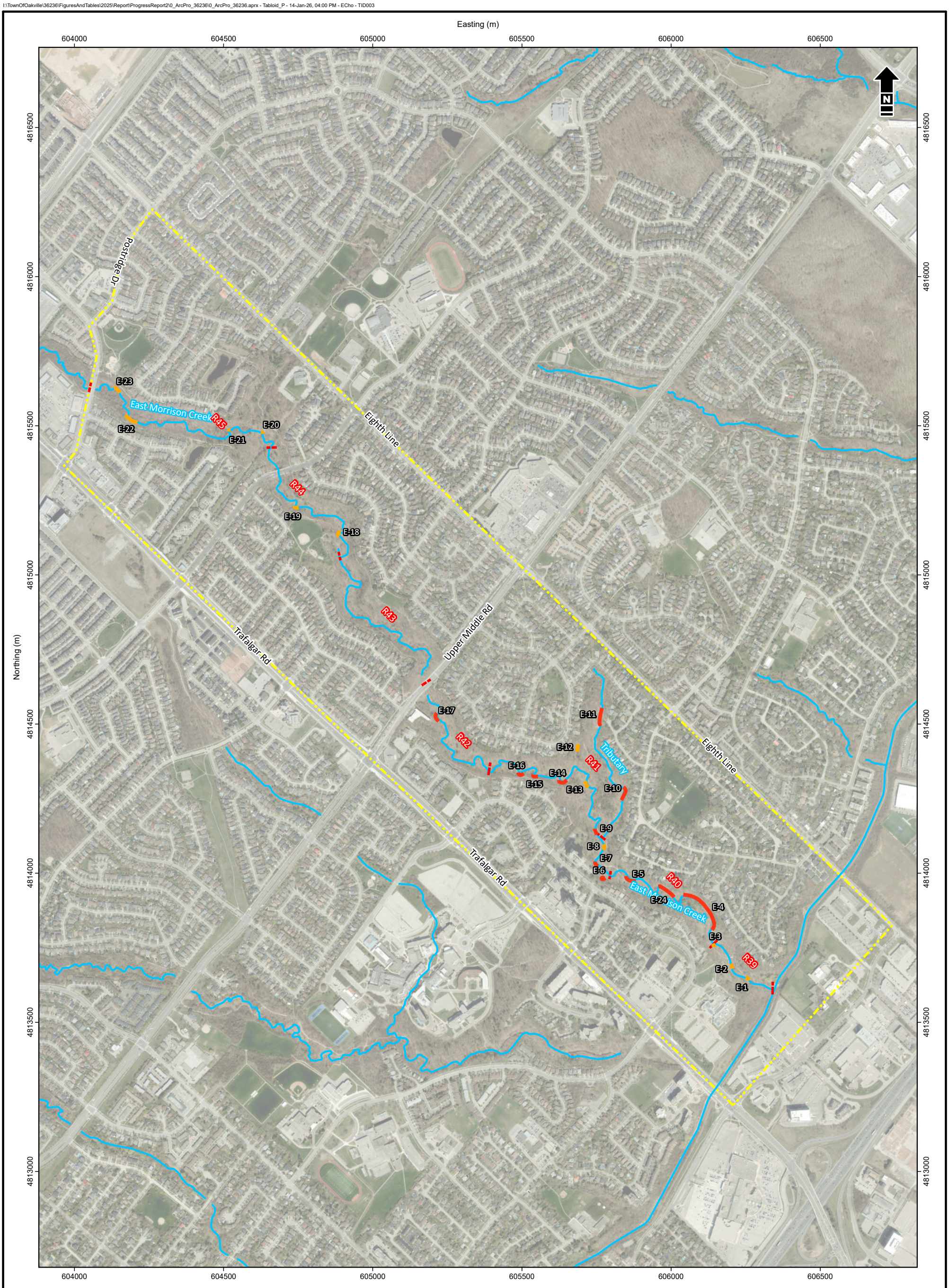

Study Limits

Watercourse

Erosion Site Extent

Included in EA Evaluation

Not Included in EA Evaluation

Reach Break

1:12,000 metres

100 0 100 200

NAD 1983 CSRS UTM Zone 17N

Reference: Imagery (2023) World Imagery: Peel Region, Town of Oakville, VantorHydrography (2017) Source: Ontario Ministry of Natural Resources and Forestry

MONTROSE ENVIRONMENTAL

Town of Oakville

East Morrison Creek Erosion Mitigation Environmental Assessment

Erosion Sites

Date:	Project:	Submitter:	Reviewer:
January 2026	36236	A. Yates	P. Campbell

Figure 9

3.4.7 Infrastructure Assessment

During the field assessment, the condition of infrastructure was also assessed following the 2021 scoring methods. Infrastructure included bank and channel treatments, stormwater outfalls, drop structures, and pedestrian bridges. Information on the type, material, dimensions, and condition of infrastructure was recorded. Infrastructure condition grading is described in Table 11.

TABLE 11 Infrastructure Condition Grading Key

Condition Grade	Description
Very Good	Well maintained and in good condition (new or recently rehabilitated).
Good	Acceptable or approaching mid stage of expected service.
Fair	Light structural deterioration and deficiencies in providing intended service.
Poor	Approaching end of life or large portion in significant deterioration, barely providing intended function.
Very Poor	At or beyond expected service life, rendering the asset unusable and unable to perform intended function.

Local bank and channel treatments were present throughout the study area at pedestrian crossings, stormwater outfalls, and valley wall contacts. Bank and channel treatments included gabion baskets, armourstones, and boulders. Many of these erosion control measures are being undermined or outflanked due to channel widening and degradation. Gabion baskets were the most common bank treatment and were generally in fair condition; they were providing some function, but evidence of wire failure and stone loss was common. Gabion baskets were in poorer condition or had failed downstream of stormwater outfalls.

Stormwater outfalls were generally in good condition, except the two outfalls in Reach 41 previously identified as being in very poor condition which correspond to erosion sites E6 and E12. These outfalls were both perched, and the gabion baskets aprons were no longer functioning. At outfall E6 a large scour pool has formed and is causing toe erosion of the valley slope. Downstream of the outfall at E12, a steep outfall channel/gully has incised into the valley slope.

There were several pedestrian bridge crossings within the study area. Bank erosion and exposed bridge footings were observed where banks were unprotected, including pedestrian bridges at erosion sites E13, E20, and E21.

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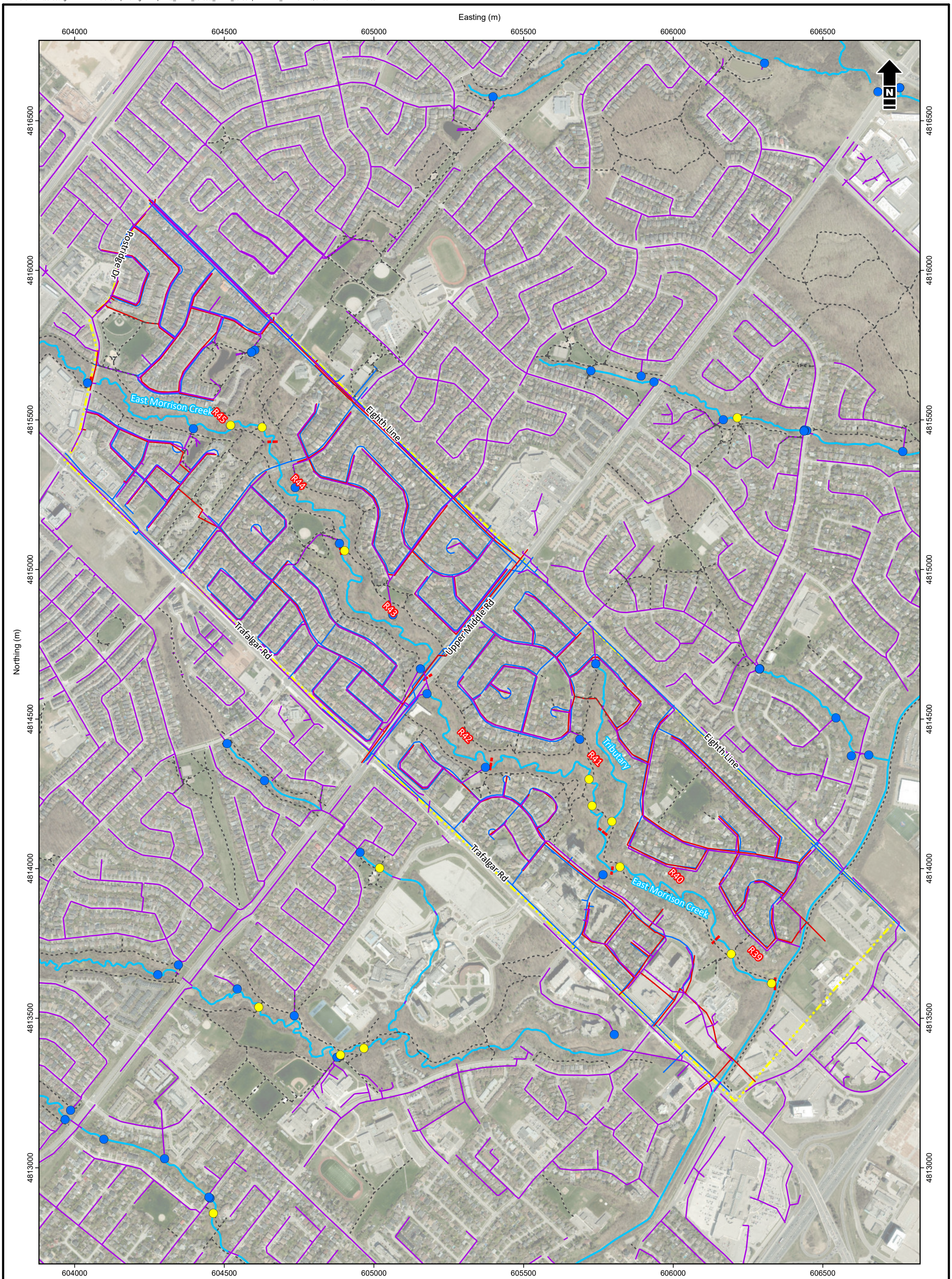

Study Limits
Watercourse
Reach Break
Sanitary Sewer
Watermain
Storm Sewer
Trail
Outfall
Pedestrian Crossing

1:12,000 metres
100 0 100 200
NAD 1983 CSRS UTM Zone 17N

Reference: Imagery (2023) World Imagery: Peel Region, Town of Oakville, VantorHydrography (2017) Source: Ontario Ministry of Natural Resources and Forestry

MONTROSE ENVIRONMENTAL

Town of Oakville
East Morrison Creek Erosion Mitigation Environmental Assessment

Existing Infrastructure

Date:	Project:	Submitter:	Reviewer:
January 2026	36236	A. Yates	P. Campbell

Figure 10

3.4.8 Additional Site Visit to Assess Storm Impacts

An additional site visit was completed to assess any impacts that occurred following a large storm in July 2024. A site walk was completed through the study area from the Morrison-Wedgewood Diversion Channel to Postridge Drive on December 2, 2024 to document any changes that occurred since the Fall 2023 field assessment. This included photographs and visual observations of erosion through the study area to document changes at previously identified erosion sites and identify any new erosion sites. Appendix F provides photographs of each erosion site from the October 2023 and December 2024 site visits for comparison, as well as descriptions of any changes observed.

