UPPER EM4 SUBCATCHMENT ENVIRONMENTAL IMPLEMENTATION REPORT AND FUNCTIONAL SERVICING STUDY

North Oakville East

July 2025

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1.0 INTRODUCTION

1.1 Study Purpose

This Environmental Implementation Report and Functional Servicing Study (EIR/FSS) has been prepared in accordance with the requirements of the Town of Oakville's (the Town) Official Plan Amendment 272 (OPA 272) in support of the development of lands located within the Upper EM4 Subwatershed in the North Oakville East Secondary Plan Area. **Figure 1.1** illustrates the location of this subcatchment west of Trafalgar Road and south of Burnhamthorpe Road.

A large majority of the property owners in the Upper EM4 Subwatershed are participating in the preparation of this EIR/FSS. The location of these properties, referred to as the Subject Lands, are shown in **Figure 1.1**. The Subject Lands encompass a combined gross area of approximately 47.94 ha. Approximately 62% of the Subject Lands lie within the Upper EM4 Subcatchment. Due to the irregular shape of the Upper EM4 subcatchment, the remaining portions of the Subject Lands lie within the adjacent JC7, JC9 and EM1 Subcatchments. To address all environmental and servicing requirements for the Subject Lands, this EIR/FSS addresses all lands within the Upper EM4 Subcatchment as well as all servicing requirements for the Subject Lands that lie within the adjacent subcatchments. As discussed further herein, this has been integrated with ongoing EIR/FSS work in these adjacent subcatchments.

Based on inputs on environmental constraints, site grading, servicing requirements, transportation assessments, Trafalgar Road proposed design and direction from the Town's Official Plan and OPA 272, development plans were prepared by individual landowners. KLM Planning subsequently prepared a consolidated Development Concept Plan for the Upper EM4/JC7/JC9 Subcatchments that has been used as the basis for the EIR/FSS analyses; see **Figure 1.2**. Landowner consultation with the Town regarding development plans has occurred over the last year. For further discussion on the Development Concept see Section 6.0.

This EIR/FSS has been prepared to address the following OPA 272 policy requirements in support of the approval of Draft Plans of Subdivision for the Subject Lands.

- Policy 7.8.3a) requires that an EIR be prepared for each subcatchment area, in accordance with the directions established in the Implementation Report, North Oakville Creeks Subwatershed Study (NOCSS), dated August 2006.

- Policy 7.8.3b) requires that a FSS be completed. The FSS must include a preferred servicing plan based on an analysis of servicing requirements, in accordance with any approved Class Environmental Assessment Studies, Halton Transportation Master Plan and the Master Servicing Plan for the North Oakville East Planning Area, and including:

- servicing design requirements;
- preliminary sizing of water and wastewater infrastructure;
- layout for roads and other transportation systems, including transit and trails; and,
- preliminary sizing and location of stormwater management (SWM) facilities and integration with environmental features and development areas.

- Policy 7.8.3a) iii) requires that EIRs be prepared in accordance with the Terms of Reference (TOR) approved by the Town, the Region of Halton (the Region) and the applicant(s), in consultation with Conservation Halton (CH).

The work completed as part of this EIR/FSS and documented in this report, was guided by requirements set out in the EIR/FSS TOR (May 2013) approved by the Town and CH, and is intended to satisfy the above policy requirements of OPA 272. A copy of the approved TOR is provided in **Appendix A**.

The purpose of the EIR is to characterize and analyze the natural heritage features and functions within the study area and to determine and address the potential impacts of a proposed development application, including servicing requirements, on the Natural Heritage System (NHS).

The purpose of the FSS is to identify servicing requirements related to roads, water supply, sanitary sewers, storm drainage, stormwater, and site grading. Further, the purpose of both the EIR and FSS is to provide a link between the Town's NOCSS Management Report and Implementation Report, the North Oakville East Secondary Plan, and the required planning approvals.

The EIR/FSS is intended to assist in the development of draft plans of subdivision, address the requirements of the NOCSS and Secondary Plan, and ensure that the site characteristics are understood in sufficient detail to provide the information necessary to process draft plans and identify conditions of approval.

As set out in the TOR, the EIR/FSS for the Subject Lands has been prepared as a joint report to fully integrate environmental and engineering recommendations to protect the function of the NHS and service the Subject Lands.

This EIR/FSS supports the formulation of Draft Plan of Subdivisions applications to be submitted for the Subject Lands.

1.2 EIR Subcatchment Area and FSS Study Area

The Subject Lands lie largely within the Upper EM4 Subcatchment. While small portions of the Subject Lands lie within the adjacent EM1, JC7 or JC9 subwatersheds, functional servicing components of this EIR/FSS address all of the Subject Lands outside of the Upper EM4 Subcatchment in these adjacent areas.

The EIR/FSS Terms of Reference differentiate between the study area for the FSS and the subcatchment study area for the EIR. The EIR is to be completed on a subcatchment basis, while the FSS will address specific servicing requirements in support of draft plans of subdivision. The NOCSS provides direction to the preparation of EIRs including the delineation of EIR subcatchments. **Figure 7.4.2** from the NOCSS Addendum illustrates EIR subcatchments. With reference to this figure (included herein) and direction from the Terms of Reference, the appropriate study areas for this EIR/FSS are:

- **EIR Subcatchment Area** is the existing Upper EM4 Subcatchment (Upper EM4) as delineated in **Figures 1.1** and **1.2.** It follows the limits of the Upper EM4 Subcatchment illustrated in OPA 272, amended to reflect development that has occurred to the north and west of the subcatchment on the Star Oak Developments lands north of Burnhamthorpe Road and the Petgor Phase 2 lands south of Burnhamthorpe Road; and,

- **FSS Study Area** is defined to be the post development Upper EM4 Subwatershed Area as shown on **Figure 1.1**. It varies from the existing EM4 Subcatchment Area to include the following areas shown on **Figure 1.1**:

  - two areas within the Subject Lands west of the western boundary of the EM4 Subcatchment Area to address environmental and engineering matters for areas that lie in between the existing EM4 Subcatchment Area and the existing or proposed development within the adjacent EM1 Subcatchment Area; and

  - two areas within the Subject Lands north and northeast of the existing EIR Subcatchment Area in the existing JC7 and JC9 subcatchments to include the Subject Lands that will be serviced (water and wastewater) through the EM4 Subcatchment Area.

This EIR/FSS uses the following four terms when referring to various land areas:

- the “EIR Subcatchment Area” refers to the Upper EM4 Subwatershed;
  the “Subject Lands” refer to participating ownerships;
- the “FSS Study Area” matches the boundaries of the Subject Lands; and
- the “Study Areas”, refer to the EIR Subcatchment Area, Subject Lands and/or the FSS Study Area.

1.3 EIR / FSS Study Objectives

The objectives to be fulfilled by the EIR/FSS are set out in the approved TOR. They are:

- to demonstrate how the subwatershed requirements set out in the NOCSS Management Report (including targets), the Implementation Report, and the Secondary Plan are being fulfilled in all proposed Draft Plans;
- to provide sufficient level of conceptual design to ensure that the various components of the NHS and infrastructure can be implemented, as envisaged in the NOCSS and Secondary Plan and to ensure that the Draft Plans are consistent with

this conceptual design;
- to ensure servicing requirements, as determined in the FSS for the areas external to the Draft Plan, are adequate;
- to identify details regarding any potential development constraints or conflicts and how they are to be resolved;
- to provide any further implementation details as needed;
- to streamline the Draft Plan approval process; and,
- to facilitate the preparation of Draft Plan conditions.

1.4 Coordination with Adjacent Subwatersheds

Three EIR/FSSs for the Upper EM4, JC7 and JC9 subcatchments were initiated in 2023. Throughout 2023, four seasons of environmental fieldwork were completed, along with preliminary grading, sanitary and SWM analyses and the formulation of a comprehensive development concept for lands within these subcatchments. The scope of these EIR/FSSs were discussed with the Town of Oakville and Conservation Halton (CH) at the July 17, 2023 NOARM meeting, including the need for multiple hydrologic and hydraulic modeling assessments of receiving watercourses and/or wetlands within the Lower EM4 and EM1 subcatchments. For further discussion on the modeling analyses, see Section 1.7.

Figure 1.3 illustrates the location of the Upper EM4, Lower EM4, EM1, JC7 and JC9 existing subcatchments. These subcatchments encompass lands along the Trafalgar Road corridor from midway between Dundas Street and Burnhamthorpe Road northerly to Highway 407. As shown, the Upper EM4 catchment shares existing drainage boundaries with the adjacent subcatchments EM1, JC7 and JC9. Due to the relationship between these subcatchments, grading, servicing and SWM analyses are being completed for the EM4, JC7 and JC9 subcatchments comprehensively to ensure compatibility and feasibility of the SWM, servicing and grading plans for future development in these subcatchments. Designs from the approved EM1 EIR/FSS were integrated into the EM4 EIR/FSS recommendations.

Throughout 2023 and 2024, the landowners consulted with the Region of Halton regarding the ongoing Trafalgar Road widening detailed design and provided input to the future road profile and adjacent site servicing based on preliminary engineering work completed to support development in the Upper EM4, JC7 and JC9 subcatchments. This preliminary engineering work is reflected in the drainage and grading plans presented in this Upper EM4 EIR/FSS.

Several approved or ongoing EIR/FSS reports for lands surrounding the Upper EM4 subcatchment were referenced during the preparation of this EIR/FSS to ensure consistency with environmental and engineering recommendations for adjacent areas. This includes:

- Upper EM4 Scoped Environment Implementation Report and SWM Report (June 2017), approved;
- Lower EM4 Environmental Implementation Report/Functional Servicing Plan (February 2015) and its Addendum (February 2016); both approved;
- EM1 Environmental Implementation Report Addendum (DSEL, 2017);
- Environmental Implementation Report/Functional Servicing Study Addendum, Green Ginger Phase 2 East Morrison Creek, Main Branch (DSEL, February 2025);
- Distrikt Upper EM4 Scoped EIR and SWM Report (Jennifer Lawrence & Associates, April 2020);
- Halton Region Trafalgar Road Improvements Design (R.V. Anderson / Urbantech, November 2021);
- Pond 30 Verification (DSEL/Urbantech, October 2023);
- New Horizon Environmental Implementation Report (2nd submission, Jennifer Lawrence & Associates, September 2024); and
- Final Drainage Area Exchange Report (January 2017).

Functional servicing components of this EIR/FSS were coordinated with developing areas to the east, north and south of the EM4 lands. The EM4 lands share drainage boundaries with the adjacent EM1, JC7 and JC9 subcatchments, and water and wastewater infrastructure to service the Upper EM4 Subcatchment Area extends beyond the Subject Lands. As such, as these EIR/FSS were advanced, an overall servicing strategy was prepared by Urbantech for the three subcatchments to coordinate water and wastewater servicing requirements. An overall storm drainage review was also completed to coordinate drainage areas and outlets to receiving watercourses. These documents are discussed in and appended to each of the EM4, JC7 and JC9 EIR/FSSs to guide the more detailed work presented in these EIR/FSSs. These documents include:

- North Oakville East (Trafalgar Road) - Comprehensive Water and Wastewater Servicing Strategy, (Urbantech Consulting, May 2025) included in **Appendix G;** and
- North Oakville East (Trafalgar Road) - Comprehensive SWM Overview (Urbantech Consulting, July 2025) included in **Appendix F-1**.

1.5 Final Upper EM4 Scoped EIR/SWM Report (2017)

The Final Upper EM4 Scoped EIR/SWM Report (June 2017) was prepared to support the Draft Plan of Subdivision (24T-13002-1215), February 27, 2017) for the Star Oak Developments lands north of Burnhamthorpe Road. The scoped study recommended a storm drainage plan for the Upper EM4 subcatchment west of Trafalgar Road including the identification of potential changes in surface water contributions to downstream features and their functions and identification of mitigative measures, where needed, to maintain their functions. It included the recommended location, design and outfalls for SWM Pond 29. Core 9 boundaries on the Mel-Oak two properties were also established and approved. The 2017 report was approved by the Town, Region and Conservation

Halton.

The Final Upper EM4 Scoped EIR/SWM Report noted that further study, including potential Addendums would be required to support draft plan approval of other lands within the Upper EM4 Subcatchment south of Burnhamthorpe Road. The Final Scoped EIR/SWM Report noted that, depending upon location in the EIR Subcatchment Area, additional study may include environmental analyses addressing field verification of NHS boundaries (Core 9 boundary), trail staking and design details, grading adjacent to Core 9, storm drainage design including SWM Pond 29 and demonstration of consistency with this Final Scoped EIR/SWM Report. Section 13.1 of that report listed specific items to be addressed as part of future study requirements. This listing is provided in **Appendix B**.

1.6 Upper EM4 EIR/FSS Scope of Work

This Upper EM4 EIR/FSS has addressed all *EIR/FSS Terms of Reference* (May 2013) matters applicable to this subwatershed as well as the future study requirements identified in the approved *Final Upper EM4 Scoped EIR/SWM Report* (2017). These documents are provided in **Appendix A** and **Appendix B-1** respectively. This EIR/FSS amends the 2017 proposed SWM Plan for this subwatershed based on the current Development Concept for the Trafalgar corridor and more recent information from the Region and Town. In particular, in 2023, the Town of Oakville advised that they did not support the 2017 SWM Pond 29 location along the Trafalgar Road frontage and requested that the pond be moved westerly to allow for higher density uses along the Trafalgar corridor. Further, the Region of Halton advised that they did not support a storm sewer outfall within the Trafalgar Road right-of-way to convey some SWM Pond 29 flows downstream to the outlet of EM4 near Dundas Street. As a result, an alternative pond location was proposed further west in the Upper EM4 subcatchment that would introduce pond outflows into upstream areas along East Morrison Creek as well as to upper portions of EM4. In July 2023, this alternative design was presented to the Town, CH and Halton Region. The agencies supported this alternative subject to the engineering feasibility analysis and environmental impact assessment of the EM1 and EM4 catchments.

On April 4, 2024, the submission entitled, "*Upper EM4, EM1 and Joshua Creek EIR/FSS Hydrologic and Hydraulic Modellin*g" was made to the Town and CH outlining proposed hydrologic and hydraulic modeling approaches to be used to assess the proposed SWM Plans for development in the Upper EM4, JC7 and JC9 subcatchments. Comments were received from both the Town and CH on April 26, 2024. At a NOARM meeting on May 30, 2024, the Upper EM4 SWM Plan was discussed along with associated preliminary hydrologic/ hydraulic modeling results addressing peak flow, water level, erosion and wetland impacts in downstream areas. Questions arising from the presentation were addressed and next steps including the submission of the modeling results for agency review was discussed. All agencies supported the preparation of a focused 'Mini-Submission' on hydrologic/hydraulics modeling analyses and results prior to the preparation of the full EIR/FSS.

1.7 Upper EM4 EIR/FSS Modeling Mini-Submission

The *Upper EM4 EIR/FSS Modeling Mini-Submission* ("Modeling Mini-Submission") was prepared to document the updated Upper EM4 SWM Plan and associated downstream hydrologic, hydraulic and erosion modeling and wetland water balance analyses. The Modeling Mini-Submission was prepared to obtain agency input/feedback relating to the proposed Upper EM4 SWM Plan and SWM Pond 29 outfall design as it may affect the design of the Trafalgar Road works and the overall servicing plans for these subcatchments.

The Modeling Mini-Submission was submitted to the Town, CH and Region on December 4, 2024 for their review and comment. Comments were received from the CH on the Mini-Submission on February 7, 2025. Additional analyses were completed by DSEL and submitted in April 16, 2025 to address CH's EM1 floodplain comments. Comments were subsequently received from CH on the April 2025 submission on June 3, 2025.

The SWM Plan presented in the Mini-Submission is reflected in this Upper EM4 EIR/FSS submission. The full Modeling Mini-Submission is not reproduced herein; rather conclusions from the Mini-Submission are included along with additional details on SWM Pond 29 design. The final Mini-Submission content, including responses to agency comments received to date, will form part of the Final Upper EM4 EIR/FSS.

1.8 Other Background Reports

The following additional studies/guidelines/documents were also reviewed in preparation of this EIR/FSS:

- Town of Oakville Draft North Oakville Creeks Subwatershed Study, August 2006;
- Town of Oakville Draft North Oakville Creeks Subwatershed Study Addendum (Draft), September 2007;
- Ontario Municipal Board Mediation Agreements, 2007;
- Town of Oakville Official Plan Amendment 272, August 2007;
- Region of Halton Official Plan Amendment 25;
- Ontario Municipal Board Minutes of Settlement, June 2006 and August 2007;
- North Oakville Environmental Implementation Report and Functional Servicing Study Terms of Reference, May 2013;
- North Oakville East Subwatersheds Study, prepared for the North Oakville Landowners' Group, August 2004;
- Halton Water and Wastewater Master Plan Review, KMK Consultants Limited, October 2002 (Master Plan);
- South Halton Water and Wastewater Master Plan Update;'
- Region of Halton, 2007 (Master Plan Update);
- Conservation Halton's Policies, Procedures and Guidelines for the Administration of Ontario Regulation 162/06, April 27, 2006;
- Stormwater Management Planning and Design Manual, Ministry of Environment,

March 2003 (SWMP Design Manual);

- Final Drainage Area Exchange Report (January 2017) prepared by Stonybrook Consulting Inc. et al.;
- Development Engineering Procedures & Guidelines Manual, Town of Oakville, May 2007;
- Design Criteria, Contract Specifications and Standard Drawings, Region of Halton, February 2001 (updated 2007); and,
- Erosion and Sediment Control Guidelines for Urban Construction, Conservation Halton et al, December 2006.

1.9 EIR/FSS Study Team

A multi-disciplinary study team has analyzed the environment and servicing of the Study Areas. Their responsibilities include:

- Rand Engineering – Lead FSS consultant addressing municipal servicing, SWM and site grading;
- David Schaeffer Engineering Ltd – Engineering – hydrology and hydraulics, downstream assessments;
- Urbantech Consulting – subcatchment hydrology and downstream assessment; comprehensive servicing strategies;
- Beacon Environmental - Limits of development and aquatic and terrestrial ecology;
- R. J. Burnside & Associates Limited – Geology and hydrogeology;
- GEO Morphix Ltd. – Fluvial geomorphology;
- Stonybrook Consulting Inc. – Consultant addressing study integration and team management; and
- KLM Planning – Development Concept Plan.

2.0 NATURAL HERITAGE SYSTEM FRAMEWORK

2.1 Natural Heritage System Components

OPA 272, the Town's NOCSS and the North Oakville Creeks Subwatershed Study Addendum (NOCSS Addendum) provide policies and/or directions with respect to the protection and management of the North Oakville East Natural Heritage/Open Space System. The NOCSS is divided into four sections, which follow the four phases of a subwatershed management approach. They include Characterization, Analysis, Management Strategy and Implementation.

The Management Strategy outlines requirements with respect to lands restricted from development, lands with development limitations or constraints, SWM, input to land use policies and servicing requirements. The Implementation Plan outlines the implementation requirements for the recommended management strategy, studies required in subsequent stages of the development process, environmental reporting requirements, Agency responsibilities, and the approval process with the Town, the Region and CH, and, where applicable, the Ministry of Natural Resources and Forestry (MNRF) .

With respect to the Subject Lands and the EIR Subcatchment Areas, OPA 272, the NOCSS and the NOCSS Addendum identify various environmental features to be protected and/or studied further during the EIR/FSS. **Figure 2.1**, prepared from Figure NOE3 of OPA 272, illustrates these features:

- *Core Preserve Area* – Core Preserve Areas include key natural features or groupings of key natural features, together with required buffers and adjacent lands intended to protect the function of those features and ensure the long-term sustainability of the Natural Heritage component of the System within the urban context.

  Portions of Core Preserve Area 9, the Trafalgar Woodlot Core, are located in the western portion of the Subject Lands forming the western boundary of proposed development. Core 9 is mostly comprised of forested communities of approximately 13.5 ha in area. Within this mature forest, small wetland pockets occur, including two pockets of Buttonbush thicket swamp. In addition to these natural areas associated with the forest, the Core 9 area also includes active agricultural lands. Core 9 was also studied in detail by others as part of the Environmental Implementation Report/Functional Servicing Study, North Oakville East Morrison Creek – Main Branch, North Oakville East (The Sernas Group et al., December 2013).

  Downstream of Trafalgar Road to the east, portions of Core 10 exist in the Lower EM4 Subcatchment Area south and east of the Subject Lands. Core 10 includes woodlands and wetlands, including large areas of deciduous swamp community and

the rare buttonbush swamp community. Core 10 is described in the NOCSS as comprising three main nodes. Portions of Core 10 within the Lower EM4 EIR Subcatchment Area, which only include the westernmost node, support upland woodland communities as well as wetland communities which are primarily thicket / deciduous swamps and meadow marshes along the East Morrison Creek Tributary.

Section 3.0 of this EIR/FSS addresses Core 9 boundary delineation and briefly discusses Core 10 located downstream of the EM4 SWM Pond outlet.

- *Linkage and Optional Linkage Preserve Areas* – Linkage and Optional Linkage Preserve Areas include areas which are designed to link the Core Preserve Areas together to maintain and enhance their environmental sustainability. They follow natural features whenever possible and are intended to be of sufficient size and character, including buffers, to ensure the functionality and sustainability of the NHS.

  There are no Linkage Preserve Areas (LPA) or Optional Linkage Preserve Areas (OLPA) in the Study Areas.

- *High Constraint Steam Corridor (Red Stream)* – High Constraint Stream Corridor areas include certain watercourses and adjacent riparian lands, as well as buffers measured from the stable top-of-bank or meander belts. These areas are located primarily inside Core Preserve Areas and LPAs, but also are found outside such areas, as per OPA 272. They are to be protected in their existing locations for hydrological and ecological reasons.

  There are no Red Streams in the Upper EM4 EIR Subcatchment Area or in the FSS Study Area. The Subject Lands are located upstream of Red Stream Reach SMA-6, located east of Trafalgar Road. Surface runoff from the Upper EM4 Subcatchment flows through this Red Stream prior to entering PSW25. This Red Stream will receive Upper EM4 SWM Pond 29 outflows as well as flows from immediately adjacent areas and thus is discussed in Sections 5 and 7 of this EIR/FSS.

- *Medium Constraint Stream Corridor (Blue Stream)* – Medium Constraint Stream Corridor areas include certain watercourses and adjacent riparian lands, including buffers measured from the stable top-of-bank or meander belts. These areas are located primarily inside Core Preserve Areas and LPAs, but also are found outside such areas. As set out in OPA 272 policies, these watercourses may be deepened and/or re-located, but must be left open for hydrological and ecological reasons.

  There are no Blue Streams in the Study Areas.

- *Other Hydrological Features* - In addition to the High and Medium Constraint Stream Corridor Areas, there are a number of other hydrological features that also form part of the Natural Heritage and Open Space System to the extent that they are maintained after development occurs. These Features include Low Constraint Streams, Hydrologic Features A and Hydrologic Features B as described as follows:

- *Low Constraint Stream Corridor (Green Stream)* – These streams do not need to be maintained, but the function of the watercourse must be sustained in accordance with the directions established in the NOCSS and Federal, Provincial and Conservation Authority regulations.

  There are no Green Streams in the Study Areas.

- *Hydrologic Feature A* – Hydrologic Features "A" are defined in NOCSS to be hydrological features located within Blue or Red Streams. The NOCSS (page 7-5) states that *"Hydrologic Features A have hydrological functions and consequently both their form and function shall be considered through hydrological and hydrogeological assessment as part of an EIR. This review will also consider the ecological benefits of these features. Further, any required buffers associated with these features will be determined through the preparation of the EIR, and will only be related to the hydrologic function of the feature.*

  There are no Hydrologic Features A in the Study Areas.

- *Hydrologic Feature B* – Hydrologic features not associated with the NHS, are called Hydrologic Feature B. The NOCSS states that *"Hydrologic Features B may be relocated and consolidated with other wetlands, water features or SWM facilities…".* OPA 272 further states *"Hydrologic Features "B" may be relocated and consolidated with other wet features, wetlands or stormwater management ponds, provided the hydrologic function of the feature is maintained."*

  As indicated on OPA 272 Figure NOE3, there are three Hydrologic Features B in the Upper EM4 Subwatershed. Figure A attached to *Mediation Item: Depression Storage* (May 30, 2007) identifies these three Hydrologic Features B's as Pond 44 and Depression 33 and 34. In accordance with this Mediation Agreement, only natural ponds or depression are included in the assessment of depression storage.

  The Hydrologic Features B, and Topographic Depressions (addressed below), are shown on **Figures 2.1** and **4.2** and summarized in **Table 2.1**. These features are also discussed in Sections 4.3. and 7.9.

- *Topographic Depressions* – These depressions do not form part of the NHS, however, NOCSS identifies topographic depressions, ponds and pits (DPP) and indicates that they must be addressed as part of the SWM system design. Constructed ponds do not have to be included in the assessment of depression storage. See Section 7.9 for the depression storage comparison (Depression 33) with SWM Pond 29 design.

Table 2.1 – Pits, Ponds and Depressions in Upper EM4

Feature Type*	Feature Identification	Origin	Comment
West of Trafalgar Road			
HYDFB	Pond 44	Man-Made Pond	This pond has been filled and no longer exists
HYDFB	Depression 33	May be natural	This is the only depression / wet area of the Subject Lands visible on aerial imagery dated 1954. As per Mediation Agreement, this feature requires comparison of its depression storage to SWM pond design
HYDFB	Depression 34	Man-made	Not visible on aerial imagery dated 1954. As per Mediation Agreement, man-made features require no further review or management

HYDFB: Hydrologic Feature B; DPP: depression, pit or pond

- *Provincially Significant Wetlands* – While there are no PSWs in the Upper EM4 Subwatershed, however, PSWs exist within the adjacent Core 9 and along downstream portions of East Morrison Creek including:
  - PSWs 19 and 20 on Core 9 that influence the Core 9 boundary delineation;
  - PSW 25 located along the East Morrison Creek Tributary within Core 10; and
  - PSWs 17 and 74 located along East Morrison Creek.

  These wetlands are all located in the NHS. Potential implications of development on each of these wetlands have been addressed in the Modeling Mini-Submission that will ultimately form part of this EIR/FSS.

2.2 Permitted Uses in the Natural Heritage System

2.2.1 OPA 272 and NOCSS

OPA 272, Policy 7.4.7.3 identifies potential permitted uses in the NHS. This policy addresses permitted uses including development, land disturbance, roads and related utilities, expansion of existing water and wastewater services, trails and passive recreational uses, SWM facilities, grading, private driveways and the adaptive use of institutional buildings. **Table 2.2** summarizes policy direction on permitted uses and notes report sections in this EIR/FSS that address these permitted uses.

