GEI Consultants

Mayfield Tullamore Local Subwatershed Study

Phase 2 - Detailed Update to Existing Conditions and Impact Assessment Report
Town of Caledon, Peel Region, Ontario

Submitted to:
Mayfield Tullamore Landowner Group Inc.
c/o Development Collective
Attn: Kim Beckman, MTLOG Group Manager

April 2025
Project 2400278





In collaboration with: SCS consulting group ltd

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Record of Revisions

Identification	Date	Description of Issued and/or Revision
00	March 14, 2025	Issued to Landowner Group for Review

Executive Summary

This report constitutes Phase 2 of the Mayfield Tullamore Secondary Plan Local Subwatershed Study. The Mayfield Tullamore Secondary Plan Area is located within the Town of Caledon, and is part of the Peel Region Settlement Area Boundary Expansion (SABE) which outlines areas for future settlement and urban development within the Town of Caledon. The Secondary Plan Area lands are approximately 612 ha in size (including Bramalea Road) and are generally bounded to the south by Mayfield Road, to the north by Old School Road, to the east by Torbram Road and is located just east of Dixie Road.

GEI Consultants Canada Ltd. (GEI) and SCS Consulting (SCS) have been retained to deliver a comprehensive local SWS for the Mayfield Tullamore Landowner Group (MTLOG).

Based on the two documents, the local SWS has been separated into three (3) phases:

- **Phase 1** includes the characterization of existing conditions, including the natural heritage features, hydrologic features, and surface and groundwater systems (*submitted in full January 2025);*
- **Phase 2** includes the analysis, impact assessment, mitigation, and recommendations; and.
- **Phase 3** consists of a comprehensive implementation plan, monitoring plan, and adaptive management plan.

This Phase 2 Local SWS Report has been prepared in alignment with the Terms of Reference (TOR) that was approved in principle by agencies in November 2024.

The objective of this Phase 2 local SWS report is to provide a multidisciplinary, integrated impact assessment of proposed land use changes within the Study Area to support the delivery of a preferred land use concept. This report includes recommendations of mitigation and management strategies for identified impacts associated with land use changes and ultimately has guided the iterative determination of a preferred land use plan for the Secondary Plan area (also referred to as the Structure Plan).

The preferred land use plan introduces high-level land uses such as Neighborhood Areas, Natural Features and Areas, and Open Spaces, and outlines approximate stormwater management facility locations. As part of the tertiary planning process, it is anticipated that Neighbourhood Areas will be comprised of a wide range of residential, institutional, commercial, and community uses such as parks, schools, community centers and emergency services. The preferred land use plan also identifies the preferred road alignment.

The impact assessment was completed based on the Proposed Land Use Plan and prepared by MGP on January 10, 2025 and the following assumptions were made:

- No SWM facilities will be located within natural heritage features, natural hazards or their associated VPZs;
- All grading will be outside of the proposed NHS limits except for localized disturbance at infrastructure crossings or to facilitate the construction of created natural heritage features;

- While a trail alignment has been proposed for the Study Area through the Town of Caledon's Transportation Master Plan, this alignment requires substantial Greenbelt NHS encroachment and crossings through sensitive features. As such, a new trail alignment is expected to be proposed as part of the tertiary planning stage. This Phase 2 Report provides recommendations and best management practices for addressing alignment and design of trails within the Study Area to minimize adverse impacts.
- The proposed collector road network within the Secondary Plan Area includes two crossings of the proposed NHS: a Greenbelt Plan Area NHS crossing (Property 9), and a non-significant valleyland/NHS crossing; while high level potential impacts and mitigative considerations are discussed, fulsome impact assessments are anticipated to be provided as part of the MCEA process (**Section 7**)
- Climate change implications and recommended mitigative/management opportunities are assessed as part of each discipline's impact assessment to support a more sustainable and adaptive community capable of withstanding the challenges of climate change.

Based on the characterization of natural features outlined in the Phase 1 Local SWS and an analysis of the Preliminary NHS outlined in the SABE Scoped SWS, a series of analyses were completed to identify an "existing NHS" comprised of existing natural hazards and natural features that meet the definition of NHS components as described in the Provincial Policy Statement, Town of Caledon Official Plan and Region of Peel Official Plan. The goal of the Phase 2 Local SWS is to assess how land use changes will impact this existing NHS and propose a NHS that will incorporate key goals (**Section 6.1**), SABE NHS targets (**Section 6.2**), and demonstrate how SABE system components (key features, supporting features, other features, linkages, and enhancements) will be addressed through net gain mitigation hierarchy principles (**Section 6.4**). A proposed NHS has been presented within this Phase 2 SWS that acknowledges impacts, mitigative measures, restoration and enhancement opportunities, and ecosystem offsetting principles.

The following is a summary of key analyses, findings, and recommendations explored within the Phase 2 Local SWS:

- Proposed storm drainage boundaries and hydrology modelling parameters were established utilizing the proposed Structure Plan and anticipated stormwater management pond locations. Any significant drainage area diversions were identified and justified. The TRCA Humber River Hydrology model was updated utilizing the proposed condition hydrology modelling parameters to confirm uncontrolled Regional storm event peak flows throughout the Secondary Plan Area and at downstream flood vulnerable areas. **(Section 4)**
- A preliminary grading plan was prepared showing centreline road grades based on the proposed Structure Plan. Town of Caledon lot and grading criteria was summarized. No grading is anticipated to be required within the proposed NHS for implementation of infrastructure, trails, or roads, with the exception of the collector road crossings. The grading plan identifies approximate slopes across development blocks and collector roads which will be refined as part of subsequent application stages to meet Town criteria. **(Section 5)**

- A fulsome review of significant and non-significant natural heritage features and their associated functions was completed **(Section 7.2)**. Each feature identified within the Study Area has been addressed, impacts identified, and mitigative and management recommendations outlined to demonstrate no negative impacts and protect these features from land use changes. No negative impacts are expected to any of the significant features identified within the Study Area, provided that mitigation, management, restoration, and compensation measures are implemented. A more detailed assessment of best practices for these recommendations are outlined in **Section 8**.
- In natural systems, watercourses regularly see flows that entrain and transport sediment and is a part of the natural process that maintains natural channel form. An erosion assessment was undertaken to assess the potential for existing rates of erosion to be exacerbated as a result of the proposed development activities. The assessment included a determination of the erosion threshold for receiving streams (i.e., downstream of proposed stormwater management outfalls). A detailed geomorphic assessment was completed for each reach downstream of the proposed outfalls, consisting of a measurement of longitudinal profile, cross-sections, and characterization of bed and bank substrates, as well as riparian vegetation cover. An erosion threshold was determined for each reach following standard geomorphic techniques. (**Section 7.3**)
- The proposed condition uncontrolled Regional storm event peak flows were typically less than existing condition peak flows throughout the Secondary Plan and resulted in a minor increase in peak flow in a downstream flood vulnerable area. The increase in peak flow in the flood vulnerable area will be mitigated by the required Regional quantity controls outlined in the Phase 1 Local SWS. Proposed condition floodplain mapping was prepared where proposed flows exceeded existing however this did not impact limits of development. As the proposed condition uncontrolled Regional storm event peak flows were less than existing, the existing arterial road culverts in the vicinity of the Secondary Plan do not require improvements to facilitate development. Preliminary culvert sizes were provided for the two proposed collector road crossings of the NHS. (**Section 7.4**)
- Hydrogeological conditions of the site were reviewed and assessed to identify potential impacts to groundwater users, the water balance, ecological features, and water resources generally. The likelihood of impacts to private wells is low due to the depth of the wells that are near the site and the fact that the proposed development will mainly result in shallow disturbances. Development is likely to reduce the average annual quantity of groundwater recharge but this can be mitigated through the implementation of low impact development (LID) features. Well-drained upland areas are located throughout much of the northwestern part of the site and in select areas in the southwestern part of the Site and may be good candidates to host LID features. Artesian conditions were identified in Oak Ridges Aquifer Complex deposits in the northeastern part of the Site: further investigation of these areas will be required at the Draft Plan stage to assess potential risks associated with excavation stability, foundation drainage, and aquifer mining. A planning level construction dewatering assessment was completed and it was identified that most of the anticipated dewatering activities would likely be carried out under the Environmental Activity and Sector Registry, while some projects (i.e., deep basements for large urban corridor buildings, deep SWM ponds in areas where artesian conditions exist) may require a Permit to Take Water but in either case it is expected that the impacts associated with dewatering could be suitably mitigated through the development of appropriate discharge management plans. (**Section 7.5**)

- Based on the subsurface conditions and slope stability assessment, potential geotechnical impacts were assessed in relation to the proposed structure plan. Mitigation measures and other considerations were prepared to support future works for the proposed development. The major and unique considerations in the Study Area, beyond what is completed for typical development, is the importance of the confined valley systems, the impact of deep sanitary sewers, and potential interactions between earthworks and groundwater. Based on the structure plan, the proposed development was outside of the Erosion Hazard Limit for the slope stability hazards. This complied with TRCA's policy for slope hazards, and impacts were generally not expected for the typical site development. For the potential deep sanitary sewers, wet sands and gravels along with artesian groundwater conditions were encountered in the northern half of the Study Area which could significantly impact both the excavation process and long-term stability of the sewer structure. Site-specific geotechnical engineering reports will be required to support future development phases. (**Section 7.6**)
- The preferred land use plan will result in an increase in impervious areas, which is expected when establishing new settlement areas. Impacts and mitigative measures as it relates to potential increases in dilute contaminant runoff are explored. Best management practices discussed include end-of-pipe SWM solutions designed to protect water quality including thermal regulation and adherence with TRCA's Stormwater Management Criteria Document (2012b) and the Guidance for Development Activities in Redside Dace Protected Habitat (MNRF 2016a), Erosion and Sediment Control, spill prevention and response protocols, and road salt management. (**Section 7.7**).
- The proposed development has the potential to affect the water balance of ecological communities (e.g., wetland features) in the area: stormwater management design shall be guided by a feature-based water balance to mitigate these impacts at the retained features (**Section 7.8**). Additional mitigative recommendations, monitoring recommendations, and next steps for site-specific feature based water balance analyses are identified for wetland features within the Study Area. Additionally, impact considerations for the removal and compensation of wetland features are discussed in **Section 7.8.5**, with more detailed wetland hydroperiod considerations discussed in **Section 8.6.3**.
- Further, the Phase 2 local SWS includes a detailed review of recommended best practices and recommendations to support ecosystem offsetting (**Section 8.3**), restoration (**Section 8.4 – 8.7**) and enhancement opportunities (**Section 8.8**). Best practices and recommendations to help achieve Town and SABE objectives and targets are detailed in **Sections 8.5-8.8.**
- Based on the impact assessment (**Section 7**) and restoration and enhancement strategy (**Section 8**), further efforts to demonstrate how the preferred land use plan and proposed NHS will support net gain principles are outlined in **Section 10**. This includes a review of the eight net gain targets defined in the SABE Scoped SWS for natural cover, woodland, wetland, valley and stream corridors, successional/open habitats, aquatic, sands/barrens/savannahs, grasslands, NHS enhancement (**Section 10.1**).

- The net gain mitigation hierarchy principles are further explored through the International Union for Conservation of Nature (IUCN)'s net gain metrics, with a focus on ecological net gain metrics including ecosystem functions/services, biodiversity, and disaster risk mitigation (**Section 10.2 – 10.4**). In general, the proposed NHS, inclusive of restoration, enhancement and compensation is expected to result in a net gain of 13% of natural cover within the Mayfield Tullamore Secondary Plan Area.
- A summary of study requirements outside of the SWS are included (**Section 11**).
- Phase 3 (Implementation and Management Strategies) will follow the Phase 2 local SWS report and will finalize the evaluation of the proposed land use scenarios and recommend management strategies and direction for their implementation to support the goals and targets outlined in the SABE SWS and Phase 1 and 2 Local SWS reports (**Section 12**).

1. Introduction

The Mayfield Tullamore Secondary Plan Study Area is generally located within Peel Region, in the Town of Caledon. The Mayfield Tullamore Secondary Plan Area is within the Peel Region's Settlement Area Boundary Expansion (SABE) Study Area, which outlines areas for future settlement and urban development. The Secondary Plan Area lands are approximately 612 ha in size (including Bramalea Road) and generally bounded to the south by Mayfield Road and to the north by Old School Road; and are located west of Torbram Road and east of Dixie Road in the Town of Caledon, Ontario (the Secondary Plan area is herein referred to as the Study Area; **Figure 1-1**).

Within the Study Area, the participating landowners make up approximately 438 ha, which is approximately 71.5% of the total Secondary Plan Area; participating properties are outlined on **Figure 1-2**). Each participating parcel has been assigned a number to assist with site specific references. As discussed within the *Mayfield Tullamore Local Subwatershed* Study *Phase 1 – Subwatershed Characterization and Integration Report* (Phase 1 SWS; GEI and SCS 2025), access was only permitted onto the participating properties; therefore, certain assumptions have been made to characterize the non-participating properties. Further site characterization will be required should these properties become participating. This Phase 2 Local Subwatershed Study (SWS) builds upon the assumptions presented within the Phase 1 SWS for the non-participating properties.

GEI Consultants Canada Inc. (GEI) and SCS Consulting (SCS) have been retained to deliver a comprehensive local SWS for the Mayfield Tullamore Landowner Group (MTLOG).

The scope of work for this local SWS has been designed in alignment with *Terms of Reference for Local Subwatershed Studies* (Town of Caledon, 2024e). Prior to completion of the Phase 1 SWS, a Terms of Reference (TOR) for the project was submitted to the Town of Caledon in May 2024; further revisions were submitted in September 2024 to address agency comments and the TOR was approved in principle by agencies in November 2024.

Based on these two documents (i.e. the Caledon Terms of Reference Guide, and the Approved MTLOG TOR), the local SWS has been separated into three (3) phases:

- **Phase 1** includes the characterization of existing conditions, including the natural heritage features, hydrologic features, and surface and groundwater systems;
- **Phase 2** includes the analysis, impact assessment, mitigation, and recommendations; and
- **Phase 3** consists of a comprehensive implementation plan, monitoring plan, and adaptive management plan.

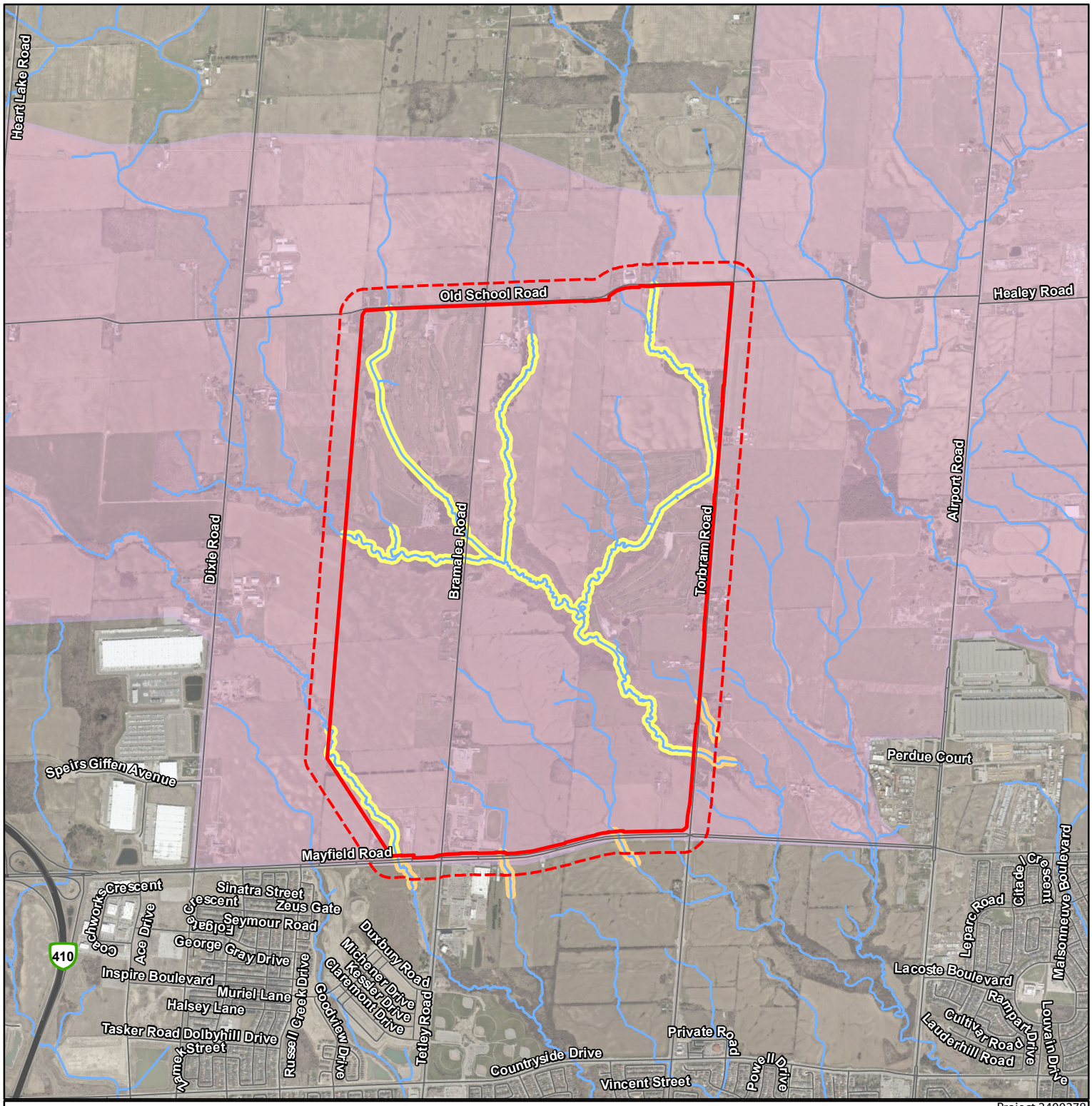
The Draft Phase 1 SWS was initially submitted in August 2024 to reviewing agencies. It was resubmitted in January 2025 to include updated field survey results and to address some initial comments that were received from members of the SWS Technical Advisory Committee (TAC) on November 1, 2024; these are provided within Appendix A of the Phase 1 SWS. Detailed comments on the Phase 1 SWS have not been received at the time of preparation of the Phase 2 Local SWS (herein referred to as "the Phase 2 SWS" or "Phase 2 Report").

The objective of this Phase 2 SWS is to build upon the detailed characterization of the existing conditions from Phase 1 SWS. The output from Phase 2 is intended to be an integrated and iterative impact assessment of all disciplines. GEI and SCS have been engaged with the consultant teams tasked with providing Planning and Transportation services as part of the Secondary Plan. Through several technical meetings and discussions, a variety of road alignment and land use concepts have been reviewed. GEI and SCS's input has been focused on how to ensure natural heritage and stormwater management policies and provisions are incorporated and considered.

This Phase 2 SWS introduces the preferred land use plan based on those discussions. This report includes a fulsome assessment of potential impacts on natural heritage and water resource features and functions, as a result of preferred land use changes (herein generally referred to as either "preferred" or "proposed" land use changes). It will also include an exploration of mitigation and management strategies for these identified impacts. At this stage, the proposed land use plan being assessed is very high-level; it contemplates the location of a natural heritage system, approximate stormwater management facility and institutional locations, parks, and general neighborhood areas where more specific land uses will be explored as part of the tertiary plan process.

Based on these high-level land use changes being proposed, where appropriate, analytical tools will be used to predict changes to existing conditions and assess potential land use scenarios in relation to subwatershed-based targets based on background data or baseline monitoring data collected during the Phase 1 SWS. These impact analyses will aim to identify preferred land use scenarios that meet the goals and targets identified within the SABE Scoped SWS and the Phase 1 SWS.

Figure 1-1. Location of the Study Area



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NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
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3. Orthoimagery © First Base Solutions, 2025. Imagery taken in 2022.