At most of the erosion sites, no significant change was observed, or minor changes associated with the movement of woody debris. The most notable changes were at erosion sites E2 and E4. At E2 more riprap was present in the channel which appears to have washed out from the upstream right bank south of the pedestrian bridge. At E4 some slope recession was visible with material loss at roots and a new fallen tree. The tree still had its leaves, so it likely fell more recently than the July storm. Exposed shale was also now visible along the thalweg at the toe of slope. Another change observed during the site visit was the loss of stone from gabion baskets upstream of E5.

A few topographic survey points were taken to confirm visual observations at top priority sites. At E4 the toe of slope had not shifted laterally and downstream bed elevations at the thalweg were approx. 0.06 m lower than the previous survey. This is slightly higher than the tolerance for survey error of 0.04 m, which indicates minor bed degradation and is consistent with visual observations. At E11 the bed elevations at the thalweg downstream of the CSP were ~0.03 m different than the previous survey, which is within the tolerance for survey error. Bank locations were also similar and consistent with visual observations of minimal change at E11.

Observed changes at a few sites did not affect the erosion assessment results. All sites within the study area are scheduled to be reassessed in 2026 through the Town inventory.

3.5 Ecological Studies and Inventories

To classify the existing natural heritage conditions onsite, Montrose completed a background review of available resources for the study area and completed applicable natural heritage field surveys to verify the background data (Appendix G). Specifics of the field surveys is discussed further in the following sections of the report.

Species Conservation Act 2026

This Environmental Assessment has been prepared while the project remains in the preliminary design phase and during a period of legislative transition in Ontario with respect to Species at Risk. A transition from the *Endangered Species Act* to the *Species Conservation Act* (SCA), which is expected to be released in 2026, is confirmed; however, the timing of full implementation remains uncertain. Accordingly, Species at Risk considerations presented herein are based on the regulatory framework in effect at the time of reporting, with the understanding that a reassessment of applicable requirements will be required at subsequent design or implementation stages to ensure compliance with the governing legislation in force at that time.

3.5.1 Terrestrial Ecology Assessment

A background review of natural heritage information for the site was completed by Montrose to identify existing and historic site conditions. Habitat conditions were verified during field surveys of the site in 2023. Historical field

surveys were completed within the study area and Montrose field surveys were intended to verify site conditions and classification of the existing natural habitat within the study area. Montrose 2023 field surveys included ecological land classification (ELC), vegetation inventory, incidental wildlife observations, and aquatic habitat monitoring. Montrose completed additional fieldwork in June 2025 including a tree inventory and an assessment of habitat for wildlife and potential Species at Risk (SAR) habitat within areas proposed for selective works (see Section 4.4; Figure 13). More detailed inventories will be required through the detailed design stage with the confirmation of staging areas and access routes.

3.5.1.1 Ecological Land Classification

Background

Through the completion of the background review, a list of vegetation species potentially present within the study area. One SAR, black ash (*Fraxinus nigra*) was identified as potentially occurring within the study area.

Methods and Results

Montrose conducted wandering transects on October 12, 2023 in order to classify the vegetation communities present within the study site. Communities were classified according to *Ecological Land Classification for Southern Ontario* (Lee et al. 1998). In conjunction with the ELC habitat verification, a vegetation inventory for the study area was also completed. No rare or SAR vegetation was recorded during the inventory. A total of six ELC communities were identified and are summarized in Table 12.

TABLE 12 ELC Communities Present on Study Site

ELC Code	ELC Community Type	S-Rank	Community Description
CUM1	Mineral Cultural Meadow	SNA	Open canopy waste areas dominated by herbaceous vegetation. Non-native species such as reed canary grass (*Phalaris arundinacea*), wild carrot (*Daucus carota*), and teasel (*Dipsacus fullonum*) were dominant.
CUT1	Mineral Cultural Thicket	SNA	This community was variable, but dominated by non-native shrub species such as common buckthorn (*Rhamnus cathartica*) and Tartarian honeysuckle (*Lonicera tartarica*).
FOD2-4	Dry – Fresh Oak – Hardwood Deciduous Forest	S5	Hardwood species such as red oak (*Quercus rubra*), basswood (*Tilia americana*), and sugar maple (*Acer saccharum*) were prominent canopy species. Canopy cover varied in density throughout the community. Small spotted jewelweed (*Impatiens capensis*) meadow marsh inclusions were scattered throughout the community.
FOD5-3	Dry – Fresh Sugar Maple – Oak Deciduous Forest	S5	This community was found on upper slopes and plateaus. Sugar maple and red oak were dominant canopy species in this community.
FOD6-5	Fresh – Moist Sugar Maple – Hardwood Deciduous Forest	S5	This was the most prominent community throughout the study site and was found along the valley floors. Canopy cover was dense and dominated by sugar maple. Rich shrub layers, with species such as gray dogwood (*Cornus racemosa*), were common in canopy breaks. Small dry-fresh and fresh-moist sugar maple inclusions were scattered throughout the community. Large diameter standing snags were present.
FOM3-1	Dry – Fresh Hardwood – Hemlock Mixed Forest	S4S5	Canopy cover was dense and dominated by hemlock (*Tsuga canadensis*) and sugar maple. Other conifer species such as white cedar (*Thuja occidentalis*) and white pine (*Pinus strobus*) were also common.

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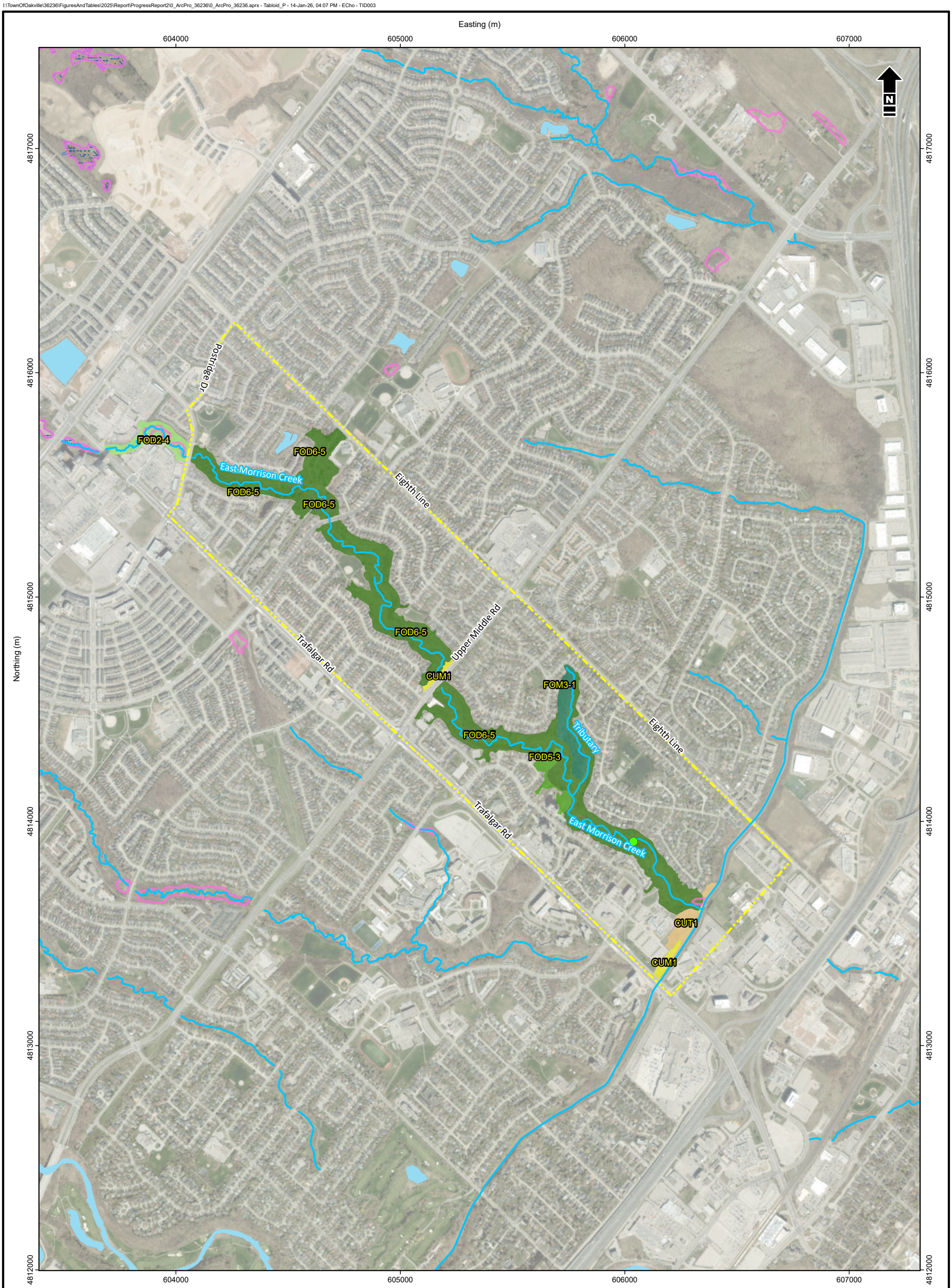

- Study Limits
- Watercourse
- Water Body
- Wetland
- Conservation Halton - Wetland Hazard
- Candidate Bat Cavity Tree

Ecological Land Classification

- CUM1: Mineral Cultural Meadow
- CUT1: Mineral Cultural Thicket
- FOD2-4: Dry-Fresh Oak-Hardwood Deciduous Forest
- FOD5-3: Dry-Fresh Sugar Maple - Oak Deciduous Forest
- FOD6-5: Fresh-Moist Sugar Maple-Hardwood Deciduous Forest
- FOM3-1: Dry-Fresh Hardwood - Hemlock Mixed Forest

1:16,000 metres
150 0 150 300
NAD 1983 CSRS UTM Zone 17N

Reference: Imagery (2023) World Imagery: Peel Region, VantorHydrography (2017) Source: Ontario Ministry of Natural Resources and Forestry

MONTROSE ENVIRONMENTAL

Town of Oakville
East Morrison Creek Erosion Mitigation Environmental Assessment

Ecological Land Classification

Date:	Project:	Submitter:	Reviewer:
January 2026	36236	A. Yates	P. Campbell

Figure 11

3.5.1.2 Tree Inventory

A tree inventory was completed on June 11, 2025. A total of 495 trees were inventoried within the work areas proposed for selective works (see Section 4.4; Figure 13). Twenty-two species were observed, with sugar maple (*Acer saccharum*) being the most common (n = 288). Other common species included ironwood (*Ostrya virginiana*; n = 31), red oak (*Quercus rubra*; n = 28), Norway maple (*Acer platanoides*; n = 27), and white pine (*Pinus strobus*; n = 21). No SAR or regionally rare trees were recorded. Further information on the tree inventory results can be found in the arborist memorandum in Appendix K (K1).