Table 2.2 - Summary of Policy Direction on NHS Permitted Uses

OPA 272 Policy Number	Potential Permitted Use	Policy Direction	Addressed in EIR/FSS Sections
7.4.7.3 c) i)	Development or land disturbance	Permitted in accordance with the directions of the North Oakville Creeks Subwatershed Study and any related Environmental Implementation Report, and Federal, Provincial and Conservation Authority regulations for required flood and stream bank erosion control; for fish, wildlife and conservation management; to accommodate a stormwater outfall; or in Medium Constraint Stream Corridor Areas.	Not applicable to this EIR/FSS
7.4.7.3 c) ii)	Roads and related utilities	Permitted only to cross the designation in the general area of the road designations shown on Figures NOE2 and NOE4 or as defined through an Environmental Assessment; road design criteria are identified in policies.	Not applicable to this EIR/FSS
7.4.7.3 c) iii)	Expansion to existing Water and Wastewater services	Expansion permitted to existing Water and Wastewater services which are located on sites with existing facilities subject to any required Environmental Assessment	Not applicable to this EIR/FSS
7.4.7.3 c) iv)	Trails, interpretative displays or signage or other similar passive recreation uses	Permitted if consistent with the purpose of the applicable designation and criteria listed in policy.	Section 6.2
7.4.7.3 c) v)	Stormwater management facilities	Permitted subject to directions of the North Oakville Creeks Subwatershed Study, conformance with technical performance specifications listed in policy and as shown conceptually on Figure NOE3.	Not applicable as proposed SWM Pond 29 is not located in the NHS
7.4.7.3 c) vi)	Grading in the Natural Heritage component of the Natural Heritage and Open Space System	Permitted in accordance with the directions established in the North Oakville Creeks Subwatershed Study or appropriate Environmental Assessment.	Section 7.6
7.4.7.3 c) vii)	Private Driveways	Permitted across the Linkage Preserve Area joining the north area and south area of the Core Preserve Area located north of Burnhamthorpe Road and west of Trafalgar Road	Not applicable to this EIR/FSS
7.4.7.3 c) viii)	Adaptive re-use of heritage buildings for institutional uses	Art gallery and art school permitted in the Linkage Preserve Area associated with Reach JC-7	Not applicable to this EIR/FSS

Section 7.3.1 of NOCSS also lists permitted uses in Cores, Linkages and High and Medium Constraints Stream Corridors. These include:

- Development or land disturbances required for flood and stream bank erosion control and protection of fish, wildlife and conservation management;
- Infrastructure/utility access and crossings;
- Public pedestrian trails; and,
- SWM facilities.

These uses are subject to studies such as this EIR/FSS to address the placement of facilities/uses to ensure that they are compatible with core area management set out in Section 6.3.5 of NOCSS. Management recommendations for Core 9 are listed in Section 3.0.

Sections 6.3.5.2 of NOCSS and some mediation agreements also address permitted uses in the NHS. With respect to this EIR/FSS, reference was made to direction provided on trails in the NHS in Section 6.3.5.2 of the NOCSS.

Direction provided in Section 6.3.5.3 on permissible grading in the NHS also was referenced and provided guidance to the preparation of a preliminary grading plan for the Subject Lands.

2.2.3 OMB Settlement and Mediation Agreements

Several water resources related agreements were made between the Town, CH and the Landowners during Ontario Municipal Board hearing mediation discussions. Also, Minutes of Settlement (MOS) were entered into between the Town, CH, the Region and the Landowners. The mediation agreements and MOS have been reviewed and matters relating to EIR study components were addressed through the preparation of this EIR/FSS.

The Subject Lands are bound by MOS dated June 15, 2006 and August 13, 2007 between Upper EM4 landowners, the Town and CH. The MOS outline agreements with respect to proposed development on the Subject Lands, including buffer setbacks, core boundaries, linkages, natural heritage features, SWM facility locations and sizes, and restoration and enhancement areas. The relevant sections of the MOS that are pertinent to this EIR include:

<u>June 15, 2006 MOS, Sections regarding Natural Heritage Lands</u>:

Section 4 (b) states that, "*subject to Sections 6 to 9, the Natural Heritage Lands shall be dedicated on an "as-is, where-is" basis. The boundaries of the Natural Heritage Lands are more particularly delineated on Schedule "D" hereto. The final precise boundaries of the Natural Heritage Lands shall be determined by an Environmental Implementation Report accepted by the Town in accordance with the Town's Position (which is intended to "ground truth", but not substantially revise, the boundaries as shown on Schedule "D" hereto."*

Section 7 states that, *"…the Town will not require the Landowners to undertake or fund, directly or indirectly,*

a) *any maintenance after dedication;*
b) *any works to enhance the Natural Heritage Lands; and*
c) any monitoring of the Natural Heritage Lands, other than in respect of the Landowners' stormwater management facilities."

Section 8 notes, "The Town and Landowners agree that Sections 4(b) and 7 shall not apply:

c) in respect to works undertaken on the Natural Heritage Lands that relate to municipal services such as roads, watermains, sanitary sewers, stormwater management works or trails (provided that nothing herein shall be deemed to grant any approval or permission to undertake such works)."

Mediation Agreements include:

- Stage-Storage-Discharge Characteristics dated February 21, 2007;
- Infiltration dated February 22, 2007;
- Depressional Storage dated May 30, 2007;
- Regional Storm Flood Protection dated May 30, 2007;
- Total Phosphorus dated May 31, 2007;
- Erosion Control for SWM and Erosion Thresholds dated May 31, 2007;
- Hydrology model and hydraulics model for a portion of Joshua's Creek floodplain mapping dated May 31, 2007;
- Stream Corridor Components dated May 31, 2007;
- SWM Ponds Outside of Core and Linkages dated June 19, 2007;
- Changes to EIR Subcatchment Boundaries dated June 29, 2007;
- Flow Rates/Hydrology dated July 4, 2007;
- Stormwater Management - Temperature and Dissolved Oxygen Targets dated July 12, 2007;
- Monitoring dated July 26, 2007; and
- EIR/FSS Terms of Reference dated August 2, 2007.

Through the review of previous EIR/FSSs, agencies requested that a summary of NOCSS grading permissions be prepared. This summary, prepared by Bird and Hale Limited, titled Grading and the Natural Heritage System, undated, forms part of the NOCSS background reference materials.

3.0 CORE PRESERVE AREAS 9 AND 10

3.1 Core 9

3.1.1 Core 9 Boundaries

As noted in Section 2.0, OPA 272 and NOCSS, the Subject Lands include a portion of Core Preserve Area 9 in the western portions of the EIR Subcatchment Area. This Core area is located approximately 400 to 700 m west of Trafalgar Road and approximately 300 m to 400 m south of Burnhamthorpe Road West. As per the NOCSS*, "the delineation of this Core Area includes the woodland. This portion of the Core was found to provide 1.6 ha of potential forest interior habitat and a fair number of forest birds of conservation concern were reported from the stand*. *The delineation of the Core is based on the limit of the forested area including 10m from the dripline or 30m from the small buttonbush pockets found in the woods*". In addition to the wooded areas and wetlands noted, Core 9 contains active agricultural lands along its northern boundary.

On the Subject Lands, the Core 9 boundary lies on the Mel-Oak South, Mel-Oak North, Trafalgar Road (Oakville) and Argo Oakville Woods lands. Consistent with direction from NOCSS (Figure 6.3.10), the Core 9 boundary was determined by the greater of the following:

- 10m from the staked dripline of the trees of the wooded areas, with the exception of portions of the core southern boundary located on adjacent Green Ginger property where no buffer was applied from dripline;
- 30m from the staked limits of PSW 19, PSW 20 and PSW 21; and
- on the north and northeast sides of Core 9, the boundary is a straight line between points of the 10m buffer from the wooded area as per the NOCSS.

Portions of the Core 9 boundary were established and approved in the *Final Scoped EIR/SWM Plan* (June 2017); others were determined through 2023 feature delineation. **Table 3.1** summarizes the status, locations and features governing the Core 9 boundary delineation. Discussion of the core boundary by property is provided below.

Mel-Oak North and Mel-Oak South

The Core 9 boundaries on the Mel-Oak North and Mel-Oak South lands were documented and approved through the *Final Scoped EIR and SWM Report.* Past fieldwork completed on the Mel-Oak South and the Mel-Oak North lands included staking of Core 9 boundaries in the field with representatives of the Town of Oakville, Conservation Halton and Region of Halton present. Stakes were subsequently surveyed and appropriate buffers added to establish the Core 9 boundary on these properties. The Core boundary on the Mel-Oak North lands lies within the EM4 Subcatchment Area and the Core boundary on the Mel-Oak South lands lies within the

EM1 Subcatchment Area**. Drawing Core 9 – NHS 3**, included in the approved *Final Scoped EIR/SWM Report* is attached (**Appendix B-3**) illustrates the approved Core 9 boundary on these lands. **Drawing 3.1** also includes these surveyed boundaries and appropriate buffers.

Consistent with NOCSS requirements, the core boundary on the Mel-Oak North lands was determined based on dripline plus 10m or a straight line between two woodland corners plus their buffers. The Core boundary on the Mel-Oak South lands was established largely by the 30m buffers from PSWs 19 and 20. South of PSW 19, the core boundary was set along the southwest property limits. The core boundary in this location provides a transition from the PSW 19 buffer to the approved Green Ginger core boundary to the south. NOCSS has defined the core limit in this location as the 30m offset from the feature limit of PSW 19. NOCSS recommendations did not include the wooded vegetation south of PSW 19 in Core 9, however, the Green Ginger core delineation includes this vegetation in the Core. The Core boundary along the Mel-Oak South southwest property boundary transitions to the Green Ginger boundary without affecting developable area on the Mel-Oak South lands, consistent with NOCSS recommendations.

Argo Oakville Woods

The previous owner of the Argo Oakville Woods lands did not participate in the *Final Scoped EIR/SWM Report* however, the Core 9 boundaries on that property were presented in the June 2017 report. Consistent with direction from NOCSS, **Drawing 3.1** presents the Core 9 boundary on the Argo Oakville Woods lands that was determined by a straight line connection between woodland corners plus their 10m buffers to minimize woodland edge. The straight line connection was made between approved feature boundary stakes and their buffers on the adjacent Mel-Oak North property and the Petgor lands to the west.

Trafalgar Road (Oakville)

Staking and surveying of the Core boundary on the Trafalgar Road (Oakville) lands was completed on June 20, 2023 by Beacon and representatives from CH. The resulting features survey was completed by J. D. Barnes on July 6, 2023. See **Appendix B-2** for the survey. **Drawing 3.1** includes the surveyed boundary and appropriate buffers to establish the Core 9 boundary in this location.

Table 3.1 – Status, Location and Features Governing Core 9 Boundaries

Property	Status of Approval	Field Staking Dates	Surveys (see Appendix B)	Features Governing Boundaries
Mel-Oak South	Approved June 2017	Sept. 30, 2008	RPE Survey (May 9, 2013)	PSWs 19 and 20 boundaries
Mel-Oak North	Approved June 2017	June 19, 2014	RPE Survey (June 25, 2014)	10m from the dripline or a diagonal straight line connecting two points (dripline plus 10m points)
Argo Oakville Woods	Addressed in this EIR/FSS	-	No survey of features required	Straight line connection between woodland edges plus 10 buffer edges on adjacent properties
Trafalgar Road (Oakville)	Addressed in this Upper EM4 EIR/FSS	June 20, 2023	J.D. Barnes (July 6, 2023)	PSWs 20 and 21 boundaries as well as woodland dripline to the north of PSW 21 and between PSW 20 and PSW 21

3.1.2 NOCSS Core 9 Management Recommendations

NOCSS identified the overall approach to the management of the NHS to, "…protect and enhance the natural environmental in a sustainable fashion". With respect to Core 9, Section 6.3.3.5 lists the management recommendations to be:

- The existing woodland and wetland are recommended for retention.
- Linkage to the south associated with the creek is seen as providing possible connectivity to habitats south of Dundas Street. The open country species that are targeted in this Core Area may use this linkage which is recommended to be 120m in width.
- The focus on management of this Core Area is anticipated to be on continued provision of forest habitat with open country habitats recommended for this linkage.

These recommendations, along with settlement and mediation agreements, provide direction to the management of Core 9. The boundaries of Core 9 on the Subject Lands that include feature buffers will be protected in an open space designation.

3.2 Core 10

Core 10 is located south and east of the Subject Lands east of Trafalgar Road along the East Morrison Creek Tributary. Only the western portion of Core 10 is located within the Lower EM4 subcatchment Area. Surface runoff from the Upper EM4 Subwatershed drains to stream reaches MOC-6 and MOC-2 that flow through the western portions of Core 10. Core 10 includes PSW25 and is therefore discussed herein given the potential drainage implications of the proposed Upper

EM4 SWM system to these downstream areas.

NOCSS Section 6.3.3.5 lists the management recommendations for Core 10 to be:

- The existing woodland and wetland are recommended for retention
- Within the Core, connectivity between forested blocks of a minimum 200m width can readily be accommodated and is recommended.

The Core 10 boundaries have been established through the *Final Dundas Trafalgar and Shieldbay Investments EIR/FSS* (date) and the *New Horizon Environmental Implementation Report* (September 2024). They require no study as part of the Upper EM4 EIR/FSS.

4.0 GEOLOGY, HYDROGEOLOGY AND FLUVIAL GEOMORPHOLOGY

4.1 Scope of Work

The scope of work completed for the hydrogeological component of the Upper EM4 EIR/FSS study was designed to address the technical requirements as set out in the EIR Hydrogeological Terms of Reference for North Oakville (May 2013) provided in **Appendix A**. Specifically, the hydrogeological work program was completed to:

- review the regional hydrogeological setting;
- characterize the local soil, groundwater, and surface water flow conditions;
- assess the local groundwater/surface water interactions and identify areas for recharge/discharge function protection;
- characterize the existing surface water and groundwater quality;
- calculate the pre- and post-development groundwater balance conditions;
- identify hydrogeological opportunities and constraints to maintaining the groundwater balance;
- identify the type, location and size of infiltration or storage measures that may be feasible for use based on the geological and hydrogeological conditions;
- evaluate opportunities for augmenting groundwater infiltration through appropriate and practical Best Management Practices (BMPs) and Low Impact Development (LID) measures to balance, or at least in part, make up the post-development infiltration deficit; and
- identify potential construction constraints related to the hydrogeological conditions.

The detailed scope of work included:

1. Review of Ministry of the Environment Conservation and Parks (MECP) water supply well records for the EIR Subcatchment Area as an aid to assess the regional hydrogeological setting and soil conditions. A listing of the MECP water supply well records for the area is provided in **Appendix C-1**.
2. The installation of a network of boreholes, groundwater observation wells, and shallow drive-point piezometers to investigate the site-specific soil and groundwater conditions. Available geotechnical and observation well records from boreholes completed during the NOCSS and other studies have also been used for this EIR. Copies of the borehole logs and observation well construction details are provided in **Appendix C-2**.

3. Single well response testing of 4 groundwater observation wells to estimate in-situ hydraulic conductivity of the geological units. The field testing results are included in **Appendix C-3**.

4. Monitoring of groundwater levels to measure the depth to the water table and assess the horizontal and vertical groundwater flow conditions. The available groundwater monitoring data are summarized in Table C-4-1 in Appendix C-4. Hydrographs to illustrate the monitoring data are also provided on Figures C-4-1 through C-4-13 in Appendix C-4. In addition to the manually recorded groundwater levels, automatic water level recorders (dataloggers) were installed in EM4-W1, EM4-W2, EM4-W3d and EM4-W8 (well locations are shown on **Figure 4.1**) to record detailed and continuous water level measurements. The datalogger hydrographs are presented on Figures C-4-4, C-4-6 and Figure C-4-11 in **Appendix C-4**.

5. Monitoring of surface water flow for this study was completed at a similar frequency as the groundwater monitoring outlined above. When possible, the monitoring was completed during dry weather conditions to characterize low flow conditions. Surface water flow observations and measurements were conducted at 1 surface water flow station (EM4-SW1) and 1 road culvert locations along Trafalgar Road (EM4-SW2) in the EIR Subcatchment Area; see **Figure 4.1**. Flow was estimated using a stream area - velocity method. The surface water monitoring locations are shown on **Figure 4.1**. The surface water flow data are summarized on Table C-5-1 in **Appendix C-5.**

6. Groundwater samples were collected from 2 observation wells in March 2024. The water samples were submitted to an accredited laboratory for analyses of general quality indicators (e.g., pH, hardness, conductivity), basic ions (including chloride and nitrate) and selected metals. Groundwater quality data is summarized in Table C-6-1 in **Appendix C-6**. Surface water quality samples were not collected as part of the study since there was insufficient flow to warrant a suitable sample.

7. Pre-development water balance calculations (based on existing land use conditions) and post-development water balance calculations (based on the proposed development concept) for the EIR Subcatchment Area will be completed to assess the potential impacts of development on the local water resources. The water balance calculations will be provided in **Appendix C-7**.

4.2 Physiography and Topography

The Upper EM4 Subcatchment Area is located on the south slope of the Trafalgar Moraine, a ‘till moraine’ originally mapped by Chapman and Putnam (1951, 1984) and by the Ontario Geological Survey (Barnett, 1992a). The Trafalgar Moraine consists of a belt of gently undulating topography extending across the North Oakville area. Highway 407, generally, marks the crest of the Trafalgar Moraine between Sixteen Mile Creek and Trafalgar Road. The

crest of the Moraine forms the regional surface water divide with all subwatershed areas on the south slope draining towards the south.

The land surface across the Study Area generally slopes to the east. Analysis of the detailed topography indicates that the highest elevations (up to 190 masl - metres above mean sea level) are found at the northwest boundary of the Study Area (**Figure 4.2**). There is a relief of about 10m, with the lowest elevations (180 masl) found near the eastern boundary of the Study Area at Trafalgar Road (**Figure 4.2**).

4.3 Drainage

The Study Area is a long narrow subcatchment extending from just north of Burnhamthorpe Road, downstream to just east of Trafalgar Road (**Figure 4.2**). Small portions of Core 9 are located on the central-west boundary of the Subject Lands.

Surface water runoff follows the topography and flows generally towards the east, through agricultural fields in no defined stream corridors. Flow crosses under Burnhamthorpe Road at a culvert and flows south through to a culvert EM4-SW1 that flows under a driveway. Flow continues to follow the topography and flow southeast crossing under Trafalgar Road via culvert at EM4-SW2 (**Figure 4.1**). The flow monitoring data for the surface monitoring stations confirm that flows are intermittent in response to precipitation and snowmelt conditions and there is no groundwater discharge or perennial baseflow present along the ill-defined flow route through agricultural fields. Typically dry or only standing water conditions (water ponded in culvert) have been observed; (refer to Table C-5-1 in Appendix C-5 for flow monitoring data).

There are two depressions (D-33 and D-34) located in the upper section of the subcatchment located generally south of Burnhamthorpe Road and west of Trafalgar Road. These two depressions were identified in the NOCSS (2006) as Hydrologic Features B (**Figure 4.2**). These ponds are isolated features (not located on defined drainage channels) and represent areas where groundwater is interpreted to have naturally or through excavation been exposed at surface. NOCSS also identified Pond 44 as a feature on the landscape, however this feature was previously removed..

4.4 Climate

The reported long-term average annual precipitation for the period between 1981 and 2010 for the North Oakville area is 897 mm based on data from the Environment Canada Royal Botanical Garden monitoring station (Station 6153301 - 43º17’30’’N, 79º54’30’’W, elevation 102 masl). Daily precipitation data from this station are also provided on the datalogger hydrographs in Appendix C-4. Average monthly records of precipitation and temperature from this station have been used for the water balance calculations in this study (refer to Section 8 and Appendix C-7).

4.5 Geology

4.5.1 Surficial Geology

Surficial geology mapping published by the Ontario Geological Survey (2003) illustrates that the Study Area is covered by clayey silt to silt glacial till deposits (**Figure 4.3**). The thickness of the overburden sediments is variable, with depths to bedrock ranging from about 5m in the southeast to 25m in the northwest, near the crest of the Trafalgar Moraine. Geological work in the North Oakville area by Eyles & Eyles (2003) identified two layers of glacial till within the overburden deposits: an upper silt-rich till referred to as the Wildfield till, and a lower coarser-grained silty sand till referred to as the Halton till. The Eyles study noted that the Halton till generally occurs north of Burnhamthorpe Road and is not continuous throughout the North Oakville area so that in most places, the Wildfield till directly overlies the shale bedrock.

Drilling records for various boreholes and groundwater monitoring wells in the vicinity of the Study Area are provided in Appendix C-2. These records indicate that the surficial soils comprise of clayey silt till with occasional thin sand and silt seams and/or layers of silty clay. These sediments are interpreted as the upper Wildfield till, as described by Eyles & Eyles (2003).

4.5.2 Bedrock Geology

Published bedrock geology mapping of the area (Ontario Geological Survey, 2011) indicates the Study Area is underlain by shale bedrock of the Queenston Formation (**Figure 4.4**). This late-Ordovician aged bedrock consists of relatively soft, friable, red and green shale containing thin (<30cm) interbeds of fine sandstone and siltstone. Available well records indicate the bedrock elevation in the area generally ranges between about 171 masl and 176 masl.

4.5.3 Stratigraphy

The MECP maintains a database that provides geological records of water supply wells drilled in the province. A list of the available MECP water well records for local private wells is provided in Appendix C-1 and the well locations are plotted on **Figure 4.5**. These records have been referenced, along with geological information obtained from local geotechnical boreholes and groundwater observation wells (Appendix C-2), to assess the regional stratigraphy. To illustrate the geological conditions, a schematic cross-section through the Study Area has been prepared. The cross-section location is illustrated on **Figure 4.5** and the interpreted cross-section is provided on **Figure 4.6**. The cross-section illustrates the stratigraphy of the North Oakville area, with glacial till overburden sediments overlying shale bedrock.

Drilling records for various boreholes and groundwater monitoring wells in the vicinity of the Study Area are provided in Appendix C-2. These records indicate that the surficial soils

comprise of clayey silt till with occasional thin sand and silt seams and/or layers of silty clay. These sediments are interpreted as the upper Wildfield till, as described by Eyles & Eyles (2003). The estimated thickness of these two types of till is shown on the schematic cross-section (**Figure 4.6**). Within the Study Area, the bedrock is encountered at depths from about 5m to 25m below ground surface.

4.6 Hydrogeology

4.6.1 Local Groundwater Use

In the North Oakville area there are no high-yielding or extensive water supply aquifers reflecting the lack of coarse-grained sand and gravels and the relatively thin, glacial till overburden. There is no municipal groundwater use and no identified Well Head Protection Areas (WHPA). The Source Water Information Atlas (MECP, 2024) indicates that there are also no Significant Groundwater Recharge Areas (SGRA) or Highly Vulnerable Aquifers (HVA) in the EIR Subcatchment Area. The absence of these vulnerable areas is in keeping with the known very low hydraulic conductivity surficial soils and absence of high yielding aquifers.

A review of MECP well records (Appendix C-1) indicates that local supply wells generally tap the upper portions of the Queenston shale bedrock. Typically the low hydraulic conductivity till and shale materials are considered as relatively poor aquifers and the local well yields are typically very low (3.8 to 17 L/min). Singer et al. (2003) suggest that the pore spaces within the Queenston Formation have relatively poor interconnections and that the rock itself does not fracture or dissolve readily thus limiting its effective porosity. In addition, it is stated by Singer et al. (2003) that typically only the top 3m to 5m of this rock is fractured which often limits domestic supply wells completed in this formation.

The proposed development will be municipally serviced from Lake Ontario, and in the long term it is anticipated that the entire North Oakville area will be on lake-based municipal supplies. There is no proposed groundwater use for the development (refer to Section X for Water Servicing Details).

It is noted that there may be continued interim use of groundwater for private well supplies in the areas surrounding the proposed development. It is important that the development does not disrupt these local water supplies and, as required by the Region of Halton, monitoring of any active local supply wells before, during and after construction will be completed (refer to Section 12 for details of the proposed monitoring of local water supply wells still in use during development).

4.6.2 Groundwater Levels

Groundwater monitoring locations are shown on **Figure 4.1.** The groundwater monitoring data show the following (refer to Appendix C-4):

- Across the EIR Subcatchment Area, the groundwater monitoring trends show seasonal groundwater level variability at most of the monitoring locations, with the groundwater levels typically changing in a range of about 1.0m to 2.0m.

- There is a seasonal groundwater fluctuation pattern that typically appears on groundwater level hydrographs from shallow wells. The groundwater levels tend to be the highest in the spring, decline throughout the summer and early fall and then rise again in the early winter. The recorded depth to the water levels in monitoring wells generally ranged from above grade to about 5m below ground.

- Monitoring in well nest MW1s/d, located near the northeast boundary of the Study Area illustrates that the water levels in the shallow well are slightly higher than water levels in the deep well indicating a downward vertical flow gradient and recharge conditions (Figure C-4-1, Appendix C-4).

- The monitoring wells at nest EM4-W3s/d are screened within silty sand at depths of 6.2 m and 9.2 m bgs. The water levels for the deep and shallow wells are similar showing little to no gradient. The datalogger installed in the deep well indicates a response to precipitation events (Figure C-4-6, Appendix C-4).

- Water levels collected at EM4-PZ1 between October 2023 and July 2024 were still stabilizing after nine months (Figure C-4-13, Appendix C-4) indicating very low fine grained soils. The water level in December 2024 was measured above grade suggesting discharge conditions, however due to the fine grained soils, discharge is expected to be minimal. No discharge was observed at EM-PZ1 in December 2024.

4.6.3 Hydraulic Conductivity

There are various methods that can be applied to assess soil hydraulic conductivity, i.e., the ability of the soil to transmit groundwater. Grain-size data and soil characteristics can be utilized to provide a general estimate of hydraulic conductivity. In-situ bail-down or slug-testing methods are used in groundwater monitoring wells to assess site-specific hydraulic conductivity.

Rising head tests were completed at 4 locations (EM4-W1, EM4-W2, EM4-W3d and EM4- W8, see locations on **Figure 4.1**) in November 2023. The hydraulic conductivities for these wells are summarized in **Table 4.1** below and detailed results are provided in **Appendix C- 3**.

The hydraulic conductivity data indicates a range of hydraulic conductivity of between 5.1×10^{-5} and 1.0×10^{-7} cm/sec. The low values are in keeping with the interpretation of low hydraulic conductivity for the till soils in this area. It is noted that conditions, such as the degree of weathering and fracturing, may increase the overall effective hydraulic conductivity of the overburden. Typically, the hydraulic conductivity decreases with depth, reflecting the trend to less fracturing with depth.

Table 4.1 - Single Well Response Testing Results

Monitoring Well	Formation Screened	Estimated Hydraulic Conductivity (cm/sec)
EM4-W1	Silty Clay and Silt	1.0×10^{-7}
EM4-W2	Silty Clay	1.9×10^{-5}
EM4-W3d	Silty Sand	5.1×10^{-5}
EM4-W8	Silty Clay and Sandy Silt Till	2.3×10^{-5}

4.6.4 Groundwater Flow Conditions

Groundwater elevation data from December 2023 are illustrated on **Figure 4.7**, along with the interpreted groundwater elevation contours for the Study Area. The groundwater flow patterns generally reflect the topography and surface water flow patterns with groundwater flow directly beneath the Study Area towards the east.

4.6.5 Recharge and Discharge Conditions

Based on surface water and groundwater monitoring data (refer to Sections 4.3 and 4.6.2, respectively), it is concluded that groundwater recharge conditions (downward movement of water) are prevalent throughout the Study Area. There is no groundwater discharge to surface in the Study Area.

The vertical and lateral flow gradients are low and the relatively low hydraulic conductivity of the surficial till soils will restrict infiltration (refer to Section 4.6.3). This suggests that the recharge and groundwater flux (quantity or volume of water flow) that occurs within the Study Area is very limited. These findings are consistent with the NOCSS findings.

4.7 Groundwater Quality

Water quality data was collected from selected monitoring wells to typify the groundwater quality on the subject lands. Groundwater sampling was completed on March 14, 2024 at three groundwater monitoring wells (EM4-W4, EM4-W3s and EM4-8). The water samples were submitted to an accredited laboratory for analyses of general water quality indicators (e.g., pH, hardness, and conductivity), basic ions (including chloride and nitrate) and selected metals to characterize the background water quality. The groundwater testing results from the analytical laboratory are provided in Table C-6, Appendix C-6 and discussed below.

For comparison purposes, the Provincial Water Quality Objectives (PWQO) (applies to surface water) are provided in Table C-6. The PWQOs provide an indication of whether the groundwater on the subject lands could be discharged to surface water should pumping associated to construction be required.