Legend
- Study Area
- Study Area + 120m
- Fluvial Geomorphology Study Area
- Additional Downstream Reaches to be Assessed
- Watercourse (TRCA, 2022)
- Approximate Settlement Area Boundary Expansion Focus Study Area (Peel, 2022)

Mayfield Tullamore Local Subwatershed Study
Phase 2 - Subwatershed Impact Assessment

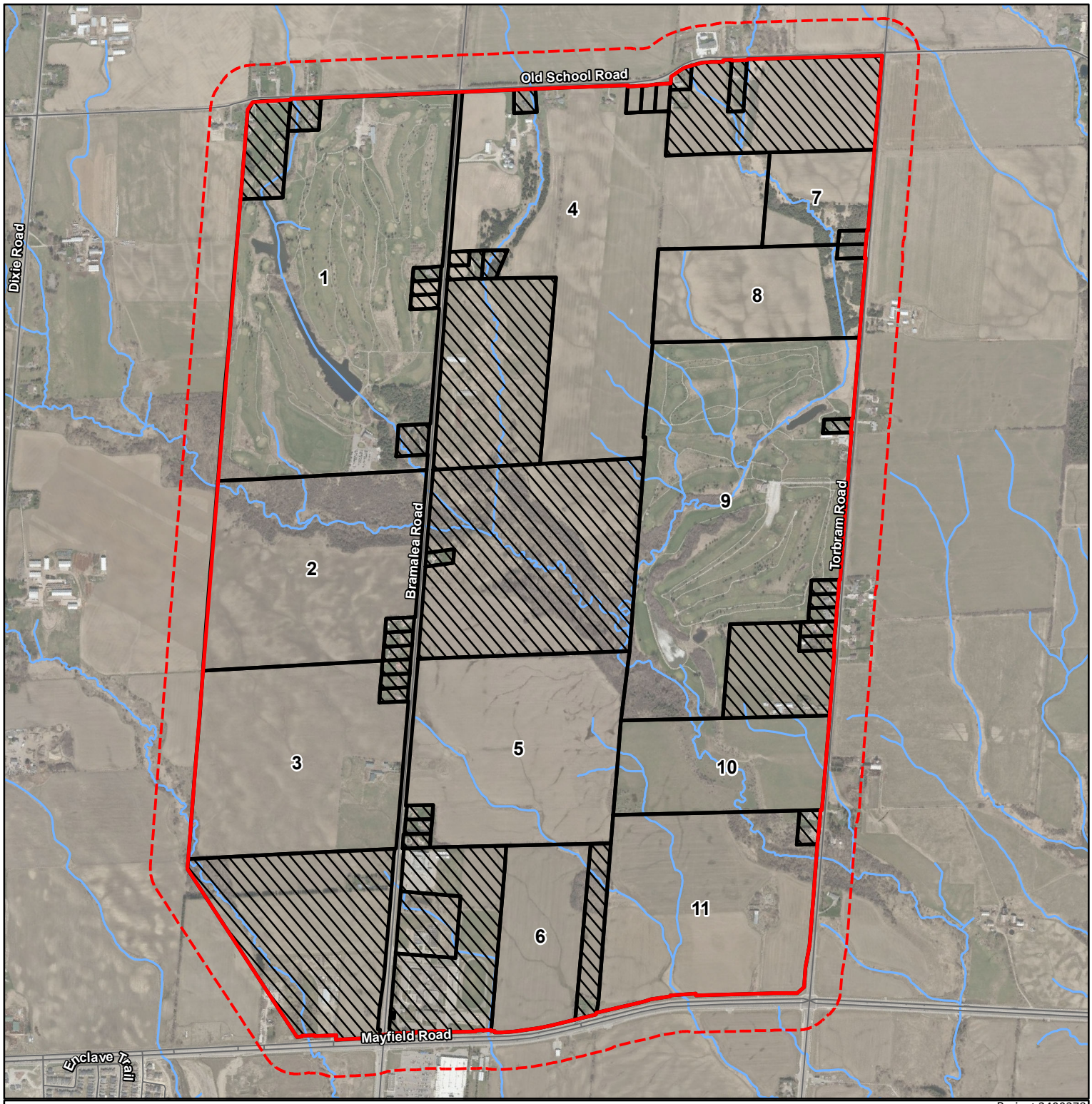
Figure 1-1
Location of Local Subwatershed Study Area

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Figure 1-2. Participating Properties within the Secondary Plan Area



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1. Coordinate System: NAD 1983 UTM Zone 17N.
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Legend
- Study Area
- Study Area + 120m
- Watercourse (TRCA, 2022)
- Non-Participating Property
- Participating Property

Map #	Property Identifier	Ownership Entity
1	Banty's Roost Golf Course	ANATOLIA INVESTMENTS CORP.
2	Broccolini North	12442 BRAMALEA LIMITED PARTNERSHIP represented by its general partner 12442 BRAMALEA LIMITED PARTNERSHIP
3	Broccolini South	BRAMALEA ROAD LIMITED PARTNERSHIP represented by its general partner BRAMALEA ROAD ROAD BP INC. and BRAMALEA ROAD CONINVEST LIMITED PARTNERSHIP represented by its general partner BRAMALEA ROAD COINVEST GP INC.
4	TACC	TACC DEVELOPMENTS (ARMSTRONG) LTD.
5	DG-1	DG (CALEDON 1) INC.
6	Torchia	2052743 ONTARIO INC.
7	DG-2	SENTINEL (TORBRAM) HOLDINGS INC.
8	DG-3	SENTINEL (TORBRAM) HOLDINGS INC.
9	Mayfield Golf Course	MAYFIELD GOLF COURSE INC.
10	Rice	TULLAMORE INDUSTRIAL GP LIMITED
11	DG-4	MAYFIELD LANDING DEVELOPMENTS INC.

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Mayfield Tullamore Local Subwatershed Study
Phase 2 - Subwatershed Impact Assessment

Figure 1-2
Participating Properties in Local Subwatershed Study Area

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2. Summary of Phase 1 Subwatershed Study

The following sections summarize the key findings presented within the *Mayfield Tullamore Local Subwatershed Study Phase 1 – Subwatershed Characterization and Integration Report* (Phase 1 SWS; GEI and SCS 2025). The below findings and characterizations will be built upon within future Phases.

2.1 Natural Environment

This section summarizes natural heritage features assessed and characterized within Section 3.1 of the Phase 1 SWS.

Detailed ecological surveys were conducted by GEI and Beacon Environmental Limited within the Study Area to characterize the presence, extent and significance of natural heritage features. Beacon Environmental Limited (2024) conducted surveys within Properties 9 and 10 in 2022 and 2023, while GEI conducted surveys within the remaining properties in 2024.

2.1.1 Natural Heritage Features

Based on the findings and significance analysis completed in the Phase 1 SWS, the following features were identified within the Study Area:

- Candidate significant wetlands (Meadow Marsh (MAM), Mineral Meadow Marsh (MAM2), Reed-Canary Mineral Meadow Marsh (MAM2-2), Forb Mineral Meadow Marsh (MAM2-10), Cattail Mineral Shallow Marsh (MAS2-1), Duckweed Floating-leaved Shallow Aquatic (SAF1-3), Pondweed Floating-leaved Shallow Aquatic (SAF1-4), Pondweed Mixed Shallow Aquatic (SAM1-4), Deciduous Swamp (SWD), Mineral Deciduous Swamp (SWD4), Willow Mineral Deciduous Swamp (SWD4-1), Thicket Swamp (SWT), Willow Mineral Thicket Swamp (SWT2-2), and Red-osier Dogwood Mineral Thicket Swamp (SWT2-5));
    - All wetlands located within the Greenbelt Plan Area are considered candidate Provincially Significant Wetlands (PSWs) and were not evaluated under Ontario Wetland Evaluation System (OWES).
- Significant woodlands (Coniferous Plantation (CUP3), White Pine Coniferous Plantation (CUP3-2), White Pine-White Spruce Coniferous Plantation (CUP3-12*), White Cedar Coniferous Plantation (CUP3-13*), Mineral Cultural Woodland (CUW1), Deciduous Forest (FOD), Dry – Fresh Poplar – White Birch Deciduous Forest (FOD3), Dry – Fresh Deciduous Forest (FOD4), Dry-Fresh Sugar Maple – Hickory Deciduous Forest (FOD5-5), Fresh – Moist Sugar Maple – Hardwood Deciduous Forest (FOD6-5), Lowland Deciduous Forest (FOD7), Fresh – Moist Willow Lowland Deciduous Forest (FOD7-3), Fresh – Moist Manitoba Maple Lowland Deciduous Forest (FODM7-7), SWD, SWD4, and SWD4-1);
    - The majority of woodland communities identified are found within the Greenbelt Plan Area. All woodlands located within the tablelands of the Study Area have been identified as non-significant woodlands.

- Significant valleylands;
    - Only the valleylands located within the Greenbelt Plan Area meet the criteria of significance. The main West Humber River valleyland, Campbell's Cross Creek and the tributary along Torbram Road are considered significant.
- Significant Wildlife Habitat (SWH) - outside the Greenbelt Plan Area:
    - The following SWH types for species of conservation concern (SOCC) were present:
        - Barn Swallow (*Hirundo rustica*; Confirmed within Property 1)
        - Eastern Wood-Pewee (*Contopus virens*; Confirmed within Property 6)
        - Snapping Turtle (*Chelydra serpentina*; Confirmed within anthropogenic ponds on Property 1)
        - Monarch (*Danaus Plexippus*; Confirmed within Property 4)
- Candidate SWH - within the Greenbelt Plan Area:
    - Seasonal Concentration Areas of Animals:
        - Raptor Wintering Areas
        - Bat Maternity Colonies
        - Turtle Wintering Areas
        - Reptile Hibernacula
        - Colonially-Nesting Bird Breeding Habitat (Tree and Shrub)
    - Rare Vegetation Communities or Specialized Habitat for Wildlife
        - Waterfowl Nesting Areas
        - Bald Eagle and Osprey Nesting, Foraging and Perching Habitat
        - Turtle Nesting Areas
        - Seeps and Springs
        - Amphibian Breeding Habitat (Woodland)
        - Amphibian Breeding Habitat (Wetland)
    - SWH Types for Species of Conservation Concern
        - Marsh Bird Breeding Habitat
        - Terrestrial Crayfish
        - Barn Swallow (*Hirundo rustica*)
        - Eastern Wood-Pewee (*Contopus virens*)
        - Wood Thrush (*Hylocichla mustelina*)
        - Common Nighthawk (*Chordeiles minor*)
        - Golden-winged Warbler (*Vermivora chrysoptera*)

        - Grasshopper Sparrow (*Ammodramus savannarum*)
        - Ruddy Duck (*Oxyura jamaicensis*)
        - Eastern Musk Turtle (*Oxyura jamaicensis*)
        - Northern Map Turtle (*Graptemys geographica*)
        - Snapping Turtle (*Chelydra serpentina*)
        - Black Dash (*Euphyes consipicua*)
        - Monarch (*Danaus Plexippus*)
    - Animal Movement Corridors
        - Amphibian Movement Corridors
- Fish habitat;
    - Direct fish habitat was identified within medium and high constraint watercourses. Some medium and low constraint watercourses were identified as indirect fish habitat. All other drainage features were identified as Headwater Drainage Features (HDFs) that provide indirect (contributing) fish habitat.
- Habitat of endangered and threatened species;
    - The following species at risk (SAR) and/or SAR habitat was identified within the Study Area:
        - Redside Dace (*Clinostomus elongatus*) – endangered in Ontario;
        - Butternut (*Juglans cinerea*)– endangered in Ontario;
        - Eastern Small Footed Myotis (*Myotis leibii*)– endangered in Ontario;
        - Little Brown Myotis (*Myotis lucifugus*) – endangered in Ontario;
        - Bobolink (*Dolichonyx oryzivorus*) – threatened in Ontario; and
        - Eastern Meadowlark (*Sturnella magna*) – threatened in Ontario.

In addition to provincially significant features, non-significant wetlands (MAM2-2, MAM2-10, Common Reed Graminoid Mineral Meadow Marsh (MAMM1-12), Cattail Graminoid Mineral Meadow Marsh (MAMM1-2), MAS2-1, SWT2-5, and SAF1-3), non-significant woodlands (FODM7-7, Norway Spruce Coniferous Plantation (CUP3-14), and Dry – Fresh Sugar Maple – Ironwood Deciduous Forest (FOD5-4)) and non-significant valleylands were identified outside of the Greenbelt Plan Area.

2.1.2 Vegetation Protection Zones

The minimum vegetation protection zones (VPZs) and setbacks proposed within the Phase 1 SWS were based on the following policy guidance:

- *The Living City Policies* (Toronto and Region Conservation Authority, 2014);
- *Town of Caledon Official Plan* (Town of Caledon, 2024 Consolidation);
- *Region of Peel Official Plan* (Region of Peel, 2022);

- *Greenbelt Plan* (Government of Ontario, 2017);
- Section 29 of Ontario Regulation 831/21 (Habitat), made under the *Endangered Species Act* (2007); and
- *Draft Guide for Determination of Setbacks and Buffers* (Carolinian Canada, 2003)

The minimum recommended VPZs, as identified in the Phase 1 SWS are shown in **Table 2-1** below.

Table 2-1. Phase 1 SWS – Natural Heritage Constraints and Minimum Recommended VPZ

Natural Heritage Constraint	Recommended Minimum VPZ
Significant wetlands	30 m
Significant woodlands within the Greenbelt Plan Area	30 m
Significant woodlands outside the Greenbelt Plan Area	20 m
Non-significant wetlands	10 m
Non-significant woodlands	10 m
Significant Valleylands	• 15 m from the greater of LTSTOS or staked top of bank boundary for confined systems; OR • the greater of meander belt or floodline boundary for unconfined systems
Non-significant Valleylands	• 10 m from the greater of LTSTOS or staked top of bank boundary for confined systems; OR • the greater of meander belt or floodline boundary for unconfined systems
Fish Habitat (direct, warmwater baitfish)	15 m
Fish Habitat (direct, cool or cold water)	30 m
Redside Dace Habitat	30 m from the meander belt of occupied habitat

Significant wetlands and woodlands received a 30 m VPZ for protection from adjacent land uses in accordance with the *Greenbelt Plan* (2017) policies. Non-significant wetlands and woodlands received a 10 m VPZ in accordance with the Toronto and Region Conservation Authority (TRCA) *Living City Policies* (2014) and Carolinian Canada (2003), respectively.

The majority of the watercourses within the Study Area are located within confined valleys, and are protected through valleyland setbacks and VPZs; the valleyland minimum VPZs were based the greater of LTSTOS or staked top of bank boundary for confined systems; or the greater of meander belt or floodline boundary for unconfined systems. A 10 m VPZ was applied to non-signifcant valleylands, and an additional 5 m was added to the VPZ for significant valleylands, in accordance with the Town of Caledon's requirements within existing settlement areas outside of Provincial Plan areas and with the TRCA's *The Living City Policies* (2014). This is also a consistent with other jurisdictions for significant valleylands (e.g., Halton Region).

VPZs are applied to direct (occupied) fish habitat. A 15 m VPZ is recommended from warmwater baitfish habitat and a 30 m VPZ is recommended from cool/cold water fish habitat.

Where multiple constraints overlapped, the greatest constraint and its VPZ guided the limit of the recommended Natural Heritage System (NHS). The above noted VPZs and setbacks are commonly accepted throughout the Greater Toronto Area.

2.1.3 Existing Natural Heritage System

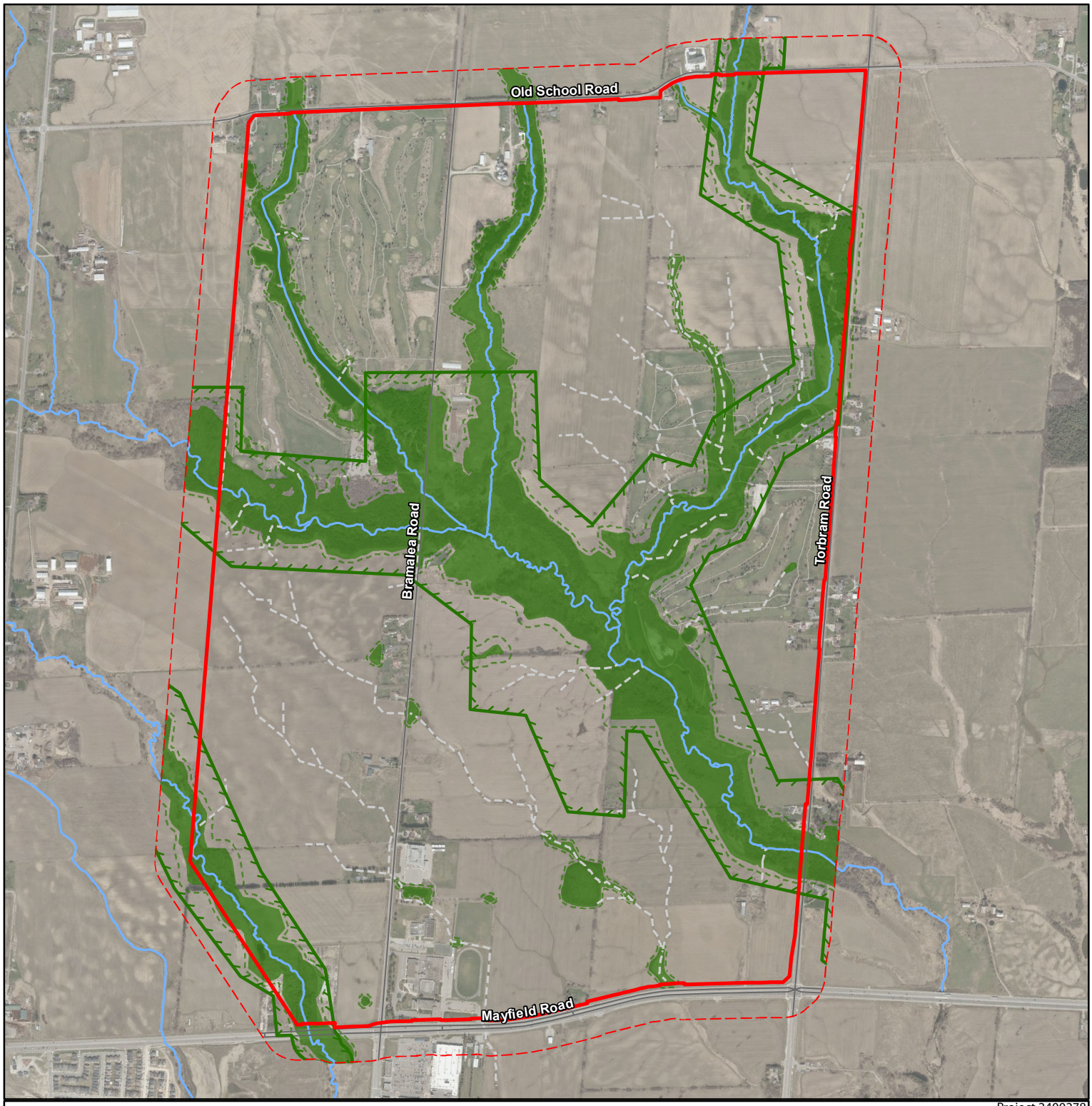
The goal for the final Mayfield Tullamore Secondary Plan NHS is to contain both natural heritage and natural hazards along with their associated setbacks. The NHS is intended to protect and enhance all natural heritage features and ecological functions that are identified in the Provincial Planning Statement (2024) as "significant" under relevant criteria in guiding documents (NHRM 2010, Town OP 2024, Region OP 2022, SWH 6E Ecoregion Criteria 2015).

The intention of the NHS is to ensure that the Mayfield Tullamore corridors continue to provide for passage, foraging and residency for a variety of species. The NHS will form the backbone of the Structure Plan and allow for responsible development within the Secondary Plan area. Refinements to the boundaries of the NHS may occur within future studies, including to include ecological offsetting or enhancement areas.

To support the delineation of a Proposed NHS, the Phase 1 SWS reviewed the SABE Preliminary NHS and integrated ground-truthed data to identify an Existing NHS. This Phase 2 Report will further refine the Existing NHS presented within the Phase 1 Report to incorporate enhancements, linkages and restoration areas; this refined system will be termed the "Proposed NHS" and has been delineated through the analyses within this Phase 2 report. These enhancement areas, linkages and restoration areas will be informed by the proposed land use plan, and based on the recommendations in the SABE report.

Error! Reference source not found. **Error! Reference source not found.** illustrates the Existing NHS that wa s identified within the Phase 1 SWS.

Figure 2-1. Existing Natural Heritage System



NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2025, © Town of Caledon, 2025, © Toronto and Region Conservation Authority, 2025, © Peel Region, 2025.
3. Orthoimagery © First Base Solutions, 2025. Imagery taken in 2022.

Legend
- Study Area
- Study Area + 120m
- Greenbelt Plan Area
- Watercourse (GEI 2024)
- Headwater Drainage Feature (GEI, Beacon)
- Natural Heritage Features and Natural Hazards
- Natural Features and Natural Hazard Setbacks

Project 2400278

Mayfield Tullamore Local Subwatershed Study
Phase 2 - Subwatershed Impact Assessment

Figure 2-1
Existing Natural Heritage System

0 400 m
1:18,000

GEI Consultants

2.2 Stream Morphology

This section summarizes fluvial geomorphic features assessed and characterized within Section 3.2 of the Phase 1 SWS.

The fluvial geomorphic assessment serves to characterize existing conditions of watercourses within the Study Area, and delineate meander belt limits associated with the watercourses, to inform the determination of environmental constraint limits. Several different types of watercourses traverse the Study Area, ranging from small, lesser defined streams to large tributaries of the Humber River, situated in confined valleys. The SWS also builds on the watercourse constraint rankings identified in the SABE (high, medium, and low constraint watercourses), through a multi-disciplinary approach, including the fluvial geomorphic assessment.

The following summarizes the key findings of the geomorphic assessment:

- Tributaries of the West Humber River traverse the Study Area, as well as Campbell's Cross Creek in the eastern portion. All the tributaries lie within the jurisdiction of the TRCA. Reaches were previously delineated as part of the Scoped SWS for the SABE and assigned a low, medium or high constraint ranking. This delineation was generally maintained, with minor revisions based on field observations. Minor adjustments to the watercourse constraint ranking occurred to reflect the updated reach breaks and incorporate multi-disciplinary evaluations;
- Rapid assessments were performed on each reach, consisting of a Rapid Geomorphic Assessment (RGA), Rapid Stream Assessment Technique (RSAT), and the Down's Method. The RGA results ranged from 0.07 (in regime) to 0.43 (in adjustment). The RSAT results for the reaches ranged between 27 (good) and 35 (excellent). The Downs method produced various results for the reaches, generally consistent with the findings of the RGA; and
- The TRCA (2004) meander belt width delineation procedures were followed to delineate the meander belt width for unconfined reaches, while Ontario's Technical Guide for River & Stream Systems: Erosion Hazard Limit (2002) was referred to for confined systems. The meander belt width was also determined within occupied Redside Dace reaches, as it defines a portion of the habitat limits for the endangered fish species.

A small error was identified in the delineation of the preliminary meander belt for reach WHT4(3)-2, which, in turn, changes the span of the Occupied Redside Dace Habitat Limits. The original span of the preliminary meander belt was reported to be 38 m, resulting in a Redside Dace Habitat Limit span of 98 m. Instead, the preliminary meander belt span should be 40 m, resulting in a Redside Dace Habitat Limit span of 100 m.