Bat Habitat

The background review identified potential habitat for seven SAR bat species: little brown myotis (*Myotis lucifugus*), northern myotis (*Myotis septentrionalis*), tri-colored bat (*Perimyotis subflavus*), eastern small-footed myotis (*Myotis leibii*), silver-haired bat (*Lasionycteris noctivagans*), eastern red bat (*Lasiurus borealis*), and hoary bat (*Lasiurus cinereus*). All of these species are currently listed as Endangered (END) under O. Reg. 230/08 of the *Endangered Species Act* 2007 (ESA);

In Ontario, cavity-roosting bat species such as little brown myotis (Myotis lucifugus) and Northern Myotis (Myotis septentrionalis) rely on trees with cavities, dead snags and/or exfoliating bark for roosting, whereas canopy-roosting migratory species such as tri-colored bat (Perimyotis subflavus), silver-haired bat (Lasionycteris noctivagans), eastern red bat (Lasiurus borealis), and hoary bat (Lasiurus cinereus) primarily use foliage or the canopy of trees for roosting habitat rather than tree cavities.

Identification of suitable bat maternity roosting habitat for cavity species was determined following Step 1 of the Maternity Roost Surveys (Forests/Woodlands) protocol provided by MECP. The location of trees exhibiting appropriate attributes, such as appropriate diameter-at-breast-height (DBH), cavities, loose bark, cracks, or knot holes in the corresponding ELC communities, were recorded during the tree inventory. Additionally, decay class was assessed. Based on Figure 12 below, each snag tree was ranked into a decay class of 1 through 6. Class 1 has the least amount of decay present, and Class 6 has the most. Trees in early stages of decay, classes 1 to 3, are of high-quality or preferred habitats, while trees in late stages of decay, classes 4 to 6, are of lower quality or less favoured habitats. Class 1 to 3 trees are typically preferred for roosting due to their bark and wood being mostly still intact, offering greater protection from the elements compared to a more decayed tree that has lost all its bark and whose wood has been decomposing for many years.

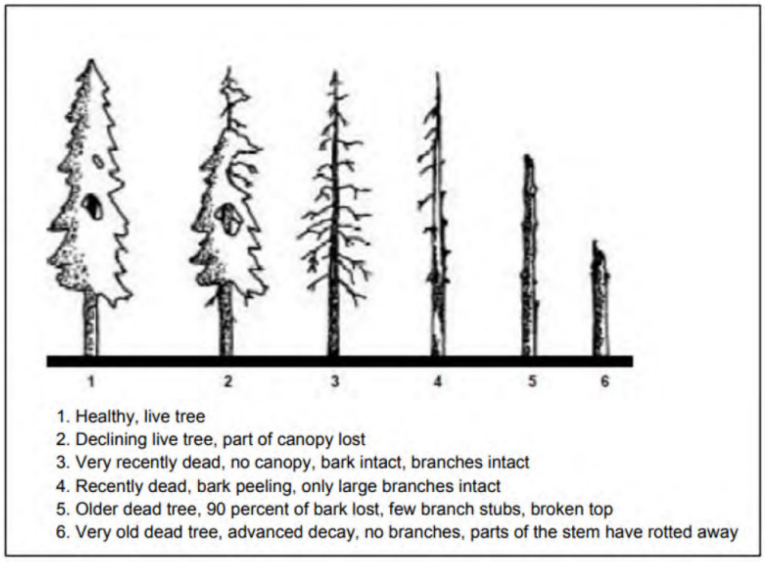

FIGURE 12 Snag Decay Classification (MNR 2017)

Only one candidate bat cavity tree was recorded during the tree inventory. This tree was a sugar maple with a DBH of 46 cm. The tree fell into decay Class 2, indicating it is high-quality or preferred habitat for cavity nesting, non-migratory species. Notable features of the tree included cavities, loose bark, and knot holes. In addition, the entire surrounding mature forest communities, particularly those associated with the main channel and characterized by closed to dense canopy conditions, provide suitable roosting habitat for migratory, canopy-roosting bat species.

3.5.1.3 Wetlands

No wetlands were identified within the study area during the background review or field visits. One Provincially Significant Wetland (PSW) wetland complex: North Oakville-Milton East Wetland Complex, was identified adjacent to the northwest extent of the study area using Land Information Ontario (LIO) wetland mapping. The PSW is approximately 400 m upstream of the study area and over 2.75 km upstream of the nearest work area (E7). No impacts to the wetland complex are anticipated as it is located outside of the study area and away from the proposed works.

Conservation Halton wetland hazard mapping indicates that the nearest wetland hazard areas are approximately 2.3 km upstream and 235 m downstream of the nearest work areas (E7 and E4, respectively). No impacts within these hazard areas are anticipated.

3.5.1.4 Wildlife

Incidental Wildlife

During the field visit on June 11, 2025, Montrose ecologists collected a list of wildlife species that were incidentally observed during the completion of the tree inventory. Incidental wildlife observations were restricted to the work areas proposed for selective works. No rare or SAR wildlife were observed. Table 13 below lists the species encountered.

TABLE 13 Incidental Wildlife Observations

Common Name	Scientific Name	ESA Status	Evidence
Avian			
American Crow	*Corvus brachyrhynchos*	-	Observation/Vocalization
American Goldfinch	*Spinus tristis*	-	Vocalization
American Robin	*Turdus migratorius*	-	Vocalization
Black-capped Chickadee	*Poecile atricapillus*	-	Vocalization
Blue Jay	*Cyanocitta cristata*	-	Vocalization
Downy Woodpecker	*Dryobates pubescens*	-	Observation/Vocalization
Great Crested Flycatcher	*Myiarchus crinitus*	-	Vocalization
Mourning Dove	*Zenaida macroura*	-	Vocalization
Northern Cardinal	*Cardinalis cardinalis*	-	Vocalization
Red-bellied Woodpecker	*Melanerpes carolinus*	-	Vocalization
Red-eyed Vireo	*Vireo olivaceus*	-	Vocalization
Red-tailed Hawk	*Buteo jamaicensis*	-	Vocalization
Herpetofauna			
Green Frog	*Lithobates clamitans*	-	Observation

SAR Screening

Species at Risk (SAR) are defined as species that are listed as either Threatened or Endangered under O. Reg. 230/08 of the *Endangered Species Act* 2007 (ESA); these species and their habitats are protected under the ESA. For the purposes of this study, species listed as Special Concern will also be considered. Special Concern species do not receive the same protection under the ESA as Threatened or Endangered species; however, their confirmed habitat is considered Significant Wildlife Habitat (SWH) under the Provincial Planning Statement (PPS; MMAH 2024). Special Concern species are also the most likely to be uplisted to Threatened or Endangered, which can have implications for projects with lengthy timelines. It is important to note that the screenings presented in this report are based on the current legislative framework under the ESA. Once the SCA is implemented, the transition may result in changes to regulatory requirements, approaches, or timelines relative to those described in this report. Accordingly, upon implementation of the SCA, a reassessment of applicable requirements should be undertaken to ensure compliance with the governing legislation at that time.

Montrose conducted a background records review to create a list of potential SAR species within the expanded study area. 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.

The following species below were included within the SAR screening:

- Species listed as either Threatened (THR), Endangered (END), or Special Concern (SC) under the ESA. Individuals of these species, as well as their habitat, are protected in Ontario.
- Species listed under Species at Risk Act (SARA*)* are protected only on federal lands or for those projects that are permitted by a federal agency. On private or provincially owned lands, only aquatic species listed as Endangered (END), Threatened (THR), or Extinct (EXT), and migratory birds listed on Schedule 1 where critical

habitat has been identified are protected under SARA. Should the species also be listed under the ESA, where the ESA provides an equal or greater protection, the ESA takes precedence.

Survey results were used to inform the assessment of potential presence for SAR. The study area was then assessed as having low, candidate or confirmed potential to support habitat for each SAR based on the following criteria:

- **Low**: The site lacks the necessary size, geographic location, or other features required for SAR habitat.
- **Candidate:** The site contains candidate habitat features, as identified during the site visit and through aerial photography interpretation. Background records identified the species within 10 km of the study area.
- **Confirmed:** The site contains candidate habitat features, as identified during previous field visits, Montrose site visits, and through aerial photography interpretation. The SAR was observed within 2 km of the study area.

A total of 29 SAR species were identified as potentially occurring within the study area during the background review. This number has been refined to 14 candidate SAR based on the habitat conditions observed during field surveys. This includes 6 birds, 2 herpetofauna, and 6 mammals which are presented in Table 14 below. The full SAR screening can be found in Appendix G.

TABLE 14 Candidate Terrestrial Species at Risk

Common Name	Scientific Name	ESA Status	Habitat Analysis
Avian			
Barn Swallow	*Hirundo rustica*	SC	**Candidate** - Suitable nesting habitat may exist under the bridges onsite.
Canada Warbler	*Cardellina canadensis*	SC	**Candidate** - Suitable habitat may exist in the FOD6-5 community.
Eastern Wood-pewee	*Contopus virens*	SC	**Candidate** - Suitable habitat may exist in the forested communities: FOD2-4, FOD5-3, FOD6-5, and FOM3-1.
Olive-sided Flycatcher	*Contopus cooperi*	SC	**Candidate** - Suitable habitat may exist in the FOM3-1 community.
Red-headed Woodpecker	*Melanerpes erythrocephalus*	END	**Candidate** - Suitable habitat may exist in the FOD2-4 and FOD6-5 communities.
Wood Thrush	*Hylocichla mustelina*	SC	**Candidate** - Suitable habitat may exist in the forested communities: FOD2-4, FOD5-3, FOD6-5, and FOM3-1.
Herpetofauna			
Northern Map Turtle	*Graptemys geographica*	SC	**Candidate** - Potential habitat may exist in East Morrison Creek.
Snapping Turtle	*Chelydra serpentina*	SC	**Candidate** - Potential habitat may exist in East Morrison Creek.
Mammalian			
Eastern Red Bat	*Lasiurus borealis*	END	**Candidate** - Suitable habitat exists in the forested communities. One candidate bat tree was recorded during the tree inventory.
Hoary Bat	*Lasiurus cinereus*	END	
Little Brown Myotis	*Myotis lucifugus*	END	
Northern Myotis	*Myotis septentrionalis*	END	
Silver-haired Bat	*Lasionycteris noctivagans*	END	
Tri-colored Bat	*Perimyotis subflavus*	END	

SC = Special Concern
END = Endangered

Significant Wildlife Habitat (SWH) Screening

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 and areas which are important to migratory or non-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 7E, in which the subject property is located, is described in the Significant Wildlife Habitat Criteria Scheduled for Ecoregion 7E (MNRF 2015). SWH is protected under the PPS (MMAH 2024).

Wildlife habitat is divided into four broad categories as described in the Significant Wildlife Habitat Technical Guide (SWHTG; MNR 2000), as follows:

- Seasonal concentration areas
- Rare vegetation communities or specialized habitats for wildlife
- Habitats of Species of Conservation Concern (SCC), excluding the habitats of Endangered and Threatened species
- Animal movement corridors

The following candidate SWH listed in Table 15 below has been identified within the study area. The full SWH screening can be found in Appendix G.

TABLE 15 Candidate Significant Wildlife Habitat (SWH)

SWH Type	Associated Habitat	Assessment
Seasonal Concentration Areas		
Bat Maternity Colonies	Tree cavities and vegetation in mature deciduous and mixed forests.	**Candidate -** SWH type may be present within the forested communities.
Migratory Butterfly Stopover	Combination of field and forest habitat at least 10 ha in size and within 5 km of Lake Ontario or Lake Erie.	**Candidate -** Forest and field habitat of an appropriate size are present within the study area, and the study area is within 5 km of Lake Ontario.
Landbird Migratory Stopover	Woodlands greater than 5 ha in size and within 5 km of Lake Ontario or Lake Erie.	**Candidate -** Forest habitat of an appropriate size is present within the study area, and the study area is within 5 km of Lake Ontario.
Specialized Habitats of Wildlife		
Special Concern and Rare Wildlife Species	Any habitat that supports Special Concern or rare wildlife species.	**Candidate -** Suitable habitat for various Special Concern species may exist within the study area.