- The water quality results are typical for shallow aquifers overlying Queenston Shale which generally has hard, mineralized water with elevated chlorides, sodium, sulphur and total dissolved solids. Chloride concentrations were 13.1mg/L at EM4-W4, 48.3 mg/L at EM4-W3s and 125 mg/L at EM4-W8. Sodium concentrations were 40.3 mg/L, 46.3 mg/L and 75.9 mg/L respectively. Sulphate was reported as 220, 241 and 386 mg/L respectively. Total dissolved solids were 644, 776 mg/L and 1190 mg/L.
- Nitrate was not detected in EM4-W4 and EM4-W3s and was reported at EM4-W8 with a value of 3.11 mg/L. Nitrate in shallow groundwater is typical of areas where agricultural activities are present such as the subject lands.
- Total phosphorus was reported as 0.06 mg/L at EM4-W4 and EM4-W8 and 0.03 mg/L at EM4-W3s. The PWQO for total phosphorus is 0.03 mg/L. Total phosphorus is a measure of all forms of phosphorus (dissolved or particulate) that are found in the water sample. There were no dissolved phosphorus (Ortho-phosphate as P) reported in the samples suggesting the reported concentrations were from particulates in the sample.
- A comparison of the water quality results with the PWQO indicates exceedances in metal parameters such as boron and uranium.

4.8 Fluvial Geomorphology

Geomorphological field investigations were completed in August 2023 along drainage features present within the Upper EM4, Lower EM4 and EM1 Subcatchments. Investigations included the following:

- Descriptions of riparian conditions
- Estimates of bankfull channel dimensions
- Determination of bed and bank material composition and structure
- Observations of erosion, scour, or deposition
- Collection of photographs to document the watercourses, riparian areas and/or valley, surrounding land use, and channel disturbances such as crossing structures

Rapid assessments were completed to identify dominant geomorphic processes, document stream health, and to identify any areas of concern regarding erosion or instability. Channel instability was objectively quantified through the application of the Ontario Ministry of the Environment's (2003) Rapid Geomorphic Assessment (RGA), where appropriate. Observations

were quantified using an index that identifies channel sensitivity based on evidence of aggradation, degradation, channel widening, and planimetric adjustment. The index produces values that indicate whether a channel is stable/in regime (score <0.20), stressed/transitional (score 0.21-0.40), or adjusting (score >0.41).

The Rapid Stream Assessment Technique (RSAT) was also employed (where appropriate) to provide a broader view of the system as it considers the ecological function of the watercourse (Galli, 1996). Observations were made of channel stability, channel scouring or sediment deposition, instream and riparian habitats, and water quality. The RSAT score ranks the channel as maintaining a poor (<13), fair (13-24), good (25-34), or excellent (35-42) degree of stream health.

Reaches were also classified according to a modified Downs (1995) Channel Evolution Model. The Downs Model describes successional stages of a channel because of a perturbation, namely hydromodification. Understanding the current stage of the system is beneficial as this allows one to predict how the channel will continue to evolve or respond to an alteration to the system.

The River Styles Framework (Brierley and Fryirs, 2005) provides a geomorphic approach to examining river character, behaviour, condition and recovery potential through the identification of the Geomorphic Process Zone. Geomorphic attributes are assessed, larger scale interactions between zones are analyzed, and historical data are studied in order to understand the historical evolution and future trajectories of those reaches. This ultimately provides a physical template for river management. A modified classification approach was applied to the study reaches.

General observations, measurements and rapid assessment results are summarized in the following subsections. Representative photos and field assessment sheets are contained in **Appendix D**.

4.8.1 Stream Reach Break Review

The EIR/FSS Terms of Reference requires that the NOCSS stream reach breaks be confirmed. To do so, assessments of stream reach conditions were completed in reaches/areas outlined in NOCSS within the Upper EM4 subcatchment and in downstream areas receiving storm drainage discharges from the Upper EM4 Subcatchment (both the Lower EM4 subcatchment and the EM1 Subcatchment). This included the review of stream reaches MOC-6, MOC-2, MOC-5A and MOC-4.

Reaches are homogenous sections of channel with regard to form and function, with consideration to channel gradient, hydrology, surficial geology, land use, and vegetative controls (Montgomery and Buffington, 1997; Richards et al., 1997). Each reach is therefore expected to

adjust in a generally uniform manner along its full length to changes in hydrology and sediment supply, as well as other modifying factors. Based on underlying geomorphic controls, the NOCSS delineated reaches within the EM4 subcatchment into 2 reaches, MOC-6 and MOC-2. In the NOCSS mapping, Reach MOC-6 extends from Burnhamthorpe Road to approximately midway within the western portion of Core 10. Reach MOC-2 extends from the downstream reach break with MOC-6 south to Dundas Street East, outside of the Subject Lands.

Based on 2023 field reconnaissance, reach characteristics along MOC-6 east and west of Trafalgar Road are quite different. In this regard, Reach MOC-6 was further subdivided into three reaches for the current study, MOC-6, MOC-6a and MOC-6b, each with differing characteristics. Reach MOC-6a extends east from Trafalgar Road to the upstream limit of the high constraint portion of watercourse along MOC-6. Reach MOC-6b extends west of Trafalgar Road upstream to south of Burnhamthorpe Road. **Figure 5.1** illustrates the reach break locations. While NOCSS did not label MOC-6 with three different segments, the differing characteristics of MOC-6 were recognized and reflected in the ultimate reach management recommendations in NOCSS (i.e., there are portions of MOC-6 through PSW25 and the upstream high constraint stream located in the NHS, while areas upstream of the high constraint stream that have very different characteristics are not part of the NHS).

Reaches MOC-5A and MOC-4 within the EM1 catchment were also reviewed as they will receive stormwater discharge from Pond 29 and are described in Section 5.3.3 below.

4.8.2 MOC-6a, MOC-6b and MOC-6

Reach MOC-6a was situated in a wetland located between Trafalgar Road and a downstream farm crossing. The reach was characterized as unconfined with poorly defined banks, and no primary flow path. Riparian vegetation was comprised of a continuous coverage of grasses. The reach was dominated by phragmites and cattails and spanned approximately 50 m. Substrate was comprised of clay and silt. Flows from MOC-6a enter the downstream property and Reach MOC-6 through two corrugated steel pipe (CSP) culverts at a driveway crossing. The drainage feature became more defined downstream of the driveway.

Reach MOC-6b was characterized as a low gradient, relatively straight ill-defined drainage feature. The surrounding land use was comprised of agricultural activities and the feature was frequently ploughed. Areas of natural vegetation along this drainage feature were fragmented and narrow and only present along hedgerows where grasses and shrubs were present. The flow path was comprised of clay, silt, and sand.

MOC-6 begins south of the farm driveway culvert north of the Church lands. This defined channel flows downstream to an online pond through a culvert on the New Horizon lands. Downstream of the pond, the reach is undefined, traverses an area which has been altered by a previous landowner through grading and placement of fill, and disperses into multi-thread

channels through a large wetland area, before entering a treed swamp. These wetland communities located within Core 10 form part of PSW 25.

Through the treed wetland communities, MOC-6 is well defined, and the riparian and bank vegetation provide adequate canopy cover. The channel lacks diversity of in-stream cover, as there is no variety of different habitat types present, such as course materials or aquatic vegetation. However, the channel did provide one form of suitable in-stream cover, consisting of small and large woody debris is present.

4.8.3 MOC-4 and MOC-5A

Reaches MOC-4 and MOC-5A were reviewed as they are proposed to receive stormwater discharge from Pond 29. Reach MOC-4 was characterized as a low sinuosity, moderate gradient channel situated within a partially confined valley. The riparian zone was comprised of a continuous buffer of mature trees and grasses. Aquatic vegetation was present along 75% of the reach and consisted of predominantly rooted emergent vegetation including cattails and grasses. Riffle-pool morphology was absent from the channel and the reach was dominated by runs. Channel substrate was comprised of clay and silt. Bank angles were moderately steep, ranging from 30° to 60° and bank erosion was observed along less than 5% of the channel banks. Average bankfull width and depth were 4.11 m and 0.36 m, respectively. PSW 17 and PSW 74 are located along this reach.

Reach MOC-5A was previously realigned and restored in 2019 as part of the residential development and stormwater management pond associated with the Mattamy Petgor Phase 2 Development. The reach contained a regularly meandering channel with a low gradient and was situated in a confined floodplain. The riparian zone was continuous, spanned greater than 10 channel widths and was dominated by grasses. Rooted emergent aquatic vegetation was present through 75% of the reach. At the time of the assessment the upstream extent of the channel was dry. Riffle-pool sequencing was present with riffle substrate comprised of gravel and cobbles, while pool substrate included clay, silt, and sand. Bank angles were moderately steep ranging from 30° to 60° and bank erosion was observed along less than 5% of the channel banks. Average bankfull width and depth were 1.49 m and 0.28 m, respectively.

General reach characteristics are summarized in **Table 4.2** below.

Table 4.2 - EM1 Catchment Reach Characteristics Summary

Reach Name	Avg. Bankfull Width (m)	Avg. Bankfull Depth (m)	Pool Substrate	Riffle Substrate	Dominant Riparian Condition	Notes
MOC-4	4.11	0.36	Clay/silt[b]		Continuous; mature trees	▪ Partially confined with irregular meanders ▪ Low density of woody debris ▪ Minimal bank erosion

Reach Name	Avg. Bankfull Width (m)	Avg. Bankfull Depth (m)	Pool Substrate	Riffle Substrate	Dominant Riparian Condition	Notes
MOC-5A	1.49	0.28	Clay/silt, and sand	Gravel and cobbles	Continuous; grasses	▪ Confined ▪ Meandering channel ▪ Realigned and enhanced in 2019

Reach MOC-4 had an RGA score of 0.27, indicating that the channel was in transition/stress. The dominant geomorphic process shaping the channel was planimetric form adjustment, largely due to the formation of chutes, single thread channel to multiple channels, and evolution of pool-riffle form to low bed relief form. The RSAT score was 24, indicating the channel was in fair condition. The limiting feature was physical instream habitat due to a lack of geomorphological units and a narrow wetted perimeter. Under the Downs (1995) model, the channel was determined to be stable. Reach MOC-4 was classified as a suspended-load dominated meandering channel under the River Styles Framework (Brierley and Fryirs, 2005).

Reach MOC-5A was determined to be in regime with an RGA score of 0. Construction of the reach was completed in 2019 and the intermittent nature of the flow regime limits channel adjustment. The RSAT score was 35, or excellent condition. Water quality was the limiting factor as the channel was dry during the assessment with the exception of standing pools of water. Under the Downs (1995) model, the channel was determined to be stable. Reach MOC-5A was classified as a suspended-load dominated meandering channel under the River Styles Framework (Brierley and Fryirs, 2005).

A summary of rapid assessment results is provided in **Table 4.3**.

Table 4.3: Summary of Rapid Assessment Results

Reach	RGA (MOE, 2003)			RSAT (Galli, 1996)			Downs (1995)	River Styles Framework[a]
	Score	Condition	Dominant Systematic Adjustment	Score	Condition	Limiting Feature(s)		
MOC-4	0.27	In transition/ stress	Evidence of planimetric form adjustment	24	Fair	Physical instream habitat	S - stable	Suspended load dominated - meandering
MOC-5A	0.0	In regime	N/A	35	Excellent	Water quality	S – stable	Suspended load dominated - meandering

5.0 STREAM, AQUATIC AND TERRESTRIAL SYSTEMS INCLUDING SPECIES AT RISK

5.1 Overview of EIR Subcatchment Area Characteristics

As explained in Section 1.1, shown on Figure 1.1, the EIR Subcatchment Area is defined by the current Upper EM4 Subcatchment boundaries. The majority of Subject Lands lie within the Upper EM4 EIR Subcatchment Area, with small portions located within East Morrison Creek Main Branch Subcatchment EM1, and Joshua's Creek Subcatchments JC7 and JC9. Subject Lands within the JC7 and JC9 subcatchment are located outside the protected NHS and currently are occupied entirely by cropped agricultural fields. The small southwest portion of Subject lands in Subcatchment EM1 that lies within Core 9 is discussed herein to provide completeness of the description of the portion of Core 9 on the Subject Lands.

The North Oakville Natural Heritage System which is documented through the Town of Oakville OPA 272 and NOCSS focuses on protecting not only the features, but their ecological function as well through a network of interconnected core areas.

The PPS notes that the diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved. "Ecological function" is broadly defined and means the natural processes, products or services that living and non-living environments provide or perform within or between species, ecosystems and landscapes.

The North Oakville East NHS Core Preserve Areas throughout North Oakville include the most significant natural features (existing woodland, wetlands) as well as adjacent areas either comprised of existing savannah, thicket, or meadow areas associated with the mature woodland/wetland or active agricultural lands around the outside of the woodlands and wetlands, promoting habitat diversity and connectivity within the core areas themselves. At the landscape level, Core Preserve Areas are interconnected through Linkage Preserve Areas, which are crucial for sustaining and enhancing wildlife habitat functions (as it promotes biological diversity and allows animal and plant populations to be more resilient to environmental changes).

Through this approach designed at the landscape level, Core Preserve Areas are designed to support the most significant and larger wildlife habitats, interconnected through Linkage Preserve Areas. Smaller, isolated features were not included in the NHS. Based on this approach, overall functional enhancements for wildlife habitat are expected over time within the NHS (Core Preserve Areas and Linkage Preserve Areas).

Within the EIR Subcatchment Area, the NOCSS NHS comprises Core Preserve Areas 9 and 10, Linkages, and High and Medium Constraint Stream Corridors. The majority of Upper EM4 Subcatchment is located outside the protected NHS and occupied by cropped agricultural fields. A small western portion (1.29 ha) of the subcatchment lies within the Core 9.

The NHS within the Lower EM4 Subcatchment, corresponding to the Core 10 western node, is associated with East Morrison Creek Tributary (high constraint stream reach MOC-6 and medium constraint stream reach MOC-2) and its floodplain as well as overlapping swamp and forested communities.

The EIR Subcatchment Area, outside Core 9 and Core 10 areas, is entirely under agriculture, mainly supporting croplands as well as remnant farm cultural thickets and cultural woodlands east of Trafalgar Road not identified for retention by NOCSS. In addition, there are small landscaped areas around homesteads as well as existing and removed farm structures along Burnhamthorpe Road East and hedgerows. One pond (D-34) dug for previous farming purposes and a wetland / topographic depression (D-33) identified as Hydrologic Feature 'B' by NOCSS (not retained as part of the NHS) are located south of Burnhamthorpe Road. The man-made pond PND-44 has been filled and no longer exists.

The following report sections document characterization of the NHS and other areas in the EIR Subcatchment.

5.2 Core 9

Only a small part of Core 9 exists within western portions of the EIR Subcatchment Area and the Subject lands. It extends well beyond the EIR Subcatchment Area and Subject Lands to west.

The entire Core 9 area is about 16.66 ha, distributed among two subcatchments: EM1 (92.3 %) and EM4 (7.7 %). The surveyed Core 9 covers an area of approximately 1.29 ha within EM4 Subcatchment.

As shown on **Figure 5.1**, within and west of the EIR Subcatchment Area, Core 9 comprises several habitat units including deciduous forest (FOD), thicket swamp (SWT), deciduous swamp (SWD) as well as cultural meadow (CUM) and agricultural land use along its outer perimeter, representation of which can be found in **Table 5.1**.

Table 5.1 – Core 9 Habitat Types

ELC community Codes (ELC Codes at the Community Series Level*)	Representation in Entire Core 9	Representation in Portion of Core 9 Located within Subject Lands and EIR Subcatchment Area
Woodlands: • Deciduous Forest (FOD)	13 ha (78%)	1.84 ha (58%)
Wetlands: • Thicket Swamp (SWT) • Deciduous Swamp (SWD)	0.77 ha (5%)	0.14 ha (4%)
Cultural Meadow (CUM)	0.87 ha (5%)	0 ha (0%)
Agriculture	2.02 ha (12%)	1.22 ha (38%)
Total	16.66 ha (100%)	3.2 ha (100%)

* Vegetation communities are described at the Ecological Land Classification (ELC) vegetation type level in Section 5.5 of this report

Only a narrow north-south strip (~20 m – 110 m wide by ~ 370 m long) of the eastern portion of Core 9 is within the Subject Lands. Within this portion of the Core, there are two wetland units (or portions of them) of the Provincially Significant North Oakville – Milton East Wetland Complex (MNR 2006, Revised July 2009): PSW 19 and portions of PSW 20.

There are additional wetlands located in the remainder of the Core, located in the EM1 subcatchment: PSW 21, PSW 22, PSW 23, PSW 24 and portions of PSWs 19 and 20.

The Core 9 woodland area, comprised of forest and treed swamp communities, is considered significant woodland, and was designated as such in the NOCSS, based on several criteria including size (> 13 ha).

5.3 Core 10

Although, as discussed in Section 2, the EIR / FSS Study Areas are located immediately upstream of Core 10 and stream reaches MOC-6 and MOC-2, Core 10 includes PSW25 and is therefore discussed herein given the potential drainage implications to PSW25 from the proposed SWM system in the Upper EM4 Subwatershed.

Core 10 is located south of the Subject Lands. Only the western node of Core 10 is located within the Lower EM4 subcatchment Area.

The entire Core 10 area is about 73 ha, distributed among three subcatchments: East Morrison (EM4) (26 %), Joshua's Creek (JC9) (39%) and Joshua's Creek (JC7) (35%). Core 10 covers an area of approximately 19.3 ha within Lower EM4 Subcatchment.

As shown on **Figure 5.1**, Core 10 comprises several habitat units including deciduous forest (FOD), thicket swamp (SWT), deciduous swamp (SWD) as well as cultural meadow (CUM) and agricultural land use along its outer perimeter, representation of which can be found in Table **5.2**.

Table 5.2 – Core 10 Habitat Types

ELC community Codes (ELC codes at the community series level*)	Representation in entire Core 10 (%)	Representation in Portion of Core 10 located within the Lower EM4 Subcatchment Area (%)
Woodlands: • Deciduous Forest (FOD)	22.4 ha	7.8 ha
Wetlands: • Meadow Marsh (MAM) • Shallow Marsh (MAS) • Thicket Swamp (SWT) • Deciduous Swamp (SWD)	19.1 ha	3 ha
Hedgerow (HE)	0.3 ha	0.0 ha
Cultural Meadow (CUM)	11.3 ha	7.7 ha
Agriculture / Anthropogenic Landscape	19.9 ha	0.8 ha
Total	73 ha	19.3 ha

* Vegetation communities are described at the Ecological Land Classification (ELC) vegetation type level in Section 5.5 of this report

The western node of Core 10 (within the Lower EM4 Subcatchment Area) associated with East Morrison Creek Tributary is a relatively low elevation area dominated by a broad floodplain with treed wetlands and meadow marshes. These wetland communities are identified as PSW25 which forms part of the Provincially Significant North Oakville – Milton East Wetland Complex (MNR 2006, Revised July 2009).

There are additional wetlands of this PSW complex in the remainder of Core 10, not addressed in this EIR/FSS, distributed in:

- the Joshua's Creek (JC9) subcatchment (PSW 26); and
- the Joshua's Creek (JC 17) subcatchment (PSWs 12, 27, 28, 29, 30, 31, 32, 33, 60).

The Core 10 woodland area, comprised of forest and treed swamp communities, is considered significant woodland, and was designated as such in the NOCSS, based on several criteria including size (> 30 ha).

5.4 Aquatic Resources

Aquatic habitat assessments on the EM4 subwatershed were undertaken in 2023 on July 27 and October 16, to identify and assess watercourse characteristics that provide habitat for the critical life processes, as outlined in the federal *Fisheries Act*. The habitat assessment details the characteristics and major physical attributes of the waterbody.

East Morrison Creek consists of two tributaries that converge just north of Dundas Street. The eastern tributary of East Morrison Creek (East Morrison Creek Tributary) is situated within the Lower EM4 subwatershed. NOCSS identified two stream reaches in the Lower EM4 subwatershed – Stream Reaches MOC-2 and MOC-6. Surface drainage from the Upper EM4 subwatershed drains into Reach MOC-6 east of Trafalgar Road.

The upper sections of the East Morrison Creek Tributary exhibit seasonal flow, with occasional isolated pooling. Habitat suitability and in-stream cover varies as the reaches change feature and form throughout. Sections of East Morrison Creek Tributary are known to support warmwater fish species. Habitat improvements and restoration has occurred in the lower portions.

5.4.1 Drainage Conditions West of Trafalgar Road

This ill-defined drainage feature (MOC-6b) begins south of Burnhamthorpe Road and drains southeast primarily through a plowed agricultural, this area was dry at time of the survey (October 16, 2023). No in-stream habitat riparian vegetation or canopy cover is present throughout this reach. Pooling of water was present at both the west and east culvert crossings under Trafalgar Road, specifically in areas where wetland vegetation was present.

This ill-defined drainage feature (MOC-6a) begins immediately east of the Trafalgar Road culvert, is undefined and disperses through an area of poor drainage with cattails along and adjacent to the Trafalgar Road ROW, connecting to an online pond through a culvert. Downstream of the pond, the reach is undefined and disperses into multiple flow paths through a wetland area on the New Horizon's lands. As both of these areas hydrologically connect to direct fish habitat (MOC-6), they have been classified as in-direct fish habitat.

5.4.2 Stream Reaches MOC-6 and MOC-2

Stream reaches MOC-6 and MOC-2 have been identified as potential coldwater habitat, attributed to historical reports of Redside Dace (*Clinostomus elongatus*), an endangered minnow, downstream of the Study Area near Upper Middle Road.

Presently, the aquatic species at risk mapping available from Fisheries and Oceans Canada (DFO) has identified no critical habitat or Species at Risk (SAR) within Eastern Morrison Creek.

High Constraint Stream Reach MOC-6

MOC-6 begins south of the farm driveway culvert north of the Church lands. This defined channel flows downstream to an online pond through a culvert on the New Horizon lands. Downstream of the pond, the reach is undefined, traverses an area which has been altered by a previous landowner through grading and placement of fill, and disperses into multi-thread channels through a large wetland area, before entering a treed swamp. These wetland communities located within Core 10 form part of PSW 25.

Through the treed wetland communities, the reach is well defined, and the riparian and bank vegetation provide adequate canopy cover. The channel lacks diversity of in-stream cover, as there is no variety of different habitat types present, such as course materials or aquatic vegetation. However, the channel did provide one form of suitable in-stream cover, consisting of small and large woody debris is present.

Updated fish sampling data records were reviewed to determine fish presence. Fish were documented both upstream and within the online pond, in 2022 and 2021, respectively (LIO, 2024). As these data records are recent, it is appropriate to classify Reach MOC-6 as direct fish habitat.

Medium Constraint Stream Reach MOC-2

The immediate upstream portion of Reach MOC-2, with respect to definition and cover, is relatively similar to Reach MOC-6. As the reach continues downstream (south) of the treed swamp into a more open wetland area, it drains southwesterly through a poorly defined area.

The reach becomes more defined approximately 70 m upstream of the culvert crossing at Threshing Mill Blvd due to natural channel design constructed in this area. The channel is full of emergent wetland and grass plant species.

In the realigned portion of this tributary east of Trafalgar Road, wetland and grasses are dominant within the channel, which can provide in-stream cover for fish. The placement of course substrate in riffles areas, also could provide unembedded habitat.

The rehabilitated channel flows through a series of box culverts under Wheat Boom Drive, opening up for a short distance before entering the Trafalgar Road culvert, connecting it to the realigned and restored natural channel design west of Trafalgar Road (referred to as Reach MOC-2A . These areas now provide adequate in-stream cover and improved fish passage for fish to the upstream reach (MOC-6).

While there are no recent fish sampling records for MOC-2, it is probable that fish are present and could likely use this area. This is because of its downstream connection to MOC-4, which is known to support a fish community as evidenced by recent fish data records. Additionally,

there are no documented fish barriers between the receiving and connected direct fish habitat reaches, MOC-6 and MOC-4.

The specific components used to categorize aquatic habitats along the East Morrison Creek Tributary by stream reach are summarized in **Table 5.3**.

Table 5.3 – Aquatic Habitat Characterization

Reach	MOC-6b	MOC-6a	MOC-6	MOC-2
NOCSS 2006	Marginal Habitat	Marginal Habitat	Marginal Habitat	Marginal Habitat
Beacon 2024	In-direct Fish Habitat	In-direct Fish Habitat	Direct Fish Habitat	Direct Fish Habitat
Feature Type	Ill-defined drainage feature	Ill-defined drainage feature	D/s of MOC-6a is a defined channel. except in the New Horizon lands where it has multiple flow paths; it is well-defined south of New Horizon lands,	Defined Channel
Flow Regime 2024	Ephemeral	Ephemeral	Intermittent	Perennial
Fish Presence	No	No	Yes	Likely
Function of habitat in sustaining fisheries	Does not contribute directly to the sustenance of the resident fish community	Does not contribute directly to the sustenance of the resident fish community	Important but not critical in sustaining the resident fish community	Important but not critical in sustaining the resident fish community
Ground Water Discharge	No ground water discharge present	No ground water discharge present	No ground water discharge present	No ground water discharge present
Thermal Regime	Habitat is not known to support coldwater species	Habitat is not known to support coldwater species	Habitat is not known to support coldwater species	Habitat is not known to support coldwater species

5.5 Terrestrial Features and Functions

The natural features, functions and attributes associated with the Subject Lands and the Upper EM4 Subcatchment area have received a high level of field investigation. Assessment and inventory of the lands natural heritage have been detailed in a number of reports, notably including:

- NOCSS Characterization Report (2006);
- North Oakville – Milton East Wetland Complex, MNR, 2006;

- North Oakville Natural Heritage Inventory and Analysis, LGL Limited, 2000; and
- Final Scoped Environmental Implementation Report / Stormwater Management Report – East Branch of East Morrison Creek Upper Subcatchment EM4, North Oakville (2017).

The NOCSS Characterization Report completed in 2006 provides the general characterization of terrestrial features within the North Oakville East Study Area, which includes the East Morrison Creek watershed area. This report was utilized to provide general and historical information with respect to terrestrial features and functions associated with the Subject Lands and EM4 Subcatchment.

In addition to the above noted background information, in the spring and summer of 2023 Beacon completed botanical inventories and vegetation community classifications (ELC) as well as amphibian call counts and breeding bird surveys.

A summary of the field visits and survey dates is presented in **Table 5.4**. More detailed survey descriptions are provided in the subsections that follow.

Table 5.4 - 2023 Field Investigations

Survey Type	Date of Survey(s)
Ecological Land Classification & Floristic Inventory	July 5, July 14 and July 27
Breeding Bird Surveys	June 2-3, June 18-19 and July 7
Amphibian surveys	April 14, May 29 and June 26

The vegetation communities and flora associated with the Subject Lands and the Upper EM4 Subcatchment and the Lower EM4 Subcatchment are described in more detail in Section 5.5.1 and Section 5.5.2 of this EIR/FSS Report and the breeding bird survey findings and amphibian call count data are presented in Section 5.5.5 and Section 5.5.6.

5.5.1 Vegetation Communities within the EIR Subcatchment Area and Subject Lands

Vegetation communities within the EIR Subcatchment Area and Subject Lands were described and mapped according to the Ecological Land Classification (ELC) system for Southern Ontario (Lee *et al.* 1998), which is a standardized vegetation classification protocol utilized in southern Ontario. Vegetation communities were delineated on an aerial photograph of the properties and pertinent information was recorded on the vegetation structure and composition of each community. A list of vascular plant species observed on the subject property was compiled in conjunction with ELC surveys.

ELC ecosites on the Subject Lands and EIR Subcatchment Area were identified in NOCSS Figures 6.3.10 and 6.3.11 and further reviewed and refined as part of this EIR as shown on **Figure 5.1** herein. They consist of a mix of cultural, wetland and forest communities.

Outside of Core 9 the EIR Subcatchment Area and Subject Lands are largely in active agricultural use but also include landscaped homesteads, road infrastructure and wet depressions.

Within Core 9 on the Subject Lands and EIR Subcatchment Area, vegetation communities comprise Dry-Fresh Sugar Maple-Beech Deciduous Forest (FOD5-2), and wetland (PSW 19 and PSW 20) (SWT2-4, SWT2).