2.3 Hydraulics and Hydrology

This section summarizes the hydrologic conditions assessed and characterized within Section 3.3 of the Phase 1 SWS.

The Secondary Plan is located within the West Humber River subwatershed which has been extensively studied by the Toronto and Region Conservation Authority (TRCA) from a hydraulics and hydrology perspective. The Secondary Plan is approximately 596 ha in size which is 11% of the West Humber River subwatershed within the Settlement Area Boundary Expansion (SABE) (approximately 5339 ha).

The hydrology and hydraulics Study Area extends beyond the limits of the Secondary Plan and includes the tributary areas of watercourses and drainage features that flow through it (approximately 3940 ha). The Study Area as outlined in the Terms of Reference has been provided in **Appendix D4**.

In support of establishing the stormwater management, hydraulics, and hydrology criteria, the following reports, design guidelines, and standards were reviewed:

- Ministry of Environment, Conservation and Parks (MECP) Design Criteria for Sanitary Sewers, Storm Sewers and Forcemains for Alterations Authorized under Environmental Compliance Approval dated January 2023, (V.1.2);
- Environmental Compliance Approval for a Municipal Stormwater Management System, Appendix A dated May 2022;
- Scoped Subwatershed Study, Part A: Existing Conditions and Characterization Final Report, Wood, dated November 2022 (SABE SWS, 2022);
- Town of Caledon Development Standards Manual dated 2019;
- Final Report Humber River Hydrology Update, Civica Infrastructure Inc., dated April 2018 (Humber River Hydrology Update, 2015);
- Final Report Humber River Hydrology Update, Civica Infrastructure Inc., dated June 2015 (Humber River Hydrology Update, 2015);
- MNRF Guidance for Development Activities in Redside Dace Protected Habitat dated 2016;
- TRCA Crossings Guideline for Valley and Stream Corridors dated September 2015;
- TRCA Stormwater Management Criteria, dated April 2012 Version 1.0;
- TRCA Low Impact Development Stormwater Management Planning and Design Guide, dated 2010 Version 1.0;
- Ministry of Environment (MOE) Stormwater Management Planning and Design Manual dated March 2003; and
- Ministry of Transportation (MTO) Drainage Management Manual (1997).

The TRCA currently uses a hydrologic model of the Humber River Watershed that has been calibrated and validated based on observed rainfall-runoff responses measured at various flow gauges throughout the watershed. The existing conditions hydrologic model was prepared using Visual OTTHYMO (VO) software in 2015 (updated 2018) and was run using the 6, 12, and 24-hour AES synthetic design storms in order to evaluate the requirements for quantity control in the Humber

River. The results concluded that the 6 and 12-hour AES storms were the critical durations in terms of flooding throughout the watershed. Additional storms such as the 350 year and 500 year events were also simulated, although not recognized as regulatory events. For the simulation of the Regional Storm event, the saturated antecedent moisture condition (AMC III) was applied to account for the increase in soil moisture caused by the first 36 hours of the storm. In accordance with the MNR Technical Guide, 2002, all SWM facilities were removed for the Regional Storm simulation and areal adjustment factors were applied based on the equivalent circular area method. Per the MTLOG TOR (2024), the TRCA VO model was utilized for establishing existing floodplain constraints throughout the Secondary Plan, refer to **Appendix AX**.

Flood Vulnerable Areas (FVAs) as identified by the TRCA were categorized in Part A of the SABE SWS (2022). One FVA applies downstream of the Study Area, the Main Humber River FVA at the confluence with the West Humber River, located in the City of Toronto. It was noted that based on a review of the time to peak results from the Humber River Hydrologic Model, the timing influences may be unfavorable for traditional stormwater management (SWM) in the headwaters, which may lead to increases in peak flows further downstream, due to lagged release of outflows.

Hydraulic analyses of open watercourses are predominately completed using the HEC-RAS hydraulic model. Previously completed hydraulic analyses and approved floodlines have been provided for the Secondary Plan and surrounding areas, as approved by the TRCA. The regulated floodlines have been generated based upon the results from the approved HEC-RAS models simulating the Regulatory event (greater of Regional Storm or 100 year event). The latest existing Regulatory floodplain mapping is provided in **Appendix D4**. The latest hydraulic models for the Study Area (Final West Humber and West Humber Zone 1) were obtained from the TRCA in February 2024.

A thorough desktop review of hydraulic models for the Humber River Watershed was completed in Part A of the SABE SWS (2022), relevant excerpts are provided in **Appendix D4**. It was noted that floodplain mapping throughout the SABE was comprised of engineered and “estimated” floodlines. Engineered floodlines are understood to have been developed from engineered hydraulic models, which were built using detailed data collection for channel/floodplain geometry and includes hydraulic structures (i.e. culverts, bridges, weirs, etc.) based upon best available sources (field survey, as-built drawings, etc.). Estimated floodlines are understood to have been developed from simplified hydraulic models, generally based upon basic channel topography (i.e. from an available DEM source only) and do not always include hydraulic structures. Where estimated, the floodplain mapping was confirmed based on detailed topographic survey and hydrologic/fluvial assessments to confirm that it meets minimum drainage area requirements (50 ha) and meets the latest definition of a “watercourse” as described in O. Reg. 41/24 (a defined channel, having a bed and banks or sides, in which a flow of water regularly or continuously occurs).

A review of existing undersized crossings was also undertaken in Part A of the SABE SWS (2022). Undersized structures within the Secondary Plan or immediately downstream have been identified in **Table D4-1** in **Appendix D4** and are illustrated on Figure WR6 of Part A of the SABE SWS (2022) also provided in **Appendix D4**. Culvert inspection reports were obtained from the Region of Peel and Town of Caledon for the existing culverts crossing Mayfield Road, Bramalea Road, Torbram Road, and Old School Road along the frontage of the Secondary Plan. In general, all culverts were noted as being in

fair or good condition with minor repairs required (e.g. minor ditching, patch repairs to concrete, minor restoration, etc.).

As discussed in the Phase 1 Local SWS (SCS and GEI, December 2024), the existing storm drainage boundaries as delineated in the Humber River Watershed hydrology model were refined based on the detailed topographic survey and LIDAR information obtained for the Secondary Plan and surrounding catchments. In general, modifications to the existing drainage boundaries and catchment areas were minimal (<2%). The most significant changes occurred in and around Catchment 30.02 based on revisions to the drainage areas of smaller tributaries and more detailed survey of rural right-of-way ditch drainage including: Catchments 30.03, 30.08, and 30.10.

Several headwater drainage features (HDFs) of the West Humber River that potentially contain floodplain constraints were identified within the Secondary Plan including HDFs: H8 (Catchment 32.26), H3 (Catchment 31.01), H22 (Catchment 31.01), WHT4(3)4 (Catchment 30.02), and WHT4(3)5 (Catchment 30.02). The individual tributaries noted above were examined in further detail to determine if they met the drainage area criteria (>50 ha) and the watercourse definition (a defined channel, having a bed and banks or sides, in which a flow of water regularly or continuously occurs) to establish a floodplain constraint. A summary of the analysis is provided in **Table 2.2** below, drainage areas are delineated on **Figure D2-2** in the Phase 1 Local SWS Report (SCS and GEI, December 2024).

Table 2.2 – Floodplain Constraint Analysis Summary

West Humber River Tributary/HDF	HEC-RAS Tributary Label	Drainage Area (ha)	Classified as Watercourse	Floodplain Constraint Required
H8	F	111.51 (Catchment 32.26)	No	No
H3	K	53.54 (Catchments 301 and 302)	No	No
H22	L	14.85 (Catchment 303)	No	No
WHT4(3)4	O	123.89 (Catchments 201-203)	Yes	Yes
N/A	P – South Reach 3	37.17 (Catchment 101)	No	No
N/A	P – South Reach 2	34.08 (Catchment 102)	No	No
WHT4(3)5-2	P – South Reach 1	71.25 (Catchments 101 and 102)	Yes	Yes
WHT4(3)5-2	P – North Reach 1	58.05 (Catchment 103)	Yes	Yes

West Humber River Tributary/HDF	HEC-RAS Tributary Label	Drainage Area (ha)	Classified as Watercourse	Floodplain Constraint Required
WHT4(3)5-1	P – Reach 1A-3A	193.41 (Catchments 101-106)	Yes	Yes

In the Phase 1 Local SWS (SCS and GEI, December 2024), hydrologic modelling was undertaken using the Humber River Watershed Model with Visual Otthymo Version 6.4.1 software (VO6) to determine updated existing peak flows during the Regional Storm event based on the revised Catchment drainage areas noted above. A second standalone VO6 model was prepared to determine the peak flows during the Regional Storm event in the tributaries with previously estimated floodplain constraints.

In general, the peak flows of the catchments that were modified did not change significantly throughout the Secondary Plan. A summary of the original and updated Regional Storm peak flows is provided in **Table D1-1** in **Appendix D1**. The peak flows during the Regional Storm event were either maintained or increased slightly. At the downstream end of West Humber River Tributary Reach WHT4(2)-1 where flows leave the Secondary Plan, the peak flow increased from 159.371 m^3/s to 162.837 m^3/s (2.2% increase) which is not anticipated to have a significant impact on downstream floodline elevations and conveyance structures. Therefore, no updates to downstream floodlines are warranted and any impacts to downstream flood vulnerable areas will be negligible based on the slight increase in peak flows.

The modified peak flows from the VO model were incorporated into the West Humber River HEC-RAS model to refine the floodplain elevations of the Regional Storm event through the Secondary Plan. Peak flows within the Study Area, outside of the Secondary Plan, were not revised as no updates were made to the VO model that would impact these reaches of the West Humber River. A summary of the updated HEC-RAS reaches is provided in **Table D1-1** in **Appendix D1**.

In addition to the Regional Storm event peak flows being refined, channel and crossing geometry, and Manning's n-values were refined based on the detailed topographic survey and orthographic imagery, where warranted. West Humber River tributaries that were determined to not have floodplain constraints were not updated. Detailed topographic survey of Campbell's Cross Creek and West Humber River reaches WHT4(2)-1, WHT4(3)-1, and WHT4(3)-2 could not be obtained due to access constraints where they passed through participating landowners. It is not anticipated that the limits of development will be governed by the floodplain constraints along these reaches, therefore the HEC-RAS geometry was not updated. The HEC-RAS model for Campbell's Creek Tributaries WHT4(3)2, WHT4(3)3, WHT4(3)4, and WHT4(3)5 (including associated existing arterial road crossings) was updated. The updated HEC-RAS model and model results are provided in **Appendix D3**.

Floodplain mapping through the Secondary Plan was prepared based on the updated hydraulic modelling. The revised Regional Storm floodplain has been provided on **Figures D2-3B** to **D2-8B** in **Appendix D2**.

The following stormwater runoff control criteria have been established based on the requirements of each of the design guidelines and standards listed in **Section 2.1,** the MTLOG terms of reference in **the** Appendix A of the Phase 1 SWS, and the scope outlined in the Pre-Application Review Committee (PARC) checklist. The stormwater runoff criteria are summarized below in **Table 2.3**. Please note that the MECP CLI ECA SWM criteria is superseded by the Final Report Humber River Hydrology Update (June 2015).

Table 2.3 – Stormwater Runoff Control Criteria

Criteria	Control Measure	Agency
Quantity Control	Per Table E.1 of the TRCA Stormwater Management Criteria, control post-development peak flow rates per unit flow Equation F Sub-Basin 36. Regional Storm controls are required.	TRCA, Town TRCA
Quality Control	MECP Enhanced Level Protection (80% TSS Removal).	TRCA, Town
Erosion Control	Minimum 5 mm on-site retention. Attenuation of the 25 mm rainfall runoff for a minimum of 48 hours.	TRCA TRCA, Town
Water Budget	Maintain existing groundwater recharge rates and appropriate distribution, ensuring the protection of related hydrology ecologic functions.	TRCA
Temperature Mitigation	SWM pond outflows should target discharge water temperatures below 24 degrees Celsius.	MECP

2.4 Geotechnical and Hydrogeology

This section summarizes the geological and hydrogeological conditions assessed and characterized in Section 3.4 of the Phase 1 SWS.

Based on subsurface investigations, the underlying soil and groundwater conditions and Study Area geology was characterized and used to support the hydrogeological study. In general, a regional deposit of stiff to hard cohesive glacial till was encountered across the Study Area, underlain at depth in some boreholes by very dense cohesionless glacial till. Underlying the glacial till, many boreholes encountered various cohesionless deposits of typically compact to dense sands and silts. Gravel deposits were locally encountered at depth in some of the boreholes advanced in the northern part of the Study Area, and locally in the eastern part of the Study Area. Based on the background review and regional stratigraphic units, the upper glacial till deposits are interpreted to be the Halton Till formation, forming the Halton Aquitard. The deeper deposits of cohesionless glacial till underlying the upper cohesive till or the sands, silts, and gravels are interpreted to be Newmarket Till, forming the Newmarket Aquitard. The deposits of sands and silts could be part of the Oak Ridges Aquifer Complex

(ORAC), or where thinner, could be part of the Halton or Newmarket Till formations. The local gravels and gravelly deposits are interpreted to be part of the ORAC.

When assessing groundwater flow directions, Study Area data was relatively consistent with the SABE Scoped SWS reporting. Artesian groundwater conditions were encountered in several locations, particularly along the watercourse or near a HDF on Properties 8 and 9. In general groundwater appears to flow towards the southeast, with local flows towards topographic lows such as valley features and watercourses. The major valley features associated with Channel Reaches WHT4(3)-2 and WHT4(3)-1 appear to cut into the water table and groundwater discharge occurs along the valley walls, eventually running off into the watercourse.

Based on the results of the subsurface investigation, several wells within the northern portion of the Study Area intersect the ORAC. The top surface of the ORAC appears to slope towards the southeast significantly. Based on the groundwater levels measured within the monitoring wells screened within the ORAC, the groundwater table within the ORAC does not slope as significantly as the upper surface of the ORAC and instead slopes gently towards the southeast. Therefore, the groundwater table within the ORAC becomes confined by the overlying Halton Till in the northeast portion of the Study Area and results in a pressurized aquifer system in this local area. Artesian conditions have been identified on Properties 8 and 9.

The GEI results measured a hydraulic conductivity typically on the order of 5×10^{-7} to 5×10^{-8} m/s for the Study Area soils tested. The bulk of this testing was completed within the Halton Till aquitard.

Some exceedances for PWQO metals were encountered in the groundwater samples tested. The filtered groundwater results show that filtration will reduce the amount of metal exceedances within the groundwater. Metals often bind to, or are associated with the mineral content of, sediments, which are removed by filtering.

Preliminary water balance calculations for existing (pre-development) conditions found the average annual runoff volume ranged from about 12,302 to 151,856 m^3/year for the participating properties, and the average annual infiltration volume ranged from about 16,500 to 103,400 m^3/year for the participating properties. The total yearly target for infiltration across the Study Area (including participating and non-participating properties) is 841,346 m^3/year.

The water table across the Study Area varies seasonally and with precipitation events, and therefore in some areas, groundwater discharge is only observed when the water table is high in the spring or following significant precipitation events. The Study Area is generally underlain by low-permeability Halton Till, which limits the rate of groundwater seepage. In locations where the topography slopes steeply, the ground surface intersects with the water table, allowing for limited groundwater seepage to emerge at the surface. In other areas, where underlying coarser sediments (i.e., ORAC deposits) are also exposed in slopes, gullies or channels, groundwater discharge from these deposits flows into and supports the nearby watercourse to some degree.

Based on the field investigations, very few natural features appear to interact with the ORAC. It is expected that the West Humber River tributary on the far east portion of the Study Area may interact with the ORAC sediments where the tributary flows through the northern portion of the Study Area

(Properties 7, 8 and 9), supporting the baseflow of the tributary. Wetlands associated with this tributary may also receive groundwater discharge from the ORAC unit where they are deep enough to intersect the unit. The tributary that extends through Property 1 (WHT4(3)5-1) may also interact with ORAC based on the relative elevation of sand encountered at MW13 (below 254.5 masl) and the elevation of the channel bottom in the southeastern part of that property (around 250 masl).

Precipitation and temperature trends observed in 2024 showed generally higher than average temperatures, and several extreme precipitation events alternated with periods of very little precipitation. Therefore, the monitoring conducted throughout 2024 is expected to be representative of future climate conditions under climate change, and the data collected in 2024 is considered to be representative of current and future normal conditions.

A slope stability study and erosion hazard assessment were completed to determine the long-term stable top of slope (LTSTOS) position for confined valley systems in the Study Area. The Study Area is within TCRA jurisdiction; therefore, the slope stability study followed TRCA guidelines within *The Living City Policies for Planning and Development in the Watersheds of the Toronto and Region Conservation Authority* dated November 28, 2014. The study also followed provincial guidelines within *Technical Guide – River and Stream Systems: Erosion Hazard Limit,* dated 2002, by Ministry of Natural Resources. Visual slope inspections were conducted and identified low to moderate risk for instability for the various confined valley slopes in the Study Area. The assessment estimated the toe erosion allowance, stable slope allowance, and LTSTOS position. The LTSTOS position ranged from coinciding with the existing top of slope to being set back 23.8 m from the top of slope. A 10 m erosion access allowance was then applied beyond the LTSTOS following TRCA's *The Living City Policies* (2014), to determine the overall Erosion Hazard Limit. GEMTEC provided slope stability setbacks specific to Properties 9 and 10. The assessment was used to support valleyland limits and setbacks for the NHS.

2.5 Surface Water Quality

This section summarizes the surface water conditions assessed and characterized in Section 3.5 of the Phase 1 SWS.

Surface water quality monitoring was completed in spring, summer and fall of 2024 in both dry conditions (no precipitation for several days leading up to the monitoring) and wet conditions (monitoring completed at the onset and end of precipitation events). Surface water quality was assessed by measuring a variety of parameters both in the field and through sample submission for laboratory analysis. Surface water quality compared to Provincial Water Quality Objective (PWQO) was fairly consistent across the Study Area and varied seasonally and with precipitation events. All monitoring stations exceeded E.Coli and Total Phosphorus during most sampling events but generally had acceptable levels of dissolved oxygen. Generally, iron and tungsten exceedances were recorded across the Study Area in the fall. For all stations, oxidation reduction potential increased throughout the monitoring period.

2.6 Climate Change

This section summarizes the climatic conditions assessed and characterized within Section 3.6 of the Phase 1 SWS.

A review of relevant historical climate trends within the region was completed within the Phase 1 SWS, sourced from observed station data, future climate projections, and local climate reports to characterize how the climate has changed and anticipated to do so in the future. Key climate variables were analyzed, including precipitation trends; temperature; drought conditions; growing season and Intensity-Duration-Frequency (IDF) conditions. Building upon work undertaken by the TRCA and Credit Valley Conservation Authority (CVC), GEI undertook a climate analysis using two comparative climate scenarios from the Sixth Phase of the Coupled Model Intercomparison Project (CMIP6), known as Shared Socioeconomic Pathways (SSPs) (Climatedata.ca). The two scenarios represent a high emission, SSP5 (Fossil-fueled Development), characterized by high challenges to mitigation and low challenges to adaptation, and SSP2 (Middle of the Road), characterized by moderate challenges to both mitigation and adaptation. As noted, the SABE's technical climate change study focused on energy and mitigation instead of climate adaptation, risk and resilience. As a result, GEI focused in on these components to characterize changes in climate conditions and potential impacts to the NHS and wildlife in Caledon and more broadly in the Region of Peel.

3. Development of the Preferred Land Use Plan

The Preliminary Land Use and Transportation Plan (**Figure 3-1**) was prepared based on an iterative review of land use options based on the establishment of the existing conditions presented in the Phase 1 SWS. The project team has considered the potential impacts of proposed land use changes with respect to the natural heritage features, hydrology and hydraulics, hydrogeology and geotechnical, surface water, and climate change as part of this Phase 2 report.

While developing the proposed land use plan, the team considered a number of alternative approaches to meet community, transportation and servicing needs of the Secondary Plan Area, and evaluated these alternatives based on the existing conditions outlined in the Phase 1 SWS. This report provides a more thorough review of potential impacts to the existing conditions outlined above, and considerations required to ensure the preferred land use plan has the ability to meet the goals outlined in the Phase 1 SWS (Section 1.2 Goals and Objectives).