3.5.2 Scoped Aquatic Habitat Assessment

3.5.2.1 Background

Montrose completed a desktop assessment of aquatic habitat using data received from CH and various online databases. Additionally, an aquatic habitat assessment was completed during the field visits on October 23, and 24, 2023. The results of the desktop and field assessments are discussed in the following sections.

Water Temperature

As per LIO data, East Morrison Creek is a coldwater system. Coldwater systems are generally classified by having a mean July temperature less than 17.5 °C and/or by the fish species present (Jones & Schmidt 2019). However, data acquired from CH indicates that thermal conditions within the study area may be warmer. The data covered June through September in the years 2009, 2011, and 2013 and was recorded at Algrove Park (Station SXM-107) located within the study area just downstream of the tributary confluence. Table 16 below summarizes the maximum, minimum, and average temperatures across the three monitoring years. Using water temperature data provided by CH, mean July temperatures ranged from 17.2 °C to 20.5 °C, resulting in an overall July mean of 19.07 °C. CH's Water Temperature Metric Update (2022), based on the same monitoring station (SXM-107), reports a mean July temperature of 18.76 °C. Both values indicate a "Cool" (>18.5 °C – <21.5 °C) Aquatic Ecosystem Classification (AEC) thermal class.

TABLE 16 East Morrison Creek Water Temperature Data

Year	Maximum Temperature	Minimum Temperature	Mean Temperature (July)	Mean Temperature (June – September)
2009	22.8 °C	11.3 °C	17.2 °C	17.2 °C
2011	25.7 °C	12.4 °C	20.5 °C	18.8 °C
2013	26.5 °C	10.3 °C	19.5 °C	17.5 °C

Benthic Invertebrates

Montrose received benthic invertebrate data from CH on May 2, 2025 to include in the background aquatic habitat assessment. Benthic invertebrate communities are excellent indicators of overall water quality and environmental conditions for the reasons outlined below (Griffiths 1999):

- Abundant in all types of aquatic systems
- Readily identifiable by experienced taxonomists
- Remain in a localized area, as they have restricted mobility and specific habitat requirements
- Continuously exposed to all conditions of the local environment through their life cycle
- Integrate the effects of pollutants and environmental conditions over time, and therefore, provide a holistic measure of water quality

The data provided by CH included samples from 3 stations over the years of 2004 to 2021, and included a total of 35 taxonomic groups. Taxa richness refers to the number of distinct taxonomic groups within a sample, which is an indicator of community diversity, and was calculated for each sampling event. Table 17 below summarizes the taxa richness for each sampling event.

TABLE 17 Taxa Richness

Station	Sampling Date	Taxon Richness
SXM-107	July 6, 2005	13
	May 13, 2009	11
	May 25, 2011	9
	April 16, 2013	10
	May 14, 2015	14
	May 23, 2017	12
	May 9, 2019	14
	May 13, 2021	8
SXM-378	June 30, 2004	11
	July 11, 2005	15
SXM-538	June 30, 2004	10

The Rapid Stream Assessment Technique (RSAT) method for benthic invertebrates was used to generally assess water quality. Given the taxonomic groups recorded across all stations and years, water quality is likely fair – good. Mayflies, caddisflies, and stoneflies, which indicate good water quality were recorded. However, groups such as aquatic worms and midgeflies, which are typically indicative of poor water quality were also recorded.

Additional indices such as the Shannon-Weiner Diversity Index (H'), Hillsenhoff Biotic Index (HBI), and Percent Ephemeroptera, Plecoptera, and Trichoptera (Percent EPT) are commonly calculated with benthic invertebrate data to gain a deeper understanding of overall stream health. These additional analyses may be considered at the detailed design phase, provided they will enhance design objectives and monitoring criteria.

3.5.2.2 Aquatic Habitat Assessment

During the site visit on October 23 and 24, 2023, Montrose completed a preliminary aquatic habitat assessment throughout the site. This did not include a fish community assessment, but any species observations were recorded. The aquatic habitat was quite variable throughout the site with many riffle-pool-riffle sequences noted. Multiple areas of erosion were noted, including undercut banks which could potentially provide shelter for fish and aquatic invertebrates. Failed riprap shoreline armouring was noted showing previous human influence on the channel. Additionally, vegetation overhanging the streambanks, while not present along the entire creek, was abundant in multiple areas, and has the potential to provide shelter and foraging habitat for aquatic species. Potential barriers for fish passage and habitat were also observed along the creek including large debris and log jams. Both detritus and woody debris was observed; however, the larger woody debris could also provide shelter for small fish and organic input for benthic invertebrates. Shale outcrops occasionally present throughout the creek could also pose a potential barrier to fish passage during low-flow conditions. Stagnant areas prone to siltation that were present within the creek reduce the amount of suitable fish breeding habitat.

Fish Community

Montrose completed a desktop fish community analysis using a mixture of agency consultation and background databases. Fish community data from CH was received on September 24, 2023 and May 2, 2025, which included 34 species. Natural Heritage Information Centre (NHIC), LIO, DFO, and iNaturalist were also searched by Montrose to gather any additional fish records. Only one additional species not included on CH's list was found when searching the other sources—White Perch. The fish species identified in the desktop analysis are listed in Appendix G.

Two SAR fish species, American Eel (*Anguilla rostrata*) and Redside Dace (*Clinostomus elongatus*), were identified in the desktop analysis. Conservation Halton records indicate that the most recent American Eel observation was December 31, 1975, and the most recent Redside Dace record was September 30, 2000. Table 18 provides further details on these species' habitat requirements. Upon enactment of the SCA, regulatory responsibility for aquatic Species at Risk will transition only to the DFO; therefore, the MECP will no longer be the responsible authority for aquatic SAR species.

TABLE 18 Aquatic Species at Risk

Common Name	Scientific Name	ESA Status	SARA Status	Preferred Habitat
American Eel	*Anguilla rostrata*	END	No Status	Freshwater, estuaries, and coastal marine waters that have access to the Atlantic Ocean.
Redside Dace	*Clinostomus elongatus*	END	END	Clear pools and slow-moving sections of streams and headwaters with rocky, sandy, or gravel bottoms and overhanging vegetation for cover.

END = Endangered

At this point, further fish community surveys or analyses are not required. These may be considered at the detailed design phase if it is shown that current fish community data are insufficient. In the case that further analysis is required, Wildlife Scientific Collector's Authorization (WCSA) and Scientific License to Collect Fish (SFCL) will need to be obtained.

3.6 Archaeological Resources Screening Assessment

A Stage 1 archaeological assessment was conducted by TMHC Inc. (TMHC) for the East Morrison Creek Mitigation Study area. The report is provided in Appendix E. The Stage 1 assessment confirmed that portions of the study area with previous disturbance have low to no archaeological potential and do not require further assessment. Grassed and treed portions are recommended for Stage 2 archaeological assessments. Therefore, EA projects identified in Section 4 that are likely to include ground disturbance within primarily undisturbed areas are recommended for Stage 2 assessments prior to, or concurrently with the detailed design phase following the completion of the EA study.

4 PHASE 2 – EVALUATION OF ALTERNATIVES

The section of East Morrison Creek through the study area has been identified as an area with several erosion concerns by the Town of Oakville. Through this study, potential causes of the erosion were identified and evaluated with the goal of ultimately recommending alternative options for erosion control.

Through the technical assessments completed for this study, an understanding of the factors contributing to the erosion concerns within the study area was established. Factors that contribute to the erosion issues include deteriorated or failing erosion control works, local energy conditions, and natural channel and valley wall adjustment processes (see discussion in Section 3).

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 infrastructure
- Protection and mitigation of erosion risks for adjacent private properties
- Long-term protection of underlying bedrock
- Protection and/or enhancement of aquatic habitat
- Protection and/or enhancement of riparian vegetation
- Protection of private property

Use of 'green solutions' (bioengineering and "soft" erosion mitigation approaches) where feasible. Detailed descriptions of the alternative solutions developed for the study area are presented in the following sections (Section 4.1), followed by alternative evaluation (Section 4.2) and public and agency consultation (Section 4.3, Appendix H) to select the preferred alternative (Section 4.4).

4.1 Development of Alternatives

Identification of alternative solutions is the second phase of the EA process. The list of alternative solutions with respect to stream erosion in the East Morrison Creek study area are described in further detail in the sections below.

4.1.1 Alternative 1: Do Nothing

In the Do Nothing alternative (Appendix H4, PIC#2 Posters 12 and 13), no action is taken to address the identified erosion issues as outlined in Section 3. This alternative is always considered in an EA to assess the impact of taking no action to address the issues under evaluation. This alternative enables a continuation of natural channel and slope processes that are posing risk to infrastructure (sanitary sewers, outfalls, trails) and private properties throughout the study area. Damage from erosion may occur gradually over time or suddenly due to a high magnitude flood event.

The Do Nothing alternative will result in no direct or immediate 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 potential slope failure. Aquatic habitat will continue to generally lack complexity and remain in fair to poor condition and may worsen over time. Bank and slope destabilization and continued erosion will result in the loss of terrestrial vegetation in impacted areas.

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 substantial failure of channel banks and/or valley slopes which would directly impact infrastructure and/or private property.

4.1.2 Alternative 2: Continuous Monitoring

In the continuous monitoring alternative, no action is immediately taken to address the identified erosion issues as outline in Section 3. However, areas of high sensitivity throughout the study area would be identified and monitored, based on potential erosion risk to infrastructure and/or private property. A site-specific monitoring program would be developed and implemented to assess progression of erosion and site conditions over time to further develop understanding of erosion risk potential to infrastructure and private property. The continuous monitoring alternative differs from the Town's regular 5-year watercourse monitoring program as it consists of more detailed monitoring of specific erosion sites including annual topographic surveys for accurate measurement of erosion rates (e.g., laser scanning) and monumented photographs, repeated annually.

Potential impacts to the natural environment are the same as Alternative 1 in that continued erosion and slope failure may impact both terrestrial and aquatic habitat.

The cost of implementing Alternative 2 is relatively low.

4.1.3 Alternative 3: Selective Works (Local Erosion Protection)

Alternative 3 consists of localized channel bank and/or bed work to address erosion issues at the site. Local erosion protection works would be identified to mitigate erosion risk to infrastructure and private properties at an erosion site (Appendix H4, PIC#2 Posters 12 and 13). A range of potential alternative methods for erosion control, along

with a brief discussion of associated limitations and opportunities, are provided in Appendix I. Selection of the erosion control methods will be assessed on a site-by-site basis. Where feasible, promoting 'green solutions' which emphasize use of natural materials / natural channel design approaches in combination with engineering techniques to encourage environmentally sustainable solutions. Emphasis on reduction of impacts (spatial and temporal) of the selected alternatives on the natural environment.

This alternative maintains, or nearly maintains, the existing footprint of engineered material, uses similar types of erosion mitigation protection (see Appendix I), and would establish protection where infrastructure and/or private property is at risk. Note this alternative is expected to provisionally reduce erosion risks to private property, but it would not change the regulatory erosion hazard limit.