Field investigations confirmed vegetation communities noted in the NOCSS, with some revisions. The vegetation communities illustrated in **Figure 5.1** are described in detail below.

The following sections detail findings and characterization of vegetation communities within the NHS. Areas outside of the NHS are developable. Further future field investigations may be required to address endangered or threatened species, or wildlife salvage in areas outside of the NHS.

Core 9 Forest Communities

Dry – Fresh Sugar Maple-Beech Deciduous Forest (FOD5-2)

This community, which represents the majority of Core 9, occurs along the western portions of the Subject Lands and EIR Subcatchment Area. It is dominated by Sugar Maple (*Acer saccharum*) and American Beech (*Fagus grandifolia*) with some White Elm (*Ulmus americana*), Sugar Maple, White Ash (*Fraxinus americana*), Red Oak (*Quercus rubra*), Shagbark Hickory (*Carya Ovata*), Bur Oak (*Quercus macrocarpa*), Basswood (*Tilia americana*), Ironwood (*Ostrya virginiana*), Eastern Hemlock (*Tsuga canadensis*), Eastern White Pine (*Pinus strobus*) and Trembling Aspen (*Populus tremuloides*) also present. The Understory cover includes Grey Dogwood (*Cornus racemosa*), White Elm, Chokecherry (*Prunus virginiana*), and Common Buckthorn (*Rhamnus cathartica*) and Red Raspberry (*Rubus idaeus*), with a ground cover composition including Trout Lily (*Erythronium americanum*), Canada Mayflower (*Maianthemum canadense*), White Trillium (*Trillium grandiflorum*), Virginia Waterleaf (*Hydrophyllum virginiana*), Jack-in-the-Pulpit (*Arisaema triphyllum*), Common Strawberry (*Fragaria virginiana*), and Garlic Mustard (*Alliaria petiolata*).

Core 9 Wetland Communities

Buttonbush Mineral Thicket Swamp (SWT2-4)

This thicket swamp occurs in two small pockets, identified as PSW 19 and PSW 21 within the Provincially Significant North Oakville –Milton East Wetland Complex, throughout the forested

Core 9, within and beyond the boundary of the Subject Lands. It contains several wetland species of shrub and notably includes Buttonbush (*Cephalanthus occidentalis*) a regionally rare species in Halton Region, as well Willow (*Salix* spp). This wetland community type is identified as provincially significant with an S-rank of S3. The delineation of the Core 9 is influenced by the presence of the two small buttonbush pockets along its eastern edge.

Mineral Thicket Swamp (SWT2)
This wetland community located in the south-eastern portion of the woodlot and partly located within the Subject Lands is associated with a swale that conveys surface water drainage through the woodlot. This narrow wetland band supports a variety of wetland shrubs, including Dogwood (*Cornus stolonifera*) and Willow (*Salix* spp), ground cover dominated by Spotted Jewelweed (*Impatiens capensis*) and sedges (*Carex* spp.) and wetland trees along its margins, including Green Ash (*Fraxinus pennsylvanica*), White Elm and Bur Oak. This wetland area is identified as PSW 20 within the Provincially Significant North Oakville – Milton East Wetland Complex.

5.5.2 Vegetation Communities within Lower EM4 Subcatchment

Outside of Core 10, the Lower EM4 Subcatchment Area are mostly developed lands, with the exception of vegetated areas located along the East Morrisson Creek Tributary East of Trafalgar Road and north of Core 10.

Within portions of Core 10 within Lower EM4 Subcatchment Area, vegetation communities comprise deciduous forests, thicket swamps, deciduous treed swamps as well as marshes. They are described in detail in the paragraphs below.

Forested Communities in Core 10

Dry – Fresh Oak – Hardwood Deciduous Forest (FOD2-4)
This mature and high-quality deciduous forest community occurs in the Lower EM4 Subcatchment Area within the central node of Core 10.

Red Oak is dominant, with associates of Sugar Maple, White Ash, Shagbark Hickory, Basswood, Ironwood, American Beech, White Oak (*Quercus alba*) and Blue-beech (*Carpinus caroliniana*). The understory is quite sparse with Gray Dogwood, Chokecherry and Common Buckthorn. Ground covers are generally sparse but diverse; they notably include Large-leaved Aster (*Eurybia macrophylla*), Carrion Flower (*Smilax herbacea*), White Baneberry (*Actaea pachypoda*), Jack-in-the-pulpit, False Solomon's Seal (*Maianthemum racemosum*), Poison-ivy (*Rhus radicans*), Wood Anemone (*Anemone quinquefolia*), Enchanter's Nightshade (*Circaea canadensis*) and Running Strawberry-Bush (*Euonymus obovatus*).

Fresh – Moist White Elm Lowland Deciduous Forest (FOD7-1)
This relatively young regenerating lowland forest community located in the Core 10 western

node within the floodplain associated with downstream East Morrisson Creek Tributary (reach MOC-6) is primarily composed of White Elm and Green Ash with an understory of Common Buckthorn, Hawthorn and Grey Dogwood.

Wetland Communities in Core 10

Mineral Meadow Marsh (MAM2)
A small and heavily disturbed MAM2 patch occurs along the East Morrison Creek Tributary within northern portions of the PSW25 on the New Horizon lands, associated with grading and ditching that was dug south of the existing pond D-42 to convey flows of the watercourse (reach MOC-6). Species figuring prominently in this unit reflect its history of disturbance: Reed Canary Grass (*Phalaris arundinacea*), Yellow Nut Sedge (*Cyperus esculentus*), Curled Dock (*Rumex crispus*), Common Reed and Creeping Bent (*Agrostis stolonifera*).

Reed-canary Grass Mineral Meadow Marsh (MAM2-2)/Forb Mineral Meadow Marsh (MAM2-10)
This wetland community located along downstream portions of the East Morrison Creek Tributary (reach MOC-6) and forming part of PSW 25 is dominated by Reed Canary Grass, interspersed with forb species dominated patches including species such as Red Top (*Agrostis gigantea*), Joe-Pye Weed (*Eupatorium maculatum*), Wool-grass (*Scirpus cyperinus*), and Purple Loosestrife (*Lythrum salicaria*). Other species notably include Panicled Aster (*Symphyotrichum lanceolatum*), Soft Rush (*Juncus effusus*), Elecampane (*Inula helenium*) and Fowl Manna Grass (*Glyceria striata*).

Reed-canary Grass Mineral Meadow Marsh (MAM2-2) / Cattail Mineral Shallow Marsh (MAS2-1)
This open community occurs where the watercourse flows southwesterly at the south end of the PSW25. It is dominated by Reed canary Grass vegetation units and some cattail shallow marsh (MAS2-1) in the deepest portions closer to the stream.

Swamp Maple Mineral Deciduous Swamp (SWD3-3) / Mineral Thicket Swamp (SWT2)
This swamp forming part PSW25 along the East Morrison Creek Tributary is bounded by.a deciduous forest on upper slopes to the south and west, a constructed berm to the north and the wetter– meadow marsh complex to the east. It is dominated by Freeman Maple, young White Elm trees and Common Buckthorn which forms dense and homogenous patches in some locations, notably closer to the stream where the grades are very flat.

Silver Maple Mineral Deciduous Swamp (SWD3-2)
This PSW25 community located east of the East Morrison Creek Tributary (reach MOC-6) is dominated by Silver Maple (*Acer saccharinum*) in association with Freeman Maple (*Acer x freemanii*), Swamp White Oak (*Quercus bicolor*), Bur Oak, Green Ash and White Elm. The understory is dominated by is dominated by Buttonbush, Red-Osier Dogwood (*Cornus sericea*), Common Buckthorn as well as young Silver Maple trees. Dominant ground covers are Sensitive Fern (*Onoclea sensibilis*), and Spotted Jewelweed.

Mineral Thicket Swamp (SWT2) / Silver Maple Mineral Deciduous Swamp (SWD3-2)
This swamp forming part PSW25 along the East Morrison Tributary is dominated by Common Buckthorn which forms dense and homogenous patches. In some locations Silver Freeman Maple and young White Elm trees are present.

Grey Dogwood Mineral Thicket Swamp (SWT2-9)
This open thicket swamp is dominated by Grey Dogwood and Common Buckthorn, with Panicled Aster, Spotted Jewelweed, Purple Loosestrife and Spreading Dogbane (*Apocynum androsaemifolium*) in the openings. It forms a transition between the closed canopy swamp and the marsh communities (MAM2-2/MAS2-1) from the southern end of PSW25.

5.5.3 Flora

Plant inventories have been undertaken in the Subject Lands, the Upper EM4 Subcatchment Area and the Lower EM4 Subcatchment Area, with a total of 169 taxa identified to species.

Subject Lands in the Upper EM4 Subcatchment Area

A total of 103 plant species have been recorded within the Subject Lands and the Upper EM4 Subcatchment Area. Onsite inventories outside of the Subject Lands have not been undertaken. Of the 103 plants identified to species, 69 (67%) plant species identified are native to Ontario and 34 (33%) plant species are considered introduced and non-native to Ontario. A list of vascular plants is presented in **Appendix E-1**.

Several plant species found within the Subject Lands and the Upper EM4 Subcatchment Area are considered regionally rare by Varga et al. (2005) and Crins *et al.* (2006). These species are presented in **Table 5.5**. All native species have a provincial conservation status of Secure (S5) or Apparently Secure (S4), indicating that they are generally common in Ontario. No floral threatened, endangered, or species of special concern were found within the Subject Lands, including Butternut (*Juglans cinerea*).

Rare or common plants in the Subject Lands and the Upper EM4 Subcatchment Area are located within thicket swamp communities of Core 9.

Table 5.5 – Rare and Uncommon Species in Subjects Lands and Upper EM4 Subcatchment Area

Scientific Name	Common Name	S-Rank	Halton (Varga 2005)	Halton (Crins 2006)	Community / Wetland or Woodland
Carex bebbii	Bebb's Sedge	S5	U	-	Wetlands in Core 9
Carex crinita	Fringed Sedge	S5	U	U	Wetlands in Core 9

Scientific Name	Common Name	S-Rank	Halton (Varga 2005)	Halton (Crins 2006)	Community / Wetland or Woodland
Carex tuckermanii	Tuckerman's Sedge	S5	U	U	Wetlands in Core 9
Cephalanthus occidentalis	Eastern Buttonbush	S5	R	U	Wetlands in Core 9
Triadenum fraseri	Fraser's St. John's-wort	S5	R	R	Wetlands in Core 9

Rare or uncommon Species Listed as part of the NOCSS in Core 9

A series of inventories were conducted in the entire Core 9 by other teams between 2000 and 2006 as part of the NOCSS and other studies (Gartner Lee 2000) in the EM1 subcatchment area. The species list presented in **Table 5.6** includes uncommon and rare species inventoried in Core 9 during this extensive review.

Table 5.6 – Core 9 Rare and Uncommon Species (NOCSS sources)

Scientific Name	Common Name	S-Rank	Halton (Varga 2005)	Halton (Crins 2006)
Bidens tripartita	Three-parted Beggarticks	S5?	U	-
Carex bebbii	*Bebb's Sedge*	S5	U	-
Carex crinita	*Fringed Sedge*	S5	U	U
Carex tribuloides	*Blunt Broom Sedge*	*S4*	*U*	*U*
Carex tuckermanii	Tuckerman's Sedge	S5	U	U
Cephalanthus occidentalis	Eastern Buttonbush	S5	R	U
Galium tinctorium	Dyer's Bedstraw	S5	R	U
Glyceria septentrionalis	Eastern Mannagrass	S4	U	U
Quercus bicolor	Swamp White Oak	S4	R	R
Ranunculus pensylvanicus	Pennsylvania Buttercup	S5	U	U
Rosa palustris	Swamp Rose	S5	R	U
Sparganium emersum	Green-fruited Burreed	SU	-	U
Symphyotrichum urophyllum	Arrow-leaved Aster	S4	R	U

Scientific Name	Common Name	S-Rank	Halton (Varga 2005)	Halton (Crins 2006)
Veronica scutellata	Marsh Speedwell	S5	R	R
Wolffia borealis	Northern Watermeal	S5	R	U
Wolffia columbiana	Columbia Watermeal	S5	U	U

Lower EM4 Subcatchment Area

A total of 128 plant species have been recorded within the Lower EM4 Subcatchment Area, both in and out of Core 10. Inventories south of Threshing Mill Boulevard have not been undertaken. Of the 128 plants identified to species, 101 (79%) plant species identified are native to Ontario and 27 (21%) plant species are considered introduced and non-native to Ontario. A list of vascular plants is presented in **Appendix E-2**.

Several plant species found within the Lower EM4 Subcatchment Area are considered regionally rare by Varga et al. (2005) and Crins *et al*. (2006). These species are presented in **Table 5.7**. All native species have a provincial conservation status of Secure (S5) or Apparently Secure (S4), indicating that they are generally common in Ontario. No floral threatened, endangered, or species of special concern were found within the Subject Lands, including Butternut.

Rare or common plants in the Lower EM4 Subcatchment Area are located within wetland and woodland communities of Core 10.

Table 5.7 – Rare and Uncommon Species in Lower EM4 Subcatchment Area (Core 10)

Scientific Name	Common Name	S-Rank	Halton (Varga 2005)	Halton (Crins 2006)	Community / Wetland or Woodland
Apocynum cannabinum	Hemp Dogbane	S5	U	U	Thicket Swamps in Core 10
Carex projecta	Necklace Sedge	S5	U	U	Swamps in Core 10
Eleocharis obtusa	Blunt Spikerush	S5	U	U	Marshes in Core 10
Geranium maculatum	Spotted Geranium	S5	U	-	Woodlands in Core 10
Mimulus ringens	Square-stemmed Monkeyflower	S5	U	U	Swamps in Core 10
Penthorum sedoides	Ditch Stonecrop	S5	U	U	Marshes in Core 10

Scientific Name	Common Name	S-Rank	Halton (Varga 2005)	Halton (Crins 2006)	Community / Wetland or Woodland
Quercus bicolor	Swamp White Oak	S4	R	R	Swamps in Core 10
Salix interior	Sandbar Willow	S5	U	-	Marshes in Core 10
Smilax tamnoides	Bristly Greenbriar	S5	U	-	Woodlands in Core 10

Rare or Uncommon Species Listed as part of the NOCSS in Core 10

A series of inventories were conducted in the entire Core 10 by other teams between 2000 and 2006 as part of the NOCSS. The species list from Table 5.8 includes uncommon and rare species inventoried in Core 10 during this extensive review.

Table 5.8 – Core 10 Rare and Uncommon Species (NOCSS sources)

Scientific Name	Common Name	S-Rank	Halton (Varga 2005)	Halton (Crins 2006)
Alopecurus aequalis	Short-awned Foxtail	S4	U	U
Bidens tripartita	Three-parted Beggarticks	S5?	U	-
Bolboschoenus fluviatilis	River Bulrush	S4S5	R	R
Botrypus virginianus	Rattlesnake Fern	S5	-	-
Carex bromoides	Brome-like Sedge	S5	U	U
Carex cephalophora	Oval-leaved Sedge	S5	R	-
Carex crinita	Fringed Sedge	S5	U	U
Carex projecta	Necklace Sedge	S5	U	U
Carex tribuloides	Blunt Broom Sedge	S4	U	U
Carex tuckermanii	Tuckerman's Sedge	S5	U	U
Cephalanthus occidentalis	Eastern Buttonbush	S5	R	U
Cinna arundinacea	Stout Woodreed	S4	U	-
Galium tinctorium	Dyer's Bedstraw	S5	R	U
Glyceria septentrionalis	Eastern Mannagrass	S4	U	U

Scientific Name	Common Name	S-Rank	Halton (Varga 2005)	Halton (Crins 2006)
Lactuca biennis	Tall Blue Lettuce	S5	R	U
Lemna trisulca	Star Duckweed	S5	R	U
Potamogeton foliosus	Leafy Pondweed	S5	R	R
Quercus bicolor	Swamp White Oak	S4	R	R
Ranunculus pensylvanicus	Pennsylvania Buttercup	S5	U	U
Rosa palustris	Swamp Rose	S5	R	U
Rubus hispidus	Bristly Dewberry	S4	R	R
Sparganium emersum	Green-fruited Burreed	SU	-	U
Sparganium eurycarpum	Broad-fruited Burreed	S5	R	U
Symphyotrichum urophyllum	Arrow-leaved Aster	S4	R	U
Triadenum fraseri	Fraser's St. John's-wort	S5	R	R
Vaccinium angustifolium	Early Lowbush Blueberry	S5	U	U
Viburnum rafinesqueanum	Downy Arrowwoods	S5	U	U

5.5.4 Significant Woodlands

Significant woodlands were assessed as part of the NOCSS and included forested and treed swamp communities in Core 9 and Core 10. The approach for significant woodlands is described in the NOCSS:

> *The intent of the NHS is to capture the majority of significant woodlands (96.4%), while also creating a system of protected areas with long term ecological integrity. The NHS includes areas which currently are classified as agricultural fields, meadows and thickets, with the intent that these areas will become wooded over time, thereby reversing the effects of forest fragmentation. As woodlands develop within these areas the total area of significant woodlands will increase possibly by up to 160 ha or 42.6%.*

Cores 9 and 10 contain more than 21 ha of lands that are currently farmed. Through their preservation within protected Cores 9 and 10, it is anticipated that substantial portions of these lands will become forested overtime resulting in an overall substantial increase in significant woodland area.

5.5.5 Description of PSW 25

The PSW25 was initially described as part of the *Final Scoped EIR/SWM Report* (June 2017) prepared for Star Oak Developments Limited for the purpose of assess impacts on the wetland water balance which would result from the proposed SWM concept and, not notably, post development flows from SWM pond 29.

The following description of PSW 25 is based on findings from the field surveys which were conducted in May, July and October 2023 to characterize vegetation communities according to the ELC classification and confirm low flow channel conditions through the entire wetland. It is generally consistent with description from the *Final Scoped EIR/SWM Report* (June 2017) which was based on the division of PSW25 into three sub-sections with differing associated wetland vegetation and stream characteristics:

- Between Points A and B along Stream Reach MOC-6;
- Between Points B and C along Stream Reaches MOC-6 and MOC-2; and,
- Between Points C and D along Stream Reach MOC-2.

Points A, B, C and D are illustrated in **Figure 5.1**.

Upstream of Point A

Areas of staked PSW 25 located on the New Horizon lands upstream of Point A have been altered by a previous landowner through grading and placement of fill with only a small portion left which still be characterized as wetland. This heavily disturbed Mineral Meadow Marsh (MAM2) patch occurs along the East Morrison Creek Tributary (reach MOC-6) downstream of the online pond, associated with grading and ditching that was dug south of the existing pond D-42 to convey flows of the watercourse. Species figuring prominently in this unit reflect its history of disturbance, notably Nut Sedge, Curled Dock, Common Reed and Creeping Bent Grass.

This area will be entirely restored as wetland with reinstatement of a sinuous low-flow channel as well as online and offline wetland pockets, plantings and habitat features. Further details are provided in the *East Morrison Creek Fluvial Geomorphology Assessment and Conceptual Restoration Design (August 15, 2024)* prepared by GEO Morphix.

Between Point A and Point B

This is a relatively wide area of flat topography. It includes a meadow marsh complex (MAM2-2/MAM2-10) which is dominated by Reed Canary Grass with patches of forb-dominated herbaceous vegetation including Red Top, Panicled Aster and Joe-Pye Weed, and areas of increase sedges presence. A low flow channel exists through the wetland along the watercourse alignment (MOC-6) but is very narrow and shallow.

The transition area on the gentles slopes west of the flat meadow marsh are occupied by disturbed swamp communities including forming part PSW 25 along the East Morisson Creek Tributary (reach MOC-6) dominated by Freeman Maple, young White Elm trees as well as Common Buckthorn which forms dense and homogenous patches in some locations. Closer to the stream the grades are very flat and based on the review of floodplain analysis flows from the stream reach itself would only enter the swamp unit under large storm events.

Between Point B and Point C

This area which corresponds to the upper Reach MOC-2 between is defined by a poorly defined watercourse flowing east of the FOD7-1/CUT unit (main wooded block) and entering a treed swamp with oak hardwood, shagbark hickory forest and silver maple along the channel, with buckthorn forming most of the tall shrub layer. Hydraulic analysis shows that flooding beyond the low flow channel frequently inundates a 10 to 20 m wide flow path throughout the disturbed swamp area along EM4.

Given local topography, upper portions of the Silver/Freeman Maple swamp (SWD3-2), representing the bulk of the swamp communities east of EM4 between B and C, are not expected to be influenced by stream flow fluctuations as they would only receive flows from the watercourse in the case of exceptional flood events**.**

Between Point C and Point D

In this area, the watercourse continues downstream (south) through a poorly defined channel in a disturbed treed swamp dominated by Common Buckhorn and treed areas of silver maple and green ash, confined to the narrow floodplain of the creek, then flows southwesterly into a progressively more open and enlarged wetland area with shrub thickets of Grey Dogwood, Buckthorn as well as Spreading Dogbane on the edges. It ultimately flows through meadow marsh vegetation units (MAM2-2/MAM2-10) with some cattail patches in the wettest deepest portions. The reach becomes more defined at Point D where this portion of the tributary has been realigned.

5.5.6 Wildlife

Field investigations were conducted within the NHS to identify wildlife and characterize habitat functions but also outside of the NHS, which are developable, to identify endangered or threatened species and determine wildlife salvage requirements for amphibians and turtles. Further future field investigations may be required to address specific endangered or threatened species in areas outside of the NHS prior to site alteration as discussed in Section 5.6 of this report.

Breeding Birds

Three rounds of breeding bird surveys were conducted across June 2-3, 18-19, 2023 and July 7, 2023. On July 7, 2023, only potential habitat for Eastern Meadowlark / Bobolink within the EM4 Subwatershed Area was surveyed.

Surveys were conducted during the morning hours on days with low to moderate winds (2-3 Beaufort Scale), no precipitation, and temperatures within 5°C of seasonal average. The breeding bird community was surveyed using a roving type survey, in which all parts of the survey area were walked to within 50 m and all birds heard or observed and showing some inclination toward breeding were recorded as breeding species. All birds heard and seen were recorded in the location observed on an aerial photograph of the site.

A total of 41 species was documented as breeding within the subwatershed; one additional non-breeding species, Turkey Vulture (*Cathartes aura*), was noted as foraging over the open areas. This diversity is reflective of the scale and habitats present within the subwatershed, with large areas of agricultural land and smaller areas of woodland, meadow and wetland. Observations were most concentrated away from the open agricultural lands in the more vegetated bordering habitats around farmed fields.

The majority of species detected are generalist species of rural or urbanizing areas. The most abundant species were Song Sparrow (*Melospiza melodia*) and Red-winged Blackbird (*Agelaius phoeniceus*) and with 22 and 21 territories recorded respectively. Other generalist species found throughout the surveyed area included: American Robin (*Turdus migratorius*), Northern Cardinal (*Cardinalis cardinalis*), Common Grackle (*Quiscalus quiscula*), Brown-headed Cowbird (*Molothrus ater*), and American Goldfinch (*Spinus tristis*).

The open agricultural lands provided habitat for few species; those recorded included Killdeer (*Charadrius vociferus*), Spotted Sandpiper (*Actitis macularia*), Horned Lark (*Eremophila alpestris*), Vesper Sparrow (*Pooecetes gramineus*), and Savannah Sparrow (*Passerculus sandwichensis*). One Field Sparrow (*Spizella pusilla*) was also recorded in a grassy meadow in the eastern portion of the subwatershed. Early successional species were observed on the boarders of the field areas included Willow Flycatcher (*Empidonax traillii*), Eastern Kingbird (*Tyrannus tyrannus*), Gray Catbird (*Dumetella carolinensis*), and Indigo Bunting (*Passerina cyanea*), in addition to previously noted generalist species.

Wetland habitat was limited within the surveyed area to the Lower EM4 Subcatchment Area, and the only obligate wetland species recorded was Swamp Sparrow (Melospiza georgiana) adjacent to the East Morrison Creek Tributary south of PSW25 outside of the Upper EM4 Subcatchment Area. Other species observed which are often associated with wetland areas included: Yellow Warbler (Setophaga petechia), Common Yellowthroat (Geothlyphis trichas) and Red-winged Blackbird.

Woodland species were observed within the woodland edges of Core 9 along the

subwatershed boundaries, in addition to a larger area of deciduous forest and thicket in Core 10 north and west of the existing subdivision in the Lower EM4 Subcatchment Area. Most woodland species were represented by one or two recorded pairs, such as: Yellow-billed Cuckoo (*Coccyzus americanus*), Red-bellied Woodpecker (*Melanerpes carolinus*), Downy Woodpecker (*Dryobates pubescens*), Great Crested Flycatcher (*Myiarchus crinitus*), Warbling and Red-eyed vireos (*Vireo gilvus* and *V. olivaceus*), and American Redstart (*Setophaga ruticilla*).

Area-sensitive species are those which typically require larger areas of suitable habitat to breed or tend to have higher breeding success in larger habitat patches. Two pairs of American Redstart were recorded, one within the FOD7-1/CUT1 community in Core 10 and a second within the FOD2-4 woodland in Core 9 along the subwatershed boundary. This species is regularly observed in smaller woodlands near urban areas. Additionally, five pairs of the area-sensitive Savannah Sparrow were recorded within or adjacent to the agricultural fields. This species typically requires large areas of open habitat for successful breeding. However, it is a common breeder in a wide variety of such open habitats, including old-field and agricultural edge habitats. Thirteen territories were recorded along the field edges.

No species provincially ranked as S1 through S3 (Critically Imperiled through Vulnerable), nor any species regulated under the ESA were recorded.

Amphibians

Three rounds of evening surveys were conducted within the Upper EM4 Subwatershed Boundary, to survey for breeding amphibians.

These surveys took place on April 14, May 29, and June 26, 2023 at seven stations within the Upper EM4 Subwatershed Area (stations # 3, 4, 5, 6, 7, 9 and 10). Amphibian survey locations are shown on **Figure 5.1**.

The surveys were conducted as per the protocol outlined in the Great Lakes Marsh Monitoring Program (Bird Studies Canada, 2009). Surveys consisted of auditory surveys undertaken during the prime breeding period to record calling males that are present, spread throughout the breeding season to include the short temporal peak for each species of interest. The surveys involved visiting the site after dusk when minimum night-time air temperatures of at least 5°C during the first visit, 10°C during the second visit and 17°C during the third visit. Calling amphibians, if present, were identified to species and chorus activity was assigned a code from the following options:

0 No calls;
1 Individuals of one species can be counted, calls not simultaneous;
2 Some calls of one species simultaneous, numbers can be reliably estimated and shown in brackets; and
3 Full chorus, calls continuous and overlapping

Upper EM4 Subwatershed Results

The following five anuran species were recorded vocalizing on site: Green Frog (*Lithobates clamitans*), American Toad (*Anaxyrus americana*), Gray Treefrog (*Dryophytes versicolor*), Wood Frog (*Lithobates sylvaticus*), and Spring Peeper (*Pseudacris crucifer*). The results are presented below in **Table 5.9** and include the call code notation along with the number of individuals in brackets.