The following goals were outlined in the Phase 1 SWS:

- Natural Heritage: To protect, restore or, where appropriate, enhance the biodiversity, connectivity and ecological functions of the natural heritage features and areas throughout the Study Area for the long term.
- Natural Hazards: To prevent, eliminate or minimize the risks to life and property caused by natural hazards such as flooding and erosion hazards and ensure existing hazards are managed.
- Water Resources: To protect, improve and/or restore the quality and quantity of water resources within, adjacent to and downstream of the Study Area, including their associated ecological and hydrologic / hydrogeologic functions.
- Stormwater Management (SWM): To mitigate negative impacts related to the quality and quantity of stormwater within, adjacent to, and downstream of the Study Area

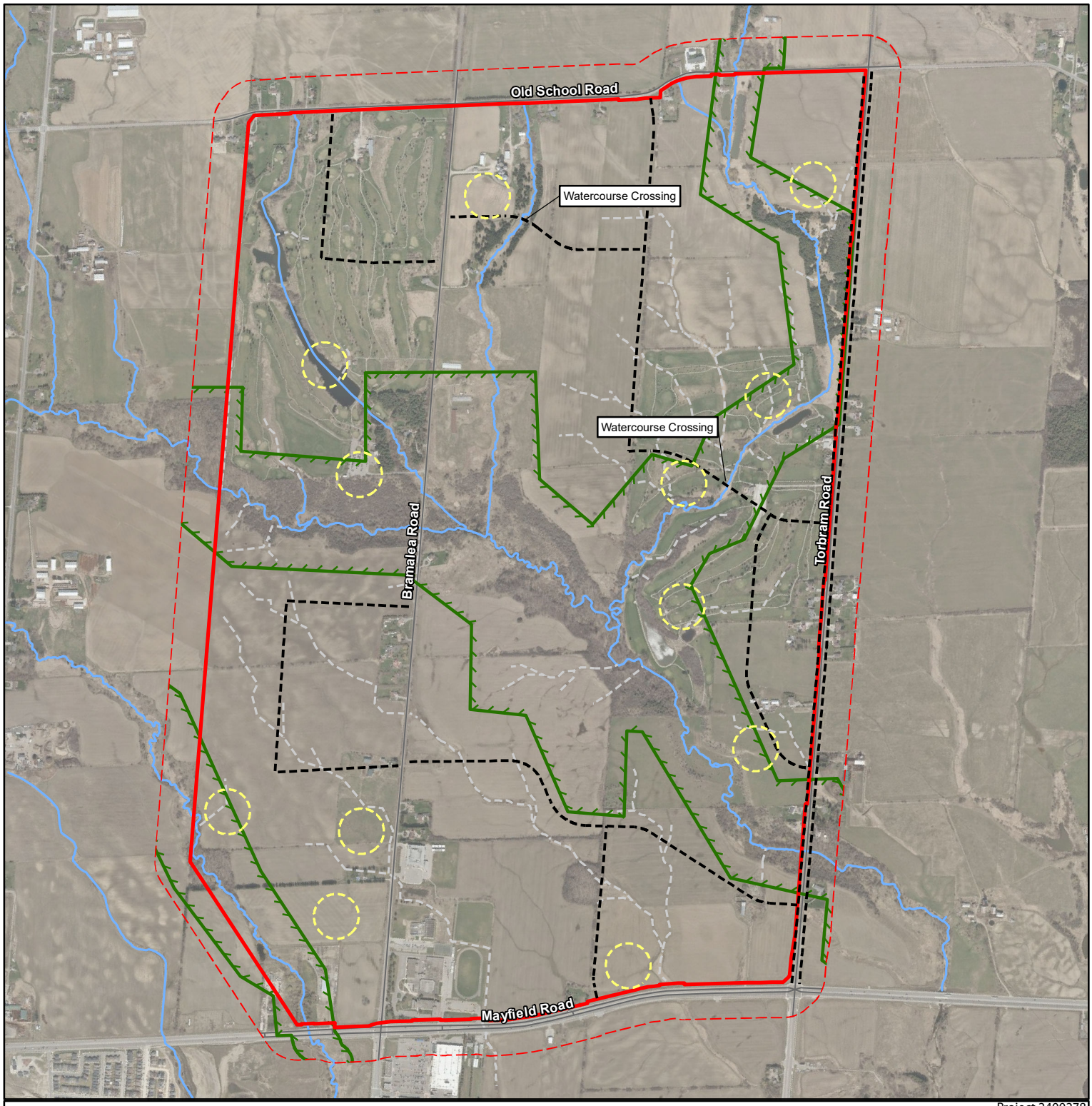
According to the *Town of Caledon Official Plan* (2024d Consolidation), the existing land uses within the Study Area are predominantly *Prime Agricultural Areas* and *Environmental Policy Areas*. The Future Caledon Official Plan (Draft, 2024a) is not yet in force, but has been updated to implement the revised land use goals outlined in the Peel Region Official Plan (2022) – which was informed by the SABE work completed, for the Study Area. The preferred land use plan (as shown on **Figure 3-1**) introduces high-level land uses including Neighborhood Areas, Natural Features and Areas, and Open Spaces; uses will likely include a wide range of residential, institutional, commercial, and community uses such as parks, schools, community centers and emergency services. It also shows the preferred alignment for collector roads, and approximate SWM facility locations.

In general, the Preliminary Land Use and Transportation Plan has evolved to prioritize a contiguous NHS that includes key Greenbelt NHS features and other features that have been identified as Natural Features and Areas and/or Supporting Features and Areas under the Future Caledon OP. From there, the net gain mitigation hierarchy process has helped to further refine a proposed NHS for integration

into the Preliminary Land Use and Transportation Plan and considers restoration, enhancement and compensation opportunities. In general, through the SWS, considerations for Neighborhood Areas (including proposed parklands, and potential institutional uses) have been vetted as part of this SWS to limit and mitigate impacts to natural heritage, consider climate change impacts, and address SWM considerations.

Collector road alignment options were reviewed by the multidisciplinary team and the preferred option, as depicted in **Figure 3-1**, is proposed as it minimizes natural heritage feature crossings. Several alternatives were explored but these would have required multiple high constraint watercourse crossings, which would impact multiple features including woodlands, wetlands, valleylands and occupied Redside Dace habitat. The alignment selected reduces this to a single high constraint watercourse crossing through the already degraded golf course lands (which will also be designed to utilize an existing crossing associated with a golf course path) and a single medium constraint crossing associated with non-significant features. More details on road alignment and impact considerations are included in the impact assessment section of this report, however the majority of detailed impact assessments will be deferred to the Municipal Class Environmental Assessment (MCEA) required for municipal road infrastructure (see **Section 7.1).**

Figure 3-1. Preliminary Land Use and Transportation Plan (MGP, 2024)



NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2025, © Town of Caledon, 2025, © Toronto and Region Conservation Authority, 2025, © Peel Region, 2025.

*SWM location are for visualization purposed only and are not representative of final location or sizingg at this stage. As noted in the Phase 2 SWS, all SWM locations are expected to be located outside of the proposed NHS and associated VPZs.
3. Orthoimagery © First Base Solutions, 2025. Imagery taken in 2022.

Legend
- Study Area
- Study Area + 120m
- Greenbelt Plan Area
- Watercourse (GEI 2024)
- Headwater Drainage Feature (GEI, Beacon)
- Proposed Collector Road Alignment
- Proposed Stormwater Management Pond Locations*

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Mayfield Tullamore Local Subwatershed Study
Phase 2 - Subwatershed Impact Assessment

Figure 3-1
Preferred Structure Plan

0 400 m
1:18,000

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4. Hydrologic Assessment

4.1 Proposed Drainage

Three tributaries of the West Humber River identified as "General River" on the Humber River Hydrology map are located within the Secondary Plan extents. Each of the three reaches have associated floodplain constraints per the Engineered Floodplain Mapping provided by the TRCA (relevant excerpts provided in **Appendix D4**). Campbell's Cross Creek is located at the southwestern corner of the Secondary Plan (Catchment 29.15 on **Figure D2-1B**) and generally slopes from north to south before crossing Mayfield Road via an existing 10.67 m wide x 2.44 m high concrete box culvert. A tributary of the West Humber River (noted as Reaches WHT4(2)-1, WHT4(2)-2, and WHT4(3)-2) passes through the approximate center of the Secondary Plan (Catchments 30.04, 30.03, 30.01, and 32.27 on **Figure D2-1B**) and generally slopes from west to southeast. The tributary crosses two arterial roads within the Secondary Plan, one crossing occurs at Bramalea Road via a 4.9 m wide x 1.8 m high concrete box culvert and the other crossing occurs at Torbram Road via an 8.0 m wide x 4.4 m high concrete elliptical culvert before leaving the Secondary Plan. A lesser tributary of the West Humber River (noted as Reaches WHT4(3)2-1a, WHT4(3)2-1b, and WHT4(3)3-1) is located along the eastern edge of the Secondary Plan (Catchment 31.01 on **Figure D2-1B**) and generally slopes from north to south before joining the central West Humber River tributary at the upstream end of Reach WHT4(3)-1. The lesser West Humber River tributary enters the Secondary Plan via an existing 4.95 m wide x 1.72 m high concrete box culvert under Old School Road.

Under proposed development conditions, the proposed grading and drainage for the Secondary Plan area will maintain existing drainage conditions as described in Section 3.3.3 of the Phase 1 Local SWS (SCS and GEI, December 2024) to the extent feasible. The proposed Structure Plan (**Figure 7-1**) provides collector road locations and general land use, with local road layout and lotting to be established later through the Draft Plan of Subdivision stage of the development process.

For the purposes of identifying potential impacts of the proposed land use on water resources, and determining a SWM strategy to mitigate those impacts, preliminary collector road proposed grading has been used to delineate proposed storm drainage catchments (**Figure A2-1**, in **Appendix A2**). Considering the existing drainage patterns outside the Secondary Plan area, in addition to the location of existing culverts, land ownership, natural heritage features and the proposed Structure Plan preliminary grading (**Figure A2-2, Appendix A2**), it is anticipated that runoff from the proposed development will typically outlet directly to adjacent watercourses. Two existing culverts are anticipated to be utilized as outlets from the Secondary Plan. As shown on **Figure D2-1B** in **Appendix D2**, Catchment 32.26 will outlet southwards to an existing 2400 mm wide by 1750 mm high CSP arch culvert on Mayfield Road, and Catchment 29.13 will outlet eastwards underneath Bramalea Road via an existing 900 mm diameter CSP culvert before ultimately draining south underneath Mayfield Road via an existing 1390 mm x 750 arch CSP culvert. The existing conditions drainage areas to each of these outlets have been delineated as shown on **Figure D2-1** of the Phase 1 Local SWS (SCS and GEI, December 2024).

It is anticipated that the proposed drainage strategy will include one area where storm drainage boundaries will be modified significantly to accommodate the development of the Secondary Plan area as outlined below and illustrated on **Figure D2-2B** (**Appendix D1**).

The drainage from the 22.73 ha portion of existing Catchment 32.26 west of Bramalea Road, will drain south under proposed conditions to proposed SWM facilities ultimately draining to Campbell's Cross Creek (2).

Under existing conditions catchment 32.26, 110.45 ha in size, drains southeasterly underneath Bramalea Road to the northern ditch on Mayfield Road, before draining southwards through existing culverts on Mayfield Road, ultimately to a tributary of the West Humber River. There are no features within or downstream of the Secondary Plan area that will be impacted by diverting the proposed drainage southwestwards. Due to the small size of the re-directed drainage area and to minimize the number of SWM facilities, this portion the drainage from catchment 32.26 will be combined with drainage from catchments 29.15 and 29.13 discharging ultimately to Campbell's Cross Creek (2).

The purpose of this drainage diversion is to remove the requirement to convey drainage from development west of Bramalea Road through development east of Bramalea Road. Replicating the existing drainage divides in this area is anticipated to result in significant infrastructure requirements as the flows from the lands west of Bramalea Road would need to be captured and conveyed in the storm sewer system through the lands east of Bramalea Road to the proposed outlet at Mayfield Road. Additionally, the SWM facility located at Mayfield Road that would treat runoff from proposed Catchment 32.26 would have a much larger area than typical (approximately 110 ha) which would require a significant SWM block size in a location that is anticipated to have higher density development. There are several existing outlets from the Secondary Plan for development west of Bramalea Road that can be utilized for the 22.73 ha of drainage from Catchment 32.26.

It is proposed to generally maintain existing drainage patterns for all remaining catchments within the Secondary Plan area (i.e. 30.03, 30.02, 30.01, 31.01, 32.27, 32.26, and 29.14), as well as for all external catchments (i.e. 30.04, 30.08, 30.10, 31.02, 32.24 and 32.28). Developable lands within the Secondary Plan and outside of the greenbelt have been consolidated based on anticipated proposed SWM facility locations to be confirmed in the Phase 3 Local SWS. Existing drainage divides within the developable lands within the greenbelt have been assumed to be maintained.

As noted in Section 4.1.1 of the Phase 1 Local SWS (SCS and GEI, December 2024), existing external drainage is conveyed through the Secondary Plan area via existing watercourses. No other external drainage enters the Secondary Plan area.

The proposed drainage strategy outlined above is based on the preferred Structure Plan and the information available as part of this Local SWS. Post-development drainage areas will be established through subsequent Draft Plan of Subdivision grading, servicing and SWM designs. Ultimately, the Draft Plan drainage strategy may differ from that presented based on more detailed grading and servicing information.

4.2 Hydrologic Modelling

In order to determine the hydrologic impact of the proposed Structure Plan (**Figure 7-1**) on surface water resources, the peak flows to i) both of the existing culverts identified in **Section 4.1.1**, ii) each of the watercourses through the Secondary Plan area, and iii) to the downstream Main Humber River flood vulnerable area were determined utilizing the Visual Otthymo Version 6.2 hydrologic model. As noted in the Phase 1 Local SWS (SCS and GEI, December 2024), the most recent calibrated hydrologic model for the Humber River watershed was obtained from the TRCA in January 2024 and discretized to establish existing conditions for the Regional Storm event. This same model has now been utilized to complete the hydrologic assessment of peak flows for this Phase 2 Local SWS. The Phase 1 model was prepared using the existing conditions scenario. The Phase 2 Local SWS analysis provides results from the development of the Secondary Plan in the existing conditions and future conditions scenarios to confirm proposed peak flows at downstream FVAs.

For the proposed conditions model, percent imperviousness was determined for each catchment based on the land uses indicated on the proposed Structure Plan (**Figure 7-1**). The percent imperviousness for each land use was calculated based on typical values or by converting the associated Runoff Coefficient from the Town of Caledon Development Standards Manual (Version 5, 2019). The percent imperviousness's for the catchments detailed on **Figures D2-1B** and **D2-2B (Appendix D2**) are summarized in **Tables D3-1 and D3-2 (Appendix D3)**.

Using the updated hydrologic model, the proposed condition Regional Storm event uncontrolled peak flows were determined at significant locations throughout the Secondary Plan. Refer to **Appendix D3** for the hydrologic model schematic, summary output for the catchments and a digital link to the hydrologic modelling files. **Section 7.4** details the results of the peak flow comparison and impacts on the existing Regional floodplain and conveyance infrastructure.

The 2 through 100 year storm events were not modelled as part of the Phase 2 Local SWS as unit release rates have been established throughout the Secondary Plan and therefore, proposed peak flows from these storm events are anticipated to be less than existing conditions.

5. Grading

5.1 Grading

Per the topographic survey provided in the Phase 1 Local SWS (SCS and GEI, December 2024), the Secondary Plan area is generally comprised of rolling agricultural lands with a grade range of less than 1% to approximately 6%. The topographic elevations vary from approximately 273.0 m at the northwestern limit of Secondary Plan area to approximately 243.0 m at the southeastern limit. The Secondary Plan area is divided by three tributaries of the West Humber River. The rolling topography generates several distinct low points along Bramalea Road, Torbram Road, and Mayfield Road. Existing culverts are located at each of the distinct low points to convey stormwater runoff within or outside the limits of the Secondary area.

A preliminary grading concept showing centerline road grades based on the proposed Structure Plan is provided on **Figure A2-2, Appendix A2**. Due to the relatively flat grades through portions of the Secondary Plan, a minimum road grade of 0.5% has been utilized where necessary to achieve continuous overland drainage towards the anticipated low points of the Secondary Plan development. It is noted that on **Figure A2-2**, there are proposed road slopes less than 0.5%. Once the local road layout is defined at the tertiary plan stage, these proposed slopes will be updated to a minimum road grade of 0.75% (minimum Town criteria) using lot or embankment grading. The local road network will coincide with the collector road low points to provide a continuous overland flow path to the ultimate storm outfall locations. Where capture of the 100 year storm event is required, the proposed grading will allow for emergency flows to be directed overland to the ultimate storm outfall or adjacent arterial road right-of-way. The proposed grading concept generally matches the existing topography to the extent possible to minimize the cut and fill volumes.

Per the current Highway 413 preliminary concept mapping, the Highway 413 Focused Analysis Area is not impacting lands within the Secondary Plan Area. Therefore, no grading considerations are required.

In general, proposed development within the Secondary Plan area must be graded in a manner which will satisfy the following goals:

- Satisfy the Town of Caledon lot and road grading criteria including:
    - Minimum Road Grade: 0.75% (exceptions proposed as necessary as outlined above)
    - Maximum Road Grade: 6.0%
    - Minimum Lot Grade (split lots): 2%
    - Minimum Lot Grade (front draining lots): 3%
    - Maximum Lot Grade: 5%
    - Maximum slope between houses in any direction: 4:1
    - Provide a 0.6 m wide gently sloped area at 2.0% away from the house on at least one side of the building where side yard setbacks permit;
- Provide continuous road grades for overland flow conveyance;
- Minimize the need for retaining walls;

- Minimize the volume of earth to be moved and minimize cut/fill differential;
- Minimize the need for rear lot catchbasins; and
- Achieve the stormwater management objectives required for the proposed development.

A more detailed grading design utilizing the criteria noted above will be provided as part of the Tertiary Plan submission. The preliminary grading shown on **Figure A2-2, Appendix A2** will be used as the basis for grading within individual parcels. The collector road grading is subject to change at the Tertiary Plan and Draft Plan of Subdivision application stages, as required, to balance the cut and fill volumes and minimize slopes and walls.

Grading is not anticipated to be required within the NHS for the implementation of infrastructure, trails, or roads. Transition grading may be required within buffers to satisfy the goals listed above. Any grading proposed within buffers will be confirmed as part of the future applications for affected properties.

6. Proposed Natural Heritage System

6.1 Summary of Natural Heritage System Goals

Goals and objectives have been established for the Study Area at a sub-watershed level based on the most current information and approaches for sub-watershed level studies within the Town of Caledon.

The goals for the SABE NHS include the following, as outlined in the *Scoped Subwatershed Study, Part A: Existing Conditions and Characterization* (Wood et al. 2022a):

- "Develop a system (NHS) that balances policy direction, emerging science and natural heritage planning best practices;
- Establish a robust, connected and ecologically resilient system (NHS) for the long-term benefit of environmental and public health, well-being and safety; and
- Provide opportunities and direction for the enhancement of the NHS to establish a sustainable system in a changing landscape matrix and that supports climate change resilience."

The SABE Study also included a technical study on climate change entitled *Opportunities for Climate Change Mitigation, Energy and Emissions Reductions*. This report establishes a vision for the SABE area to be a low carbon community, with the ultimate goal of transitioning to net zero overtime. The Town of Caledon has incorporated this policy direction in the *Future Caledon Official Plan* (2024a), including policies that prioritize climate change at the forefront of land use planning decisions. Goal 2.4.1(a) is to achieve a built form and system of infrastructure that mitigates the Town's contribution to climate change and enhances resiliency to its impacts.

Goals and objectives have been established for the Study Area related to four critical areas including Natural Heritage, Natural Hazards, Water Resources and Stormwater Management, and were developed to integrate the goals outlined in the SABE Local SWS These goals are integral to the assessment of the preferred land use for the Mayfield Tullamore Secondary Plan Area.

6.1.1 Natural Heritage

Goal:

To protect, restore or, where appropriate, enhance the biodiversity, connectivity and ecological functions of the natural heritage features and areas throughout the Study Area for the long term.

Objectives:

- Through the net gain mitigation hierarchy, ensure that natural heritage features and their ecological and hydrological functions are protected from potential adverse and cumulative impacts of development within the Study Area;

- To ensure that buffers, corridors and linkages between natural features and areas, surface water features and groundwater features are maintained, restored or, where possible, improved through the establishment of the NHS;
- Establish environmental targets to maintain, restore and enhance existing conditions;
- To establish development standards and land use controls that will ensure the proposed structure plan does not negatively impact the NHS;
- To consider climate change mitigation and adaptation measures as part of the development of natural heritage management strategies;
- To establish a healthy and diverse NHS that compliments and enhances the ecological functions of existing habitat types;
- Recommend monitoring and adaptive management opportunities for the NHS;
- Provide direction for implementation that will support future stages of land use planning and decision-making in achieving net benefit outcomes for the NHS; and,
- To develop integrated SWM plans to help manage water balance with the intent to maintain both hydrological and ecological function of features within the adjacent NHS.

6.1.2 Natural Hazards

Goal:

To prevent, eliminate or minimize the risks to life and property caused by natural hazards such as flooding and erosion hazards and ensure existing hazards are managed.

Objectives:

- To ensure land use changes do not increase the frequency and intensity of flooding, the rate of natural stream erosion or increase slope instability;
- To establish development standards, land use planning and engineering practices that ensure future development is located outside of, and appropriately setback from, flooding and erosion hazards;
- To ensure that proposed land use changes explore appropriate mitigation measures in order to avoid adverse impacts to natural features and areas as it relates to natural hazards; and
- To consider climate change adaptation measures as part of flooding and erosion management strategies.

6.1.3 Water Resources

Goal:

To protect, improve and/or restore the quality and quantity of water resources within, adjacent to and downstream of the Study Area, including their associated ecological and hydrologic/hydrogeologic functions.

Objectives:

- To ensure fluvial processes and stream morphology are maintained or improved to support important habitat attributes (pools, riffles, etc.), dynamic channel form and diversity which will contribute to maintaining a sustainable NHS;
- To prevent nutrient enrichment and contamination of surface and groundwater resources from proposed land use changes;
- To ensure surface and groundwater features and their hydrologic functions are protected, improved or restored;
- To maintain important linkages and related functions among groundwater features, functional groundwater recharge, surface water features, hydrologic functions, and natural heritage features and areas; and
- To consider climate change mitigation and adaptation measures as part of establishing management strategies.

6.1.4 Stormwater Management

Goal:

To mitigate negative impacts related to the quality and quantity of stormwater within, adjacent to, and downstream of the Study Area.