Selective works will result in some localized impact to the natural environment. Impacts to the terrestrial natural environment will result at the locations of construction access where the removal of trees and other vegetation will likely be required. However, these impacts will be temporary, as access points will be re-vegetated using native vegetation upon completion of the work. Construction access should occur within the less sensitive areas of the forested communities and impacts to riparian habitat should be kept localized to the proposed work areas. Removal of trees will avoid the breeding bird window, and a cavity tree assessment should be completed prior to any tree removal to avoid impacts to potential bat maternity roosts. Tree loss and removal of heritage trees will also be avoided. Where removals are unavoidable, the Town adheres to a "no net loss or canopy cover" standard. This alternative allows for enhancement opportunities to the terrestrial natural environment. Removed vegetation should be replaced with a diversity of native species and riparian vegetation. For example, the potential reduction in white pine through late-stage succussion could be replaced with local openings in the canopy associated with the works and required tree removals.

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. Riparian plantings will also provide some additional cover and refuge habitats at these localized treatments for fish.

While it is understood that local erosion protection works may require ongoing maintenance, occasional repairs, or eventual replacement, this alternative is often still preferred to limit the economic cost, and the environmental disturbance, of large-scale channel engineering and stream restoration works.

4.1.4 Alternative 4: Reach-Scale Channel Engineering (Channel Realignment)

This alternative consists of a reach-scale approach (or near reach-scale) to address erosion issues at the site (Appendix H4, PIC#2 Posters 12 and 13). Reach-scale engineering typically focuses on minimizing the risks of erosion and flooding in highly constrained urban watercourses, but may also include restoration opportunities on less constrained systems. This alternative generally has a longer life cycle with lower maintenance costs compared to selective works; however, the capital costs and environmental disturbance are much higher, and long-term maintenance and repair may still be required in perpetuity. Depending on constraints and risks, this alternative may vary with the degree of channel hardening to control erosion:

- Stable Channel Engineering – This alternative primarily applies "hard" channel engineering approaches for erosion control (e.g., armourstone, riprap, boulder, rock buttresses), but may incorporate some environmentally sensitive materials and geomorphically referenced features in the channel (e.g., riffles).
- Natural Channel Design (NCD) – This alternative consists of constructing a new channel that is intended to mimic natural channel features—such as riffles and pools—typically using stone materials similar to native alluvium (e.g., typically rounded, or platy in limestone bedrock systems), but still with a high priority for channel stabilization. As such, large cobble materials are often specified in the riffles, and banks may incorporate varying degrees of "soft" bioengineering (e.g., live cribwalls, root wads and log structures, live staking) and "hard" erosion control measures (e.g., vegetated rock buttresses, rib structures, flow deflectors).

Where feasible, promoting 'green solutions' which emphasize use of natural materials / natural channel design approaches in combination with engineering techniques to encourage environmentally sustainable solutions. Through detailed design, the footprint of the channel realignment, and configuration of the proposed profile and cross-section will be determined; the intent of the channel realignment is to minimize impact to the natural environment while supporting channel function, and to avoid any increase in natural hazard risk, and risk to infrastructure. As such, lengths of channel realignment and/or reach-based works will be assessed to ensure both protection of infrastructure/property and erosion mitigation, while reducing impacts to the natural environment.

Temporary impacts to the terrestrial natural environment will result at the locations of construction access, modification of erosion control works, and 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. This provides an 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. Construction access has not been evaluated as part of the current assessment and is introduced here as a general consideration only. Where feasible, construction access should be located within the less sensitive portions of forested communities; however, any proposed access routes should be assessed at a later stage to evaluate potential impacts to candidate Species at Risk prior to access locations being confirmed. 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 maternity 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. Channel realignment provides a hydraulically and geomorphologically stable creek configuration for long-term erosion control. Note this alternative is expected to provisionally reduce erosion risks to private property, but it would not change the regulatory erosion hazard limit. The recommended works under this alternative are not expected to impact the erosion hazard on the opposite side of the valley, and this is to be confirmed at detailed design.

The cost of implementing Alternative 4 is considered to be significantly higher than Alternative 3.

4.1.5 Alternative 5: Removal of Risk

This alternative consists of allowing erosion to continue and/or restoring natural stream processes, including natural erosion, by removing risks from the channel and corridor (Appendix H4, PIC Posters 12 and 13). This alternative may include some combination of:

- Removal of artificial materials and engineering structures in the channel where risks are low or have been removed from the corridor.
- Removal of public infrastructure from channel and corridor and future relocations of public trails.
- Removal of private yards, structures, and fences that have encroached into public property.
- Land acquisition by Town to remove private lands from hazard zones (erosion and flooding), and for securement of natural features, including negotiations with landowners through easement, severance/consent, or expropriation processes.
- Assist with natural recovery of the channel and corridor (and dynamic fluvial processes) by locally replacing natural materials and channel features, where deemed effective.

The cost of implementing Alternative 5 is considered to be the highest of all alternatives.

4.2 Alternative Evaluation

To identify a preferred alternative that best addresses the study objectives, each of the erosion mitigation alternatives developed in Section 4.1 are rated against a consistent set of evaluation criteria. The criteria include consideration for technical, economic, environmental, and social factors that are defined by the Ministry of Environment as part of the EA process. The alternatives are considered and evaluated in comparison to the 'Do Nothing' scenario. Where feasible, promoting 'green solutions' which emphasize use of natural materials / natural channel design approaches in combination with engineering techniques to encourage environmentally sustainable solutions was considered and prioritized.

4.2.1 Evaluation Criteria and Methodology

The erosion mitigation 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. Evaluation criteria are developed and weighted by their relative importance to the evaluation of erosion control alternatives. Each criteria is ranked, with the highest ranking 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).

An initial long list of evaluation criteria was presented to the Town and public in the first phase of consultation (Appendix H3, PIC#1 Poster 13). This list was refined into 4 categories (physical/natural environment, technical/engineering, social/cultural, and economic) which align with the criteria commonly used in municipal EA studies. Each of the 4 categories was equally weighted to account for 25% of the final score. Each category was broken up into 3 equally weighted subcategories which were each scored out of 5. The refined list of evaluation criteria and rational for the scoring is presented in Table 19.

Climate change and green solutions were integrated into the physical/natural environment and technical/engineering categories, respectively. The climate change criteria was included in the physical/natural environment category as it focuses on the ability to adapt to, and be resilient to a changed hydrological flow regime and accompanied geomorphic response due to climate change. The green solutions criteria focuses on the potential to employ bioengineering, plantings, and natural channel design approaches; therefore, it was included under the technical/engineering category. Local works are typically “harder” erosion controls, while reach-scale works generally allow for “softer” bioengineering and natural channel design approaches, although the two approaches are not mutually exclusive and can be integrated together on a continuum. The removal of risk alternative was considered to be the greenest solution as it consists of allowing erosion to continue and/or restoring natural stream processes, including natural erosion, by removing risks from the channel and corridor. However, removal risk tends to be less acceptable due to its extremely high cost and/or significant impacts to local residents due to moving infrastructure and/or expropriating private property. Monitoring was considered as somewhat “green” as it limits negative environmental impacts of doing work if not immediately necessary.

Another consideration associated with climate change and green solutions is Impacts to Aquatic and/or Terrestrial Habitat, which has been included as a separate criterion, whereby smaller construction “footprints” and fewer tree removals would be considered “greener” solutions and potentially better for climate change resiliency if mature vegetation can be maintained. While it is noted that each of these evaluation criteria are relevant to the promotion of green solutions (as indicated in Table 19), the labelled “green solutions” criterion is focused on the potential value of specific design methods for erosion protection.

TABLE 19 Criteria for the Evaluation of Erosion Control Alternatives

Criteria	Description	Rational for Scoring (1-5)
Physical / Natural Environment Criteria (25%)		
Management of Existing Erosion Risks	Effectiveness of the alternative to manage or mitigate erosion risks, both existing and ongoing, relative to the level of urgency.	Least effective at managing erosion risks (1) to most effective at managing the level of erosion risk/urgency (5).
Impacts to Aquatic and/or Terrestrial Habitat	Potential to provide greater improvements to aquatic and terrestrial species and habitat, while also considering potential construction impacts relative to existing condition.	Environmental degradation or extensive construction related impacts (1) to environmental enhancement or least amount of construction disturbance/no construction (5).
Climate Change Adaptation/Resiliency	Relative potential to provide additional hydrological and ecological resiliency, through physical, hydrological, and ecological redundancy for buffering extreme events and seasonal climate shifts. Ability to improve geomorphic stability and natural components of watercourse function.	Creek will not be more resilient to climate change impacts (1) to improved channel stability and resiliency to climate change (5).
Technical and Engineering Criteria (25%)		
Technical Feasibility	Constructability and construction access. Ability to limit impacts to existing infrastructure (e.g., sewers, watermains, gas, roads), including the feasibility of not intervening.	Difficult implementation, intervention not necessary at this time (1) to ease of implementation, intervention needed (5).
Approvability	Acceptability of agencies, community members and stakeholders. Less complexity of the Project: Consider permitting/coordination requirements with community members and stakeholders, etc.	Least likely (1) to most likely (5) to be accepted for permitting.
Green Solutions	Potential to employ green solutions, such as bioengineering, plantings, natural channel and other “soft” erosion mitigation approaches.	Least opportunity (1) to greatest opportunity (5) to employ green solutions. Removal of risk was considered the greenest solution (5).
Social / Cultural Environment Criteria (25%)		
Community Disruption and Recreational Impacts	Compatibility of proposed works with adjacent properties (i.e., removal or addition of features which reduces utility for neighbouring lands scores lower). Less or limited disruption to surrounding community and residents (e.g., access and use of park/trails).	Greatest disruption (1) to least disruption (5) to the surrounding community, residences, and use of park/trails.
Landowner and Public Acceptance	Ability to be accepted by landowners and community including First Nations and Indigenous consultation. This includes acceptance of impacts to trees.	Least accepted by the community and Indigenous stakeholders, negative tree impacts (1) to most accepted by the public and Indigenous stakeholders, minimal tree impacts (5).
Archaeological Impacts	Ability to protect built heritage resources, cultural heritage landscapes, and archaeological resources.	Negative impact (1) to most positive impact (5) to potential archaeological resources.

Criteria	Description	Rational for Scoring (1-5)
Economic Criteria (25%)		
Construction and Capital Costs	Relative measure of initial costs to install/construct the proposed works.	Greatest capital/construction costs (1) to no capital/construction costs (5).
Maintenance Costs	Relative measure of the ongoing maintenance costs in the creek.	Greatest maintenance costs (1) to lowest or no maintenance costs (5).
Life Cycle Costs	Relative measure of the lifespan of erosion mitigation works or existing assets.	Greatest life cycle costs (1) to lowest or no life cycle costs (5).

4.2.2 Evaluation of Alternatives

A comparative evaluation in a matrix table format was prepared and used to present the evaluation of alternative solutions for each priority erosion site. Sites that were similar and scored the same were grouped together. Sites E4 and E24 are both valley contacts in close proximity with risks to upland private properties. Sites E9, E10, and E17 were grouped as they are lower risk valley contacts with private properties at top of slope. Sites E14, E15, and E16 are a similar grouping of valley contacts with a trail at the top of the slope before the private properties. Appendix J includes detailed evaluation/scoring matrices for each site/group of sites. Table 20 presents summary scores (out of 100) per alternative, for each site/group of sites, with the highest scoring alternative solutions highlighted with bold text.