Table 5.9 - Breeding Amphibian Survey Results

Station	Wetlands / Ponds Surveyed	Visit 1 April 14	Visit 2 May 29	Visit 3 June 21
3	Areas of poor drainage along MOC-6a east of Trafalgar Road outside of the NHS	AMTO – 2(3), GRTR – 1(1), SPPE* to East (from distant wetlands of Core 10)	GRTR - 3	GRTR – 2(1)
4	PSW 25 (located approximately 70m south of Station 4)	SPPE* to Southeast (PSW 25)	-	-
5	Pond in remnant farm cultural woodland east of Trafalgar Road	SPPE* and AMTO* to Northeast	GRTR – 3	GRTR – 1(3)
6	PSW 19 (and PSW 20)	SPPE – 2(5), WOFR – 1, AMTO* and SPPE* to West	GRTR* to Southwest	GRTR* to Northeast
7	PSW 21 (and PSW 20)	SPPE – 3, WOFR – 1(3), GRTR – 1(1), AMTO* to West	GRTR – 3, SPPE – 1(1)	-
9	Man-made pond south of Burnhamthorpe Road (Fire Storage Pond)	SPPE* to East	GRFR – 1(4)	GRFR – 2(7)
10	HYDFB / Depression 33 isolated in agricultural lands	SPPE – 1(1), GRTR* and SPPE* to Southeast	-	-

* = Call recorded from outside of station area
- = No frog calls recorded
AMTO = American Toad, GRFR = Green Frog, GRTR = Gray Treefrog,
SPPE = Spring Peeper, WOFR – Wood Frog

The greatest breeding productivity was recorded (Stations 6 and 7) in wetlands and vernal ponds from the forested Core 9 (corresponding to eastern PSW units 19, 20 and 21) with full choruses of both Spring Peeper and Gray Treefrog.

Outside of the NHS, an area of poor drainage near Station 3) and a pond within an abandoned farmstead east of Trafalgar Road consistently provided breeding habitat for Gray Treefrog (recorded at full chorus in both units) and American Toad (call code of two for three breeding individuals near Station 3).

Call surveys conducted from Station 4 identified Spring Peeper calling at full chorus from distant wetland communities of PSW25 south and east of the Subject Lands. Amphibian surveys conducted in 2009 as part of the *Upper EM4 Subcatchment Scoped EIR/SWM Report* determined the presence of five species within PSW25 including American Toad, Spring Peeper, Gray Treefrog, Northern Leopard Frog and Chorus Frog. Only the dug-out pond forming part of PSW25 (at its northern tip) was observed to contain large number of calling individuals (>10 Spring Peeper individuals).

Call count surveys confirmed small population of amphibians within the unlabeled man-made pond near Burnhamthorpe Road (surveyed from Station 9) with only records of Green Frog which is a very common late-season breeder in permanent waterbodies.

The wetland isolated in agricultural matrix identified D-33 near station 10 had even lower amphibian productivity, with only one individual of Spring Peeper recorder during the first round.

None of the amphibian species confirmed present are regulated by the Provincial Endangered Species Act (ESA). All species observed on the Subject Lands are common and abundant in Ontario.

Western Chorus Frog (*Pseudacris triseriata*), a species that is federally Threatened and is ranked S3 in Ontario, was only heard calling in Core 10 wetlands well to the east of the EM4 Subwatershed Boundary.

5.5.7 Turtles

The Ontario Reptile and Amphibian Atlas database was searched for background information regarding known ranges for each of Ontario's turtle species. The result of this search suggests the following species present in Oakville *before and after 1999*, in 10km grid squares including the EIR/FSS lands:

- Midland painted turtle (*Chrysemys picta marginata*);
- Blanding's Turtle (*Emydoidea blandingii*); and,
- Snapping Turtle (*Chelydra serpentina*).

Midland painted Turtle and Snapping Turtle were confirmed in North Oakville during inventories conducted as part of the NOCSS.

Areas outside of the NHS where turtles are more likely to be found were surveyed to assess the likelihood that the above-mentioned species are present.

Table 5.10 provides Beacon's assessment based on the results of field investigations combined with knowledge of the habitat preferences and natural history of the species being considered. For the purpose of ensuring conformity with the ESA and addressing wildlife

salvage requirements, turtle surveys will be required in habitats with suitability assessed as moderate or high to confirm presence or absence of turtle species and their use of the habitat.

Table 5.10 – Turtle Habitat Suitability for Hydrologic Features Outside of the NHS

Station ID*	Feature	Habitat Attributes	Habitat Suitability for Turtles
2089 - A	Man-made pond immediately south of Burnhamthorpe Road (Fire Storage Pond)	Open pond surrounded by phragmites and cattails. No aquatic vegetation floating on pond for cover. Limited basking opportunities. This pond is deep in the middle and shallow at the edges. Aqua basking is possible for Snapping but less likely for other species.	Moderate
2091 - B	HYDFB / Depression (D-33)	Deeper pond surrounded by cattails. No aquatic vegetation for cover or natural basking opportunities in pond. A wooden board and sheet of plastic at opposite ends of pond that turtles could bask on. Shallower at edges suitable for aqua basking.	Moderate
2092 - C	Areas of poor drainage along drainage feature MOC-6a, 50 m east of Trafalgar Road, occupied by wetland vegetation when not farmed	Shallower pond area with soft, muddy bottom. Some raised areas suitable for basking opportunities.	Low
2093 - D	Pond in remnant farm cultural woodland east of Trafalgar Road	Pond with logs, vegetation and edges for basking opportunities. Pond deeper in the middle and shallow at the edges. Potential for Blanding's Turtle, Snapping Turtle and Midland Painted Turtle.	Moderate-High

*See Figure 5.1 for station locations

5.6 Provincially Endangered or Threatened Species

In preparation for on-site investigations, Beacon staff conducted desktop investigations to assess whether any endangered or threatened species were likely to occur on or within a 5-kilometer (km) radius of the Subject Lands and EIR Subcatchment Area. As part of the desktop screening, the following information sources were reviewed:

- Natural Heritage Information Centre (NHIC) Data via the Make-A-Map application;
- Databases of the Ontario Breeding Bird Atlas (OBBA) project;
- Ontario Reptile and Amphibian Atlas (ORAA);
- SAR range maps https://www.ontario.ca/environment-and-energy/species-risk-ontario-list;
- Aquatic SAR maps http://www.dfo-mpo.gc.ca/species-especes/fpp-ppp/index-eng.htm;
- High Resolution aerial photography of the property; and
- Natural and physical feature layers from Land Information Ontario (LIO).

The information sources referenced above were reviewed in a Geographic Information System (GIS) mapping environment that Beacon uses to assess the likelihood that potential endangered or threatened species are present in an area of interest. This system allows Beacon to combine the most current information provided by MNRF through the LIO portal with GIS layers from provincial floral and faunal atlases. All relevant layers can then be overlaid on the most recent high resolution ortho-imagery. The screening process helps identify areas that can then be targeted (for example, potential habitat) during field assessment to maximize the efficiency and effectiveness of on-site investigations.

Table 5.11 provides Beacon's assessment based on the results of the desktop investigations combined with knowledge of the habitat preferences and natural history of the species being considered.

Table 5.11 - Endangered or Threatened Species

Species	Status on SARO List	Were Species and/or Habitat Documented During On-site Assessment(s)?
Amphibians		
Jefferson Salamander, *Ambystoma jeffersonianum*	END	**Unlikely.** This species lives in woodland ponds or wetlands, and surrounding forest. These conditions exist within core areas of the Subject Lands and EIR Subcatchment Area but the presence of this species is unlikely and noted only from the atlas databases. It was not recorded during the series of inventories that were conducted in Core 9 and Core 10 by other teams between 2000 and 2006 as part of the NOCSS or by landowner field investigations.
Birds		
Bank Swallow, *Riparia riparia*	THR	**No.** This species nests where there are vertical faces in silt and sand deposits. This can be found along 16 Mile Creek, which lies within the 5 km radius of the property. However, there is no suitable habitat present on the Subject Lands and EIR Subcatchment Area and species were not recorded during breeding bird surveys.

Species	Status on SARO List	Were Species and/or Habitat Documented During On-site Assessment(s)?
Bobolink, *Dolichonyx oryzivorus*	THR	**No.** This species was not recorded on the Subject Lands or in the EIR Subcatchment Area during the 2023 breeding bird surveys.
Chimney Swift, *Chaetura pelagica*	THR	**No.** This species typically nests and roosts in chimneys and other manmade structures, that are present in the vicinity of the property. There is no suitable habitat present on the Subject Lands or in the EIR Subcatchment Area.
Eastern Meadowlark, *Sturnella magna*	THR	**No.** This species was not recorded on Subject Lands or in the EIR Subcatchment Area during the 2023 breeding bird surveys.
Eastern Whip-poor-will, *Antrostomus vociferus*	THR	**Potential.** This species is found in areas with a mix of open and forested areas, in mature deciduous, coniferous, or mixed forests. This potential exists within Core 9 and Core 10 woodlands as well as outside the NHS immediately east of Trafalgar Road at the location of an abandoned farmstead (outside of the Subject Lands).
Henslow's Sparrow, *Ammodramus henslowii*	THR	**No.** This species lives in abandoned farm fields, pastures, and meadows with extensive, dense, tall grasslands. This species was not recorded on Subject Lands or in the EIR Subcatchment Area during the 2023 breeding bird surveys.
Key: SARO Species at Risk in Ontario List EN: Endangered; THR Threatened; ORAA Ontario Reptile and AmphibianAtlas; NHIC Natural Heritage Information Centre		
Northern Bobwhite, *Colinus virginianus*	END	**No.** This species typically lives in savannahs, grasslands, and abandoned farm fields. This species was not recorded on the Subject Lands or in the EIR Subcatchment Area during the 2023 breeding bird surveys.
Plants		
American Chestnut, *Castanea dentata*	END	**No.** This species was not recorded on the Subject Lands or in the EIR Subcatchment Area.
Butternut, *Juglans cinerea*	END	**No.** No Butternut were recorded during the series of inventories that were conducted in Core 9 and Core 10 by other teams between 2000 and 2006 as part of the NOCSS or through a targeted search for Butternut on the Subject Lands and EIR Subcatchment Area during the 2023 surveys.
Fishes		
American Eel, *Anguilla rostrata*	END	**No.** This species can live in tributaries of Lake Ontario. There is no suitable habitat present on the Subject Lands or in the EIR Subcatchment Area.
Redside Dace, *Clinostomus elongatus*	END	**No.** This species is not found on the Subject Lands or in the EIR Subcatchment Area, but historically was within the 5 km vicinity.

Species	Status on SARO List	Were Species and/or Habitat Documented During On-site Assessment(s)?
Turtles		
Blanding's Turtle, *oidea blandingii*	THR	**Unlikely.** This species lives in shallow water with lots of aquatic plants, which is present within the 5km vicinity of the Subject Lands and EIR Subcatchment Area. The presence of this species is unlikely and noted in North Oakville only from the atlas databases.
Mammals		
Eastern Small-footed Myotis, *Myotis leibii*	END	**Potential**. Potential roosting habitat may be present in Core 9 and Core 10 woodlands as well as wooded areas outside of the NHS. Recordings from acoustic monitoring may be required in areas proposed for removal to determine whether endangered bats are present in these areas.
Little Brown Myotis, *Myotis lucifugus*	END	
Northern Myotis, *Myotis septentrionalis*	END	
Tri-colored Bat, *Perimyotis subflavus*	END	
Eastern Red Bat *Lasiurus borealis*	END	
Hoary Bat *Lasiurus cinereus*	END	
Silver-haired Bat *Lasionycteris noctivagans*	END	

Butternut

Butternut (*Juglans cinerea*) is a native tree listed as endangered (*Endangered Species Act*, 2007) with a range that extends through most of southern and eastern Ontario's forests. They naturally occur in a scattered, small numbers within deciduous forests and edge habitats such as hedgerows. The species has suffered dramatic declines as a result of a canker fungus, called Butternut Canker. Butternut trees are known to occur in the general area (within the 5 km vicinity). Field investigations in the spring/summer of 2023 revealed no Butternut. The Subject Lands and EIR Subcatchment Area were not surveyed in their entirety for this species; however particular focus was on woodlands outside the NHS, forest edges and hedgerows. Due to the occasionally cryptic nature of sapling trees and limited field visits, it is still possible individual trees went unidentified. If a Butternut tree is discovered during additional site visits, a Butternut Health Assessment will be required prior to consultations with the MECP to determine further steps.

Bobolink and Eastern Meadowlark

Both Bobolink and Eastern Meadowlark are grassland birds listed as threatened in the ESA typically occupy large areas (30-50 ha) of open grassland habitat. This habitat is effectively not present on the Subject Lands or in the EIR Subcatchment Area due to persistent cultivation of agricultural lands. Grassland habitat is limited to relatively small areas (< 5 ha) of cultural meadow. The breeding bird surveys conducted in June 2023 confirmed the absence of these species.

Eastern Whip-poor-will

Potential habitat exists within Core 9 and Core 10 woodlands as well as wooded areas outside of the NHS, located immediately east of Trafalgar Road at the location of an abandoned farmstead (outside of the Subject Lands). Specific crepuscular surveys applying the MNRF protocol will be required prior to tree removals in developable wooded areas to determine whether Whip-poor-will is breeding in these locations, to ensure conformity with the ESA.

Endangered Bats

Screening and habitat assessments confirmed that the Subject Lands support potential habitat for endangered bats.

Several bat species in Ontario have recently experienced marked population declines attributed to a rampant fungal disease, known as White-nose Syndrome. Several species are thus now listed as provincially Endangered. Apart from migratory species, bats hibernate from October or November to March or April, most often in caves or abandoned mines that are humid and remain above freezing. Certain species, such as the Little Brown Myotis (*Myotis lucifugus*), Northern Myotis (*M. septentrionalis*), Tricolored (*Perimyotis subflavus*) and Eastern Small- footed Myotis (*M. leibii*) are known to roost in trees (under loose bark or in cavities),

under rocks or in attics during other times of the year.

Suitable habitat for endangered bats is present in Core 9 and Core 10 forested communities as well as treed areas of the Subject Lands and EIR Subcatchment Area outside of the NHS, based on the provincial habitat guidelines. Prior to site alteration in developable areas or trail construction, targeted surveys should be undertaken in these habitats outside of the NHS that are proposed for removal. Should endangered bats be observed, consultation with MECP will be required to determine the necessary steps to ensure conformity with the ESA as the project proceeds.

Redside Dace

Redside Dace is a small colourful minnow that reaches a maximum length of approximately 12 cm. They are most often associated with small, cool headwater streams, are sensitive to siltation, and tend not to be widely dispersed because of this habitat preference (CH 2020b). Destruction and degradation of habitat have been the major factors in the reduction of Redside Dace distribution. Siltation, removal of riparian vegetation, channelization, agricultural run-off and pollution of streams in urban areas all reduce suitable habitat and food sources for this species.

Historical records indicate the presence of Redside Dace within the Sixteen Mile Creek watershed; however no records indicate the species occupy or utilize the reaches of East Morrison Creek. East Morrison Creek is not shown as Redside Dace habitat in DFO mapping for aquatic species listed under the Species at Risk Act (SARA). Furthermore, MNRF confirmed that East Morrison Creek was not considered regulated Redside Dace habitat.

6.0 LAND USE

6.1 Description of Development Concept Plan

The North Oakville East Secondary Plan establishes a detailed planning framework for future urban development in the North Oakville East Planning Area. Various urban land uses are distributed across the secondary plan area and policies are provided for the proposed land uses as well as the protection of the NHS and the establishment of urban infrastructure. As noted in Section 1.1, the completion of EIR/FSSs for the EM4, JC7 and JC9 Subcatchment Areas have been advanced concurrently to ensure that planning, servicing and NHS protection are well integrated. In this regard, the landowners within each of these Subcatchment Areas have coordinated the preparation of the comprehensive Preliminary Development Concept illustrated in **Figure 6.1** that depicts the proposed road fabric and land use pattern within the combined area of all three subcatchments. The participating landowners depicted within the Development Concept include the following:

Within the Upper EM4 Subcatchment:

- Argo Oakville Woods Corporation
- Dunburn Developments Limited
- River Thames Building Group Corporation
- DGB Trafalgar Ltd.
- Mel-Oak Developments (North) Ltd.
- Mel-Oak Developments Inc.
- Trafalgar Road (Oakville) Developments Limited

Within the JC7 Subcatchment:

- Star Oak Developments Limited
- Argo Trafalgar Corporation

Within the JC9 Subcatchment:

- Tribaden Investments Inc.
- Westerkirk Trafalgar Inc.

As shown on **Figure 6.1**, the proposed road fabric is organized in a modified grid to maximize proposed land use efficiency as well as accommodating existing utility infrastructure and protect environmental features. Trafalgar Road, a major regional arterial with an ultimate cross-section of six lanes, is the main north/south route. William Halton Parkway and Burnhamthorpe Road East are the major east/west routes. William Halton Parkway is a major regional arterial with four lanes tapering down to two lanes approximately 400 metres east of Trafalgar Road. The Town is currently preparing the design of Burnhamthorpe Road East to provide two lanes of traffic with two additional lanes for parking. All three roads serve to connect the proposed

development with other neighbourhoods in the Town, with Trafalgar Road also providing connectivity to other municipalities in Halton Region, and Burnhamthorpe Road East providing connectivity to Peel Region. The intersection of Trafalgar Road and Burnhamthorpe Road represents the geographic and land use focal point of the Development Concept. Trafalgar Road is currently served by public transit while the other two roads are anticipated to accommodate future public transit service.

In addition to the arterial roads and Burnhamthorpe Road East, the Development Concept includes numerous Avenue and Connector Roads under Town jurisdiction serving collector functions providing connectivity with areas immediately external as well as accommodating varying levels of transit. Finally, a system of local roads serving to disperse traffic from the Avenue and Connector roads to individual properties are also illustrated with road widths dependent upon the land uses they generally serve.

The Development Concept depicts several land uses which correspond to the land use schedules of the North Oakville East Secondary Plan. The overall structure of the Development Concept is a refinement of the Master Plan presented as an Appendix 7.3 of the North Oakville East Secondary Plan. Refinements to the precise distribution of land uses may occur through the formal submission of development applications. The Master Plan, shown on **Figure 6.2**, illustrates the EM4/JC7/JC9 study areas as spanning across several distinct land use categories. The following Master Plan land uses are included in the Development Concept as follows:

- 'Trafalgar Urban Core' is located on either side of Trafalgar south of the Highway 407 Transitway and is intended for medium and high density residential, commercial, and mixed use urban development with a density gradient decreasing based on distance from Trafalgar Road. The Development Concept reflects the Trafalgar Urban Core designation through the proposed development of apartments and commercial uses in generally rectangular blocks of various sizes spanning between 50 and 500 metres on either side of Trafalgar Road. In addition to the apartment and commercial blocks, other residential development in both block and freehold built form is proposed south of Burnhamthorpe Road separated from Trafalgar Road by the apartment and commercial blocks.

- 'Transitional Area', located up to 200 metres on the north side of Burnhamthorpe Road East and separated from Trafalgar Road by the Trafalgar Urban Core, is intended to accommodate low and medium density residential as well as mixed use development; high density residential is also permitted in certain situations. The Development Concept contemplates residential uses including low and mid-rise built form in both block and freehold development within this area.

- 'Employment District', located between Highway 407 and the Transitional Area and separated from Trafalgar Road by the Trafalgar Urban Core, is intended to accommodate a range of manufacturing and industrial development. The Development Concept

contemplates employment uses in larger rectangular or square blocks focused on either side of William Halton Parkway.

- 'General Urban', located south of Burnhamthorpe Road East and separated from Trafalgar Road by the Trafalgar Urban Core, is intended to accommodate low and medium density residential uses in generally freehold built form. The Development Concept proposes low and medium density development in freehold built form including single detached, townhouses, and back to back dwellings south of Burnhamthorpe Road East approximately 500 metres west of Trafalgar Road.

- 'Joshua Creek Community Park Area', located south of Burnhamthorpe Road East within and west of the Joshua Creek floodplain, is to accommodate the highest intensity recreational use and level of activity and may include parkland with illuminated sports fields and other major public facilities. The Development Concept illustrates a community park in the same location.

- 'Village Squares' are meant for generally passive open spaces which are intended to serve as focal points for neighbourhoods. One Village Square in the form of a parkette is located within the Development Concept south of Burnhamthorpe Road East surrounded by proposed low rise residential uses.

- Two secondary schools are located within the Development Concept - one secondary school is located approximately 250 metres west of Trafalgar Road near the southern limit of the Development Concept while the other is located abutting the Joshua Creek Community Park Area. One elementary school is located in the southeast portion of the Development Concept. All three schools are located in positions generally reflective of the Master Plan.

In addition to the aforementioned main urban land uses, the Secondary Plan also identifies various 'Natural Heritage System Areas' which protect existing wetlands, woodlands, and other natural features as well as accommodating connectivity corridors between major existing natural features. Within the Development Concept, Core Preserve Areas within the NHS include a portion of Core 8 within the JC7 Subcatchment in the northwest quadrant of Trafalgar Road and Burnhamthorpe Road East, a portion of Core 9 within the EM4 Subcatchment Area in the southwest quadrant of Trafalgar Road and Burnhamthorpe Road East, and a portion of Core 10 within the south quadrant of Trafalgar Road and Burnhamthorpe Road East. Joshua's Creek stream corridor lies within the NHS in the JC7 and JC9 Subcatchment Areas.

Several utility uses are shown within the Development Concept including an existing regional water tower and a future transit passenger parking facility in the northwest quadrant of the Trafalgar Road/Burnhamthorpe Road East intersection.

Six stormwater management facilities are illustrated in the Development Concept to manage water resources including:

- SWM Pond 29 located in the southern portion of EM4 west of Trafalgar Road;
- SWM Pond 38 located in the southern portion of JC9 east of Trafalgar Road;
- SWM Pond 60 located within JC7 northwest of the Trafalgar Road / Burnhamthorpe Road intersection, and the GO SWM Pond for the exclusive use of the future transit passenger parking facility; and
- SWM Ponds 35 and 35A located in JC7 northeast of the Trafalgar Road / Burnhamthorpe Road intersection.

Figure 6.3 illustrates the Development Concept specific to the EM4 Subcatchment Area and adjacent lands west of Trafalgar Road and south of Burnhamthorpe Road East. As shown, apartment blocks are focused along Trafalgar Road with ground related residential dwellings in the form of townhouses, back-to-back dwellings, and single detached located south of Burnhamthorpe Road East more distant from Trafalgar Road represent the majority of the urban land uses. Other urban land uses include stacked townhouse and front accessed townhouses north of Burnhamthorpe Road. Community facilities include a secondary school, a parkette located within a ground related residential neighbourhood, and SWM Pond 29. The edge of Core 9 in the southwest portion of the study area represents the limits of urban development for the adjacent ground related residential, apartments, and secondary school.

The extensions of Settlers Road East and Marvin Avenue provide two east/west collector function roads while the extension of a proposed road within a currently active development application south of the Development Concept will provide a north/south collector road function. Numerous 17 metre width local roads serve to provide direct access to ground related residential dwellings as well as serving apartment blocks.

6.2 Trail Planning

6.2.1 North Oakville Trails Plan

Trail planning direction, as described by Policy 7.4.7.3 of OPA 272, Section 6.3.5.2 of the NOCSS, and the North Oakville Trails Plan, May 2013, provided the framework for which to design the trail system on the Subject Lands. This EIR addresses all trail requirements for the Upper EM4 subcatchment as per the EIR/FSS TOR.

The location of trails as proposed by the North Oakville Trails Plan is shown on **Figure 6.4** from the North Oakville Trails Plan. Within the Subject Lands, the North Oakville Trails Plan indicates a Major Trail around the complete perimeter of Core 9, inside the Core. Major Trails, as dictated by the North Oakville Trails Plan, are:

- to be off-road, soft-surfaced trails (compacted limestone screenings) through natural areas, open space corridors, typically 2.4 metres wide;
- intended for pedestrian, cyclists and passive recreation use;
- accessible where possible; and
- typically seasonal use that will not receive winter maintenance.

Figure 6.5 illustrates the location of the trail on the Upper EM4 Development Concept.

6.2.2 Major Trail Within Core 9

The trail locations provided on **Figure 6.5** are consistent with general requirements for recreational trails for pedestrian and bicycle use as discussed in the NOCSS, Section 6.3.5.2 and the requirements of Policy 7.4.7.3 of OPA 272. As per the Town's Trail Master Plan, the trail corridor will be 3.4m wide, comprising a 2.4m travel surface and a 0.5m cleared area (with no trail surface) on either side.

The Major Trail within the NHS (Core 9) is shown on **Figure 6.5** and summarized below. The trail alignment is located close to the outer edge of the NHS to provide as much separation as possible between the trail and the features within the NHS. The majority of the alignment for the Major Trail on the Subject Lands will be located in agricultural lands in the NHS, either within the large agricultural areas in the north and northeast portion of the Core or in buffers to the natural heritage features (wetlands and woodland) that define the NHS. Trail grading is limited to the outer portions of buffers consistent with NOCSS recommendations. There are two areas where the trail will cross the remnant hedgerow in the NHS shown on **Figure 6.5** as Area A and Area B.

For the purposes of trail description and impact assessment, the trail has been divided into six segments (TR1, TR2, TR3, TR4, TR5 and TR6) shown in **Figure 6.5**.

Table 6.1 provides a description of each trail segment including general location, and relationship to Core 9 NHS. **Drawing 7.3** illustrates the proposed grading to accommodate trail design. **Drawing 7.4** presents cross sections through trail locations illustrating trail grading and drainage swale requirements. For further discussion on trail grading, see Section 7.6.

Trails are largely located in agricultural fields. Short lengths of trail within sections TR4 and TR6 are the only locations where the trail will be located through treed areas (hedgerows) inside Core 9. These isolated areas are shown on **Figure 6.5**, and the affected and potentially affected trees are summarized in **Table 6.2** below.

Table 0.1 - Summary of Trail Sections Associated within Core 9

Trail Section and Location	Description
TR1 Located on Subject Lands along woodland community limit at the south end of Core 9	▪ Trail is aligned to connect to the proposed trail on the adjacent Green Ginger lands located south of the woodland. The location and elevation of the Green Ginger trail shown on **Figure 6.5** were obtained from the approved *Green Ginger EIR/FSS* (February 2025). ▪ Similar to the Green Ginger trail design, the trail is located immediately adjacent to the woodland, outside of the approved Core 9 boundary. Trail grading will match existing conditions at the Mel-Oak Developments property line. ▪ For trees that are not proposed for removal but in close proximity to the trail alignment, hoarding is recommended in advance of any construction activity, as identified by arborist/environmental consultant.
TR2 Located on Subject Lands just inside outer portions of the northeastern boundary of Core 9, defined by the more conservative of the 10m buffer from dripline and the 30m buffer from PSWs 19 and 20	▪ Entire area for trail currently is cropped ▪ Trail grading is limited to the outer portion of buffers consistent with NOCSS recommendations (generally located in the outer 5m of the 10m dripline buffer or outer 20m of the wetland buffer) ▪ For trees in close proximity to the trail alignment, hoarding is recommended in advance of any construction activity, as identified by arborist/environmental consultant.
TR3 and TR5 Located on Subject Lands along the Core 9 northern boundary, diagonally across agricultural fields where Core 9 has been defined by a straight-line segment	▪ Entire area for trail currently is cropped; trail is largely located in agricultural field with no existing features present ▪ Along the entire alignment, opportunities exist for the trail to meander away from the lot line, if desirable; to be determined at detailed design through consultation with Town Parks staff.
TR4 and TR6 Located within Subject Lands through treed hedgerows at the north end of Core 9 in Areas 1 and 2	▪ Tree inventory completed; impact to treed community discussed below ▪ For trees that are not proposed for removal but in close proximity to the trail alignment, hoarding is recommended in advance of any construction activity, as identified by arborist/environmental consultant

The proposed trail alignment, located just inside the core boundary, crosses through several hedgerow communities in Areas A and B that are dominated by Apple, Pear, Shagbark Hickory and Largetooth Aspen with some immature White Elm and Bur Oak. An inventory of the trees

within areas of trail encroachment into existing hedgerows is presented in **Table 6.2** and shown in **Figure 6.5**.