Objectives:

- To maintain/enhance baseflow to the receiving regulated watercourses to maintain existing hydrologic function;
- To ensure that post- to pre-development peak flow control criteria is achieved for all storm events (2 year to 100 year) and including the Regional Storm event;
- To mitigate changes to existing flow-duration exceedance characteristics and other erosion indicators in the receiving regulated watercourses;
- To ensure that the treatment of runoff mitigates surface water quality impacts due to development in accordance with MECP guidelines, to an *enhanced* standard;
- To mitigate thermal impacts from stormwater runoff to the extent possible;
- To consider Low Impact Development (LID), Green Infrastructure and Best Management Practices (BMPs) to treat stormwater at its source; and
- To consider climate change mitigation and adaptation measures as part of establishing SWM strategies.

6.2 Summary of SABE Natural Heritage System Targets

The SABE SWS also outlines recommended targets for the NHS within the SABE area. These targets are recommendations that should be explored through the local SWS to support the identification and planning of the NHS. Targets for feature types are as follows:

- **Natural cover:** no net loss;
- **Wetlands:** no net loss of wetland cover; increase total wetland cover through NHS enhancements;
- **Valley and Stream corridors:** no net loss of ecological and hydrological functions; increase natural cover within these corridors through enhancements
- **Successional/Open Habitats:** Maintain important existing successional / open habitats contiguous to other features and areas of the NHS; increase representation and quality of open country habitats across the landscape through NHS enhancement opportunities; strive to create at least one habitat area with a minimum size threshold of 5 ha
- **Aquatic:** achieve 75% naturally vegetated watercourse length through protection, enhancement or restoration
- **Sand Barrens, Savannahs, Grasslands:** protect these where they occur
- **NHS Enhancements:** identify and distribute enhancement opportunities across the NHS to support a robust and sustainable system; increase natural cover by 30%

It is the intention of the SWS to demonstrate how these targets can be achieved by adhering to the Net Gain Mitigation Hierarchy (discussed below in **Section 6.4.2**) and by promoting an ecosystem offsetting approach that would be further defined through subsequent site-specific planning applications. Recommendations as it relates to ecosystem offsetting/compensation to achieve no net loss are discussed in **Section 10**.

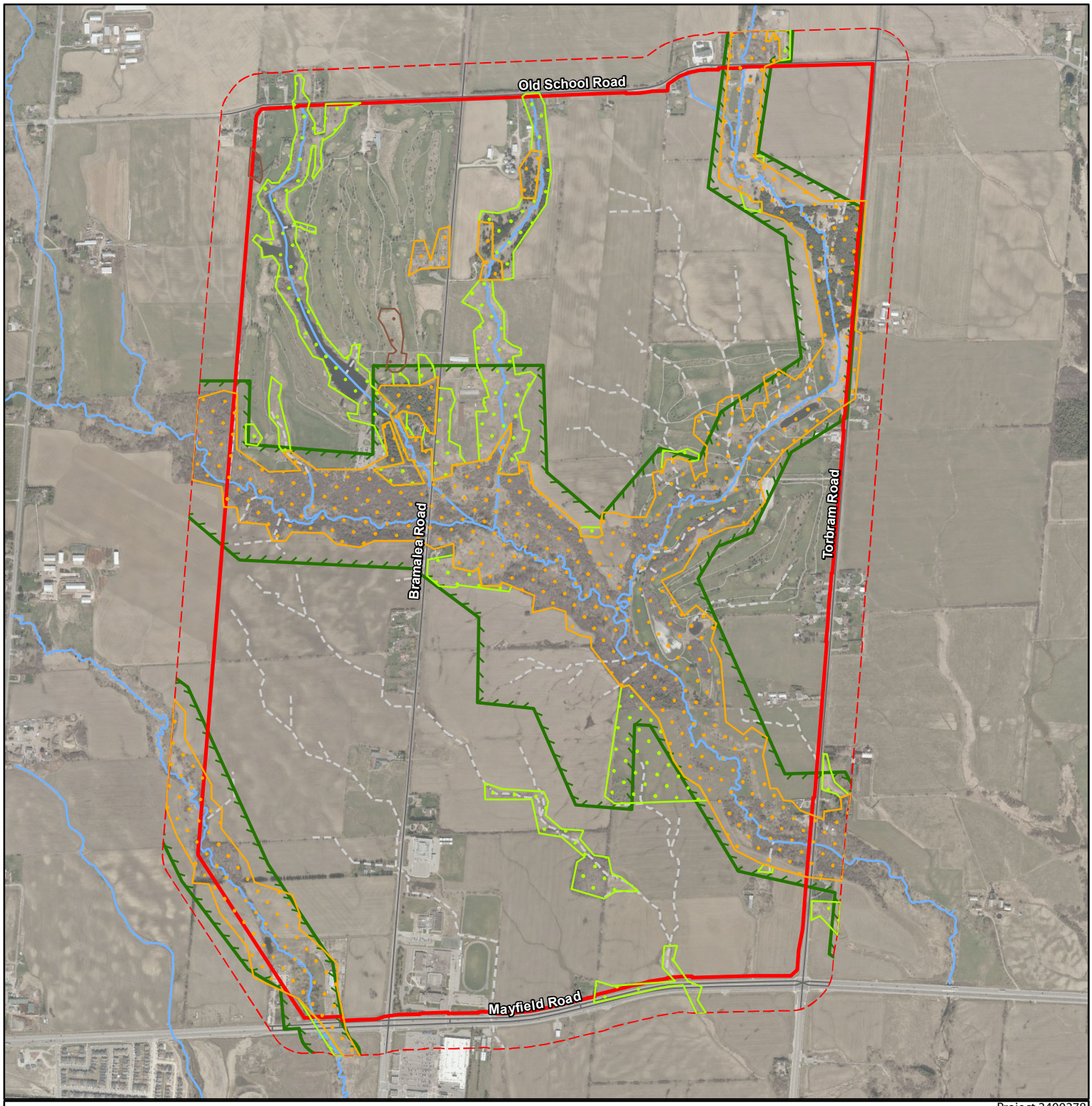
A fulsome review of these targets in the context of the proposed NHS is found in **Table 10-3**, **Section 10**.

6.3. System Components

In order to define the preliminary NHS as part of the SABE Scoped SWS, the following five feature classes were identified and integrated into the preliminary SABE NHS as shown in Drawing DA2-14 (depicted in **Figure 6-1**):

- Key Features;
- Supporting Features;
- Other Features;
- Linkages; and,
- Enhancements.

Figure 6-1. SABE NHS



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NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2025, © Town of Caledon, 2025, © Toronto and Region Conservation Authority, 2025, © Peel Region, 2025.
3. Orthoimagery © First Base Solutions, 2025. Imagery taken in 2022.

Legend
- Study Area
- Study Area + 120m
- Greenbelt Plan Area
- Watercourse (GEI 2024)
- Headwater Drainage Feature (GEI, Beacon)

SABE Preliminary NHS*
- Key Features
- Supporting Features
- Other Features

*SABE Preliminary NHS linework has been drawn using the best approximation from Figure DA2-11b of the SABE

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Figure 6-1
Peel Region SABE Preliminary Natural Heritage System

0 400 m
1:18,000

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The following subsections describe each of these feature classes and their presence within the Study Area. These system components were then assessed based on the Net Gain Mitigation Hierarchy that is introduced in **Section 6.4.1** below; and a detailed assessment of how system components will align with the hierarchy is provided in **Sections 6.4.2.**

6.3.1. Key Features

According to the SABE, Key Features are features that are essential natural areas identified for protection as part of a connected NHS. They include all Core Areas from the Peel Regional Official Plan (ROP) and selected Natural Areas and Corridors (NAC) or Potential Natural Areas and Corridors (PNAC) that meet specific criteria set out by the SABE. Key Natural Heritage and some Key Hydrologic Features are also captured in this category.

Based on the NHS definitions set out in the SABE listed above, the following key features were identified within the Study Area:

- PSWs (associated with all wetlands in the Greenbelt Plan Area);
- Significant Woodlands (associated with all woodlands in the Greenbelt Plan Area);
- Valley and Stream Corridors (associated with all medium and high constraint watercourses);
- SWH (candidate and confirmed);
- HDFs identified as 'Protection' or 'Conservation' (HDF 3A, 3C and 4C);
- Habitat for Aquatic SAR (Occupied Redside Dace Habitat), and
- Habitat for endangered and threatened species (Butternut, Eastern Meadowlark, Bobolink, Redside Dace and candidate SAR Bats).

6.3.2 Supporting Features

Supporting Features: These areas do not initially qualify as Key Features but meet criteria for Supporting Features. Depending on their function, they may require in-situ protection, replication, compensation, or no management. These generally include NACs and PNACs, as defined in Table 2.5.2.8 and Table 2.5.2.10 within the Part A SABE.

Based on the NHS definitions set out in the SABE Scoped SWS listed above, the supporting features were identified within the Study Area:

- Non-significant wetlands (MAM2-2, MAM2-10, MAMM1-12, MAMM1-2, MAS2-1, SWT2-5, SAF1-3),
- Other valleylands (associated with HDF 3A);
- Non-significant woodlands (FOD5-4, FODM7-7, and CUP3-14);
- Contributing Habitat for Redside Dace (Aquatic SAR);
- HDFs identified as 'Mitigation' (all HDFs within the Study Area, except HDF 3A, 3C and 4C); and
- Fish habitat (direct and indirect; other than those providing Occupied Habitat for Redside Dace and inclusive of the golf course ponds within Property 1).

6.3.3 Other Features

Other Features: These features are typically smaller, isolated, or require additional assessment to confirm their ecological value or classification. They may offer secondary ecological benefits, and their management needs will be reviewed in future studies.

Within the Study Area, based on the investigations completed during the Phase 1 SWS, other features include isolated, successional habitats (culturally influenced communities including Cultural Meadow (CUM) and Cultural Thicket (CUT)) and the other Open Aquatic (OAO) golf course ponds associated with the Property 9 where no fish habitat has been confirmed to-date.

6.3.4 Linkages

Linkages: These are corridors that help maintain ecological connections within the NHS and link to areas outside of the SABE limits, supporting species movement and system resilience. Linkages ensure that the NHS remains connected across the landscape.

Preliminary linkages and enhancements that were identified as part of the SABE NHS on Drawing D2-11b (Preliminary Natural Heritage System and Enhancements – Central FSA). There are four types of linkages; major landscape linkages, local landscape linkages, feature/site-scale linkages, and conceptual linkages. These linkage types are further defined by their "Minimum Vegetated Widths" (MVWs) and/or "Permeable Landscape Zones" (PLZs; **Table 6-1**).

The MVW is the minimum amount of width of a corridor/linkage that should be comprised of natural, self-sustaining vegetation. All features within this MVW should be retained or enhanced and where buffers are required, the greatest extent of the MVW or buffer shall apply.

The PLZ is a blended transition between natural and built form, which allows for some permeable land uses to support the overall width of a linkage. This could include linkage-compatible uses such as native landscaping, natural design SWM facilities, open space/parks/amenity spaces, urban agriculture or community gardens, or trails. Up to 30% of the PLZ can be used for general development or infrastructure, excluding area constrained by NHS and buffers.

Table 2.1.3.1 of the SABE (Wood et al., 2022b) outlines linkage widths and has been included below in **Table 6-1**.

Table 6-1. SABE Linkage Types (Wood et al., 2022b)

Linkage Type	MVW (m)	Minimum PLZ (m)	Total Minimum Width (m)
Major Landscape Linkage	100	60	160
Minor Landscape Linkage	60	30	90
Feature (or Site) Scale	30	n/a	30

Major Landscape Linkages: These are large, landscape connections (100+ m width) which connect major corridors / areas south and north of the SABE. They are generally aligned with and/or are in the same areas as the province's NHS where linkages are interpreted as a key function. Major Landscape Linkages are comprised of a MVW and a PLZ.

Local Landscape Linkages: These are smaller scale (60+ m width) linkages which provide landscape-level connectivity within or to areas external to the FSA. They often provide important redundancy in landscape connectivity, link and connect blocks of features. Local Landscape Linkages are comprised of a MVW and a PLZ.

Conceptual Linkages: these recognize opportunities to connect to the Peel Greenlands Network or other key areas where the type of linkage has not yet been determined, and linkages that require additional study to determine location, alignment and type. There were no conceptual linkages identified within the SABE for the Study Area.

Feature/Site-specific linkages aren't illustrated within the SABE. These represent small, localized linkages (30 – 59 m width) intended to connect over shorter distances. Feature-Scale Linkages are comprised of a Minimum 30 m Vegetated Width and are expected to be assessed through detailed site investigations.

The following table outlines how each linkage is defined in the SABE and addresses the features that were considered preliminary linkages within the SABE (Drawing DA2-10), and have been ground-truthed during the Phase 1 SWS as depicted in **Table 6-2**. GEI's "average width" calculations are based on a GIS exercise that assesses the width of the feature at 20 m intervals to define an average across the length of the feature within the Study Area.

Table 6-2. Mayfield Tullamore Secondary Plan Linkages

Feature	Linkage Type	Average Width (m)	Proposed minimum VPZ	Total Approximate Minimum Width (m)
West Humber Tributary (North/South) (WHT4(3)3-1, WHT4(3)2-1b, WHT4(3)2-1a, WHT4(2)-2 and WHT4(2)-1)	Major Landscape Linkage	133	15 m from TOB	163
West Humber Tributary (East/West) (WHT4(3)-2)	Major Landscape Linkage	220	15 m from TOB	250
Campbell's Cross Creek (CCC(2))	Minor Landscape Linkage	92	15 m from TOB	122
WHT4(3)4-2 (Predominately within Property 4)	Minor Landscape Linkage	86	10 m from TOB	106
WHT4(3)5-2 (Predominately within Property 1)	Minor Landscape Linkage	90	10 m from TOB	110
HDF3-A (Within Property 9)*	Feature/Site-Scale Linkage	42 m	n/a	42 m

There was a non-significant valleyland feature identified in association with WHT4(3)6-1 within Property 1, however, it is GEI's interpretation that this is likely a gully feature within the larger West Humber Valleyland System; and not a valleyland itself. Based on its short length (154 m) and lack of northern connection point, this has not been considered an independent linkage as part of this SWS.

6.3.5. Enhancements

Enhancements: These are opportunities to improve the structure, connectivity, and ecological function of the NHS, contributing to long-term resilience and meeting net environmental benefit targets. Enhancements may involve reforestation, habitat creation, or restoration efforts. Enhancements are broken down into two main types within the SABE Part B; defined and undefined.

Defined enhancements are discrete areas recommended for complete feature/area restoration. There are three subtypes of defined enhancements:

1. **Improved shape, size and contiguity:** naturalization of terrestrial key and supporting features on the NHS including valleylands, gaps of less than 120 m within the NHS, and connect key features to significant valleylands where they are within 60 m.
2. **Floodplain:** naturalization of floodplain areas where natural cover is currently limited;
3. **Linkage – MVW:** Enhancements associated with the establishment of natural, self-sustaining vegetation to facilitate connectivity for the SABE NHS linkages.

Undefined Enhancements are areas where a portion of the area is recommended for enhancement so support achieving SWS targets. These include the following:

1. **Linkage – PLZs:** Enhancements associated with the establishment of natural, self-sustaining vegetation to facilitate habitat connectivity for the SABE NHS linkages. A minimum of 30% of the PLZ outside of natural cover and buffers comprising the NHS is to be established as natural, self-sustaining vegetation.
2. **Provincial NHS:** Enhancements within the Greenbelt Plan Area and outside of the defined NHS
3. **Un-mapped Enhancements:** areas where, based on detailed studies and targets, opportunities for enhancements to promote habitat diversity, improve feature size/shape and/or achieve species-specific habitat objectives.

Within the SABE Phase 2 report, Drawing DA2-11b "Preliminary Natural Heritage System and Enhancements – Central FSA" identifies the following preliminary areas for enhancement consideration within the Study Area:

- Improved Shape, Size and Continuity:
  - Property 1: Associated with the Orchard community in the golf course
  - Property 4: Associated with the piped watercourse, and a small area along the eastern edge of the CUP3-14
  - Property 7, 8, 9, 10 and 11: Associated with the edges of the Greenbelt Plan Area
  - Non-Participating Properties: Associated with NHS VPZs within the Greenbelt Plan Area, or continuity gaps within the Greenbelt Plan Area NHS
- Floodplain Enhancements:
  - Property 5, 8 and 11: enhancement area coincides with the floodplain associated with H8-S9 to HS8-S1 and related tableland wetlands
- Linkage MVW:

    - Associated with the inner edges of the major landscape linkages associated with the West Humber Tributary (WHT4(3)3-1, WHT4(3)2-1b, WHT4(3)2-1a, WHT4(2)-2, and WHT4(2)0-1) and Campbell's Cross Creek (CCC2)
- Linkage PLZ:
    - Associated with the outer edges of the major landscape linkages associated with the West Humber Tributary (WHT4(3)3-1, WHT4(3)2-1b, WHT4(3)2-1a, WHT4(2)-2, and WHT4(2)0-1) and Campbell's Cross Creek (CCC2)
    - Additional areas associated with the PLZ for the local landscape linkage (WHT4(3)-2 corridor.
- Provincial NHS:
    - Associated with the remaining Greenbelt Plan Area outside of the NHS

Section 6.4 provides a brief review of these features in the context of the Net Gain Mitigation Hierarchy. **Section 8.5** then outlines the enhancement areas/restoration areas that have been identified as priorities for the Study Area based on the above enhancement criteria and includes identification of additional, enhancement areas beyond the SABE.

6.4 Natural Environment Mitigation Hierarchy Review

A critical consideration in assessing the preferred land use concept and development of a robust NHS that will meet the goals and targets for the Study Area, as outlined in **Section 6.2** above, is the Net Gain Mitigation Hierarchy. The Net Gain Mitigation Hierarchy is outlined in Section 2.6.3.1 of the Wood report (2022b). This hierarchy establishes a strategic framework that endeavours to protect, restore or enhance ecological functions during land use planning and development. It aims to achieve net ecological benefits by adhering to a progressive, stepwise process that prioritizes avoidance of harm, mitigation of impacts, and enhancement of ecosystems. The hierarchy's principles align with provincial policies and best practices for sustainable development. The following subsections provide a more detailed breakdown of each step in the hierarchy.

6.4.1 Net Gain Mitigation Hierarchy Guiding Principles

The guiding principles of the Net Gain Mitigation Hierarchy emphasize the importance of long-term monitoring and adaptive management to ensure that mitigation and enhancement measures remain effective over time. Continuous monitoring allows for the identification of emerging challenges, enabling adaptive strategies to be implemented as needed. Additionally, the hierarchy aligns with climate resilience goals by incorporating climate adaptation measures at every stage to enhance the ecosystems' capacity to withstand environmental changes. Collaboration with local stakeholders, the Town, and conservation authorities, is recommended to ensure that ecological outcomes are aligned with local and regional sustainability objectives and reflect a shared commitment to preserving and enhancing natural systems.

This structured approach not only emphasizes conservation-first planning but also ensures that unavoidable impacts are minimized and offset through science-based mitigation and enhancement efforts. By following the Net Gain Mitigation Hierarchy, this SWS aims to foster sustainable urban

growth while protecting and improving the ecological integrity of natural systems. The following subsections outline in order, the mitigation hierarchy that will be used to support this Phase 2 report.

6.4.1.1 Avoid Impacts

- **Objective:** Prevent harm to sensitive ecological features and functions by careful preparation of the land use plan to incorporate in-situ protection as a primary mechanism.
- **Application:** Site selection should prioritize key features and critical habitat zones.
- **Best Practices:**
    - Conduct an environmental screening during early stages to identify and exclude high-risk areas from land use changes

6.4.1.2 Minimize and Mitigate Impacts

- **Objective:** Where avoidance is not feasible, efforts should focus on reducing the scale, scope, or duration of impacts and mitigating any unavoidable effects through compensatory measures.
- **Application:** Design strategies could include setting ecological buffers (VPZs) around watercourses, retaining native vegetation, and implementing erosion control measures.
- **Examples of Mitigation:**
    - Installing wildlife corridors or crossings to maintain habitat connectivity.
    - Employing LID techniques (e.g., bioswales, permeable pavement) to manage stormwater and protect water quality.

6.4.1.3 Restore the System

- **Objective:** Restore degraded natural features and functions within the Study Area to enhance ecological performance.
- **Application:** Restoration could include activities such as naturalization of disturbed areas, restoring riparian buffers, or stabilizing stream banks to prevent future erosion.
- **Outcomes:**
    - Improved hydrological performance, such as increased groundwater recharge.
    - Enhanced biodiversity through the re-establishment of native plant species.

6.4.1.4 Enhance the System

- **Objective:** Enhancements often include adding to the system by improving or expanding natural features to support greater ecological function, resilience, and biodiversity.
- **Application:** Enhancement efforts could include increasing native vegetation cover, improving wildlife habitats, and establishing ecological linkages between fragmented natural areas.
- **Examples of Enhancement:**
    - Addition or expansion of wetlands, to improve water filtration, flood mitigation, and provide amphibian breeding habitat.
    - Establishing pollinator meadows to support wildlife.

6.4.1.5 Replicate or Compensate

- **Objective:** As a last resort, when avoidance, mitigation, and restoration efforts are insufficient, compensation may be required by replicating lost features elsewhere to maintain ecological integrity.
- **Application:** Compensation plans should follow a "no net loss" principle, meaning the replicated feature must perform at an equal or higher ecological value than the impacted feature.
- **Examples of Compensation:**
    - Creating a new wetland if removal is required.
    - Off-site tree planting initiatives to offset woodland loss.

6.4.2 Net Gain Mitigation Hierarchy Assessment

Each of the System Components that were identified in **Section 0** above have been assessed against the Net Gain Mitigation Hierarchy to determine which step is most appropriate to maintain ecological form and function for the communities and the overall system. A summary of each System Component is provided in the subsections below. A fulsome impact assessment is provided in **Section 7**, and a proposed restoration and enhancement strategy is provided in **Section 8** to further support the mitigation hierarchy recommendations. Further, an assessment and summary of predicted net gain is provided in **Section 10** to demonstrate system gains.