TABLE 20 Summary Scores per Alternative

Erosion Site(s)	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5
E4, E24	51.7	61.7	**75.0**	73.3	51.7
E11	46.7	58.3	**75.0**	68.3	53.3
E5	45.0	56.7	**75.0**	71.7	55.0
E6	51.7	66.7	**76.7**	58.3	50.0
E7	53.3	68.3	**73.3**	55.0	50.0
E9, E10, E17	60.0	**76.7**	65.0	50.0	50.0
E14, E15, E16	63.3	**80.0**	58.3	48.3	48.3

Based on the evaluation of alternatives, Alternative 3 (selective works) has been identified as the preferred solution for erosion sites E4/E24, E11, E5, E6, and E7. Alternative 3 consists of localized channel bank and/or bed work to address erosion issues at the site. Local erosion protection works would be identified to mitigate erosion risk to infrastructure or private properties at these erosion sites. Alternative 2 (continuous monitoring) has been selected for erosion sites E9, E10, and E17, and E14, E15, and E16.

Sites E4 and E24 were scored the same as they are valley wall contacts in close proximity with similar risks to private properties at the top of slope. These are considered the highest risk sites and cover the large area. Alternative 4 (reach-scale channel engineering) also scored high for these sites. Erosion sites E5, E6, and E7 are also in relatively close proximity and recommended for local works. A series of local works through this area could be completed concurrently to allow for some of the benefits of reach-scale works.

The remaining erosion sites are recommended for Alternative 2 (continuous monitoring). Sites E9, E10, and E17 involve risks to private property but they are lower urgency and would benefit from monitoring. Sites E14, E15, and E16 consist of risks to the pedestrian trail at the top of the slope which was also considered lower urgency. These sites would also require additional disturbance to access. Under the EA recommendations, the Town is to proceed with the development and implementation of a 5-year detailed monitoring program, including annual topographic surveys for accurate measurement of erosion rates (e.g., laser scanning) and monumented photographs repeated yearly. At the end of the 5-year program under Alternative 2, a detailed monitoring and erosion hazard assessment study is to be prepared to reassess the level of risk and urgency of each erosion site. A risk probability trigger for intervention has been proposed based on an estimated time to contact of less than 25 years (i.e., estimated time for creek to expose and damage infrastructure and/or property based on erosion rates and distance). This threshold reflects the potential for ongoing erosion to impact critical infrastructures or

properties within the 25-year timeframe. If this threshold is triggered for any of the Alternative 2 sites, the Town may choose to file an EA addendum and proceed with additional erosion mitigation designs within 5 years of filing the EA addendum. All additional works for Alternative 2 sites should be implemented within the 10-year expiry period of the initial filing of the EA study.

Local works was identified as the preferred alternative for E11, which is located on the tributary away from the other local works sites. E10 is downstream of E11; therefore, additional monitoring of any downstream impacts from work at E11 should be completed. Alternative 4 (reach-scale works) was the next highest scoring alternative at E11. If reach-scale channel engineering was completed, it could address erosion risks at E10 as well as the gabion basket bed and bank treatment towards the downstream end of the tributary which is in poor condition.

All other erosion sites in the study area, including those in Figure 1 identified as "not included in the EA" assessment (and additional sites upstream of Upper Middle Road) have been classified as lower priority and will continue to be monitored as part of the Town-wide watercourse erosion inventory program completed approximately every 5 years.

4.3 Public and Agency Consultation

The public and agency consultation requirements for a Schedule B project under the Municipal Class EA process includes:

- Notice of Study Commencement to inform the public, Indigenous communities, and applicable agencies that the Class EA is being undertaken.
- Outreach to utility companies through the circulation of a letter outlining the project and requesting infrastructure information.
- Public Information Centre (PIC) 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. Agency and public consultation documents are presented in Appendix H.

4.3.1 Public and Agency Notification

A Notice of Study Commencement (NOC) was issued December 18, 2023. The notice was distributed to agencies and stakeholders and displayed on the City's project webpage.

Agency and public responses to the NOC are included in Appendix H1.

A Notice of Public Information Centre was issued September 3, 2024 (PIC #1) and May 28, 2025 (PIC #2). The PIC invitations were mailed to properties adjacent to the project area and appeared on the City's project webpage.

Outreach to Indigenous communities has proceed—as identified and outlined in Section 1.3—concurrently with the public and agency consultation, and the responses received are included in Section 4.3.6 and Appendix H.

The Notice of Study Completion will be issued on March 31, 2026, marking the start of the formal public and agency review period for this Environmental Study Report, as documented in Appendix H.

4.3.2 Utility Outreach

Montrose circulated a letter titled "Existing Utility and Regional Infrastructure Verification, East Morrison Creek Erosion Mitigation Study Schedule 'B' Municipal Class Environmental Assessment, Oakville, Ontario" sent on January 9, 2024. Copies of the emailed responses are appended. Utility responses are included in Appendix H2.

4.3.3 Public Information Centre #1

PIC #1 was held on September 17, 2024, between 6:30 and 8:30 p.m. at the Oakville Town Hall. The PIC was attended by 13 members of the public. The purpose of this PIC was to outline the EA process, present background information, characterize the existing conditions of the study area, and to present the different alternatives for East Morrison Creek through the study area.

The PIC consisted of an introductory presentation by the Town's project manager, Jing Liu, followed by an open house format with presentation boards displaying project information, analysis, and conclusions. Staff from Montrose and the Town were present to answer any questions and assist the public with developing an understanding of the study.

A comment sheet was prepared and provided to attendees to share their feedback. One comment sheet with written feedback was received and is included along with the PIC display materials in Appendix H3.

4.3.4 Public Information Centre #2

PIC #2 was held on June 11, 2024, between 6:30 and 8:30 p.m. at the Oakville Town Hall. The PIC was attended by 12 members of the public. The purpose of this PIC was to outline the evaluation of alternatives, selection of preferred alternative, and the preliminary functional designs for erosion mitigation works within the East Morrison Creek study area.

Similar to the first PIC, it consisted of an introductory presentation by the Town's project manager, Jing Liu, followed by an open house format with presentation boards displaying the same information from the first PIC plus additional display boards outlining the evaluation of alternatives, preliminary functional designs for erosion sites E4/E24, E5/E6/E7, and E11, as well as implementation and construction phase considerations including access routes. Staff from Montrose and the Town were present to answer any questions and assist the public with developing an understanding of the proposed works.

Written and online comment sheets were available for attendees to share their feedback. One comment sheet with written feedback was received following the PIC and is included along with PIC display materials in Appendix H4. Resident comments received by email prior to and following the PIC are also included in Appendix H4.

4.3.5 Agency Consultation

A pre-consultation meeting with CH was held at the initiation of the project. This meeting and site visit occurred on September 13, 2023 with members of the Town, Montrose, and CH.

A project update email including Progress Report #1, Alternative Evaluation Memo, and PIC #2 materials was provided to CH at the end of May 2025. CH provided preliminary comments on the PIC #2 materials on June 3, 2025. A second pre-consultation meeting with CH was held on June 18, 2025. CH provided written comments on the provided documents on June 16, 2025, which are provided in Appendix H5 along with Montrose responses.

The draft ESR report was provided to CH for review in February 2026. CH provided written comments on March 17, 2026, which were incorporated into the final ESR and are provided in Appendix H5 along with Montrose responses.

4.3.6 Indigenous Engagement Notice of Commencement

In coordination with the public and agency consultation outlined in Section 4.3, the Notice of Commencement for the East Morrison Creek Erosion Mitigation EA study was emailed to the four identified Indigenous communities December 2023. A Notice of PIC#1 was also posted publicly and distributed to the project stakeholders list in September 2024 including the four impacted Indigenous communities as identified in Section 1.3.

A response from Six Nations of the Grand River was received on September 11, 2024 following the Notice of PIC #1 and is included in Appendix H6. Another response from Six Nations was received on June 3, 2025, following the Notice of PIC #2 and is also included in Appendix H6.

PIC #2 materials and the Stage 1 archaeological assessment report were provided to Six Nations on June 27, 2025. The Halton Regional Official Plan, now implemented by the Town, contains policies concerning archaeological potential and the preservation, mitigation, and documentation of archaeological sites and artifacts. The Town provided letters (included in Appendix H7) on December 9, 2025 and March 16, 2026 including a review of the Stage 1 archaeological assessment report and recommendations including the requirement for a Stage 2 assessment and Letter of Acknowledgement(s) from the Ministry of Citizenship and Multiculturalism (MCM) indicating all assessments have been reviewed and registered. These recommendations are consistent with the Stage 1 archaeology assessment completed as part of this EA, including reporting provided under Appendix E and as summarized under Section 3 of this ESR.

The draft ESR report was provided to Six Nations for review in February 2026. Six Nations provided written comments on March 9, 2026, which are provided in Appendix H6 along with Montrose responses. Most comments are reflected as clarifications on environmental stewardship and management, as described in Appendix H6 responses. Some additional clarifications around invasive species management and tree compensation were also addressed in the Preliminary Functional Design Report (Appendix K).

At the time of preparing this report, no other responses have been received by the project team from the other Indigenous communities notified. Engagement activities have proceeded as outlined in the project's Indigenous Engagement Plan (Section 1.3). Reasonable efforts are to be made to fulfill the intent of the engagement plan and MECP requirements, ensuring the community's comments and concerns are sufficiently addressed, while also not substantively delaying urgent works that may pose risks to public health and safety.

4.4 Selection of Preferred Alternative

Based on the alternative concepts presented in Section 4.1 and the evaluation scoring presented in Section 4.2.2 (Table 20 and Appendix J), the following Table 21 summarizes the recommended preferred alternatives as evaluated for high-priority erosion sites within the East Morrison Creek study area. At the time of this report, the alternative solutions selected have proceeded through the EA public and agency consultation requirements, as

documented in Section 4.2, and through the review of the draft ESR by CH and Six Nations. The proposed EA project sites to address the high-priority erosion sites identified, with reference to the selected preferred alternatives, are presented in Figure 13.

TABLE 21 Summary of Selected Preferred Alternatives

Erosion Site(s)	Preferred Alternative	General Recommendations	Specific Recommendations
Project E4, E24	**Alternative 3** Selective Works*	Natural Channel Design with combined hard & soft engineering approaches • vegetated flagstone buttress • flagstone riffle substrate • bank restoration, bioengineering	**E4 & E24:** Realign channel away from slope with armourstone wall, replacement of gabion baskets
Project E5, E6, E7	**Alternative 3** Selective Works*	Natural Channel Design with soft engineering • vegetated flagstone buttress • flagstone riffle substrate • bank restoration, bioengineering	**E5:** Removal of gabion baskets and add larger span pedestrian bridge **E6:** Reinforce outfall (armourstone) and restoration of outfall channel **E7:** Channel realignment and vegetated flagstone buttress at toe of slope erosion
Project E11	**Alternative 3** Selective Works	Integrated hard & soft engineering approaches	**E11:** Retrofit CSP crossing, stabilize trail embankment with amourstone walls and stabilize channel downstream
Monitoring Studies E9, E10, E14, E15, E16, E17	**Alternative 2** Continuous Monitoring	• Annual topographic surveys for accurate measurement of erosion rates (5 years) • Monumented photos	**Risk Probability Trigger for Intervention:** Monitoring & erosion hazard assessment studies to indicate time to contact of less than 25 years

*Implementing project E4 & E24 concurrently with project E5, E6, E7 will provide some advantages similar to reach-scale channel engineering as discussed for Alternative 4 (Section 4.1.4).