Table 6.2 - Tree Inventory in Areas of Potential Impact from Trail Construction (Removal or Injury)

Area A (correspond to trail section TR6)		**Tree DBH**					**Total**
Scientific Name	**Common Name**	**15 - 19**	**20 - 29**	**30 - 39**	**40 - 49**	**50 - 59**	
Carya ovata	Shagbark Hickory	1	0	0	0	1	2
Ulmus americana	American Elm	2	0	0	0	0	2
Pryus communis	Common Pear	0	4	2	0	0	6
Totals							10
Area B (correspond to trail section TR4)		**Tree DBH**					**Total**
Scientific Name	**Common Name**	**15 - 19**	**20 - 29**	**30 - 39**	**40 - 49**	**50 - 60**	
Populus grandidentata	Largetooth Aspen	5	5	1	1	0	12
Malus pumila	Common Apple	0	0	0	1	1	2
Quercus macrocarpa	Bur Oak	1	0	0	0	0	1
Totals							15

As shown in **Table 6.2**, there are 25 trees within Core 9 remnant hedgerows that will require removal for the trail due to location in the vicinity of the trail. These trees are common species (not endangered or species at risk) and are not unique or distinctive specimens. The final proposed alignment should be discussed with agencies at detail design, based on assessments of various site-specific conditions, including maturity, health and density of trees, trail drainage requirements including drainage to PSW and potential bat habitat trees. A site visit will be organized with the Town prior to detailed design.

6.2.3 Endangered or Threatened Species in the Trail Vicinity

Matters related to the Endangered Species Act are under the jurisdiction of the Ministry of Environment, Conservation and Parks. The EIR/FSS TOR document outlines study requirements regarding trails. TOR section 3.7.1 states that "*Trail sections that are exclusively located within buffers that are active agricultural lands (row crops) must undertake Species at Risk (SAR) screening and complete appropriate seasonal field surveys*."

As discussed in Section 5, botanical inventories and breeding bird surveys were completed in 2023 within the Subject lands. Species at Risk (Special Concern, Threatened or Endangered) were not observed specific to the proposed trail areas within impacted woodland portions or hedgerow communities.

Woodland portions impacted by the proposed trail alignment have potential to be maternal summer roost bat habitat based on the provincial habitat guidelines, as discussed in Section 5.6 of this report. Prior to the trail construction, targeted surveys should be undertaken in this woodland habitat proposed for removal.

Should endangered bats be recorded, consultation with MECP will be required to determine the necessary steps to ensure conformity with the ESA as the project proceeds. However, given the nature and size of the woodland in Core 9 with similar potential habitat trees being in the vicinity, the bat populations are not anticipated to be negatively impacted as a result of the placement of the trail through Core 9 within Subject Lands, over an area representing approximately than 0.1% of the woodland.

In addition, precautionary mitigation measures, including timing windows for vegetation clearing, are recommended to minimize/eliminate the potential for negative effects to plant and wildlife communities/species (tree removals to occur outside bat roost activity window and breeding bird season).

6.2.4 Trail Restoration Plantings

For locations within the NHS where disturbance will occur due to the construction of the trail, a detailed landscape naturalization-restoration plan will be required at detailed design and prepared to the satisfaction of the Town (Parks) and CH, following the CH guidelines.

7.0 STORMWATER MANAGEMENT

7.1 OPA 272 and NOCSS Recommendations

Preparation of the Stormwater Management Plan for the Subject Lands has been guided by OPA 272 and the NOCSS recommendations.

OPA 272 policy 7.4.5 states that, *"The management of water resources within the North Oakville East Planning Area shall be undertaken in accordance with the directions established in the North Oakville Creeks Subwatershed Study. No amendments to the Secondary Plan shall be required to implement the recommendations of the Subwatershed Study or for changes to the number or location of stormwater management facilities in accordance with the policies of Section 7.6.2.2 a) of this Plan".*

Section 6.0 of the NOCSS presents the recommended Management Strategy for North Oakville. It includes strategies for natural heritage protection, stormwater management, terrestrial and wetland resources management, riparian corridor management, rehabilitation plans, remediation plans and monitoring. The goals, objectives and targets of the Management Strategy are set out in NOCSS Section 6.2 (see Table 6.2.1 of NOCSS as modified by the September 5, 2007 Addendum).

The recommended NOCSS Management Strategy addresses the development of an approach to stormwater management that will, *"… protect and enhance environmental characteristics through managing stormwater response and conveyance processes".* The water resource related goals, objectives and targets from the Management Strategy are presented in **Table 7.1**.

The NOCSS Section 6.3.6 discusses the Stormwater Management component of the Management Strategy. It includes discussion on hydrology, peak flow control, hydrogeology, water quality, fisheries protection, low impact development, source pollution protection and various types of SWM measures.

Table 7.1 - North Oakville Creeks Subwatershed Study Meeting the Subwatershed Goals & Objectives - Target Setting

Goals	Objectives	Targets
1. To minimize the threat of life and destruction of property and natural resources from flooding, and preserve (or re-establish, where possible) natural floodplain hydrologic functions.	1.1 To ensure that runoff from developing and urbanized areas is controlled such that it does not increase the frequency and intensity of flooding at the risk of threatening life and property.	• Maintain existing peak discharge rates for all design events, particularly high flows. • Target discharge rates required for each catchment (unit area). • Stream reach floodplain storage targets to protect existing floodplain storage. • Remove flood potential at identified locations within the Study Area. • Delineate floodplains to provide development limits. • Restrict development in the floodplains as per Provincial and CA policies.
	1.2 To adopt appropriate land use controls and development standards to prevent development in natural flood hazard and erosion hazard areas.	• Delineate floodplains to provide development limits. • Restrict development in the floodplains as per Provincial and CA policies. • Delineate meander belt and erosion setback to be applied on all streams designated to be left as open watercourse (providing erosion protection). • Apply valley wall setback standard (slope plus top of valley setback). • Develop SWM plan to replicate flow-frequency-duration from existing conditions. • Meet threshold tractive force targets. • Use Distributed Runoff Control (DRC) approach.
	1.3 To ensure that new development incorporates the most appropriate development form and mitigation measures necessary to optimize compatibility with natural features and their associated functions.	• Aquatic protection based upon resident fish community and existing aquatic habitat conditions. • Achieve MOE ‘enhanced’ level of SWM protection (80% TSS removal) for all reaches of streams supporting resident Redside Dace populations (14 Mile and Morrison Creeks). • For all other stream reaches, achieve ‘normal’ level of SWM protection (70% TSS removal) to adequately protect aquatic habitat and resident fish. Note that ‘enhanced’ protection of these streams will be required for reasons not directly related to aquatic habitat and resident fish (see Section 2.2 regarding Phosphorus loadings).

Goals	Objectives	Targets
2. To restore, protect, and enhance water quality and associated aquatic resources and water supplies for watercourses, including their associated hydrologic and hydrogeologic functions, within the subwatershed areas.	2.1 Protect stream morphological and fluvial character; restore, where appropriate and feasible, sinuosity; maintain physical habitat attributes (e.g., pools and riffles), diversity and fluvial processes (e.g., bedload transport and energy reduction through sinuosity); and prevent increase in erosions and deposition, through maintenance of hydrological regime.	• Streams that displayed a high sensitivity to change and have a well-developed geomorphic form and function. • Streams that exhibited some sensitivity to change and geomorphic function with a moderate degree of form. • Streams that lacked a defined form but still had a geomorphic function such as sediment transport, flow conveyance, and connectivity to other features.
	2.2 To prevent the accelerated enrichment of streams and contamination of waterways from runoff containing nutrients, pathogenic organisms, organic substances, and heavy metals and toxic substances.	• Control current nutrient levels in the streams to mitigate the potential increases in nutrients and associated impacts on algae growth. • The potential increase in suspended solids and associated urban pollutants. • The level of chloride and potential increase. • The need to manage stream temperature for fisheries protection.
	2.3 To maintain or restore a natural vegetative canopy along streams, where required, to ensure that mid-summer stream temperatures do not exceed tolerance limits of desirable aquatic organisms.	• Maintain existing riparian vegetation associated with watercourses, where feasible. • Active restoration of riparian zones with native plantings, in cases where watercourse modifications/alterations require permitting/authorization.
	2.4 To minimize the disturbance of the streambed and prevent streambank erosion and, where practical, to restore eroding streambanks to a natural or stable condition.	• Targets as outlined in Objectives 2.1 and 2.2.
	2.5 To restore, rehabilitate, or enhance water quality and associated resources through the implementation of appropriate best management practices on the land.	• Targets for surface water as outlined in Objective 2.2. • For groundwater, target of no detrimental change in existing groundwater quality.
	2.6 To ensure that hydrogeologic functions are preserved and maintained and take full advantage of stream and groundwater discharge/baseflow enhancement opportunities.	• Maintaining groundwater supplies for existing residents while development and servicing proceed. • Keeping changes in the depth to the local water table to within the seasonal fluctuations normally experienced. Maintaining the groundwater contribution to stream health (groundwater quantity and quality), where it currently exists.

Goals	Objectives	Targets
	2.7 To maintain and enhance the aquatic habitat.	• The targets relating to biodiversity for Fourteen Mile, Morrison, and Joshua's Creeks should be that the biodiversity of the fish community be, at a minimum, maintained at existing levels and increased if possible. • Identify stream corridors for protection.
		• Fluvial geomorphology/erosion control targets under Objective 2.1. • Water quality targets under Objective 2.2. • Designate reaches, which support Redside Dace populations, as "no touch" areas where stream sections cannot be relocated. • Enhanced level of stormwater quality control for Fourteen Mile and Morrison Creeks. • Retain wetlands associated with streams if possible and incorporate into drainage system.
	2.8 To minimize disturbance of wetlands, preserving and/or enhancing the habitat and functions they provide.	• Minimize fragmentation of wetlands. • Maintain the function of all wetlands associated with watercourses. • Maintain the function and structure of wetlands within woodlands.
	2.9 Provide appropriate buffers to wetlands, watercourses, and valleylands to maintain or enhance their biological health and meet objectives of long-term sustainability of these features.	• Establish appropriate feature-specific buffers for protection of natural habitats.
3. To restore, protect, develop, and enhance the natural heritage, historic cultural, recreational, and visual amenities of rural and urban stream corridors.	3.1 To ensure that environmental resource constraints are fully considered in establishing land use patterns in the subwatershed.	• Minimize the fragmentation of woodlands. • Maintain the function of all woodlands that are >200m in width (i.e., provide potential interior conditions). • Maintain the function of woodlands associated with watercourses.
	3.2 To ensure that existing wildlife linkages are preserved and that opportunities for improving these linkages are considered/implemented as part of any future development.	• Minimize the discontinuities in linkages (especially >20m). • Linkages to be 100m wide. • Allow for linkages to habitats or other linkages located outside the study area (for example Sixteen Mile Creek valley and Bronte Creek).

Goals	Objectives	Targets
	3.3 To retain, preserve, or maintain natural heritage features (i.e., open space and visual amenities) in urban and rural areas by establishing and maintaining greenbelts along stream corridors and adjacent natural areas and maintaining linkages between these areas.	• See discussions under Objectives 2.8, 3.1, and 3.2.
	3.4 To ensure that development in the stream corridor is consistent with the historical and cultural character of the surroundings and reflects the need to protect visual amenities.	• Presence of visual and historic amenities through the subwatershed and secondary planning processes.
	3.5 To ensure that the recreational and fisheries potential of a stream corridor are developed to the fullest extent practicable.	• See discussion under Objectives 1.3, 2.3, and 2.7.

7.2 Final Scoped EIR/SWM Report (June 2017)

The SWM concept for the Upper EM4 Subcatchment was initially established and approved as part of the *Final Scoped EIR/SWM Report* (June 2017) prepared for Star Oak Developments Limited. The report established the following approach to stormwater management:

- As required by NOCSS, the Upper EM4 Subcatchment drainage boundaries were confirmed through the review of additional more detailed topographic work and field investigations. A comparison was made between the drainage area determined in the NOCSS (153.1ha) and the drainage area determined using LiDAR technology (147.8ha) for the entire Subcatchment EM4 to its confluence with creek in the EM1 subcatchment. This assessment concluded that the difference was a minor reduction of 3.4%. As such, the NOCSS target unit flow rates are applicable for use in the determination of target flows for this EIR Subcatchment Area. The updated pre-development drainage boundaries for Subcatchment EM4 as presented in the June 2017 report are illustrated in **Figure 7.1**.

- To simplify the SWM plan and meet the Town's interest in reducing the total number of SWM facilities, a single SWM Pond 29 was recommended to service the Upper EM4 Subcatchment west of Trafalgar Road. SWM Pond 29 was designed as an extended detention wet pond to provide water quality, erosion and quantity control for the contributing 32.2 ha drainage area with an average impervious level of 65%. The preliminary 3.6 ha facility was sized to provide water quantity control of post-development flows to the target rates for the 2-year to 100-year storm and Regional Storm events.

- The report identified the need for splitting the pond discharges at the outlet to two locations. The controlled flows up to and including 5-year storm event would be conveyed easterly via storm sewer crossing Trafalgar Road to PSW 25. The controlled flows less frequent than the 5-year storm event and up to and including the Regional Storm event would be conveyed southerly to a trunk sewer installed within the Trafalgar Road right-of-way with an outlet to the lower portion of the EM4 Subcatchment west of Trafalgar Road.

- The proposed SWM concept also included the implementation of a roof drainage collector (RDC) system to convey runoff from a 1.0 ha roof drainage area towards PSW 25. An impact assessment of the proposed SWM concept on PSW 25 using the SWMHYMO continuous hydrologic modeling was included.

The proposed SWM Plan presented in the June 2017 *Final Scoped EIR/SWM Report* was supported by the Town, Region and CH in 2017.

7.3 Proposed SWM Plan

Subsequent to the completion of the *Final Scoped EIR/SWM Report* (June 2017), several changes have been made to the proposed Upper EM4 SWM plan, as outlined below. The current SWM Plan concept is illustrated on **Figure 7.3**.

- The existing topography and drainage figure has been updated to reflect the completed Star Oak and Petgor Phase 2 developments north and south of Burnhamthorpe Road, respectively, as shown in **Figure 7.2.**

- The SWM plan has been revised to reflect the currently proposed Upper EM4 land uses and coordination of development plans in the adjacent JC7 and JC9 subwatersheds. The drainage boundaries have been revised to the extent possible in order to align more closely with the existing boundaries and minimize the drainage area exchanges between subwatersheds. The SWM plan has also considered the proposed grading and servicing plans for the adjacent Green Ginger development located within the EM1 subwatershed and latest design information for the proposed Trafalgar Road Improvements project undertaken by Halton Region. The currently proposed development plan, subcatchment drainage boundaries and Pond 29 location are illustrated in **Figure 7.3**.

- In 2023, the Town of Oakville advised that they did not support the SWM Pond 29 location along the Trafalgar Road frontage and requested that the pond be moved westerly to allow for higher density uses along the Trafalgar corridor. Further, the Region of Halton advised that they did not support a storm sewer outfall within the Trafalgar Road right-of-way to convey some pond flows downstream to the outlet of EM4 near Dundas Street. As a result, an alternative pond location was proposed further west in the Upper EM4 subcatchment that would introduce pond outflows into upstream areas along East Morrison Creek as well as to upper portions of EM4. **Figure 7.5** illustrates the locations of the Pond 29 outlets. Section 7.5 provides further details on the outlets. In July 2023, this alternative design was presented to the Town, CH and Halton Region. The agencies supported this alternative subject to the engineering feasibility analysis and environmental impact assessment of the EM1 and EM4 catchments.

- Due to grading constraints, post-development uncontrolled drainage from the 1.4 ha apartment block, located within the Mel-Oak Developments Inc. property will be directed westerly to the existing SWM Pond 27 (refer to **Figures 7.3 and 7.5**). Pond 27 was designed and constructed as part of the Petgor Phase 2 subdivision in 2019. The pond was initially designed for a total drainage area of 84.92 hectares with 62% imperviousness. In order to offset the increased area to Pond 27, a similar area of the proposed school block will be directed to Pond 29. As a result of the proposed drainage area changes, the total drainage area to Pond 27 is revised to 84.55 hectares with 62%

imperviousness. Since the total drainage area to the pond has been reduced, and the total imperviousness has not increased, no negative impacts are anticipated to SWM Pond 27. Revised hydrologic modeling of Pond 27 confirmed that it would continue to function as designed with this minor proposed change to its catchment area.

- Considering the significant change to the impervious level for the contributing drainage area and associated higher runoff volumes, the previously proposed RDC system to augment the flows and runoff volumes to PSW 25 is no longer recommended.

- As noted in Section 1.2, the FSS Study Area extends beyond the existing and proposed EM4 Subcatchment Area boundaries. Proposed storm drainage from the school site in the southwest portion of the FSS Study Area will be directed to Pond 27. Storm drainage from FSS Study Area lands northeast of the Upper EM4 Subcatchment Area will be directed easterly to Pond 38 east of Trafalgar Road in the JC9 Subcatchment Area.

As noted in Section 1.7, the Upper EM4 EIR/FSS Modeling Mini-Submission (Modeling Mini-Submission) was prepared to document the updated Upper EM4 SWM Plan and associated downstream hydrologic, hydraulic and erosion modeling and wetland water balance analyses. It was prepared to obtain agency input/feedback on the proposed Upper EM4 SWM Plan and SWM Pond 29 outfall design as it may affect the design of the Trafalgar Road works and the overall servicing plans for these subcatchments. The Modeling Mini-Submission was submitted to the Town, CH and Region on December 4, 2024 for their review and comment. Comments were provided by CH and subsequent additional analyses relating to the EM1 floodplain were submitted in April 2025.

This EIR/FSS submission does not include the hydrologic, hydraulic, ecological and fluvial geomorphological presented in the Mini-Submission, however, conclusions from this work are provided in **Appendix B-4**. Once agency discussions on the Mini-Submission conclude, the complete analyses and recommendations will be added to the final version of this EIR/FSS.

Water balance and water quality requirements have been addressed herein based on recommendations from NOCSS, the approved Upper EM4 Scoped EIR/SWM Report (June 2017) and ongoing consultation with the Town and CH. The Town of Oakville Consolidated Linear Infrastructure – Environmental Compliance Approvals (CLI ECA) process with the Province also sets out criteria for water balance and water quality. These criteria vary to some degree from NOCSS and the approved EIR/SWM Report recommendations. Discussions with the Town staff will be organized to review their CLI ECA requirements, study area specific constraints, feasibility of various LID BMPs and implications to the SWM Plan.

7.4 Drainage Boundary Modifications

As noted in Section 1.1, the completion of EIR/FSSs for the EM4, JC7 and JC9 Subcatchment

Areas have been advanced concurrently to ensure that planning, servicing and NHS protection are well integrated. In this regard, the landowners within each of these Subcatchment Areas have coordinated the preparation of the "North Oakville East (Trafalgar Road) – Overall Stormwater Management Strategy" prepared by Urbantech Consulting, (July 2025) (included in **Appendix F-1**). The report was prepared to provide a comprehensive review of drainage boundaries under existing and future conditions, target unit peak flow rates and SWM pond locations within the EM4, JC7, and JC9 subcatchment areas.

The Upper EM4 drainage area modifications presented herein are consistent with those outlined in the Overall SWM Strategy. As outlined in the Overall SWM Strategy, the North Oakville East Drainage Area Exchange Report (DAE Report) was prepared in 2017 to consolidate the documentation of proposed changes to existing drainage area boundaries in North Oakville East. Changes were proposed across nine subcatchments including EM1, EM4 JC7 and JC9. The Overall SWM Strategy Memorandum (Urbantech, July 2025) provides a summary of the DAE Report relevant to Upper EM4 and its adjacent subcatchments and notes currently proposed drainage area changes in light of the DAE recommendations, current conditions and the SWM analyses completed as part of this EIR/FSS. For the complete discussion on drainage area exchanges, see the Overall SWM Strategy Memorandum (**Appendix F-1**). A summary of the drainage area changes along EM4 drainage boundaries includes:

- The drainage boundary between Upper EM4 and EM1 north of Core 9 follows the east boundary of the Star Oak Development (north of Burnhamthorpe Road) and Petgor (south of Burnhamthorpe Road) subdivisions. Pond 27 in EM1 was designed to accommodate drainage from these developing areas. The resulting EM4/EM1 boundary leaves a small area (0.7 ha) between the Petgor subdivision, Core 9 and the existing Upper EM4 boundary on the Subject Lands to be directed to the Upper EM4 subcatchment. This is consistent with the DAE Report (2017) recommendations.

- South of Core 9, small changes have been made to the drainage boundary between the Upper EM4 and EM1 subcatchments that follow the intent of the DAE Report to direct surface runoff from a portion of the proposed school from EM4 to EM1. Due to Pond 29 sizing/area constraints, an additional area east of Pond 29 is also proposed to be directed from Upper EM4 to Pond 27 in EM1.

- Some changes to the existing drainage boundary south of Burnhamthorpe Road are proposed along the eastern boundary of EM4 with JC9. These revisions south of Burnhamthorpe Road and upstream of Trafalgar Road were made to minimize changes to the shared EM4/JC9 drainage boundary due to Pond 29 constraints.

- The DAE Report (2017) shows a 2.3ha area north of Burnhamthorpe Road to be directed from JC7 to EM4. As part of CH's review of the DAE Report (2017), they advised that they

may seek to have these lands remain in JC7. The currently proposed EM4 drainage boundaries do not include the re-direction of 2.3ha of runoff from JC7 into EM4.

7.5 Conveyance of Minor and Major System Flows

Storm drainage from the proposed development will be managed utilizing minor and major conveyance systems. The general layout of the post development drainage system servicing the development is provided on **Drawing 7.1** (minor system) and **Drawing 7.2** (major system).

The internal minor drainage system consists of storm sewers sized to accommodate the 5-year peak flow calculated using the Rational Method and Town's design criteria. The storm sewer system has been designed in accordance with the Town's design criteria. See **Appendix F-2** for storm sewer design sheets.

Flows exceeding the capacity of the storm drainage system (minor system) will be conveyed along streets and storm easements within the proposed development and directed to the SWM facilities. Roadways will be designed to provide overland flow routes for the 100-year less 5-year storm, in accordance with the Town's design criteria.

7.6 Preliminary Grading Plan

The preliminary Grading Plan, including centreline road grades and overland flow direction within the FSS study area, is shown on **Drawing 7.3.** The plan was prepared in conjunction with the proposed storm and sanitary servicing design and considered boundary grading constraints including adjacent roads and the Core 9 NHS, and grading information provided for the existing and future developments adjacent to and within the Upper EM4 Subcatchment. Details of the preliminary grading design for SWM Pond 29 are provided on **Figure 7.5** (Preliminary Grading Design – SWM Pond 29) and **Figure 7.6** (Typical Cross Sections – SWM Pond 29). At detailed design, additional lot/block grading details will be provided in accordance with Town grading standards.

The preliminary trail grading and drainage system design adjacent to and within the NHS boundary is provided on **Drawing 7.3**. Consistent with NOCSS recommendations, grading within the NHS adjacent to natural features will be limited to the outer 9m of the 10 m dripline buffer or the outer 20m of the 30 m wetland buffer from existing wetlands, matching existing grades along the interior. The buffer will contain a multi-use pathway in the north and east portions of the Core connecting the sidewalk on Settler's Road at the north limit of the Core to the future trail within the Green Ginger development at the south limit. Typical cross-section details for the proposed pathway are provided on **Drawing 7.4**.

The NOCSS requires that grade transition between development and the Core be shared

between the lots and core. At detailed design, sloping to address grading differences between the NHS and adjacent development will be shared 50/50 across the NHS boundary.

Core 9 contains six PSWs (19-24) largely with internal drainage. As discussed in Section 7.8 and shown on **Figure 7.7**, three PSWs have drainage boundaries which contain future development lands. Grading within the NHS is proposed so that drainage to/from these PSWs will be maintained as follows:

- PSW 19 - clean water from grassed areas within the School Block will be directed to the PSW via a culvert crossing the proposed pathway.
- PSW 20 - clean water from grassed areas within the Apartment Block will be directed to the PSW via a culvert crossing the proposed pathway.
- PSW 23 - clean water from rooftops and rear lots backing on the core will be directed to the PSW via a culvert crossing the proposed pathway.

Collector / conveyance swales proposed within the NHS buffer, which are required to manage flows entering the Core, will be designed as enhanced swales. While their purpose is to convey water to the wetlands, enhanced swale design would also promote infiltration. This design will include the provision of check dams and will be naturally vegetated but will not include any form of infrastructure such as underdrains. Swales to convey drainage to PSW 19 and 20 will be located within the outer 20m of the wetland buffers with appropriately designed energy dissipation at their outlets. A swale conveying drainage to PSW 23 will be located in portions of the Core that are currently agriculture; its location will be addressed at detailed design.

As shown on **Figure 7.7**, an area of 1.14 ha within the Core drains from the northeast portion of Core 9 easterly to the proposed development area. Drainage from this area will be conveyed into the Apartment Block via a culvert crossing the proposed pathway and ultimately conveyed to SWM Pond 29 via the storm sewer system.

7.7 SWM Pond 29

SWM Pond 29 has been designed to provide stormwater quality, erosion and quantity control for a total drainage area of 27.7 ha with an average impervious ratio of 85%. The general layout of the stormwater conveyance network servicing the development along with the contributing drainage boundaries to the pond are shown schematically on **Figure 7.3**.

SWM Pond 29 will be constructed within a 2.3 ha block and will include 13,390 m^3 of permanent storage, 6,594 m^3 of extended detention storage to address quality and erosion control (25mm detention for 7 days) and 26,312 m^3 of additional storage to provide peak flow attenuation to the established NOCSS target release rates for all storm events up to and including the Regional Storm event. Preliminary pond grading and outfall locations are

illustrated on **Figure 7.5**. Preliminary pond sizing calculations are included in **Appendix F-3** and summarized in **Table 7.2**.

Table 7.2 – Summary of Stormwater Management Facility Characteristics

	Drainage Area (ha)	Imp. (%)	Permanent Pool Volume (m^3)	Erosion Control Volume (m^3)	Regional Storm Volume (m^3)	SWM Pond Block Area (ha)
Pond 29	27.7	83	13,390	6,594	32,906	2.3

The target release rates for SWM Pond 29 are based on the unit rates provided in the NOCSS study area tributary at the existing culvert crossing at Dundas Street. The existing drainage area used to establish target release rates for SWM Pond 29 has been updated to reflect the completion of developments west and north of the Subject Lands. The updated drainage area of 30.2 ha to Culvert ME-T5 at Trafalgar Road is illustrated on **Figure 7.2**. Unit flow rates and resulting target release rates are listed in **Table 7.3**.

The storage requirements for SWM Pond 29 to meet established target unit peak flows for the 2-year to 100-year storms and Regional Storm event were calculated using the GAWSER hydrologic model prepared by Urbantech Consulting. Design storm hyetographs in the hydrologic simulation are based on the 24-hour Chicago distribution using Oakville IDF curves for the 2-year to 100-year storm events. The Regional Storm is based upon the 48-hour distribution of Hurricane Hazel.

Post-development GAWSER modeling results are summarized in **Table 7.3** and included in **Appendix F-3**. Prior to finalization of this EIR/FSS, facility function will be confirmed under storm stacking conditions for the Regional Storm and emergency conditions considering complete blockage of the pond outlet.

Table 7.3 - Pond 29 Inflow/Volume Characteristics

Storm Event	Unit Flow Rate ($m^3/s/ha$)	Target Release Rate[1] (m^3/s)	Peak Inflow (m^3/s)	Peak Outflow (m^3/s)	Storage Requirements (m^3)
25mm	-	-	2.566	0.008	5,200
2	0.005	0.151	3.495	0.077	7,9550
5	0.008	0.242	5.280	0.146	9,574
10	0.010	0.302	6.476	0.238	10,639
25	0.013	0.393	7.955	0.269	12,272
50	0.015	0.453	9.239	0.355	13,274

Storm Event	Unit Flow Rate ($m^3/s/ha$)	Target Release Rate[1] (m^3/s)	Peak Inflow (m^3/s)	Peak Outflow (m^3/s)	Storage Requirements (m^3)
100	0.016	0.483	10.344	0.409	14,542
Regional	0.044	1.329	3.973	1.242	32,906

[1] Target flow based on NOCSS unit flow rates and existing drainage area of 30.2 ha.
[2] The 25mm release rate is based on provision of 7-day drawdown of the extended detention volume.