6.4.2.1 Key Features

It is expected that in general, key features as defined by the SABE will be retained and impacts avoided. There are also restoration and feature compensation efforts that will take place within the Greenbelt Plan Area; where these occur, existing retained key features will be enhanced as part of a more robust NHS. This is described in more detail throughout this report.

Key Features, as described in **Section 6.3.1.1** above include:

- PSWs (associated with all wetlands in the Greenbelt Plan Area), Significant woodlands (associated with all woodlands in the Greenbelt Plan Area); and Valley and Stream Corridors (associated with all medium and high constraint watercourses).
    - "**Avoid Impacts**" will be the preferred approach for these features, all of which are associated with the Greenbelt Plan Area. All of these features will be retained in place with naturalized minimum VPZs to prevent harm to sensitive ecological features and functions; retaining these features will avoid fragmentation along the Valley and Stream Corridors. It is expected that any potential disturbance to these features will be limited to the VPZ and will be restricted to low-impact, natural infrastructure strategies that minimize encroachment on the feature.
- Occupied Habitat for Redside Dace (Aquatic SAR):
    - "**Avoid Impacts**" will be the preferred approach for these features, and in general, occupied habitat is associated with significant valleylands that will be retained in place

within the Greenbelt Plan Area with a vegetated buffer. Where crossings have been identified as necessary to facilitate infrastructure projects for the Secondary Plan Area, or where SWM facilities (i.e., outlets) may impact these watercourses, consideration for "**Minimize and Mitigate Impacts**" and "**Enhance the System**" are recommended. This should be reviewed in alignment with the Guidance for Development Activities in Redside Dace Protected Habitat (MNRF 2016). Measures to support the protection of Redside Dace have been further detailed in **Section 7.2.1.5**.

- Valley and Stream Corridors (associated with all medium and high constraint watercourses);
    - "**Avoid Impacts**" will be the preferred approach where feasible. All high constraint watercourses are associated with Redside Dace habitat and should be managed based on the mitigation hierarchy recommendations above including "**Minimize and Mitigate Impacts**" and "**Enhance the System**" as necessary to improve the overall system. Additionally, all high constraint watercourses will be protected in place as they are all located within the Greenbelt Plan Area and within significant valleylands that will be protected by a vegetated setback.
    - Medium constraint watercourse WHT4(3)6-1 and WHT4(3)4-2 will be retained in place. Similar to high constraint systems, impacts will be avoided and efforts to "**Minimize and Mitigate Impacts**" and "**Enhance the System**" should be taken as it relates to any alteration near this feature;
    - While WHT4(3)5-2 is considered a medium constraint watercourse, it is not a significant valleyland and is proposed for realignment. This feature is currently associated with three online golf course ponds and has been proposed for realignment to help restore appropriate flow and improve aquatic habitat conditions. As such, this feature falls under the "**Replicate or Compensate**" and "**Restore the System**" categories of the mitigation hierarchy. While this is a feature removal and compensation, the final naturalized channel will incorporate enhancement efforts that will aim to increase native vegetation cover, improve wildlife habitat, and establishing a more naturalized channel and a comprehensive ecological linkage to the Greenbelt Plan Area NHS Linkages.
- SWH (candidate and confirmed) (More details on SWH impacts and mitigative measures are detailed in **Section 7.2.1.4**):
    - "**Avoid Impacts**" will be the preferred approach for these features, the majority of candidate SWH identified occurs within the Greenbelt Plan Area and will be retained in place with naturalized minimum VPZs to prevent harm to these habitats and their functions;
    - The following are SWH features that were identified outside the Greenbelt Plan Area and the recommended approach under the mitigation hierarchy:
        - Barn Swallow (Property 1): this SWH is associated with temporary shipping containers on-site, which are proposed for removal. As such, "**Minimize and Mitigate**" and "**Replicate or Compensate**" are the recommended approaches. Feature removal may provide temporary disruption to this species, as such it should be timed to limit impact to breeding birds.

- Eastern Wood Pewee (FOD5-4, Property 6): this SWH is recommended for "**Minimize and Mitigate Impacts**" - the woodland feature providing habitat for this species will be retained in place with an appropriate minimum VPZ that will be naturalized. Additional mitigative measures that should be considered to protect this wildlife habitat from adverse effects associated with potential land use changes are discussed in **Section 7.2.1.4**.
- Snapping Turtle (Golf Course Ponds, Property 1): these golf course ponds (OAO) are highly modified and likely do not provide high quality habitat. Pond 1 (SAF wetland community) is a higher quality feature that is proposed to be retained in place with minimum VPZs. For SWH within anthropogenic OAO communities, it is recommended for "**Replication and Compensate**" as part of the larger watercourse realignment discussed in the following section. This will require consideration of habitat recreation and wildlife rescue as part of the natural channel design planning during site-specific works.
- Monarch (Property 4): this SWH is associated with a milkweed patch within a MAM2 and associated with the non-significant WHT4(3)4-2 valleyland. This area is expected to fall under ""**Avoid Impacts**" as the wetland and valleyland are expected to be retained in place and buffered by an appropriate VPZ. This habitat type could also be considered through the "**Enhance the System**" category of the net gain mitigation hierarchy as milkweed are a fairly robust plant that can be easily incorporated into other restoration, enhancement or buffer naturalization projects.

- HDFs identified as 'Protection' or 'Conservation':
  - This applies to three features within Property 9 – HDF-3A and HDF-4C were assigned 'Conservation' and HDF-3C was assigned 'Conservation'. HDF 3C and HDF4C are located within the Greenbelt Plan Area and are associated with the high constraint watercourse/significant valleyland. These features are expected to fall under "**Avoid Impact"** as there will be a naturalized 30 m VPZ that will ensure these features are retained in place and that the HDF management recommendations are met.
- Habitat for endangered and threatened species (Butternut, Eastern Meadowlark, Bobolink, and candidate SAR Bats; see above for Redside Dace considerations)
  - In general, **Avoid Impacts** is the primary recommendation for SAR habitat. Where habitat is located within the Greenbelt Plan Area NHS, impacts will generally be avoided as natural heritage features will be retained in place with a minimum 30 m VPZ.
  - However, where it is identified as not feasible to protect habitat for SAR, impacts should be assessed in accordance with appropriate regulations under the ESA with consideration for "**Minimize and Mitigate Impacts**" and "**Replicate or Compensate**" strategies. More details on impacts and mitigation measures for SAR are available in **Section 7.2.1.5**.

6.4.2.2 Supporting Features

Supporting Features, as described in **Section 0** above include:

- Non-significant wetlands (all wetlands outside of the Greenbelt Plan Area)
    - All non-significant tableland wetlands (i.e. features outside of confined valley systems and the Greenbelt Plan Area) are recommended to be removed and **"Replicated or Compensated"**. Considering the nature of these tableland wetland features, given the adjacent land-uses (active agricultural and managed golf-courses), the abundance of invasives, anthropogenic origin (i.e., ditches/manmade ponds) and/or the commonality of these communities, it was determined that they are generally of low ecological function, and retention in-place is not conducive to long term function in an urbanizing landscape. Based on the net-gain hierarchy, compensation for feature removals should ensure no net-loss and the replacement feature should contribute an equal or higher ecological value than the impacted feature. Where replication/compensation is required, opportunities to provide increased ecological benefits (e.g., increased habitat diversity, increased native plant diversity) will be created to promote net-gain.
- Non-significant woodlands:
    - These woodlands are recommended to be retained in place at this time; the preferred approach for the FOD5-3 feature (Woodland C on **Figure B-1**, **Appendix B**) is to retain it in place and "**Minimize and Mitigate Impacts**". As there are land use changes proposed within the immediate vicinity of these features, it is recommended that methods to reduce the scale, scope, and/or duration of impacts should be considered and mitigating any unavoidable effects through buffers and other measures. These are explored in more detail in **Section 7**.
    - Cultural plantations (CUP3-14; Woodlands A and B on **Figure B-1**, **Appendix B**) are generally associated with planted, monocultural communities and have low-diversity. These communities are also made of non-native trees (Norway Spruce). For these features, should removal and offsetting be required as part of site-specific development applications, the **Replicate or Compensate** strategy should be implemented. Compensation for feature removals should ensure no net-loss and the replacement feature should perform at an equal or higher ecological value than the impacted feature. Should relocation be required, opportunities exist to provide increased ecological benefits (e.g., increased habitat diversity, increase native plant diversity).
    - On Property 1, the tableland woodland is a lowland community comprised mostly of Manitoba Maple (Woodland D on **Figure B-1**, **Appendix B**) and is surrounded by anthropogenic communities including golf course lands and manmade golf course ponds. As this is a generally common ecological community with relatively low species diversity it falls under the "**Replicate or Compensate**" category of the mitigation hierarchy. It is expected that compensation for this feature will deliver a "no net loss" principle and will function at higher ecological value.

- Other valleylands (associated with HDF 3A);
    - These features are recommended be retained in place at this time; the preferred approach for these features is to "Minimize and Mitigate Impacts". As there are land use changes proposed within the immediate vicinity of these features, it is recommended that methods to reduce the scale, scope, and/or duration of impacts should be considered and mitigating any unavoidable effects through buffers, riparian naturalization and other measures.
- HDF identified as 'Mitigation':
    - This applied to all HDFs within the Study Area except HDF-3A and HDF-4C. Mitigation HDF reaches will fall under the "Minimize and Mitigate" net gain hierarchy where the removals of these features will be generally mitigated through the replication of their functions (i.e., flow contribution, allochthonous material contributions, etc.) in alignment with HDFA Guideline (TRCA and CVC 2014). The sensitive in-water work timing window should be considered to minimize impacts, with removals occurring when features are dry or water levels are lower.
- Fish habitat (direct and indirect; contributing habitat for Redside Dace and inclusive of the golf course ponds within Property 1):
    - Direct fish habitat was identified with all high constraint watercourses as well as WHT 4(3)5-2 within Property 1. In general, **"Avoid Impacts"** is the primary recommendation for direct fish habitat, except for Property 1 within WHT 4(3)5-2 where degraded habitat is present within a series of golf course ponds. These golf course pond habitats accumulate nutrients from the adjacent golf course runoff and warm the downstream reaches. Additionally, several barriers were identified between the ponds, which would limit fish movement through the ponds, as well as between the ponds and the adjacent watercourses. Therefore, it is recommended to restore this habitat to a more natural trajectory through natural channel restoration work. When undertaking the natural channel restoration work it is recommended to **"Replicate and Compensate**". The sensitive in-water work timing window should be considered to minimize impacts, with removal occurring when water levels are lower.
    - All other medium and low constraint watercourses, as well as all HDFs within the Study Area, were identified as indirect fish habitat. In general, **"Avoid Impacts"** is the primary recommendation for indirect fish habitat within medium constraint watercourses, given that they are located within defined valleylands. These features will be protected by minimum VPZs associated with the valleylands. Efforts to **"Minimize and Mitigate Impact"** to other indirect fish habitat (low constraint watercourses and HDFs) is warranted to ensure that the functions of these features are replicated, and considerations of timing of the feature removals occurs to limit the amount of potential impact.
    - Contributing Redside Dace habitat can be associated with low and medium constraint watercourses, as well as HDFs and riparian wetlands. These features are not required to be maintained in place rather it is recommended that a **"Minimize and Mitigate Impact"** approach is applied to ensure that if removals are contemplated, the functions of the feature are replicated. The sensitive in-water work timing window should be considered

to minimize impacts, with removals occurring when features are dry or water levels are lower.

6.4.2.3 Other Features

Other Features, as described in **Section 0** above, include:

- Successional communities: in general, these features have been determined to be generally of low ecological value. Cultural thicket communities within the Study Area (and outside of the Greenbelt Plan Area NHS) are generally associated with high proportions of invasive species. Cultural meadows within the Study Area (and outside of the Greenbelt Plan Area NHS) are generally associated with disturbances as a result of invasive species and adjacent agricultural and golf course management. Successional features within the Greenbelt Plan Area NHS will fall under **"Avoid Impacts"** or **"Enhance the System"**; outside of the Greenbelt Plan Area NHS these communities will fall under **"Minimize and Mitigate Impacts"**;
- Other Open Aquatic: communities where no fish habitat has been confirmed to-date include golf course ponds located within Property 9 identified. These features are located within the Greenbelt Plan Area NHS and will be retained in place; as these features fall under **"No Impact"** and will be protected by the minimum Greenbelt Plan Area VPZs.

As part of the restoration goals and objectives, outlined in **Section 8.4** of this report, consideration for diverse communities will be considered to support the general goal of no net-loss in natural coverage.

6.4.2.4 Linkages

Linkages, as described in **Section 0** above, and the recommended net gain mitigation hierarchy approach are as follows:

- Major Landscape Linkages: **"Avoid Impacts"** (by retaining the feature in place) and **"Minimize Impacts"** and **"Enhance the System"** through natural buffer plantings.
- Local Landscape Linkages: In general, **"Avoid Impacts"** (by retaining the feature in place), and **"Minimize Impacts"** and **"Enhance the System"** through natural buffer plantings.
    - However, for the linkage on Property 1, due to the anthropogenic conditions of this feature (golf course land uses and golf course ponds), realignment and naturalization of this corridor is recommended; by pursuing the **"Replicate and Compensate"** strategy along with **"Restoring the System"**, the "no net loss" principle will be applied and the replicated corridor is expected to perform at an equal or higher ecological value than the impacted feature.
- Site/Feature-Specific Linkages: In general, **"Avoid Impacts"** (by retaining the feature in place), and **"Minimize Impacts"** and **"Enhance the System"** through natural buffer plantings.

6.4.2.5 Enhancements

Enhancements will inherently support either **system restoration** or **system enhancement**. Further recommendations regarding the feasibility and suitability of enhancements for the Secondary Plan Study Area are discussed in **Section 8.5.** Several enhancement areas and/or restoration have been identified as priorities for the Study Area based on the above enhancement criteria, in alignment with the net gain mitigation hierarchy, and includes identification of additional, enhancement areas beyond the SABE recommendations.

7. Impact Assessment

The following subsections will provide an overview of our assessment of the proposed land use plan on the natural environment, hydraulics and hydrology, geotechnical and hydrogeology, stream morphology, and surface water quality. Additionally, for each of these disciplines, a review of climate change impacts has been integrated.

This impact assessment was completed based on the Proposed Land Use Plan (herein referred to as "the Structure Plan"; **Figure 3-1**) prepared by MGP on January 10, 2025, and uses the following assumptions:

- No SWM facilities will be located within natural heritage features, natural hazards or their associated VPZs. It is recognized that outfalls to these facilities will be required within the NHS, however, the exact location of these outfalls (and their associated impacts) should be determined at site specific planning phases. The extent of disturbance within the NHS should be minimized to the extent possible.
- All grading will be outside of the NHS limits except for localized disturbance at infrastructure crossings or to facilitate the construction of created natural heritage features. This was assumed based on Preliminary Grading work completed to support this Phase 2 Report, as summarized within **Section 5**. Where road crossings are required, locations should be selected to minimize the extent of disturbance, where feasible. It is assumed that detailed impacts associated with the road alignment and its NHS crossings will be further explored through the Environmental Assessment (EA) process. Where grading is required to support the construction of new natural heritage features (e.g., realigned channel corridor, wetland and woodland creation, or other natural heritage restoration efforts), disturbance should be minimized to the extent possible. The extent of disturbance should be reviewed further at the detailed design stage.
- There are currently two proposed collector road NHS crossings delineated on the Structure Plan on Properties 4 and 9. The location of local road networks have not been determined at this stage; therefore, the impacts associated with local road networks should be evaluated at the site-specific design stage.
- A trail alignment has been envisioned within the Study Area (as shown on Figure ES-2 of the Town of Caledon Multi-Modal Transportation Master Plan (MMTMP, June 2024c)). A thorough review of the proposed trail alignment is required to minimize the amount of disturbance within the NHS, as the current proposed trail alignment would have significant impacts to the most-sensitive features within the NHS. As a result, trail alignment has not been identified at this stage; however best practices for trails have been explored within this Phase 2 SWS. It is recommended that the trails be designed for three-season use and constructed with a granular material to encourage infiltration and avoid impacts related to salt management. Moreover, physical barriers (e.g., fencing, thorny plantings) should be considered for installation between the proposed trail edge and the NHS to discourage human-wildlife interactions. The installation of these barriers will also assist in preventing ad-hoc trails within the NHS.

Collector Road Alignment

The proposed collector road network within the Secondary Plan Area include two crossings of the NHS: a Greenbelt Plan Area NHS crossing (Property 9), and a non-significant valleyland/NHS crossing (Property 4). **Section 3** of this report provides a brief discussion on the multidisciplinary review of initial road alignment options before selection of the preferred concept; this analysis was generally based on reducing the total number and magnitude of watercourse/valleyland crossings, however also considered other design criteria. As part of the transportation planning process, the preferred road alignment will require a MCEA, which will identify and evaluate a series of alternative alignments and alternative methods, including the do-nothing approach. Each alternative will be evaluated based on set criteria points, which may include the anticipated costs, property acquisition, construction feasibility and timelines, archaeological and cultural heritage impacts, climate change and environmental impacts (to terrestrial ecosystems, fish and fish habitat, and SAR and their habitats).

As the MCEA process has not yet been completed, this Phase 2 SWS impact assessment explores some potential impacts associated with the proposed collector road alignment and provides some recommendations and best practices for reducing impacts on natural heritage features, however a fulsome evaluation must occur during the MCEA process.

7.1 Proposed Structure Plan

The Preliminary Land Use and Transportation Plan (**Figure 3-1**) within the Study Area is documented in **Section 3** above, and is proposed to include a variety of uses including Neighborhood Areas, Natural Features and Areas, and Open Spaces; uses will likely include a wide range of residential, institutional, commercial, and community uses such as parks, schools, community centers and emergency services.

To scope relevant environmental impacts within this Phase 2 SWS, this Impact Assessment focuses on the Structure Plan prepared by MGP – as shown in **Figure 3-1**, which generally displays collector road alignments, SWM facilities, and existing natural heritage conditions. Details on the preferred collector road alignments can be found in **Section 3**, but in general were design to minimize natural heritage feature crossings and encroachments.

The Study Area is divided into 11 parcels where Parcels 1, 2, 3, 4, 7, 9, 10, and 11, are expected to need SWM ponds, as well as some non-participating properties to support stormwater drainage across the Study Area. No development is proposed for the portions of the Study Area that are located within the Greenbelt Plan Area, with the exception of the development of SWM facilities. Other uses proposed within the Greenbelt Plan Area are limited to public parks and a road connection.

7.2 Natural Heritage

This Phase 2 SWS presents and discusses the natural heritage features and associated functions that occur on, and/or adjacent to, the Study Area. Findings in this report should be considered preliminary and are based on several assumptions that will be further refined during the site-specific application. Further impact assessments will be required for non-participating parcels following detailed evaluation of on-site ecological features and functions.

This comprehensive study assesses the potential effects on these natural heritage features and functions that could occur over various periods of time (short-term or long-term) following the implementation of the proposed structure plan. It also identifies planning, design and construction practices that are recommended to maintain, and where possible, improve or restore the health, diversity and size of natural heritage features within and adjacent to the Study Area.

This section provides a summary of the natural heritage features and their associated functions, as well as their significance and sensitivity within the landscape. It outlines expected impacts associated with land use changes outlined in the proposed Structure Plan **Figure 3-1.** It also provides a preliminary assessment of potential impacts from development that should be considered in the future, as the Mayfield Tullamore Secondary Plan Area proceeds to subsequent *Planning Act* submissions. Impactors are identified along with potential effects without any form of mitigation. Impact avoidance, mitigation and/or restoration measures are identified along with predicted net effects. Recommended monitoring strategies are provided to assess the effectiveness of mitigation measures.

As noted, the results of this Phase 2 SWS will be carried through and considered as part of subsequent *Planning Act* submissions within the Secondary Plan. This may include, but is not limited to additional studies, mitigation measure implementation, restoration best practices, monitoring programs, adaptive management considerations and/or phasing recommendations.

For example, Section 2.6.3 of the Wood report (2022b) further states that “timing and phasing of compensation activities relative to the proposed impact should be considered. To the extent possible, compensation areas should be established early to reduce effects of lag between implementation and reaching full function”. This will be a general recommendation for any feature removals and compensation to consider as part of detailed design plans.

Additionally, as discussed within **Section 7.2.1.2** and **Section 7.2.2.1**, a feature-based water balance risk assessment was completed to determine where mitigative measures are required in order to support retained wetland hydroperiods in a post-development scenario. It is recommended that these mitigative measures are implemented as soon as possible to avoid any prolonged impacts to retained wetlands, although it is recognized that some mitigative measures may be connected to the construction of buildings (i.e., roof top contributions). During site specific applications, a fulsome wetland water balance will be completed for impacted wetlands to confirm the appropriate mitigative measures. During that time, phasing opportunities to reduce impacts to the hydrology of wetlands will be explored. Additionally, a wetland water availability assessment will be completed for created wetlands during detailed design to confirm that the targeted wetland community can be supported in the compensation location.

The following sections review significant and non-significant features as identified in the Existing NHS, in the context of the proposed Structure Plan, and in alignment with the commitments for the Phase 2 SWS as outlined in the Approved MTLOG TOR (November, 2024).