4.4.1 Preliminary Functional Designs

Preliminary functional designs were prepared for the 6 sites, grouped into 3 project areas (Figure 13), where selective works are recommended, including sites E4 and E24, sites E5, E6, and E7, and site E11 (Table 21). The preliminary functional design report and drawings are included in Appendix K. The drawings show preliminary alignments and specifications for the proposed plan and profiles and cross-sections for each of the project sites. Preliminary information regarding the typical details, a site access and staging, and restoration plan are also included.

I:\TownOfOakville\36236\FiguresAndTables\2025\Report\ProgressReport2\0_ArcPro_36236\0_ArcPro_36236.aprx - Tabloid_P - 14-Jan-26, 04:08 PM - ECho - TID003

Easting (m)

604000 605000 606000

Northing (m)

4816000 4815000 4814000 4813000

E-23 E-22 E-21 E-20 E-19 E-18 E-17 E-16 E-15 E-14 E-13 E-12 E-11 E-10 E-9 E-8 E-7 E-6 E-5 E-24 E-4 E-3 E-2 E-1

N

Study Limits
Watercourse
Reach Break

Erosion Site Extent

High Priority Erosion Site (Included in the EA Alternatives Evaluation)
Low Priority Erosion Site (Not Included in the EA Alternative Evaluation) Note: Monitored through the Town's Erosion Inventory Program - 5 year Cycle
Preferred Alternative - Selective Works
E-9 Preferred Alternative - Continuous Monitoring

1:12,000 metres
100 0 100 200
NAD 1983 CSRS UTM Zone 17N

Reference: Imagery (2023) World Imagery: Peel Region, Town of Oakville, VantorHydrography (2017) Source: Ontario Ministry of Natural Resources and Forestry

MONTROSE ENVIRONMENTAL

Town of Oakville
East Morrison Creek Erosion Mitigation Environmental Assessment

Erosion Sites and Preferred Alternatives

Date:	Project:	Submitter:	Reviewer:
January 2026	36236	A. Yates	P. Campbell

Figure 13

4.5 Cost Estimate

For the Erosion Sites where Alternative 3, Selective Works was selected, a high-level cost estimate was prepared to the nearest $100,000 for the proposed erosion mitigation works (Table 22). The costs represent a Class D estimate for the purposes of capital works planning, based on the length of channel works required, the type of channel works required, requirements for infrastructure alteration (such as wing walls), mobilization / demobilization, and restoration. In addition to construction costs, the estimates include a buffer for contingency costs of 20% of the major construction costs, plus additional contingencies have been added for other general and minor construction costs. The cost estimations are exclusive of economic allowances, taxes, cost sharing (if applicable), property acquisition (if applicable), phased/staged implementations and post-construction requirements (i.e., monitoring). The total estimated construction costs are estimated at $3.5 million based on 2025 pricing. Given the recommended investigations and assessments outlined in sections 4.7 and 4.8 for detailed design and implementation, an additional 15% ($525K) is recommended to complete the engineering and supporting technical studies, for a total estimate of $4.025 million. Further details regarding the cost estimates for the sites with proposed selective works are provided within the preliminary function design report in Appendix K.

For the Erosion Sites where Alternative 2, Continuous Monitoring was selected, $300,000 is estimated for annual continuous monitoring, including annual topographic surveys, monumented photos, and reporting for 5 years.

TABLE 22 Cost Estimate for the Preferred Alternatives

Erosion Site(s)	Preferred Alternative	Description	Estimated Cost
E4 & E24	**Alternative 3** Selective Works (1)	Channel realignment away from toe of slope and replacement of gabion baskets with armourstone wall.	$1,800,000
E5, E6, & E7	**Alternative 3** Selective Works (1)	E5: Removal of gabion baskets and channel realignment. E6: Erosion protection downstream of outfall. E7: Channel realignment and vegetated flagstone buttress at toe of slope.	$1,300,000
E11	**Alternative 3** Selective Works	Install slip liner and headwalls/wingwalls to reinforce culvert. Stabilize channel upstream and downstream.	$400,000
		Total	**$3,500,000**
E9, E10, E14, E15, E16, E17	**Alternative 2** Continuous Monitoring	Continuous monitoring including annual topographic surveys to measure erosion rates, monumented photos, and reporting for 5 years. (2)	$300,000

Note:

1) Implementing project E4 & E24 concurrently with project E5, E6, E7 will provide some advantages similar to reach-scale channel engineering as discussed for Alternative 4

2) May require EA addendum after 5 years if detailed erosion hazard assessment triggers an intervention recommendation, with additional erosion mitigation works identified prior to the 10-year expiry of the initial EA study.

4.6 Environmental Assessment Requirements

This study was undertaken as a Schedule B project under the Municipal Class Environmental Assessment process, the East Morrison Creek Erosion Mitigation EA, including Phases 1 and 2 of the planning and design process that were addressed in this study. Building on Phase 2, preliminary design concepts have been developed based on the preferred alternative solutions and the EA project reporting files have been compiled into a ESR. The ESR and preliminary function design report provide recommendations for detailed design, approvals, and implementation. With the completion of Phases 1 and 2, and submission of the final approved ESR (plus optional elements of Phases 3 and 4 based on due diligence best practices by Town), implementation of the preferred alternatives can proceed under Phase 5 of the Municipal Class EA process.

Implementation of the recommended preferred alterative solutions, starting with advancement of the preliminary functional designs to detailed design and approval, is based on a 5 to 10 year timeline that would commence after the final ESR posting and the public review process is complete (Phase 5). A summary of the proposed EA erosion mitigation projects for East Morrison Creek are presented in Table 22 and Figure 13. Typically, the proposed projects should be completed within the first 5 years after the EA is completed, or may be completed 5-10 years later with an EA addendum updating the existing conditions and confirming alternative solutions. For the three high-priority erosion mitigation projects identified in the East Morrison Creek EA study—E4/E24, E5/E6/E7, and E11—it is recommended these sites be completed concurrently given their similar level risk and urgency, and given the environmental and economic advantages of mobilizing one contractor to the site to complete the works under a single construction contract.

Six erosion sites have been identified for continuous monitoring under Alternative 2, including sites E9, E10, E14, E15, E16, and E17. Under the EA recommendations, the Town is to proceed with the development and implementation of a 5-year detailed monitoring program, including annual topographic surveys for accurate measurement of erosion rates (e.g., laser scanning) and monumented photographs repeated yearly. At the end of the 5-year program under Alternative 2, a detailed monitoring and erosion hazard assessment study is to be prepared to reassess the level of risk and urgency of each erosion site. A risk probability trigger for intervention has been proposed based on an estimated time to contact of less than 25 years to initiate erosion mitigation works under the EA. If required, the Town may file an EA addendum and proceed with additional erosion mitigation works for the Alternative 2 sites, if triggered, and complete these works within 5 years of filing the EA addendum. Thus, any additional works for Alternative 2 sites, if required, are to be completed within the 10-year expiry period of the initial EA study.

4.7 Detailed Design Requirements

The current study provides a conceptual design for the preferred alternatives to mitigate erosion risks in the East Morrison Creek study area. At the detailed design stage, the following items will need to be addressed:

- **Geotechnical Investigation** – Detailed geotechnical investigations are recommended for each of the three project sites identified in the EA study, including the following:
    - Drilling of boreholes to confirm the soil stratigraphy and bedrock surface elevations, determine the characteristics of the soil and bedrock, and develop geotechnical parameters for slope stability modelling. The boreholes should extend an adequate depth below the creek bed and include recovery of bedrock

core samples. Approximately 5 to 8 boreholes are assumed between the three project sites, with number and locations to be confirmed at detailed design.

  - The borehole investigation must define the extent and depth of the till deposits, the extent and connectivity of cohesionless sand layers potentially present within the till, and the bedrock surface elevation along the creek alignment. The existing data indicates that the overburden depth and bedrock elevation may vary across the site.
  - Precise surveying of slope features to enable accurate digital stability modelling.
  - Geotechnical laboratory testing to confirm visual identification and classification of the soils, and to assess geotechnical parameters pertinent to excavation, erosion control, and groundwater control.
  - A detailed assessment to determine where table land drainage over the slope face is contributing to slope instability.

- **Soil Management and Excess Soils** – The project may generate some volume of excavated soils to be disposed offsite, which may require an interim stockpiling location to facilitate soil sampling, characterization, and disposal planning. The roles and requirements of O. Reg. 406/19 for management of excess soils potentially applicable to the project should be considered and carried forward for detailed design.
- **Archaeological Assessments** – The Stage 1 archaeological assessment has identified grassed and treed portions of the proposed project areas that are recommended for Stage 2 archaeological assessments. As such, project areas where new ground disturbance is planned within primarily undisturbed areas are recommended for Stage 2 assessments prior to, or concurrently with the detailed design phase following the completion of the EA study.
- **Potential Impact on SAR Species** – Red-headed Woodpecker has been identified as a potential candidate Species at Risk within the areas subject to proposed impacts. Where suitable habitat is present and vegetation removal or disturbance is proposed during the breeding season, targeted bird surveys are recommended to confirm species presence and breeding activity. Surveys should be completed during the appropriate breeding period and in accordance with applicable provincial guidance.

  If Red-headed Woodpecker or other SAR bird species are confirmed, species-specific mitigation measures and timing restrictions may be required, and consultation with the MECP may be necessary prior to the commencement of works. Additional species may be listed, or existing species' statuses amended, under the forthcoming SCA; accordingly, Species at Risk requirements should be reassessed once the SCA is enacted to confirm applicable obligations and mitigation measures.
- **Bats** – The ESA remains in force until it is repealed and replaced by the SCA, which is anticipated in early 2026. Permitting requirements will change and a review of project impacts and implications will be required once enacted. The ESA currently applies to all species listed as Threatened or Endangered on the SARO List as of January 26, 2022, and any impacts to these species or their habitats require a permit or applicable regulatory exemption. As of January 29, 2025, three migratory bat species eastern red bat (*Lasiurus borealis*), hoary bat (*Lasiurus cinereus*), and silver-haired bat (*Lasionycteris noctivagans*) were added to the SARO List as Endangered and are not eligible for the conditional exemption under *O. Reg. 242/08*. Therefore, additional bat surveys, including acoustic monitoring, are recommended during detailed design to confirm species

presence and habitat use. Pending further assessment of potential impacts to maternity roosting habitat, confirmation of any timing restrictions or mitigation measures should be implemented. Bats are generally expected to use maternity roosting sites between April 1 and November 30; therefore, tree removals are recommended to occur outside of this period, where feasible.

With that said, under the current ESA permitting structure, the project may be eligible registration under O. Reg. 23.18, subsection 1(4) (*Threats to Human Health and Safety – Not Imminent*), provided the activities are limited to protective works and do not include the construction of new infrastructure for the cavity tree species (Myotis). Should this option be used, a Notice of Activity and Species at Risk Mitigation Plan would be required prior to construction. However, should any migratory species be confirmed, these species will require the completion and submission of an Information Gathering Form (IGF), as they are not eligible for registration. It is our understanding, once the SCA is enacted, all species will be eligible for registration under the new system, therefore project requirements should be reassessed once the SCA is in force.