The stormwater management pond has been designed in accordance with directions of the NOCSS and the MOE SWM Design Manual, and includes the following features:

- Sediment forebay
  - improves sediment removal and reduces influent velocities
  - sized based on MOE forebay settling and dispersion length calculations
  - The forebay has been designed to be submerged below the normal water level, has a length to width ratio of approximately 3:1 and does not exceed one third of the permanent pool surface area, as required in the MOE SWMP Design Manual for wet SWM facilities

- Permanent pool and extended detention storage
  - provides water quality and erosion control to satisfy Enhanced Level of protection requirements (i.e., capture of 80 percent Total Suspended Solids) and reduction of Phosphorus levels
  - sized according to MOE Table 3.2 and corresponding imperviousness
  - extended detention storage will be released over a 7-day drawdown

- Quantity Control Storage
  - attenuates post development flows to the unit flow release rates as per the NOCSS for the 2-year through 100-year and Regional Storm event.
  - storage volume requirements for all storms are based on the GAWSER model simulation of post-development drainage areas controlled to the NOCSS unit rates

- Slope and Access Road
  - In accordance with the Town of Oakville SWM facility grading guidelines, 4:1 slopes will be provided below the 7:1 pond shelf down to the pond bottom. Slopes of 7:1 (H:V) have been be provided in the safety shelf (4 m wide below permanent pool and 4 m wide up to the extended detention level) on either side of the permanent pool wetted perimeter.
  - In accordance with the Town of Oakville standards, 3.0m wide access roads are provided above the active storage elevation. Access roads are provided in order to facilitate routine inspection and maintenance activities. The maximum slope of access roads is 10:1 (H:V). The access road will extend to the base of the pond, and not exceed a maximum slope of 10% which will be included at the detailed design stage.

- Pond Control Structures
  - As shown in **Figure 7.5**, SWM Pond 29 will include two storm outlets. Flows up to and including 5 year storm event will be directed easterly to PSW 25 and flows less frequent than the 5 year storm event up to and including the Regional Storm event will be conveyed westerly via a trunk sewer installed on Marvin Avenue, with an outlet to the EM1 tributary.
  - Based on the preliminary design, the east outlet will include a bottom-draw, reverse-slope 300 mm diameter PVC pipe sized to convey extended detention quality control of the 25mm storm event and a 450 mm diameter storm pipe designed to convey the control flows less frequent than 25mm storm event up to and including 5-year storm. The outlet pipes will be connected to a 2.4 m x 1.8 m concrete box structure (MH 100). An 80mm diameter orifice will be installed on a 300 mm diameter pipe within manhole MH 100 at the permanent water elevation of 179.50 m, allowing the extended detention volume to drain at a rate of 0.009 m^3/s over a period of approximately 180 hours. A second 120mm diameter orifice plate will be installed on the 450mm diameter pipe to control the flows from storms up to and including 5-year storm event.
  - An additional 300 mm diameter PVC de-watering pipe with a control valve will be connected to MH 100 for the maintenance purposes.
  - The west outlet to provide water quantity control will include a 3.6 m x 3.60 m concrete box structure (MH 67) with a side weir set at the 5 year storm water level of 180.50. The weir will control release rates from the 2-year to 100-year and Regional storm events. The top of the quantity control structure will be set at the Regional Storm water level of 182.4 m.
  - In the event of blockage of the quantity control structure, flows will be conveyed by a 45 m wide emergency overflow spillway located on the south side of the facility with an invert elevation of 182.5 m (i.e. 0.10 m higher than the Regional Storm water level). Emergency flows will follow Marvin Avenue ROW westerly to discharge to the upper end of EM1.

7.8 Drainage to/from Provincially Significant Wetlands

Specific design consideration has been given in the preparation of the SMW Plan to maintain drainage into PSWs within the EM4 Subcatchment Area. Aside from PSW 25 that was addressed in detail in the December 2024 Modeling Mini-Submission, there are six wetlands designated PSWs located in Core 9. **Figure 7.7** illustrates the location, contributing surface drainage areas to each of PSWs 19, 20, 21, 22, 23 and 24 in Core 9. **Table 7.4** provides information on wetland size, contributing drainage areas, planned development within catchments and identifies which wetlands require further study to address wetland water balance requirements.

Table 7.4 - Wetland Drainage and Water Balance Requirements, Core 9

PSW #	Wetland Area	Description of Wetland Drainage Patterns*	Wetland Water Balance Required?	
			Yes	No**
19	0.15 ha	• Existing contributing drainage area to PSW = 0.49 ha • Drainage area to PSW is largely contained in Core 9; approximately 27% (0.13 ha) is located on developable lands to east of core • Servicing of lands east of core is to address maintenance of flows to this PSW	X	
20	0.23 ha	• Existing contributing drainage area to PSW = 1.62 ha • Drainage area to PSW is largely contained in Core 9; approximately 36% (0.58 ha) is located on developable lands to east of core • Servicing of lands east of core is to address maintenance of flows to this PSW	X	
21	0.15 ha	• Existing contributing drainage area to PSW = 0.74 ha • Drainage area to PSW is entirely contained in Core 9; • No development is proposed in its catchment		X
22	0.07 ha	• Existing contributing drainage area to PSW = 1.02 ha • Drainage area to PSW is almost entirely contained in Core 9; approximately 3% (0.03 ha) is located on developable lands to east of core • Development impacts on wetland hydrology considered negligible		X
23	0.12 ha	• Existing contributing drainage area to PSW = 1.67 ha • Drainage area to PSW is largely contained in Core 9; approximately 16% (0.27 ha) is located on developable lands to north of core • Servicing of lands north of core is to address maintenance of flows to this PSW	X	
24	0.05 ha	• Existing contributing drainage area to PSW = 0.33 ha • Drainage area to PSW is entirely contained in Core 9 • No development is proposed in its catchment		X

*Wetland Drainage Area includes wetland area
**No water balance required where there is no proposed development in the wetland catchment

As noted in **Table 7.4,** there are three areas where development is proposed within the contributing drainage areas of PSWs (PSWs 19, 20, 23) to the east and north of Core 9. The remaining three PSWs (PSWs 21, 22 and 24) have none or very little development proposed in their catchments.

It is important to maintain surface water to these wetlands to preserve their form and function. This may be accomplished by directing clean water from adjacent development areas to the

wetlands via overland swales. Surface drainage can be fed to PSW 23 from adjacent roof and/or rear yard drainage. Overland flow from the school block can be directed to PSW 19 and from the apartment block can be directed to PSW 20. **Figure 7.7** shows general areas where drainage may be directed to adjacent wetlands. Hydrologic simulations and analyses at detail design should identify/quantify specific areas of development where clean surface water will be directed to the wetlands. This should include:

- PSW 19 - clean water from grassed areas or rooftops within the School Block to be directed to the PSW via a culvert crossing the proposed pathway;
- PSW 20 - clean water from grassed areas or rooftops within the Apartment Block to be directed to the PSW via a culvert crossing the proposed pathway; and
- PSW 23 - clean water from rooftops and rear lots backing on the core to be directed to the PSW via a culvert crossing the proposed pathway.

Analyses will be completed at detailed design when more detailed information is available for site plans and draft plans to demonstrate where, how and the amount of surface water volume contributions to be directed to these wetlands.

7.9 Topographic Depression Storage Assessment

As discussed in Section 7.1, the NOCSS Addendum recommendations require that the surface storage volumes in topographic depressions be identified and comparisons be made to SWM pond storage design. The Mediation Agreement on Depressional Storage (May 30, 2007) notes that the NOCSS existing conditions hydrologic modeling includes existing depression storage identified on NOCSS topographic mapping and that the resulting target unit flow rates reflect existing depression storage. At the EIR stage, depression storage is to be confirmed using more detailed mapping as well as natural or man-made conditions.

The Mediation Agreement notes that, “the calculated depression volume is to be compared to the SWM pond volume of the proposed SWM facility within the same drainage area. If the depressional volume is less than or equal to the SWM facility volume, no additional analysis or change to the SWM facility design is required. In the event that the depressional storage is greater than the SWM facility volumes, the SWM facility volume (as noted in item 5) is to be adjusted to be equal to the depressional storage volume.” It notes that the 2-year and 100-year or Regional Storm storage volumes should be compared to proposed SWM pond volumes. In the ES6-East subcatchment, the 100-year storage volume requirement applies.

In accordance with this Mediation Agreement, only natural ponds or depressions are included in the assessment of depression storage. As noted in Section 2.1, within the Upper EM4 subcatchment, only Depression 33 requires this assessment. **Figure 7.7** shows the location of

this depression.

Table 7.5 summarizes the estimated volume provided in Depression 33 and SWM Pond 29 extended detention and 100-year volumes. Where detailed topographic information is not available for the feature; as such a conservative depth of 2 m was assumed over its entire area. This analysis concludes that the storage in this existing depression is substantially smaller than SWM pond extended detention and 100-year volumes and therefore, no adjustments are needed to the SWM pond design.

Table 7.5 – Volume Comparisons, Depression and SWM Pond 29 Storage Volumes

Feature Type	Depression ID	Depression Area (m^2)	Volume (m^3)
DPP	Depression 33	1,245	2,490
Pond 29 Extended Detention Volume			>6,000
Pond 29 100-Year Storm Volume			>17,000

A pond was constructed to provide water for fire protection for a business located on the south side of Burnhamthorpe Road on the Oakville Woods property. This man-made pond does not appear on NOCSS mapping, likely because it was considered water servicing infrastructure. As such, no storage assessment of this pond is required.

8.0 WATER BALANCE

To assess potential land development impacts on the groundwater conditions within the EIR/ FSS Subcatchment Area, a water balance analysis has been completed to determine the pre-development recharge volumes based on existing land use conditions, and the post-development recharge volumes that would be expected based on the proposed land use plan.

8.0 Components of the Water Balance

A water balance is an accounting of the water resources within a given area. As a concept, the water balance is relatively simple and may be estimated from the following equation:

$$P = S + R + I + ET$$

where:
- P = precipitation
- S = change in groundwater storage
- R = surface water runoff
- I = infiltration
- ET = evapotranspiration/evaporation

The components of the water balance vary in space and time and depend on climatic conditions as well as the soil and land cover conditions (e.g., rainfall intensity, land slope, soil hydraulic conductivity and vegetation). Runoff, for example, occurs particularly during periods of snowmelt when the ground is frozen, or during intense rainfall events. Precise measurement or calculation of the water balance components is difficult and as such, approximations and simplifications are made to characterize the water balance of a study area. Field observations of the drainage conditions, land cover and soil types, groundwater levels and local climatic records are important input considerations for the water balance calculations.

The water balance components considered for the current assessment are discussed below:

Precipitation (P) As noted in Section 4.4, the long-term average annual precipitation for the area is 897mm based on data from the Environment Canada Royal Botanical Garden climate station (Station 6153301 - 43º17'30''N, 79º54'30''W, elevation 102 masl) for the period between 1981 and 2010. The precipitation data are provided in Tables C-7-1 and C-7-2, **Appendix C-7**.

Storage (S) Although there are groundwater storage gains and losses on a short-term basis, the net change in groundwater storage on a long-term basis is assumed to be zero so this term is dropped from the equation.

Evapotranspiration (ET) Evapotranspiration varies based on the land surface cover (e.g., type of vegetation, soil moisture conditions, impervious surfaces, etc.). Potential evapotranspiration (PET) refers to the water loss from a vegetated surface to the atmosphere under conditions of an unlimited water supply. The actual rate of evapotranspiration (AET) is generally less than the PET under dry conditions (e.g., during the summer when there is a soil moisture deficit).

Water Surplus (R + I) The difference between the mean annual P and the mean annual ET is referred to as the water surplus. Part of the water surplus travels across the surface of the soil as surface or overland runoff (R) and the remainder infiltrates the surficial soil (I). Infiltrating water may either move downward through the surficial sediments to the water table (groundwater recharge) or move laterally through the topsoil profile as interflow. Weathering and fracture patterns in the relatively low hydraulic conductivity till soils of the Study Area may aid the vertical and lateral movement of water. The interflow moves relatively quickly and often re-emerges locally at the ground surface as seepage. So as opposed to the "direct" component of surface runoff that occurs during precipitation or snowmelt events, interflow becomes an "indirect" component of runoff. Since it is generally very difficult to distinguish between interflow and surface (overland) runoff, they are often considered together.

8.1 Approach and Methodology

The analytical approach to calculate a water balance for the EIR/ FSS Subcaatchment Area involved monthly soil-moisture balance calculations (based on the Thornthwaite and Mather methodology) to determine the evapotranspiration and the corresponding water surplus components. A soil-moisture balance approach was used for the current assessment and assumes that soils do not release water as "potential recharge" while a soil moisture deficit exists. During wetter periods, any excess of precipitation over evapotranspiration first goes to restore soil moisture. Once the soil moisture deficit is overcome, any further excess water can then pass through the soil as infiltration and either become interflow (indirect runoff) or recharge (deep infiltration).

A soil moisture storage capacity of 100mm was used to represent the predominantly short- rooted vegetation in the open agricultural fields with clayey soils and a soil moisture capacity of 200mm was used to represent the more moderately deeply-rooted shrub and wooded areas with clayey soils. Tables C-7-1 and C-7-2 in **Appendix C-7** detail the monthly potential evapotranspiration calculations accounting for local latitude and climate, and then calculate the actual evapotranspiration and water surplus components of the water balance based on the monthly precipitation and soil moisture conditions. The SWMP Design Manual (2003) methodology for calculating total infiltration based on topography, soil type and land cover was used and a corresponding runoff component was calculated for conditions (i.e., the agricultural and shrub/wooded areas). The monthly water balance component calculations are shown in Tables C-7-1 and C-7-2 in **Appendix C-7**.

As noted in Section 8.1, the infiltration component will divide into shallow interflow and deeper groundwater recharge components. Although there is no widely-accepted standard methodology for calculating this division of flow, reasonable estimates can be made based on the nature of the surficial soils. For example, for soils underlain by very permeable sand, it is considered that the interflow component would likely approach 0% with most of the infiltrating water recharging downwards to the water table. For soils underlain by very low hydraulic conductivity sediments, the interflow component would likely approach 100%, with most of the water infiltrating into the topsoil seeping laterally along the topsoil/till contact to re-emerge locally at surface. Although the topsoil is underlain by low hydraulic conductivity till sediments, weathering and fracturing of the shallow soils may improve the recharge capabilities. In the water balance analyses completed for the North Oakville East Subwatersheds Study (NOMI, 2004), an interflow component value of 50% was used in the soil moisture balance calculations and this was found to correlate very well with numerical modelling results of the regional groundwater flow conditions, as well as the study findings of the NOCSS (2006) and other regional modeling completed by the Region of Halton (1995). Therefore, this estimate has been used in this study also to calculate the direct and indirect runoff components of the water balance (Tables C-7-1 and C-7-2, **Appendix C-7**).

To evaluate the effects of development, the monthly water surplus component is also calculated for impervious surfaces on Table C-7-1 in **Appendix C-7**.

Using these calculated water balance components, the total annual infiltration and runoff water volumes for the EIR/FSS Subcatchment Area was then calculated for the pre- development conditions (based on the existing land use characteristics) and post- development conditions (based on the proposed development plan). The post-development water balance scenario is calculated assuming no mitigation strategies or use of Low Impact Development (LID) measures for stormwater management and infiltration. The post- development land uses have been broken down into land use categories and assigned an average percentage of imperviousness for the water balance calculations as summarized in **Table 8.1**. The detailed infiltration and runoff volume calculations are presented in Table C- 7-4 in **Appendix C-7**.

Table 8.1 - Water Balance Land Use Categories

Land Use Category	% Imperviousness
Apartment	85
Detached Dwellings	70
Townhouses	75
Institutional (School)	75
Roads	90
SWM Pond	90
NHS Wetland	0

8.2 Component Values

The detailed monthly calculations of the water balance components are provided on Tables C-7-1 and C-7-2 in **Appendix C-7**. The calculations show that a water surplus is generally available from November to May. The monthly water balance calculations illustrate how infiltration occurs during periods when there is sufficient water available to overcome the soil moisture storage requirements. In our winter climate, frozen conditions may affect when the actual runoff and infiltration will occur, however, the monthly balance calculations show the potential volumes available for these water balance components.

The monthly calculations are summed to provide estimates of the annual water balance component values (Tables C-7-1 and C-7-2; **Appendix C-7**). A summary of these values is provided in **Table 8.2** (note that the values from the tables in **Appendix C-7** have been rounded accounting for the minor variances in balance additions).

It is acknowledged that the infiltration, recharge and runoff values presented in **Table 8.2** are estimates. These values are used for the water balance calculations, but it is important to understand that infiltration rates are directly dependent upon the hydraulic conductivity of the surficial soils and this may vary over several orders of magnitude. As such, the margins of error for calculated infiltration and recharge rates are large. The margins of error are recognized, but for the purposes of this assessment, the numbers used in the water balance calculations are all considered reasonable estimates based on the site-specific conditions and anticipated post-development conditions. It is noted further that the estimates for groundwater recharge are consistent with the previous subwatershed studies done for the area, including the NOCSS (2006) and NOMI (2004) studies, and a comprehensive hydrogeological study of aquifers throughout the Region of Halton that included regional groundwater flow modeling by Holysh (1995).

Table 8.2 - Water Balance Component Values

Water Balance Component	Agricultural/ Open Space	Woodlots
Average Precipitation	897 mm/year	897 mm/year
Actual Evapotranspiration	591 mm/year	626 mm/year
Water Surplus	306 mm/year	271 mm/year
Total Infiltration	107 mm/year	122 mm/year
Direct Runoff	199 mm/year	149 mm/year
Recharge (deep infiltration)	54 mm/year	61 mm/year
Interflow (indirect runoff)	54 mm/year	61 mm/year
Total Runoff	252 mm/year	210 mm/year

8.3 Pre-Development Recharge (Existing Conditions)

The pre-development water balance calculations for the EIR/FSS Subcatchment Area are presented in Table C-7-3 in **Appendix C-7**. As summarized on Table C-7-3, the developable portion of the FSS Study Area is approximately 30ha. Although much of the area is agricultural land, there are a few wooded areas associated with the Core 9 Area. There are buildings associated with rural residential lands and agriculture buildings and an existing farm pond. The total area for these land cover/land use types have been estimated and assigned appropriate water balance component values short-rooted vegetation for the agricultural lands and open space / rural residential (100mm soil moisture storage) or land covered by the existing farm pond. Based on these component values, the total pre-development recharge volume for the EIR/FSS Subcatchment Area is calculated to be about 15,600 m^3/year (Table C-7-3, **Appendix C-7**). It is again acknowledged that the recharge rates are directly dependent upon the hydraulic conductivity of the soils and may naturally vary over several orders of magnitude. Recognizing the wide margins of error associated with this analysis, the recharge volume presented above is considered simply as a reasonable estimate and not the precise volume of infiltration that may recharge the water table.

8.4 Potential Development Impacts to Water Balance

Development of an area affects the natural water balance. The most significant difference is the addition of impervious surfaces as a type of surface cover (e.g., roads, parking lots, driveways, and rooftops). Impervious surfaces prevent infiltration of water into the soils and the removal of the vegetation removes the evapotranspiration component of the natural water balance. There is still an evaporation component from impervious surfaces as well assume losses of water through infiltration because of cracks, however, this is relatively minor (estimated to be 10% to 20% of precipitation) compared to the evapotranspiration component that occurs with vegetation (about 65% of precipitation in this area). The net effect of the construction of impervious surfaces is that most of the precipitation that falls onto impervious surfaces becomes surplus water and direct runoff.

A calculation of the potential water surplus for impervious areas is shown at the bottom of Table C-7-1 in **Appendix C-7**. Assuming a maximum evaporation loss from impervious surfaces of up to 20% of the precipitation of 897 mm/year (i.e., 179 mm/year), there is a potential water surplus (runoff) from the impervious areas of 718 mm/year.

8.5 Post-Development Recharge

As described in Section 8.2, the EIR/ FSS Subcatchment Area has been broken down into proposed developed land use areas and each land use has been assigned an average percentage of imperviousness as summarized in **Table 8.1**. These data have been used to

calculate potential post-development runoff and recharge volumes assuming no mitigation or LID measures are in place (Table C-7-3, **Appendix C-7**). These calculations allow the quantification of recharge targets for the implementation of LID measures into the stormwater management strategy for the developed area.

Based on the proposed land use analysis, the total post-development recharge (again with no LID measures) is estimated to be about 3,800 m^3/year. The calculations shows that there is potential for a decrease in recharge to the groundwater regime of about 75% (Table C-7-3, **Appendix C-7**). This results in a potential recharge deficit of 11,800 m^3/year.

8.6 Water Balance Impact Assessment

8.6.1 Water Quantity

The increases in surface water runoff that will occur with urban development are typically addressed through the use of appropriate stormwater management techniques and best management practices to reduce the runoff volumes and peak flows. Details of the proposed stormwater management plans for the FSS Study Area are provided in Section 7.0.

The predicted water balance for the proposed development suggests that, without mitigation, recharge will be about 25% of the average annual recharge that occurs under existing conditions (refer to Section 8.5). The natural recharge conditions are limited due to the low permeability surficial soils. Monitoring has shown that the surface water flows in drainage swales across the EIR Subcatchment Area are intermittent and groundwater discharge does not make a major contribution to the flows (the main source of water to the watercourses is surface water runoff). The reduction in recharge that may occur with land development is not expected to result in any significant impacts to the local groundwater flow patterns (the flow directions are related to the overall regional topography) but there is potential to lower the local water table and lower the recharge that reaches the shale bedrock. It is recommended to minimize potential changes to the natural water balance throughout the EIR Subcatchment Area where possible through the incorporation of Low Impact Development (LID) measures to promote recharge into the development design. Water balance mitigation measures are discussed in Section 8.8.

In addition to the loss of direct recharge, the construction of buried services below the water table has the potential to capture and redirect groundwater flow through more permeable fill materials typically placed in the base of excavated trenches. Over the long term, these impacts can lower the local groundwater table. Anti-seepage collars could be placed along sewer trenches to prevent this lowering.

8.6.2 Water Quality

Depending on land use, runoff from urban developments may contain a variety of dilute

contaminants such as suspended solids, chloride from road salt, oil and grease, metals, pesticide residues, bacteria and viruses. For the surface water, the SWM ponds will be designed to meet Enhanced Level quality controls (refer to Section 7). For groundwater, generally, with the exception of the dissolved constituents such as nitrogen and salt, most contaminants are attenuated by filtration during groundwater transport through the soils. The potential for effects on groundwater quality from infiltration in the urban areas is therefore expected to be limited. Any potential changes to the groundwater quality are not expected to influence conditions in surface water features given the limited discharge conditions.

LID measures recommended for the promotion of infiltration will involve the direction of clean roof runoff to pervious areas within the development and no impact to local groundwater quality would be anticipated.

8.6.3 Private Services

The proposed development within the Study Areas will be serviced by municipal water supply and waste water services. Therefore there will be no impact on the local groundwater or surface water quantity and quality conditions related to any on-site groundwater supply pumping or disposal of septic effluent. There are some existing groundwater supply wells and septic systems within the Study Areas, however, it is anticipated that all these systems will be decommissioned or removed during the development process. Further discussion on interim monitoring and decommissioning of any active private wells is provided in Section 11.3.

8.7 Infiltration Mitigation Measures

Where feasible, LID measures for stormwater management will be incorporated into the development design to minimize development impacts on the natural water balance and control runoff.

The basic premise for LID is to try to manage stormwater to minimize the runoff of rainfall and increase the potential for infiltration through the use of various design techniques. The relatively low hydraulic conductivity of the surficial till and shale materials limit infiltration potential and there are no significant enhancement opportunities for infiltration in the EIR/ FSS Subcatchment Area. The use of large engineered subsurface infiltration measures are generally not considered suitable for the development. There are, however, as outlined in the SWMP Design Manual (2003), a number of surface techniques that can be used to increase the potential for post-development infiltration and mitigate the reductions in recharge that occur with urban land development. Operational experience in the Oakville area has demonstrated that subsurface LID measures are not feasible and that the direction of roof leaders to grass is an effective “best efforts” approach. Due to the relatively low hydraulic conductivity of the surficial till and locally high water table conditions, there are no significant enhancement opportunities for infiltration in the EIR Subcatchment Areas. The use of large engineered facilities and constructed subsurface infiltration

measures such as trenches and pervious storm pipe systems are generally not considered suitable for the development. As a result, NOCSS recommended a best efforts approach to infiltration measures.

For the Upper EM4 Subcatchment Area, LID techniques to be implemented includes designing grades to direct roof runoff towards pervious areas (e.g., lawns, side and rear yard swales) throughout the development where possible, increased topsoil depths and tree pits on all roads. To demonstrate the effectiveness of directing roof runoff to pervious areas, the water balance components were re-calculated for areas where roof runoff is directed to grass (Table C-7-4, **Appendix C-7**). These areas would receive water from precipitation (897 mm/year) as well as extra water from roof runoff (718 mm/year), providing a total potential water supply of 1,615 mm/year. Under these conditions of increased water supply, evapotranspiration can occur at the potential rate, leaving a water surplus of 972 mm/year. Calculation of the potential recharge that could occur in pervious areas under these conditions of increased water supply is 194 mm/year (Table C-7-4, **Appendix C-7**). The pre-development recharge was calculated to be about 54 mm/year (Table C-7-1, **Appendix C-7**), therefore, the recharge in pervious areas receiving extra roof water could theoretically be more than 3.5 times higher than natural conditions. The Toronto and Region Conservation Authority (TRCA) in their *Low Impact Development Stormwater Management Planning and Design Guide* allow for a 25% runoff reduction (contribution to recharge) from roof leader disconnection and discharge to pervious areas with greater than 5m of overland flow. This credit can be applied in the land use areas where roof leader disconnection is proposed. This 25% credit is based on the presence hydrologic soil group C soils being present at the site. Based on the previous calculations and geological and soil information from the study area, it was confirmed that hydrologic soil group C is present across the study area lands. Applying this correction to the post-development water balance (Table C-7-5 in Appendix C) indicates that roof leader disconnection in detached dwellings can reduce the post-development deficit from 11,800 m^3/year to around 11,200 m^3/year. As outlined above, considering that large scale engineered facilities to provide enhanced infiltration are not feasible in the current setting, roof leader disconnection is an appropriate best effort approach.

Water balance and water quality requirements have been addressed herein based on recommendations from NOCSS, the approved Upper EM4 Scoped EIR/SWM Report (June 2017) and ongoing consultation with the Town and CH. The Town of Oakville Consolidated Linear Infrastructure – Environmental Compliance Approvals (CLI ECA) process with the Province also sets out criteria for water balance and water quality. This criteria varies to some degree from NOCSS and the approved EIR/SWM Report recommendations. Discussions with the Town staff will be organized to review their CLI ECA requirements, study area-specific constraints, feasibility of various LID BMPs and implications to the SWM Plan.

9.0 WATER AND WASTEWATER SERVICING

9.1 Water and Wastewater Servicing Framework

The proposed wastewater and water servicing plans were prepared in accordance with the findings and recommendations of the April 2011 Area Servicing Plan (ASP) for North Oakville East prepared by MMM Group and based on discussions with the Region of Halton and Town of Oakville engineering staff. The MMM Group study was prepared on behalf of the North Oakville Community Builders Inc. in support of the North Oakville East Secondary Plan. Additional servicing information was obtained from the June 2008 "South Halton Water and Wastewater Master Plan Update", prepared by KMK Consultants Limited for the Region.