7.2.1 Provincially Significant Natural Heritage Features

7.2.1.1 Significant Woodlands

Candidate significant woodland communities were identified within the Greenbelt Plan Area (as shown on **Figure B-1**, **Appendix B**). Candidate significant woodlands include the following ELC community types:

- CUP3: Coniferous Plantation
- CUP3-2: White Pine Coniferous Plantation
- CUP3-12*: White Pine - White Spruce Coniferous Plantation
- CUP3-13*: White Cedar Coniferous Plantation
- CUW1: Mineral Cultural Woodland
- FOD: Deciduous Forest
- FOD3: Dry – Fresh Poplar – White Birch Deciduous Forest
- FOD4: Dry – Fresh Deciduous Forest
- FOD5-5: Dry – Fresh Sugar Maple – Hickory Deciduous Forest
- FOD6-5: Fresh – Moist Sugar Maple – Hardwood Deciduous Forest
- FOD7: Lowland Deciduous Forest
- FOD7-3: Fresh – Moist Willow Lowland Deciduous Forest
- FODM7-7: Fresh – Moist Manitoba Maple Lowland Deciduous Forest
- SWD: Deciduous Swamp
- SWD4: Mineral Deciduous Swamp
- SWD4-1: Willow Mineral Deciduous Swamp

Please see the Phase 1 SWS **Section 3.1.4.3** (GEI and SCS, 2025), for more information pertaining to the woodland evaluations. Based on results presented in the Phase 1 SWS (GEI and SCS, 2025), none of the woodlands within the tablelands of the Study Area (outside of the Greenbelt Plan Area) have been assessed as significant woodlands and are therefore discussed in **Section 7.2.2.2** (Non-Significant Woodlands).

No encroachment into the significant woodlands will occur due to the proposed structure plan. A minimum of a 30 m VPZ will be provided from the dripline of all significant woodlands within the Greenbelt Plan Area as shown on **Figure B-1**, **Appendix B**. All VPZs will be planted with native species (refer to **Section 8.6.5** for additional details), which will increase the overall size of the natural area and create transitional habitat to further protect significant woodland features from disturbance associated with the proposed structure plan. VPZs will be planted in a banded approach to provide more successional habitat and offer a variety of habitat functions. As previously noted, most of these VPZ areas are currently anthropogenic in nature; thus, restoring these areas to a more natural state and incorporating them into the overall NHS will provide benefits throughout the system. As a result, no direct impacts are expected to the significant woodlands given that development and site alteration is not expected within or immediately adjacent to the features.

The existing VPZ areas are represented by golf courses and their associated infrastructure such as golf cart pathways, as well as actively managed agricultural lands. In general, encroachment into the VPZ associated with significant woodlands should be minimized where possible; however, given that most of these VPZ are currently anthropogenically influenced, it is expected that minor alterations within the VPZs can be mitigated if required. These minor alterations could be associated with temporary grading work in order to restore the naturalness of the VPZ while assisting with the adjacent construction activities associated with the proposed development. As noted in **Section 7** above, essential infrastructure (e.g. SWM outlets) may encroach upon the vegetation buffer to the dripline of the significant woodland. Impacts associated with essential infrastructure should be reviewed during the site-specific application once the location and area of disturbance is better understood. Where infrastructure other than SWM outlets are proposed within these VPZs, it is expected that there will be a separate environmental approvals process (e.g. MCEA) to evaluate alternatives and address potential impacts. However, in general, it is expected that disturbance impacts can be mitigated through established best practices as discussed below.

Tree protection fencing and erosion and sediment control (ESC) measures should be installed along the outer limit of the NHS (i.e., at the limit of the greatest buffer) which will aide in eliminating excess impacts to significant woodlands features through ground disturbance and dislodgement of sediment as part of adjacent land works. This will help protect the form and function of the significant woodlands, as well as the remainder of the NHS.

There are also potential indirect impacts to the significant woodlands that should be considered. This could be related to Study Area grading and machinery adjacent to the retained feature. In general, machinery is not expected within 30 m from the edge of the woodlands and no impacts to the rooting zone of the trees are expected (e.g., as a result of soil compaction). However, should some localized grading occur to facilitate construction of essential infrastructure or SWM outfalls, the below mitigative measures should be explored. Other potential indirect impacts to these features could be associated with noise and light disturbances, wildlife activity disruptions, and introduction of invasive and non-native plants.

The following potential proposed mitigative measures are recommended to reduce and/or minimize these potential negative impacts, with more details on some of these measures provided below:

- To ensure root zones are protected during construction, a Tree Protection Zone should be implemented based on recommendations from a Certified Arborist;
    - Heavy machinery should not be operated within the Tree Protection Zone (TPZ), including overhead swinging or machine arms;
    - Construction materials, equipment, soil, construction waste or debris are not to be stored within the TPZ or dripline of trees identified for protection;
    - Any tree removals, pruning or root cutting required is to be conducted by a qualified Arborist;
    - No signs or objects should be displayed or affixed to any trees;
    - Disposal of any liquids shall not occur within the TPZ;

    - Should any additional, incidental or accidental tree injuries occur during construction, a qualified Arborist should be consulted to determine whether additional mitigation measures should be employed;

- To limit impacts on wildlife activity, construction activities adjacent to the retained woodland should be timed outside of the nighttime and early morning periods during the bat breeding seasons (April 1 to September 30). Some localized movement of wildlife out of these edge areas may still occur during the construction phase; however, refuge habitats exist within the broader landscape;
- New lighting should be directed away from the woodland to avoid impact to wildlife activities and lighting should consider Section 7.7.7 of the Future Caledon OP where "*Lighting will be internally oriented within a property to minimize glare and light pollution on adjacent properties, environmentally protected areas or public streets. Dark sky compliant lighting fixtures, and smart lighting solutions that reduce lighting requirements will be encouraged*," more details on Caledon's guidelines are found in the Green Development Standard Guidebook (Caledon, 2024b). Other best practices for bird friendly solutions should be reviewed (e.g. the City of Toronto's Best Practices for Effective Lighting Strategy (Toronto, 2017).
- To limit invasive or non-native plants being introduced construction equipment should be regularly cleaned to reduce the potential for transportation of invasive material within and outside of the Study Area; and,

To slow the spread of invasive species (such as Emerald Ash Borer), all trees (not just Ash) should be disposed of locally to reduce transportation to other local municipalities. As noted in the list above, TPZs are a critical protection measure for significant woodlands. Monitoring of the TPZ should be conducted or supervised by a Certified Arborist prior to and during construction to ensure compliance with tree protection guidelines. Proposed monitoring will assess the health and structure of the trees, identify changes to environmental conditions, and respond appropriately where necessary. The Certified Arborist must be on site at all times prior to and during any construction activity occurring within any TPZ to monitor root exposure, identify root disturbance, and propose site-specific mitigation where appropriate. Additionally, noise pollution into the NHS has the potential to cause adverse impacts to the flora and fauna within the Greenbelt Plan Area, if unmitigated. Wildlife may vacate the area during construction activities. However, this disturbance would be temporary, and it is likely that the wildlife within the significant woodlands is accustomed to a higher level of background noise resulting from the frequent use of machinery within the nearby agricultural and golf course areas. Given that the NHS is a large, connected system it is likely that the wildlife would temporarily relocate to other areas within the NHS.

As per the Structure Plan (**Figure 3-1**), the proposed collector road alignment avoids the significant woodlands. Therefore, no impacts to significant woodlands are expected as a result of the road alignment.

Another post-construction impact consideration that must be addressed is the potential for human access to these features post-development. Given that proposed land use is 'Neighborhood Area" (**Figure 3-1**) and that a trail alignment will be proposed within the Study Area (**Section 7.1**), impacts

associated with human and pet interactions with the significant woodlands must be considered. Where possible, the trails should be located outside of the significant woodlands and instead be located within the outer few meters of the VPZs. Where trails are located within the NHS, physical barriers such as the inclusion of thorny native species (e.g., raspberry species) or chain-link fencing should be explored to deter humans from interacting with the NHS, especially adjacent to more sensitive habitats. The exact type of physical barriers should be further explored at the site-specific stage.

Through the implementation of the preliminary avoidance, mitigation and enhancement measures described above, it is expected that that the proposed structure plan can be carried out to result in no negative impacts to Significant Woodlands. Additional impacts associated with grading, SWM outlets and trails will be identified through subsequent development applications. Site-specific detailed studies should assess the effectiveness of the mitigation and recommend monitoring of enhancement measures, including restoration plantings to ensure that they are functioning as defined. Therefore, given the current structure plan and the intent to retain the significant woodlands in place (thus avoiding direct impacts) and to re-vegetate the remainder of the 30 m VPZ, no negative impacts are expected.

Climate Change Implications

Proposed mitigation measures, buffer plantings, and enhancement measures are expected to help support the overall resilience of the significant woodlands within the Study Area. The establishment of a 30 m VPZs using native species increases the overall size of the woodland and enhances transitional habitat, which supports greater biodiversity and ecological stability. This additional vegetation will help regulate microclimates, stabilize soil, and improve water infiltration, all of which bolster the woodlands capacity to adapt to changing conditions such as increased temperature and altered precipitation patterns.

The use of TRCA's *Forest Edge Management Plan Guidelines* (2004) ensures that edge effects are minimized, promoting healthier interior forest conditions. It is recognized that true "interior forest" habitat is not achievable within the NHS at this time, however other edge management best practices are still relevant. The inclusion of thorny species and other barriers will discourage human intrusion, maintaining the ecological integrity of the woodland. The focus on ESC, proper grading, and SWM practices prevents soil compaction and limits the introduction of non-native species, preserving the woodland's hydrological and structural functions. Together, these actions create a more sustainable and adaptive woodland community capable of withstanding the challenges of climate change.

If woodland removal and compensation should be required in subsequent stages, it is recommended that ecosystem offsetting and restoration practices integrate for climate resilient measures into the process. For example, enhanced species diversity ensures that forests are less vulnerable to pests, diseases, or climate extremes affecting specific species, promoting overall ecosystem resilience. Structural diversity, including a variety of tree ages, heights, and canopy layers, strengthens the forest's ability to respond to disturbances such as storms or droughts by providing redundant ecological functions.

Incorporating climate-adapted native species supports woodlands under shifting temperature and precipitation patterns by maintaining ecosystem services like carbon sequestration and habitat provision. Buffer zones reduce edge effects, such as increased exposure to wind, heat, and invasive species, creating a more stable microclimate within the forest. Finally, connectivity to other natural areas supports wildlife movement, gene flow, and species migration, allowing the forest ecosystem to adapt dynamically to climate-induced shifts in habitats. Together, these measures foster robust, adaptive forests that are more capable of withstanding and recovering from climate-related impacts.

7.2.1.2 Significant Wetlands

An evaluation was completed by GEI's Ontario Wetland Evaluator following the Ontario Wetland Evaluation System (OWES; MNRF, 2022) to determine whether any PSWs may be present within the Study Area (**Figure B-2**, **Appendix B**). More information pertaining to the wetland evaluation is found in Section 3.1.4.1 of the Phase 1 SWS (GEI and SCS, 2025).

All wetlands located within the Greenbelt Plan Area are considered Candidate PSWs. The candidate PSW include:

- Meadow Marsh (MAM);
- Mineral Meadow Marsh (MAM2);
- Reed-canary Mineral Meadow Marsh (MAM2-2);
- Forb Mineral Meadow Marsh (MAM2-10);
- Cattail Mineral Shallow Marsh (MAS2-1);
- Duckweed Floating-leaved Shallow Aquatic (SAF1-3);
- Pondweed Floating-leaved Shallow Aquatic (SAF_1-4);
- Pondweed Mixed Shallow Aquatic (SAM1-4);
- Deciduous Swamp (SWD);
- Mineral Deciduous Swamp (SWD4);
- Willow Mineral Deciduous Swamp (SWD4-1);
- Thicket Swamp (SWT);
- Willow Mineral Thicket Swamp (SWT2-2); and
- Red-osier Dogwood Mineral Thicket Swamp (SWT2-5).

Based on results presented in the Phase 1 SWS (GEI and SCS, 2025), ten wetland units located within the Study Area outside of the Greenbelt Plan Area were screened to determine whether an OWES evaluation was required. Eight wetland units were not evaluated given their size (<2 ha) and two units were evaluated as non-provincially significant. These eight wetlands, both unevaluated and non-PSWs are addressed in **Section 7.2.2.1** (Other Wetlands).

Riparian wetlands were also located within occupied and contributing Redside Dace habitat. Please refer to **Section 7.2.1.5** for discussion on Redside Dace.

All candidate PSW communities located within the Greenbelt Plan Area will be retained on the landscape with a minimum 30 m VPZ, except for one wetland unit within Property 9 where the proposed collector road alignment will bisect the community. This road crossing has been designed to utilize an existing crossing associated with a golf course path. However, one wetland unit consisting of

a MAM2-10 community will be removed and/or encroached into as a result of the proposed road alignment. As final crossing design, including total crossing widths have not been assessed yet (as part of an MCEA), impacts associated with the wetland removal as a result of the proposed collector road alignment will be further explored as part of the MCEA. Where possible, it is recommended to minimize and avoid impacts to the candidate PSW unit.

Currently the areas identified as minimum VPZs consist of a mixture of naturalized vegetation, actively managed agricultural lands and golf course lands. These anthropogenic areas will be planted with native plant materials to further enhance the wetlands form and function. Furthermore, plantings of native thorny species such as Raspberry (*Rubus* sp.) within the buffers is recommended as it will discourage public access into the retained wetland communities. Further discussion surrounding the proposed wetland buffer planting approach is provided within **Section 8.6.5** of this report.

SWM infrastructure is proposed near several PSWs within the Greenbelt Plan Area located on Properties 3, 8, 9 and 10 (**Figure 3-1**). Impacts associated with the proposed SWM infrastructure will be evaluated at the site-specific stage; however, it is recommended that the extent of disturbance within PSWs and their associated VPZs are minimized to the extent possible. Should the SWM infrastructure outlet into the PSWs instead of the receiving watercourse, erosion considerations will need to be explored. The increase in flows from the SWM ponds are not expected to negatively impact the wetlands since excess flows directed to riparian wetlands will continue to drain downstream (i.e., it wouldn't collect and impact the volume of the wetland).

No impacts to the rooting zone of trees within wetland communities (e.g., SWD communities) are expected given that construction and site alteration activities are expected to occur outside of the TPZs.

A feature-based water balance risk assessment was completed in accordance with the TRCA's *Wetland Water Balance Risk Evaluation* (2017) for all candidate PSWs to ensure that there would be no impact to the hydroperiod of the wetlands. The results of this feature-based water balance risk assessment is summarized within **Section 7.8.6**. Several of the wetlands have catchment areas which extend largely into the proposed development areas of the Study Area. As a result, several of the PSWs may experience a high magnitude in hydrological change. Detailed studies will be required at the site-specific stage in order to quantify the water balance and ensure no negative impacts to the PSWs. A fulsome description of the wetland water balance impacts and recommended further steps are included in **Section 7.8.6.**

Impacts associated with short- and long-term dewatering should be reviewed at the site-specific stage to determine whether the hydroperiod of the wetlands can be avoid and/or supported through proposed mitigative strategies.

Grading, as a result of the development applications, should not be proposed within the candidate PSWs or its VPZs, except to facilitate essential SWM infrastructure (e.g., SWM outfalls). Grading within the adjacent lands is permitted, however, ESC measures should be installed to protect the form and function of the wetlands. ESC measures should be informed by the *Erosion and Sediment Control Guide for Urban Construction* (TRCA, 2019) and will be further defined through the site-specific application. Installation of ESC measures along the outer edge of the VPZ (or the limit of the NHS, whatever is

greater) will ensure that wetlands are protected and will limit disturbance caused by construction through ground disturbance and dislodgement of sediment.

In order to mitigate the potential for adverse effects on wetlands due to accidental spills during construction, it is recommended that appropriate spill prevention and response measures (e.g., material handling and storage protocols, mitigation measures (e.g., spill kits on-site), monitoring measures and spill response procedures) (i.e., emergency contact procedures, including Spills Action Centre, and response measures including containment and clean-up) be in place and implemented and necessary during construction. Implementation of an effective spill prevention and response plan is anticipated to be largely effective in preventing adverse effects on wetlands due to accidental spills during construction.

With the implementation of these mitigation measures, no negative impacts to candidate PSWs and their associated functions are expected based on the high-level assumptions. The removal of candidate PSW as a result of the proposed collector road alignment will require additional review as part of the MCEA. Detailed impact assessments are required during the site-specific stages to confirm that the hydroperiods of the wetlands will not be impacted by the changes to the pre to post development catchment areas and as a result of potential dewatering activities (e.g., under artesian conditions).

Climate Change Implications

The approach being taken to retain wetlands helps maintain their vital functions, promoting climate resilience. The retention of candidate PSWs, except for the one wetland unit that will be impacted by the proposed collector road alignment, supports the preservation of ecological functions, thereby supporting the overall resilience of the NHS to climate change. Wetlands are integral to climate adaptation and mitigation efforts due to their ability to regulate hydrological cycles, mitigate flooding by absorbing and slowly releasing water, and filter pollutants, thereby maintaining water quality. They also serve as carbon sinks, sequestering carbon dioxide within their vegetation and soils, which contributes to reducing greenhouse gas concentrations.

To further enhance the resilience of these retained wetland systems, a 30 m VPZ is proposed to protect against potential indirect impacts such as sedimentation, surface runoff, and anthropogenic disturbances. The establishment of this VPZ, including native species plantings, will improve habitat quality, support increased biodiversity, and provide shading and cooling effects, which are essential for mitigating thermal impacts on watercourses and associated wetland habitats. These measures will also promote the natural regeneration of wetland ecosystems and stabilize the adjacent soils, reducing erosion and sediment transport into the wetlands.

Additionally, the implementation of ESC measures at the outer limits of the VPZ will further mitigate risks during construction activities, while spill prevention and response plans will minimize the potential for contamination events. The inclusion of native thorny plant species, such as Raspberry (Rubus sp.), within these areas will discourage unauthorized access, reducing human-induced disturbances. These interventions not only maintain but also enhance the ecological integrity of the wetlands, ensuring their continued ability to provide essential ecosystem services such as flood

attenuation, groundwater recharge, and carbon sequestration, thereby strengthening their role in both climate change adaptation and mitigation within the subwatershed.

7.2.1.3 Significant Valleylands

Significant valleyland communities were identified within the Greenbelt Plan Area (as shown on **Figure B-3**, **Appendix B**). Please see Phase 1 SWS Section 3.1.4.4 (GEI and SCS, 2025), for more information pertaining to the valleyland evaluation. Based on the findings of the Phase 1 SWS, the main West Humber River valleyland, the tributary along Torbram Road, and Campbell's Cross Creek valleyland are considered significant valleylands. These three valleylands coincide with the Greenbelt Plan Area and the delineation of the Key Valleylands Features within the SABE Report.

As discussed within **Section 6.3.4**, two major linkages associated with the West Humber River and its associated tributary were identified within the Study Area. Campbell's Cross Creek was identified as a local linkage based on the criteria outlined in the SABE.

The form and function of any of the identified significant valleylands will not be disturbed or directly affected, except for one collector road crossing which is recommended at an existing watercourse crossing associated with a golf course path within Property 9. The impacts associated with the proposed collector road crossing will be evaluated as part of the MCEA; however, the use of existing watercourse crossings (i.e. golf cart paths) is recommended to discourage additional disturbance within the significant valleylands. This upgraded crossing is also located within an actively managed golf course; thus, minimizing the amount of native vegetation that would be removed within the significant valleyland corridor as a result of the proposed road network. Recommendations regarding the proposed collector road crossing from a wildlife perspective are provided within **Section 8.7.2**.

The proposed structure plan illustrates that Neighborhood Area designations are not proposed within any of the significant valleylands. As well, a minimum 15 m VPZ will be provided from the staked top of bank and/or the stable top of slope (whichever is the greatest constraint); as shown on **Figure B-3**, **Appendix B**. This will ensure that the form and function of the significant valleylands will be protected as a result of future land use changes on the tablelands. Please refer to **Section 7.6.1** for a review from a slope stability perspective.

As previously discussed, SWM outlets may be required to support the SWM strategy for future development on the tablelands. The exact location and extent of disturbance will be reviewed at the site-specific stage; however, it is recommended that the amount of disturbance within the significant valleylands are reduced to the extent possible. For other essential infrastructure, such as sanitary sewers, if they are required underneath the watercourse bed, it is recommended that trenchless drilling best management practices are enacted. More details on servicing are discussed in **Section 5.**

It is acknowledged that a trail network has been envisioned within the significant valleylands by the Town of Caledon (MMTMP, June 2024). Refinement of the proposed trail network is recommended to minimize the amount of disturbance within the significant valleylands to the extent possible. Where feasible, incorporation of the trail along the outer limits of the NHS is recommended.

Unmitigated, the following indirect impacts could occur to the form and function as a result of the proposed development:

- Erosion of banks as a result of uncontrolled flows from the development (during and post construction);
- Human interactions with the valleyland resulting in disturbance or illegal dumping within the corridor; and
- Impacts to wildlife behaviours as a result of construction and permanent development along the corridor.

The establishment and regular monitoring of ESC measures during construction will minimize the potential for negative impacts to occur within the significant valleylands. The following ESC measures are recommended to minimize against potential impacts to downstream (receiving) natural features:

- Limit the size of disturbance;
- Limit the duration of soil exposure and prioritize restabilizing areas once construction is completed in an area;
- Preserve overland sheet flow and micro-drainage (avoid concentrated channel flows);
- Break and redirect flows to lower gradients;
- Design and implement staged stripping;
- Prevent disturbance of previously stripped and stabilized areas;
- Accumulated sediment shall be removed, as part of a maintenance program, from all control measures when accumulation reaches 50% of the height or volume of the control structure; and
- Stabilize stripped areas with temporary ESC controls (e.g., vegetative or mechanical controls).

ESC measures should follow the TRCA's *Erosion and Sediment Control Guide for Urban Construction* (2019). Following construction, all bare soils should be revegetated with native plant materials. The establishment of the 15 m VPZs with native plants will help restore and enhance the existing valleyland.