- **Information Gathering Form (IGF)** – Where the proposed works are not eligible to be registered under O. Reg. 23.18, subsection 1(4) (*Threats to Human Health and Safety – Not Imminent*), the proponent may be required to proceed through the IGF process under the *Endangered Species Act* (ESA).

  The purpose of an IGF is to provide relevant project information to the MECP to inform the Ministry's determination of:

  - whether any protected species or their habitats are present or adjacent to the location of the proposed activity;
  - the potential effects of the proposed activity on these species and habitats;
  - whether the activity is likely to contravene subsection 9(1) or 10(1) of the ESA; and,
  - whether it is advisable for the proponent to apply for an overall benefit permit under clause 17(2)(c) of the ESA prior to proceeding with the activity.

  As endangered bats are potentially present within the study area, it is recommended that an IGF be completed using applicable information contained within this report and submitted to the MECP for review once the detailed design drawings are completed.

- **Private Property and Landowner Engagement** – Landowner engagement will be required for proposed work on or near private properties. At erosion site E4, there are two private residential properties along Hillview Cresent that extend into the creek. Armourstone wall structures are proposed within these properties; therefore, an easement would be required. An additional 1-2 properties are within the proposed grading limits at erosion site E24. The proposed staging and access at erosion site E11 could impact driveway access for two properties on the Forest Glade Drive cul-de-sac. Engagement with these landowners should be initiated at the project planning stage to facilitate property access and easement requirements. There are several other properties within approximately 5 m of proposed access routes. Landowner engagement with any impacted properties should occur at detailed design when access routes are confirmed.

- **Construction Access Plan** – A detailed assessment of construction access routes is required to identify critical constraints, access road construction, tree removal/protection requirements, and trail restoration plans. Potential staging areas and access points off of White Oaks Blvd will require details plans to manage and mitigate impacts to other public and private infrastructure and utilities. Of specific note, the main access point

into the valley is adjacent to a dry stormwater management facility and passes under electrical lines (see Appendix K, drawing sheet 1, Option 1 Staging and Access; E4/E24). Access routes into the valley will require modification or removal of existing trail infrastructure (e.g., asphalt, gates, stairs) with road construction down the steep slope. Pedestrian management and trail restoration plans will be required to deal with major disruptions to recreational trail infrastructure within the East Morrison Creek valley during construction.

- **Restoration Planting Plan** – Vegetative restoration plans must be developed at each site specifying native species to be used to restore channel banks, the floodplain, staging areas, and the access route associated with the detailed design. The plan is expected to include compensation for trees removed for construction in accordance with accepted ratios based on Town standards, and with reference to CH's *Guidelines for Landscaping and Rehabilitation Plans, Seed Mixes, and Native Species List* (Halton Region 2018) documents. Planting quantities and compensation requirements will be determined based on tree removals and the final tree inventory of the staging areas and access routes which will be confirmed during detailed design.

- **Conservation Halton Permit** – Permits for works associated with the erosion mitigation works on East Morrison Creek will be required from CH in accordance with the Conservation Authorities Act and Ontario Regulation 41/24. For each site, a design package will need to be submitted to CH with the design drawings, a design brief, and hydraulic model files. Scheduling of the project should allow for review of the submission by CH and revisions to the design and resubmission following receipt of comments from CH. For alternatives involving creek realignment or channel widening that require a CH Permit, the erosion hazard limit is not to be increased on private property.

- **DFO Request for Review** – Once the detailed design for erosion mitigation works has been completed, a request for review under the *Fisheries Act* should be submitted to DFO since channel work below the high-water mark will be required.

- **Utilities** – A sanitary sewer crosses over the existing culvert along the tributary at Erosion Site 11. All utility details should be confirmed at detailed design. Notably, all sanitary sewer infrastructure is the jurisdictional responsibility of the Region of Halton. Coordination between the Town and Region will be required for shared project objectives and requirements.

- **Monitoring** – A monitoring plan should be developed in conjunction with the Town and CH once detailed designs have been completed. The monitoring plan should include the Alternative 3 (selective work sites) as well as the staging and access areas and terrestrial restoration works associated with those sites.

4.8 Implementation Measures

The following implementation measures must be considered at the detailed design and implementation stages:

Construction Staging, Erosion and Sediment Control Measures - Appropriate plans are to be included within the detailed design package, based on consultations with the Town and CH. The construction access route and staging areas are to be finalized during the detailed design and a restoration plan will be required to ensure that the access route and staging area are replanted and restored in accordance with CH's requirements.

Construction Timing – Construction should adhere to the MNRF and DFO in-water works timing restriction for spring-spawning fish species which is March 15-July 15 (i.e., this is the period when no work should occur) or as

specified by the MNRF, DFO, and CH (DFO 2013, MNRF 2013). Therefore, the permitted work window for all in-water work is from July 16 – March 14 unless otherwise specified. 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.

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 November 30) to reduce impacts to breeding birds avoiding incidental take under the *MBCA* and bats under the ESA (soon to be governed be the SCA). Therefore, the permitted work window for all tree and or/vegetation removal can occur from December 1 – March 31, unless otherwise specified.

Tree Protection - Tree protection fencing, with reference to CH's *Guidelines for Landscaping and Rehabilitation Plans,* should be erected to protect trees along all construction access routes and work areas. Fencing should consist of posts or t-bars with filter cloth affixed to paige wire fencing. Tree protection fencing should be located at a minimum distance of 1 m from the dripline of potentially affected trees. Maintaining the minimum 1 m distance separation may will not be possible in some areas. In such case, fencing should be located as far as possible from the tree.

Environmental Approvals and Permitting – In addition to approvals by the Town's works and parks departments, applications will be required for permits from CH under the Conservation Authorities Act and Ontario Regulation 41/24, as noted in Section 4.7. Approval from the MNRF is required for a fish collection permit (fish rescue).

As well, works must consider the Provincial Policy Statement regarding water (Policies 2.2.1 and 2.2.2) which states that "planning authorities shall protect, improve or restore the quality and quantity of water" and that "site alteration shall be restricted in or near sensitive surface water features and sensitive ground water features." To comply with the Provincial Policy Statement (MMAH 2024), channel works should be completed in the dry to protect water quality, and downstream base flows should be provided during construction to protect water quantity. No sensitive surface water or groundwater features were identified during the field assessments.

Tendering, Construction Administration, and Supervision – The design engineering and geoscience consultants may be retained to provide all of these services. However, as a minimum for natural channel design projects, the design engineering and geoscience consultants should provide input to the tender document, specifically the special provisions, and should provide at least part-time construction supervision. The consultants may also be asked to provide recommendations for qualified stream construction contractors for consideration within the Town's tender process.

5 CONCLUSIONS AND RECOMMENDATIONS

The study followed the Class Environmental Assessment for Municipal Water and Wastewater Projects and is subject to the requirements of the Environmental Assessment Act. This document provides relevant information with respect to Phases 1 and 2 of the Environmental Assessment Process, with details of the project-specific EA process outlined in sections 1.1 and 4.6 for the ESR. After the EA study is complete, subsequent phases of the process will involve implementation (Phase 5) through detailed design, completion of contract drawings and documents for all proposed works, and construction of proposed works. Additional detailed monitoring studies

have been recommended for six erosion sites to confirm the level of risk and urgency with respect to the erosion hazard within 5 years to allow for an EA addendum, if required.

5.1 Conclusions

Key conclusions drawn from the East Morrison Creek Erosion Mitigation EA study are listed below.

- The East Morrison Creek Erosion Mitigation EA study has been completed building off the recommendations of the Town of Oakville 2021 Creek Inventory and Assessment (Aquafor Beech 2022) whereby the study area was identified as a high priority "long" reach area of concern.
- Baseline technical studies of existing channel and valley conditions were completed to support the EA study, including geotechnical, hydraulic, geomorphic and infrastructure assessments.
- Scoped ecological studies and inventories have been completed to assess the existing conditions and potential impacts to vegetation, wildlife, and SAR to document baseline conditions and potential impacts to natural heritage systems.
- A cultural heritage screening and a Stage 1 archaeological assessment were completed, indicating some archaeological potential in undisturbed project areas and thus Stage 2 assessments are recommended to be completed during detailed design.
- For the purposes of the EA study, 24 erosion sites were classified as higher priority and lower priority sites based on visual risk assessment scores in the field. Higher priority sites (12) were evaluated for alternative erosion mitigation solutions under the EA study, where as lower priorities sites (12) were not evaluated and are to be monitored under the Town's ongoing watercourse monitoring program about once every 5 years. The recommended erosion mitigation "selective works" for 3 project areas (6 erosion sites) include a balance of hard engineering, natural channel design, and soft bioengineering approaches. The remaining higher priority erosion sites (6) are recommended for detail erosion hazard assessments through "continuous monitoring" annually for 5 years to confirm the level of risk and urgency. These remaining six sites may be added for future erosion mitigation projects under an EA addendum within 5-years of the completion of the final ESR posting and public review process, to be implemented within 10 years of the initial EA study, if required.
- Some impacts to the ecological and natural heritage system are expected under the preferred alternatives for the six erosion sites, under three project areas. However, it is anticipated that mitigation measures (e.g., tree protection, compensation/restoration plantings and sediment and erosion controls, temporary flow diversion/dam and pumping, application of appropriate timing windows) would limit impacts, and that the environment would return to the pre-project level or better over the duration of the successional period of about 10 years or greater.
- Two PICs were held September 17, 2024 and June 11, 2025, where public feedback was provided to the study team regarding preferences for balancing erosion mitigation measures versus construction disturbances in the creek corridor, as well as specific questions were asked about the potential for local impacts to specific private properties. Two pre-consultation meetings were held with CH, with written responses provided to review comments. Indigenous outreach was followed up based on responses received from Six Nations of the Grand River.

- Typical requirements for detailed design and implementation requirements have been outlined for the next phase of the project, including specifically for environmental approvals and permitting.

5.2 Summary of Recommendations

It is recommended that erosion mitigation works be undertaken at six higher priority erosion sites, combined into three project areas within the East Morrison Creek study area using a balance of hard engineering, natural channel design, and soft bioengineering approaches (Table 23). Recommendations for detailed design and implementation are provided, including for environmental mitigation of construction impacts and associated permitting requirements. Six additional higher priority erosion sites were identified for "continuous monitoring" annually over a 5 year period to confirm the level of risk and urgency with respect to the erosion hazard.

TABLE 23 Summary of Selected Preferred Alternatives

Erosion Site(s)	Preferred Alternative	General Recommendations*
Project E4, E24	**Alternative 3** Selective Works*	Natural Channel Design with combined hard & soft engineering approaches
Project E5, E6, E7	**Alternative 3** Selective Works*	Natural Channel Design with soft engineering
Project E11	**Alternative 3** Selective Works	Integrated hard & soft engineering approaches
Monitoring Studies E9, E10, E14, E15, E16, E17	**Alternative 2** Continuous Monitoring	Annual topographic surveys for accurate measurement of erosion rates (5 years) and monumented photos

* Detailed recommendations are outlined in Section 4.4 and Table 22, with descriptions and cost estimates provided in Table 23.

** Implementing project E4 & E24 concurrently with project E5, E6, E7 will provide some advantages similar to reach-scale channel engineering as discussed for Alternative 4 (Section 4.1.4).

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