As noted in Section 1.1, the completion of EIR/FSSs for the EM4, JC7 and JC9 Subcatchment Areas have been advanced concurrently to ensure that planning, servicing and NHS protection are well integrated. In this regard, the landowners within each of these Subcatchment Areas have coordinated the preparation of the "North Oakville East (Trafalgar Road) - Comprehensive Water and Wastewater Servicing Strategy" prepared by Urbantech Consulting, completed in May 2025 (included in **Appendix G**). The report was prepared to provide a comprehensive water and wastewater servicing strategy for future developments within the EM4, JC7, and JC9 subcatchment areas. The Upper EM4 water and wastewater servicing plans presented herein were guided by recommendations from the overall servicing strategy.

The following report sections identify water and wastewater servicing requirements specific to the Upper EM4 lands consistent with the framework servicing framework established in the Comprehensive Water and Wastewater Servicing Strategy.

9.2 Wastewater Servicing

9.2.1 Wastewater Design Criteria

Wastewater infrastructure will be designed in accordance with the latest Region of Halton Water and Wastewater Linear Design Manual (2024), as follows:

Sewer Design Criteria

Average Dry Weather Flow	215 Litres per capita per day
Infiltration	0.260 Litres per second per hectare
Peaking Factor	Harmon Formula

Population Criteria

Single Family	95 persons/hectare
Street Townhouse	260 persons/hectare
Stacked Townhouse & Low/Mid-Rise Apartments (outside Strategic Growth Areas)	420 persons/hectare
Apartments (within MTSA, Urban Growth Areas)	2000 persons/hectare
Light Commercial Areas	90 persons/hectare
Light Industrial Areas	125 persons/hectare
Community Services	40 persons/hectare
Schools	70 persons/hectare

9.2.2 Proposed Wastewater Servicing

The Subject Lands will be serviced by a network of local gravity sewers designed in accordance with Region of Halton standards and specifications. The local sewers will convey flows southerly through internal rights-of-way, culminating in a 525 mm diameter sewer along Marvin Avenue. The sewer will convey flows to the proposed 750 mm diameter Trafalgar Road sub-trunk via a connection at Marvin Avenue.

As noted in the North Oakville East Servicing Strategy, the proposed 750 mm Trafalgar Road sub-trunk is currently in detailed design as part of the Trafalgar Road widening project (ongoing). Construction of the road and the sewer is anticipated to commence in the late 2026 / 2027 timeframe.

The Upper EM4 proposed wastewater servicing plan is illustrated on **Drawing 9.1**. Design sheets and tributary area plans are included on **Drawing 9.1**.

9.3 Water Servicing

9.3.1 Water Supply Design Criteria

Water supply and distribution infrastructure will be designed in accordance with the latest Region of Halton Water and Wastewater Linear Design Manual (2024), as follows:

Water Design Criteria

Residential - Average Day Flow	265 Litres per capita per day
Residential – Max. Day Peaking Factor	2.25
Residential – Peak Hour Peaking Factor	4.0
Employment - Average Day Flow	225 Litres per capita per day
Employment – Max. Day Peaking Factor	2.25
Employment – Peak Hour Peaking Factor	2.25
Density - Detached and Semi-Detached	3.5 persons/unit
Density - Townhouse	2.6 persons/unit

9.3.2 Proposed Water Servicing

The Subject Lands lie within Oakville Pressure Zone O4 and will be serviced by a network of new local watermains designed in accordance with Region of Halton standards and specifications.

Local watermains will be serviced by connections to the existing 750 mm diameter transmission main on Trafalgar Road and existing 1200 mm diameter transmission main on Burnhamthorpe Road.

The proposed watermain servicing plan is illustrated on **Figure 9.1**.

10.0 ROADS

Through the Secondary Plan process, alternate road allowance design standards were proposed by the Town of Oakville. The road allowance design was undertaken to establish preliminary right-of-way widths for various road types.

Since the time of the Secondary Plan, the road allowance design has continued to evolve in order to reflect the detailed requirements of the many stakeholders whose infrastructure is located within the road allowance. The proposed road allowances which have been approved by the Town of Oakville are included in **Figures 10A**, **10B**, **10C** and **10D**.

The Development Concept presented on **Figure 6.1** includes road allowance widths in general conformance with the Secondary Plan widths.

Sidewalks are proposed on both sides of all streets, see **Figure 6.5**. There are no road crossings or servicing crossings of the NHS.

11.0 CONSTRUCTION PRACTICES

This section of the EIR/FSS includes discussions on a number of construction related matters including erosion and sediment control requirements, dewatering, well decommissioning and topsoil management.

11.1 Erosion and Sediment Controls

An Erosion and Sediment Control (ESC) strategy will be prepared and implemented in accordance with the *Erosion and Sediment Control Guide for Urban Construction* (TRCA, 2019) prior to any earthworks or grading activities on the Subject Lands. The ESC strategy will include the following:

- methods for constructing SWM and environmental features in the dry;
- methods to stabilize disturbed areas to minimize transfer of sediment;
- special measures for works in or adjacent to stream corridors, such as culvert crossings, wetland construction, etc.;
- environmental fencing;
- stone mud mat at all construction entrances;
- consideration for proper topsoil stockpiling (location, height, side slopes), exclusion of compaction activities, good site management control (i.e., no waste additions), and avoidance of dust control application that may adversely affect soil integrity (e.g., use of water only; no oil-based sprays, etc.);
- use of the permanent ponds as temporary silt basins during site construction activities;
- regular inspection of the ESC devices; and,
- removal and disposal of the ESC devices after the site has been stabilized.

11.2 Dewatering Requirements

There are areas in the Subject Lands with high water table within the surficial till and shale bedrock units. Dewatering may be required in the short-term to ensure that construction of buildings and installation of services occurs in the dry or over the long-term to keep foundations dry.

Short-term (Construction) Dewatering

Construction dewatering may be required where sewer trench grades and excavations encounter groundwater. No significant or extensive construction dewatering is anticipated in the FSS Study Area. The amount of seepage from the clayey silt and sandy silt till deposits is expected to be small and manageable by sump pumps.

There may be areas where heavily fractured sediments or bedrock have higher hydraulic conductivity and groundwater seepage may be more appreciable. Should such permeable zones be encountered during construction, more active dewatering may be required. The undertaking of dewatering, according to industry standards and in accordance with MECP processes, will ensure that adequate attention is paid to potential adverse impacts to the environment.

Currently the MECP allows construction dewatering of less than 400,000 L/d to proceed under the Environmental Activity Sector Registry (EASR) process. If dewatering is required above this threshold, then the standard Permit to Take Water (PTTW) process applies. In both cases, a scientific study is required in support of EASR registration or PTTW application. This scientific study must review the potential for environmental impacts and provide mitigation and monitoring measures to the satisfaction of the MECP or other review agency. The requirements for construction dewatering will be confirmed by geotechnical and hydrogeological investigations completed in support of detailed design.

Long-term (Foundation) Dewatering

The construction of buildings with underground garages is anticipated to encounter groundwater and therefore will require groundwater management. As outlined above, the amount of seepage from the clayey silt and sandy till deposits is expected to be small. In addition, the competence of the bedrock is expected to increase with depth and therefore no significant increases in groundwater seepage are expected with depth.

To support foundation dewatering further geotechnical and hydrogeological studies will be required that evaluate the volume of seepage that will require removal and the quality of water to be removed. The operational experience in the Oakville area has demonstrated that dewatering volumes are small and the dewatering discharge can be directed to the storm sewer system.

11.3 Private Water Wells

The proposed development will be municipally serviced and therefore, in the long term, it is expected that any existing domestic water supply wells in the area will no longer be used. In the interim, however, it is important to ensure that construction does not adversely affect local groundwater supplies while the private water supply wells are still in use. Prior to construction activities, it will be necessary to complete a house-to-house survey to determine the precise well locations and uses of local groundwater supply wells. For any active and accessible water supply wells, the water levels will be measured in each well during non-pumping conditions prior to the commencement of site construction activities, and a water sample will be collected from each well for analysis of background water quality. The water analysis will include general water quality indicator parameters including chloride, nitrate, turbidity and conductivity. The recommended monitoring program for the local private wells includes quarterly water level measurements throughout the earthworks period (if the wells remain in use). At the end of the construction period, a water sample will again be collected from each of the monitored supply wells to confirm

the water quality has not been affected.

11.4 Well Decommissioning

Prior to construction, it will be necessary to ensure that all inactive water supply wells within the development footprint have been located and properly decommissioned by a licensed water well contractor according to Ontario Regulation 903. In addition, all groundwater monitoring wells and standpipes installed for this study must be decommissioned in accordance with provincial regulations prior to or during the site development, unless they are maintained throughout the construction for monitoring purposes.

11.5 Topsoil Management

Increased topsoil depths are one of the proposed LID measures for implementation throughout the FSS Study Area. Topsoil should be carefully managed to ensure its viability for use for LID purposes. This should be considered during the Site Alteration process.

12.0 MONITORING

12.1 OPA 272 Monitoring Requirements

Policy 7.9.5.2 of OPA 272 requires that an annual monitoring program be completed as follows:

> *"A program shall be established by the Town in consultation with the Region of Halton and Conservation Halton to monitor the development in the Planning Area on an annual basis. The monitoring program shall be in accordance with directions established in the North Oakville Creeks Subwatershed Study and shall also consider such factors as:*
>
> *a) relationship and level of population and employment growth;*
>
> *b) supply of existing lots and number of building permits granted;*
>
> *c) the general achievement of housing mix targets;*
>
> *d) the functioning of stormwater management facilities to ensure they are constructed and operate as designed,*
>
> *e) stream alterations/relocations to ensure that natural channel designs were implemented and operate as designed;*
>
> *f) erosion and operation of sediment controls during construction;*
>
> *g) utilization of wastewater treatment and water supply system capacity; and,*
>
> *h) development application status".*

12.2 NOCSS Monitoring Requirements

The NOCSS includes monitoring requirements for:

- Erosion and sediment control;
- SWM facilities;
- Monitoring of modified streams; and,
- Monitoring of SWM works, municipal services and trails installed by a landowner within the NHS.

With respect to the above monitoring components, the principles of monitoring, for which the landowners are responsible, include the following, as set out in OMB Monitoring Mediation Agreement dated July 27, 2007.

Erosion and Sediment Control

1. An ESC plan will be required to be submitted to the Town. The plan must be reviewed and approved by the Town prior to any clearing and grading.

2. The ESC requirements will follow applicable approved guidelines and bylaws in effect at the time of development. Deliverables will include a site alteration design report, an existing site conditions survey plan, an ESC plan, and a schedule of monitoring and reporting.

3. The ESC plan will include inspection, sampling for total suspended solids at all outlets from the site and reporting of results.

4. Remedial action to correct deficiencies of ESC practices and facilities may be required based on either inspection or sampling results.

Stormwater Management Facilities

1. SWM facilities constructed in the conveyance system and at the end-of-pipe will be included in the monitoring program, which applies to the period prior to the assumption of the facilities by the Town. The monitoring plan will include monitoring of the receiving system for the effectiveness of the SWM facilities at the location of the outfall for the purpose of water quality monitoring, and at a location or locations to be determined through the EIR for the purpose of erosion control. Monitoring will follow applicable approved guidelines in effect at the time of development. These guidelines will replace Appendix KK – Stormwater Pond Monitoring Protocol from the Subwatershed Study. The Town and CH will consult with the North Oakville landowners in the preparation of such guidelines. Monitoring requirements will be reflected in subdivision agreements.

2. Privately owned SWM facilities are not included in this mediation document and will be subject to site specific requirements at the time of application.

3. All SWM facilities to be assumed by the Town will be monitored by the owner for design conformance, maintenance of function and hydraulic performance. Monitoring and reporting requirements are to be reviewed and approved by the Town.

4. Facilities with water quality function(s) will be monitored by the owner for performance in meeting the specific pond design target for total suspended solids (80% removal). Total phosphorus and temperature sampling will also be required.

5. Facilities subject to Ontario Water Resources Act approval may be required to do additional monitoring as a condition of the Certificate of Approval.

Monitoring in Relation to SWM Works, Municipal Services and Trails Installed by an Owner within the NHS

1. A monitoring program will be implemented for all municipal services such as roads, watermains, sanitary sewers, SWM works or trails within the NHS.

2. A monitoring program, approved by the Town and CH, is to be developed based on the natural features and functions potentially affected by the specific works noted above.

3. The details of the monitoring program are to be included in the EIR.

4. The monitoring program will be implemented by the landowners installing the SWM works, municipal services and trails.

12.3 Proposed Monitoring

Consistent with the monitoring principles set out above, the following monitoring will be undertaken by the landowners.

12.3.1 Erosion and Sediment Control

Section 11.2 of this report discusses the need for an ESC strategy in accordance with Town and CH guidelines and sets out typical components of the strategy. Guidelines endorsed by CH entitled, *Erosion and Sediment Control Guide for Urban Construction* (TRCA, 2019) will be applied to site construction plans at the detailed design stage to identify specific details of an ESC strategy, including the type and location of control measures to be implemented, timing of implementation, details of responsibilities for monitoring, reporting and maintenance needs. Deliverables will include a site alteration design report, an existing site conditions survey plan, an ESC plan and a schedule of monitoring and reporting.

12.3.2 Stormwater Management Facilities

SWM facilities to be assumed by the Town will be monitored by the owner for design conformance and hydraulic performance. Monitoring and reporting requirements are to be reviewed and approved by the Town and CH.

The Town has prepared comprehensive monitoring requirements for SWM ponds, as set out in *Town of Oakville Guidelines for Operation, Maintenance, and Monitoring of Stormwater Management Facilities South of Dundas Street.* Furthermore, the Town has prepared monitoring guidelines for North Oakville. All monitoring will be prepared in accordance with the final, approved version of "*North Oakville Monitoring Program for Stormwater Management Facilities*".

The North Oakville Monitoring Program Guidelines requires "*Baseline temperature and TSS monitoring be undertaken in the receiving watercourse upstream and downstream of the anticipated SWM pond outlet; temperature monitoring be undertaken during the months of July, August and September prior to construction of the SWMF. Temperature monitoring should be carried out as per Section 5 of the Ontario Stream Assessment Protocol; and the TSS monitoring should be undertaken during 3 dry weather sampling events and during at least 4 wet weather events prior to the construction of the SWMF*".

As noted previously, flows up to and including the 5-year storm event from SWM Pond 29 will be conveyed across Trafalgar Road via a 675 mm diameter storm sewer and will outlet to PSW 25 (i.e., upstream extent of Reach MOC-6). Flow events that exceed the 5-year return period event will outlet west to the realigned corridor at the upstream extent of Reach MOC-5A. The monitoring program outlined below addresses monitoring of drainage at both of these future pond outlet locations.

Water Quality Monitoring

Typically, post-construction monitoring programs for SWM Ponds include water quality monitoring upstream and downstream of proposed outlets (where possible). GEO Morphix previously completed baseline water quality monitoring along Reaches MOC-5A and MOC-6 in support of the *Upper EM4 Scoped EIR/SWM Report* (2017), as well as during previous phases of development within the catchment. Given the passage of time, it is recommended that baseline water quality monitoring be re-established along Reaches MOC-5A and MOC-6 in 2025. This would involve monitoring upstream and downstream of proposed the SWM Pond 29 outlet location along Reach MOC-6, as well as immediately downstream of the MOC-5A proposed outlet, as proposed outlet will be located at the upstream extent of Reach MOC-5A. Proposed monitoring locations are shown in **Appendix H**. 2025 baseline monitoring would include the following activities between April 1st and November 30th:

- Conduct continuous water level and temperature monitoring at 15-minute intervals using an installed HOBO U20 water level logger at three (3) locations along reaches MOC-5A and MOC-6. An additional control sensor will be installed nearby to measure atmospheric pressure and temperature on at these locations;
- Complete discrete baseline water quality sampling including measurements of temperature, TSS, turbidity, dissolved oxygen, and conductivity for seven (7) water quality monitoring events per year as follows:
  - Four (4) wet events (≥ 10 mm in 24 hours)
  - Three (3) dry events (two consecutive days with no rainfall)
  - Collect monumented photographs of all sampling activities to verify locations and timing

Geomorphological Monitoring

GEO Morphix conducted baseline geomorphological monitoring along Reach MOC-2 (downstream of Reach MOC-6) within Core 10 from 2016 to 2019 in support of the *Upper EM4 Scoped EIR and SWM Report* (2017). Additionally, GEO Morphix has been conducting baseline geomorphological monitoring along reaches MOC-4 and MOC-5A since 2015 in support of development activities and the construction and operation of SWM Ponds 27, 31 and 32. It is recommended that baseline monitoring be re-initiated at four (4) locations along these three reaches in 2025. The baseline monitoring program will include the following activities:

- Re-establish two (2) monumented cross-sections surveyed as part of baseline monitoring conducted along Reach MOC-2 within Core 10
- Re-establish two (2) monumented cross-sections surveyed as part of baseline monitoring conducted along Reaches MOC-4 and MOC-5A
- Re-establish erosion pins to measure changes in channel bank conditions
- Complete a Wolman (1954) pebble count or collect a substrate sample for grain size analysis at each cross-section, as appropriate
- Conduct rapid stream assessments using a combination of the Rapid Geomorphic Assessment (RGA) (MOE, 2003) and Rapid Stream Assessment Technique (RSAT) (Galli, 1996) to document potential indicators of channel instability and systematic adjustment
- Compile monumented photographs at each cross-section to confirm the location, timing and instream conditions at the time of the survey

To confirm pre-development conditions, the above activities will be completed along Reaches MOC-2, MOC-4, and MOC-5A, twice a year (i.e., spring and autumn). Once SWMP 29 is operational, annual post-construction monitoring is recommended to continue for a period of three (3) years. Proposed monitoring locations are included in **Appendix H**.

12.3.3 Monitoring in Relation to Municipal Services and Trails Installed by an Owner within the NHS

All municipal services (water, wastewater, stormwater controls and roads) are located in ROWs and other areas outside the NHS. Therefore, there are no NHS-related monitoring requirements associated with this infrastructure.

This EIR/FSS identifies future trail locations in the northern and eastern perimeters of Core 9. The locations of the trails are shown on **Figure 6.5**. The monitoring requirements associated with trail design will be finalized at the time the trail design is completed. This will be undertaken as a condition of Draft Plan approval. The primary focus of this monitoring is associated with the construction and the naturalization/planting requirements for locations where disturbance to the natural cover would occur. Specifically, monitoring should occur to ensure that:

- the habitat protection requirements including erosion and sediment controls and fencing

of features in Core 9 are implemented and maintained in good working order until construction is completed;

- drainage swales are stabilized with (seeding, matting, as finalized in the detailed trail design);

- disturbed zones adjacent to trails/swales, primarily between the edge of these features and the NHS Core boundary are landscaped with native indigenous species and in consultation with CH and Town (Parks); and,

- during the plantings warranty period, all planted materials would be managed appropriately, in consultation with CH and Town (Parks).

13.0 SUMMARY

This EIR/FSS identifies and characterizes the natural heritage features and functions within the Study Areas and recommends measures to mitigate any potential impacts of the proposed development applications and associated servicing requirements on the NHS within the EIR Subcatchment Area and FSS Area. It also identifies servicing requirements related to roads, water supply, storm drainage, SWM, sanitary sewage and site grading. The EIR/FSS provides a link between the Town's NOCSS Management and Implementation Report, the North Oakville East Secondary Plan and the required planning approvals for the FSS lands.

Table 13.1 summarizes main report findings and recommendations and notes the Section(s) of this report that can be referenced for more details.

Table 13.1 – Summary of EIR/FSS Recommendations

Topic	Recommendations	Report Section for Further Details
Areas Studied	The extent of the area studied as part of this EIR/FSS is the Upper East Branch of East Morrison Creek west of Trafalgar Road. This includes the upper portions of the existing EM4 Subcatchment Area and adjacent areas shown on **Figure 1.1**. This EIR/FSS is being completed in coordination with the preparation of EIR/FSSs for the JC7 and JC9 Subcatchment Areas to ensure that planning, servicing and NHS protection are well integrated.	Section 1.2
Development Concept	Landowners within each of the EM4, JC7 and JC9 Subcatchment Areas have coordinated the preparation of one comprehensive Development Concept illustrated in **Figure 6.1** that depicts the proposed road fabric and land use pattern within the combined area of these subcatchment areas. The Development Concept depicts several land uses which correspond to the land use schedules of the North Oakville East Secondary Plan.	Section 6.1
Subcatchment Drainage Boundaries	As required by NOCSS, the EM4 Subcatchment drainage boundaries were confirmed through the review of additional more detailed topographic work and field investigations. This was documented and approved as part of the Scoped EIR and SWM Report (2017).	Sections 7.2 and 7.4

Table 13.1 – Summary of EIR/FSS Recommendations

Topic	Recommendations	Report Section for Further Details
NHS Framework and Associated Components	Only limited portions of the NHS exist in the Upper EM4 Subcatchment within the Study Area. They include: ▪ Small portions of Core 9; ▪ No Linkage Preserve Areas or Optional Linkage Preserve Areas; ▪ No High, Medium or Low Constraint Streams; and, ▪ No Hydrologic Feature A; three Hydrologic Features B. **Figure 2.1** illustrates the NHS within and downstream of the Upper EM4 Subcatchment. Area. Several PSWs exist in adjacent areas. Where appropriate, drainage implications to these wetlands are addressed herein. While outside of the EIR Subcatchment Area, assessments of downstream impacts within EM4 and EM1 extend east of Trafalgar Road in downstream portions of the EM4 subwatershed and west of Trafalgar Road in the downstream portions of EM1.	2.0
NHS Boundaries	Boundaries of Core 9 within the EIR Subcatchment Area are presented on **Drawing 3.1**. They have been delineated based on approved boundaries from the 2017 Scoped EIR and SWM Report and recent field staking of features on properties where this work was not completed in 2017. Core 9 boundaries were established based on direction from NOCSS, field staking surveys of wetland and woodland boundaries and application of NOCSS buffers to these features. Core 10 boundaries in downstream areas along EM4 have been determined/approved through other EIR/FSS reports and required no further study as part of this EIR/FSS.	Section 3.1 Section 3.2
Trail System	Portions of the proposed trail system are located in the outer buffer areas of Core 9 as shown on **Figure 6.5.** Section 6.2 provides discussion on the trail design and alignment and addresses impacts of the trail to adjacent areas.	Section 6.2
Target Flows	NOCSS target peak flows are appropriate for SWM design and were applied to determine target outflow rates for the proposed SWM Pond 29 for the 2 year to 100 year events and the Regional Storm event. Target unit rates are shown in **Table 7.3**.	Section 7.7

Table 13.1 – Summary of EIR/FSS Recommendations

Topic	Recommendations	Report Section for Further Details
SWM Plan	The 2017 Upper EM4 Subcatchment SWM plan has been revised to reflect the currently proposed Upper EM4 land uses, coordination of adjacent development plans, and the latest design information for the proposed Trafalgar Road Improvements project undertaken by Halton Region. The location of SWM Pond 29 has been revised in accordance at the request from the Town of Oakville that the pond be moved westerly to allow for higher density uses along the Trafalgar Road corridor. Further, the Region of Halton advised that they did not support a storm sewer outfall within the Trafalgar Road right-of-way, necessitating relocation of the pond outlet to two tributaries of East Morrison Creek. Lands outside of the Upper EM4 Subcatchment but within the FSS Study Area will drain to existing Pond 27 in the EM1 Subcatchment or future Pond 38 in the JC9 Subcatchment. **Figure 7.3** illustrates major elements of the SWM Plan including the future drainage boundaries, SWM Pond 29 location and conceptual design, pond outfall locations and areas to be serviced to Ponds 27 and 38.	Section 7.3
SWM Pond 29	SWM Pond 29 is located in the southern end of the Upper EM4 Subcatchment and has been designed to provide stormwater quality, erosion and quantity control for a total drainage area of 27.7 ha with an average impervious ratio of 85%. The general layout of the stormwater conveyance network servicing the development along with the contributing drainage boundaries to the pond is shown schematically on **Figure 7.3**. The pond is designed to provide Enhanced Level quality control, extended detention erosion control (25mm detention for seven day drawdown) and additional storage to provide peak flow attenuation to the established NOCSS target release rates for all storm events up to and including the Regional Storm event. The pond outlet splits flows to both the downstream PSW 25 along the East Branch of East Morrison Creek as well as to the upstream end of East Morrison Creek. The preliminary Pond 29 design is provided in **Figures 7.5 and 7.6**; operating characteristics are presented in **Tables 7.2 and 7.3**.	Section 7.7

Table 13.1 – Summary of EIR/FSS Recommendations

Topic	Recommendations	Report Section for Further Details
Downstream Impact Assessments	The stand-alone Upper EM4 EIR/FSS Modeling Mini-Submission was prepared to document the updated Upper EM4 SWM Plan and associated downstream hydrologic, hydraulic and erosion modeling and wetland water balance analyses. The Modeling Mini-Submission was prepared to obtain agency input/feedback relating to the proposed Upper EM4 SWM Plan and SWM Pond 29 outfall design as it may affect the design of the Trafalgar Road works, downstream natural features and natural hazards and the overall servicing plans for these subcatchments. Discussions with the Town and CH related to the Mini-Submission are ongoing. Outcomes of those discussions will be reflected in the Final EIR/FSS. **Appendix B-4** contains the conclusions from the Modeling Mini-Submission. This EIR/FSS includes the design of SWM Pond 29 from the Modeling Mini-Submission.	Section 7.2 and Appendix B-4
LID Measures	LID options have been evaluated. Large scale infiltration measures are not feasible due to the urban form of the proposed development and surficial soil characteristics; however, other LID measures have been recommended, including techniques such as designing grades to direct roof runoff towards lawns, side and rear yard swales, boulevards, parks, and other open space areas throughout the development, tree pits in road boulevards as well as increased topsoil depths to improve the potential for water storage and infiltration.	Section 8.8
Sanitary Servicing	The Subject Lands will be serviced by a network of local gravity sewers, conveying flows to the proposed 750 mm diameter Trafalgar Road sub-trunk via a connection at Marvin Avenue. As noted in the North Oakville East Servicing Strategy, the proposed 750 mm Trafalgar Road sub-trunk is currently in detailed design as part of the Trafalgar Road widening project (ongoing). Construction of the road and the sewer is anticipated to commence in the late 2026 / 2027 timeframe.	Section 9.2
Water Servicing	The Subject Lands lie within Oakville Pressure Zone O4 and will be serviced by connections to the existing 750 mm diameter transmission main on Trafalgar Road and existing 1200 mm diameter transmission main on Burnhamthorpe Road.	Section 9.3

Table 13.1 – Summary of EIR/FSS Recommendations

Topic	Recommendations	Report Section for Further Details
Roads	Proposed road allowances will be designed to Town of Oakville design standards. Typical cross-sections for the proposed road allowances are provided. There are no NHS road crossings identified within OPA 272 within the Subject Lands.	Section 10.0
Baseline SWM Pond Monitoring	Recommendations are made for surface water monitoring (i.e., temperature, turbidity, TSS, conductivity and dissolved oxygen upstream and downstream of SWM Pond 29 to characterize baseline conditions. Recommendations are also made for baseline geomorphological monitoring along stream reaches downstream of the future SWM Pond 29 outlets.	Section 12.3.2
SWM Pond Post Construction Monitoring	In accordance with the Town's requirements, a detailed monitoring program will be provided at detailed design to assess the performance of Pond 29.	Section 12.3.2
Future Study Requirements	Future study requirements to be addressed at detailed design include: ▪ Consultation with MECP and completion of additional field investigations where there is the potential for works to affect endangered or threatened species; approval may require permitting under the Endangered Species Act. ▪ Review and confirmation of trail alignments based on a site visit with agencies; and ▪ Wildlife salvage protocol to be developed in anticipation of the site preparation activities.	-