Where relevant and feasible, the incorporation of bioengineering measures should be explored should localized erosion be identified within the significant valleyland corridor during the site-specific applications. The use of bioengineering approaches uses a "nature-first" approach instead of the traditional engineering measures.

To promote the function of these valleyland features, removal of anthropogenic influences (e.g., sand traps, golf course holds, existing cart paths, etc.) is recommended to restore natural linkage functions within the corridor. The proposed naturalization and restoration measures (as presented below within **Section 8**) will create a more connected and naturalized system throughout the Study Area. The significant valleyland corridors form much of the "backbone" of the NHS and contain many other sensitive features (e.g., wetlands, woodlands, SAR, SWH). By increasing vegetation community types,

the diversity of habitats also increases thereby hosting greater number of species' life processes. The addition of specialized wildlife habitat structures and enhancements will add or enhance additional habitats that are currently limited, degraded or not present within the corridor. The increased natural cover and removal of anthropogenic features (e.g., cart paths, sand traps, golf course holes, agricultural fields) will support both the major and local linkages within the Study Area and will be an overall enhancement to existing conditions.

The establishment of physical barriers such as thorny native plant material or fencing along the edge of the NHS should also be explored to discourage residents from interacting with the significant valleylands. The usage of educational materials (e.g., signage and brochures) to the Mayfield Tullamore residents could be reviewed to explain the importance of maintaining the significant valleyland corridors in its enhanced condition. Protective measures for the valleylands from future residents should be assessed further at subsequent planning stages and finalize as part of detailed design.

As a result of the proposed mitigative and restorative measures, no negative impacts to the significant valleylands are expected. Impacts associated with the proposed collector road crossing should be reviewed as part of the MCEA. Impacts associated with the proposed trail network will be reviewed in subsequent submissions. Impacts associated with proposed SWM infrastructure within the valleylands will be explored as part of the site-specific applications.

Climate Change Implications

The above noted mitigation measures ensures that the valleylands ecological form and function remain intact, promoting greater ecological and climate resilience. Valleylands offer important climate adaptation and mitigation services and act as natural corridors for wildlife, facilitate groundwater recharge, stabilize slopes to prevent erosion, and provide flood mitigation by absorbing and dissipating stormwater flows. The inclusion of a minimum 15 m VPZ from the staked top of bank or stable top of slope (whichever is greater) further enhances their ability to filter pollutants, regulate water quality, and maintain microclimatic stability.

7.2.1.4 Significant Wildlife Habitat

Please see Section 3.1.4.5 of the Phase 1 SWS (GEI and SCS, 2025), for additional information pertaining to SWH. Candidate SWH occurrences were identified in concentration within the Greenbelt Plan Areas and were associated with the West Humber River Valley and its associated tributaries. Candidate SWH for the following were identified within the Greenbelt Plan Area:

The following SWH types were confirmed within the participating properties of the Study Area:

- Turtle Wintering Areas (Property 8 – Greenbelt Plan Area);
- Seeps and Springs (Properties 2, 10 and 11 – Greenbelt Plan Area);
- Terrestrial Crayfish Habitat (Properties 2 and 8 – Greenbelt Plan Area);
- Species of Conservation Concern:
    - Barn Swallow (Property 1 – Anthropogenic structures);

- Eastern Wood Pewee (Property 1 – Greenbelt Plan Area; Property 6 – FOD5-4);
- Snapping Turtle (Property 1 – Golf course ponds; Property 8 – Greenbelt Plan Area; and
- Monarch (Property 4 – MAM2-2).

The following SWH types are considerate candidate within non-participating properties and the Greenbelt Plan Area, where targeted surveys were not completed:

- Raptor Wintering Areas;
- Bat Maternity Colonies;
- Turtle Wintering Areas;
- Reptile Hibernaculum;
- Colonial Bird Nesting (trees/shrubs);
- Waterfowl Nesting Area;
- Bald Eagle and Osprey Nesting, Foraging and Perching Habitat;
- Turtle Nesting Areas;
- Seeps and Springs;
- Amphibian Breeding Habitat (Woodland and Wetland);
- Marsh Bird Breeding Habitat;
- Terrestrial Crayfish Habitat;
- Special Concern and Rare Wildlife Species; and
  - Barn Swallow;
  - Eastern Wood-Pewee;
  - Wood Thrush;
  - Common Nighthawk;
  - Golden-winged Warbler;
  - Grasshopper Sparrow;
  - Ruddy Duck;
  - Eastern Musk Turtle;
  - Northern Map Turtle;
  - Snapping Turtle;
  - Black Dash;
  - Monarch;
- Amphibian Movement Corridors.

While SWH does not have specific setback requirements, the prescribed minimum VPZs associated with Greenbelt Plan Area key natural heritage and key hydrologic features are anticipated to provide suitable protection. Many of these SWH types are associated with significant woodlands, significant wetlands, within watercourses (reviewed as part of the fish habitat section) – all of which are protected by a minimum 30 m VPZ, or within the significant valleylands which are protected by a minimum 15 m VPZ. The Greenbelt Plan Area NHS VPZs will be planted with native species, and key recommendations for plantings should include species that will support species' lifecycles and enhance SWH. For example, consideration of potential bat maternity roosting tree species, such as Shagbark Hickory (*Carya ovata*), Sugar Maple (*Acer saccharum*) and Oak species (*Quercus* sp.) should be explored during restoration planning. Additional information pertaining to recommendations for revegetation is provided in **Section 8.6** of this report. Mitigative and restorative measures identified within the significant woodland, significant wetland, significant valleyland and fish habitat sections will also support the protection and enhancement of SWH.

Similar to the other significant natural heritage features identified within the Greenbelt Plan Area, impacts associated with the proposed collector road alignment may be reviewed as part of the MCEA. Additionally, impacts associated with any trail alignments within or adjacent to SWH should be reviewed. Where feasible, opportunities to locate the trail outside of SWH habitat and within the outer limits of the VPZ is recommended.

The following SWH types were found within the participating properties of the Study Area outside of the Greenbelt Plan Area:

- Species of Conservation Concern:
    - Barn Swallow (Property 1 within anthropogenic structures)
    - Snapping Turtle (Property 1 within the golf course ponds)
    - Monarch (Property 4 within the MAM2-2 community)
    - Eastern Wood Pewee (Property 6 within the FOD5-4 community)

Each SWH type is further discussed below.

<u>Barn Swallow</u>

Barn Swallows were documented nesting within two shipping containers within Property 1. Barn Swallow commonly use anthropogenic structures to support breeding (nesting) activities. These nesting structures are proposed for removal from the Study Area.

Given the prevalence of nesting habitat (anthropogenic structures) in the area surrounding the Study Area, there is no expectation that the removal of these structures would be expected to impact the long-term health and survival of the species.

Mitigation measures to limit Barn Swallow impacts are as follows:

- Detailed surveys should be conducted by a qualified avian biologist prior to any removals to confirm the presence of nests and assess breeding status. Should large quantities of active nests be identified during the detailed surveys, construction of artificial nesting structures should be reviewed. This will be further explored during the site-specific stage.

- Structure removal should occur outside of the active nesting season (between September 1 and April 30).
- Enhancement of surrounding habitats to increase foraging opportunities by maintaining open areas free of tall vegetation.
- Planting of native flora that supports insect populations within the NHS buffers to support Barn Swallow and other aerial insectivores.

By implementing the outlined mitigation measures, it is expected that the removal of the two shipping structures will not result in a negative impact to Barn Swallows.

Snapping Turtle

Habitat for Special Concern Species (Snapping Turtle) was identified within the Golf Course Ponds within Property 1 of the Study Area. Specifically, Snapping Turtles were noted within the SAF and OAO communities. As previously noted, these ponds have been heavily altered over the past decades to support golf course activities.

The SAF community will be retained in place with a 10 m VPZ, as this community was identified as a non-significant wetland. Mitigative and restorative measures identified to support the SAF community (within **Section 7.2.2.1**) will also protect Snapping Turtles. The addition of exclusionary fencing during site-construction should occur to ensure that Snapping Turtles are not moving into the construction area and on-site contractors should be made aware of how to appropriately respond to wildlife, such as snapping turtles, entering an active construction site.

The OAO ponds are proposed for removal as part of the proposed natural channel realignment (as discussed in **Section 7.2.2.3 and Section 8.8.1**) and as such compensation for this habitat removal will be incorporated into the restoration design during the site-specific application. The compensatory habitat will be located either within the realigned channel and/or the Greenbelt Plan Area. Detailed water availability assessment should be completed as part of the site-specific application to confirm that Snapping Turtle overwintering requirements are able to be supported; in general, ponds will need to be at least 1 m in depth to avoid freezing. Given that the OAO ponds, which are an anthropogenic feature that have naturalized over time, have been able to support SWH to-date, this suggests that other intentionally designed habitats can support SWH when re-created on the landscape.

Unmitigated, the removal of this habitat could result in a localized absence of these species within Property 1. As such, best practices for rescue, habitat compensation and mitigation measures are outlined in this section. Despite the golf course ponds providing SWH within Property 1, in general, online ponds can have other negative impacts on the surrounding ecological system including thermal impacts, impediments to fish movement and disruption to sediment transport. While the ponds are proposed for removal, it is expected that the proposed watercourse realignment will provide benefits related to thermal conditions, provide for unimpeded fish movement and allow for a more natural sediment transfer. The realignment of the existing watercourse will also remove in-stream barriers and increase connectivity into the West Humber River corridor. More details on the proposed channel realignment design are summarized in **Section 8.8.1**, but in general the intention is to create wetland pockets and online pools as well as to create a compensatory pond to support breeding and overwintering turtle habitat. The creation of this type of habitat will also support other species (e.g.,

amphibians). Considerations for potential nesting habitat should also be considered in the design to support all lifecycles for this species. Snapping Turtle nesting was documented within the golf course within created sand traps. Other habitat criteria should be reviewed and assessed during the next planning application phase.

Additional considerations to support suitable SWH compensation may include:

- Overwintering ponds should include a layer of soft, muddy substrate to bury into (ECCC, 2016; Ernst & Lovich, 2009; Ultsch, 2006), and water depth and substrate depth should vary within the pond to provide turtles with a diverse option for overwintering;

- Deciduous trees and shrub plantings are recommended to provide partial shade and leaf litter that will serve to regulate pond and wetland temperature and provide shelter sites;

- Scattered installation of basking logs throughout the watercourse corridor can provide basking opportunities adjacent to overwintering pools for turtles;

- Turtle nesting areas are recommended to be placed along southern facing slopes to receive optimal sun exposure to facilitate nest incubation (Toronto Zoo, n.d.; Buhlmann & Osborn, 2011). If being implemented, a nesting beach should include variations in sand and gravel depth, and sand and gravel mixture to increase variety and ultimately nest success and the surrounding watercourse corridor design should provide vegetative cover for hatchlings for protective cover from predation and the elements (Buhlmann & Osborn, 2011; Toronto Zoo n.d.);

- Steeper slope grading is recommended where compensation habitat fronts the proposed development, to discourage wildlife movement towards development/roadways, where feasible; and,

- In terms of timing for removal of online ponds, it is recommended to complete this prior to the active nesting season (May – August). Prior to taking the ponds offline, an aquatic wildlife rescue should be conducted by a qualified ecologist based on appropriate permitting from the MNR. Opportunities to phase construction of the compensation habitat should be considered during the site-specific application to allow for an appropriate relocation spot for rescued wildlife. Alternative locations within the vicinity of Property 1 may be explored if required, including the retained SAF community at the northern limit of the Property. A formal wildlife rescue protocol should be developed as part of detailed design.

In addition to wildlife rescue and habitat compensation efforts, indirect impacts to this species should be mitigated for. This may include, but is not limited to:

- SWM design that considers quality control to mitigate potential effects on water quality in receiving wildlife habitats due to suspended sediments and turbidity;
- Salt management strategies to limit road salt discharge into post-construction compensation habitat and channel realignment; and

- ESC fencing and/or alternative fencing options should be used to restrict wildlife access to construction sites.

The proposed collector road alignment avoids Snapping Turtle habitat. Therefore, no impacts to Snapping Turtle SWH are expected as a result of the road alignment.

Given the proposed residential land-use and potential opportunities for multi-use trails (MMTMP, June 2024) within the Study Area, impacts associated with human and pet interactions with created and retained habitats must be considered. Where possible, the trails should be located outside of SWH and instead be located within the outer few metres of the VPZs. Where trails are located within the NHS, physical barriers such as the inclusion of thorny native species (e.g., raspberry species) or chain-link fencing should be explored to deter humans from interacting with the NHS, especially adjacent to more sensitive habitats. The exact type of physical barriers should be further explored at the site-specific stage. At detailed design, consideration for resident educational materials should be considered.

As result of the proposed mitigative and restorative measures, no negative impacts are expected to amphibians and turtles. The removal of existing anthropogenic features can easily be replicated and further enhanced within the proposed NHS.

Species of Conservation Concern – Monarch

Habitat for Special Concern Species (Monarch) was identified within one MAM2-2 vegetation community within Property 4 of the Study Area. This habitat is based on areas with the highest density of Common Milkweed and the highest breeding evidence (eggs and caterpillars). This MAM2-2 community will be retained in place and protected by a minimum 10 m wetland VPZ and further protected as part of the non-significant valleyland system by a 10 m VPZ. These buffers and setbacks will be revegetated and general recommendations for revegetation are outlined in **Section 8.6**.

One proposed road crossing within Monarch SWH habitat is expected as a result of the proposed collector road alignment. Impacts associated with the Monarch SWH habitat removal as a result of the proposed collector road alignment will be further explored as part of the MCEA. Where possible, it is recommended to minimize and avoid impacts to the MAM2-2 unit. If encroachment or removal of this habitat is required to support the collector road, it is recommended that vegetation removals occur outside of the active monarch breeding season (June 1 to September 30) and that compensatory habitat creation is considered as part of restorative measures. More details on how to enhance and replicate milkweed patch removal is discussed further below.

Mitigation measures to protect the non-significant wetland and non-significant valleyland would also support the protection of Monarch SWH habitat. Please refer to **Sections 7.2.2.1** and **Section 7.2.2.3** for mitigation measures.

Within the Study Area, despite not meeting SWH criteria, several milkweed patches have been identified that could provide general habitat for Monarch. Unmitigated, the removal of these patches could result in a localized absence of this species within the Study Area. Moreover, vegetation

management as part of the proposed development may impact availability of Milkweed as a host plant and other nectaring species that support the Monarch life cycle. However, the establishment of Common Milkweed (and other plants used for nectaring) is quick and they are commonly found in early successional habitats. As a result, the removal of the specific patches of Common Milkweed are not predicted to have a negative impact if replaced elsewhere in the general vicinity of the Study Area (e.g., within the VPZs and landscaped planting beds where feasible).

To replicate milkweed patch and other nectaring plant species removal throughout the tablelands, pollinator habitat is recommended as part of the restoration efforts throughout the NHS. Seed mixes that provide pollinator breeding and foraging habitat for Monarch should be selected, targeting for the inclusion of other nectaring species that flower from mid-spring to mid-fall (such as Wild Bergamot; *Monarda fistulosa*, Spotted Joe Pye Weed; *Eupatorium maculatum,* New England Aster; *Symphyotrichum novae-angliae*, Black-eyed Susan; *Rudbeckia hirta*) along with the Common Milkweed throughout the seeded area. This habitat creation will not only target Monarch but will also be suitable for other generalist pollinator species (such as Common Eastern Bumble Bee; B*ombus impatiens*, Red Admiral; *Vanessa atalanta*, Common Eastern Little Carpenter Bee; *Ceratina dupla* and Least Skipper; *Ancyloxypha numitor* to name a few). More details on flora considerations for restoration and enhancement areas are discussed in **Section 8.6**.

Additionally, where possible, the removal of Common Milkweed should be completed outside of the active breeding season (June 1 to September 30) to avoid any direct impacts to any of the Monarch life stages before their migration south (Environment Canada 2014).

Installation of fencing and signage along the edge of the restoration area could be explored during the site-specific stage. Fencing would act as a physical barrier to prevent mowing within the restoration areas. Signage along the NHS can also be provided to highlight that the NHS is a “no mow” area. With the proposed mitigative and restorative measures, as well as Monarchs having little to no site fidelity, no negative impacts are expected following implementation of the pollinator compensation habitat. An overall improvement in the abundance of Milkweed and diversity of nectaring species is expected within the designed NHS.

Currently the trail alignment is not proposed near Monarch SWH habitat; however, a detailed review of the proposed trail alignment is required in subsequent phases. Efforts to avoid impacts to Monarch SWH should be considered.

Since Monarch SWH will be avoided as a result of the proposed Structure Plan, no negative impacts are expected.

<u>Eastern Wood Pewee</u>

Habitat for Eastern Wood Pewee was identified within the FOD5-4 woodland feature that is predominately located within a non-participating property and Property 6, with some minimal overlap into Property 11. The FOD5-4 feature is proposed to be retained in place with a minimum 10 VPZ. This buffer will be revegetated and general recommendations for revegetation are outlined in **Section 8.6**.

Indirect impacts to Eastern Wood Pewee habitat may include disturbances due to adjacent vegetation clearing, construction noises, and/or post-development impacts such as lighting and human activities on adjacent lands. Given the prevalence of adjacent woodland within the Greenbelt Plan Area, and anticipated revegetation of VPZs, disturbances during construction or post-development are not anticipated to have long-term impacts on this species.

In order to minimize any potential effects on Eastern Wood Pewee, potential mitigation measures are as follows:

- In general, any adjacent vegetation clearing removal should occur outside of the active nesting season (between September 1 and March 30).
- Enhancement of surrounding habitats to increase foraging opportunities and alternative habitat; for example, there is likely suitable habitat within the Greenbelt Plan Area woodlands; revegetation of minimum VPZs with suitable woodland species will help provide alternative habitat for these species;
- Planting of native flora that supports insect populations within the NHS buffers to support aerial insectivores.

By retaining the FOD5-4 woodland and implementing the outlined mitigation measures, as well as the mitigation measures outlined in the subsequent "General Mitigation Measures" section, no negative impacts to Eastern Wood Pewee SWH are expected.

General Mitigation Measures

Some wildlife will be susceptible to short-term and long-term effects. Noise from construction activities may result in wildlife avoidance of the edges abutting active work areas during the construction period. Where feasible, construction activities should be timed outside of the nighttime and early morning periods during the bat and bird breeding seasons (April 1 to September 31). Some localized movement of wildlife out of these edge areas may still occur during the construction phase. The wildlife in this area are expected to have generally adjusted to the existing urban level of background noise and interference associated with existing anthropogenic Study Area conditions.

Other mitigative measures to prevent adverse effects as a result of the proposed development include:

- Installing and maintaining tree protection measures (e.g., hoarding, temporary fencing) during construction activities to avoid impacts to the woodland;
- Installing and maintaining ESC measures during construction activities to aide in eliminating excess disturbance through vegetation removal, ground disturbance and dislodgement of sediment on the tablelands.
- Installing exclusionary fencing to limit wildlife encounters within construction areas; and
- Directing new lighting away from the NHS to avoid impacts to wildlife in a post-development scenario.

Additional mitigative measures should be explored as appropriate as part of subsequent planning stages to minimize indirect impacts on wildlife.

No negative impacts to SWH are expected, provided that the proposed avoidance, mitigation, habitat compensation, and enhancement measures are enacted, monitored and maintained. Overall, it is expected that in addition to no negative impacts, the establishment of the vegetated buffer will also greatly enhance the NHS and subsequently wildlife habitat, as compared to the existing limited functions of the actively managed agricultural fields and golf courses currently in place.

Climate Change Considerations

The proposed mitigation measures directly support ecological and climate resilience by protecting and enhancing species habitats, ensuring that these natural systems can better withstand the impacts of climate change by support healthy, intact systems. By incorporating vegetative buffers, ESC measures, and habitat restoration into the development plan, the project maintains critical habitat connectivity and safeguards ecosystem functions. Vegetated buffers, not only protect habitat areas from development-related disturbances but also provide thermal regulation, improve water quality, and offer shelter for species adjusting to shifting climates. Native plantings within these buffers further enhance biodiversity by creating diverse, climate-adapted habitats that can sustain various life stages of wildlife.

For species like the Monarch butterfly and Snapping Turtle, habitat compensation and restoration efforts are designed to address both current and future needs under changing climatic conditions. The creation of pollinator habitats with native seed mixes, creation of nesting and overwintering habitats, and improved wetland functions ensures that species have access to resources necessary for survival and reproduction. These measures also enhance ecosystem stability, as habitats with higher species and structural diversity are better equipped to recover from climate-induced disturbances such as extreme weather events.

The protection and enhancement of SWH further contributes to climate adaptation and mitigation by maintaining ecosystem services that buffer climate change impacts. These include flood attenuation, groundwater recharge, carbon sequestration, and soil stabilization. For example, the retention and enhancement of valleylands and associated SWH, such as turtle wintering areas and amphibian breeding habitats, ensure that these natural features continue to support species migration, hydrological balance, and carbon storage. The inclusion of invasive species management, and public education initiatives strengthens these habitats, making them more resilient to future changes.

The integration of avoidance, mitigation, and restoration measures not only preserves existing habitats but also enhances their ecological function and resilience. This approach supports the natural system's ability to adapt to climate variability, sustain biodiversity, and provide vital ecosystem services that contribute to both local and regional climate resilience.

7.2.1.5 Habitat for Endangered and Threatened Species

SAR and their habitats are protected under the *Endangered Species Act (ESA)* in subsections 9 and 10. Potential direct and indirect impacts associated with land use changes, development and/or site alteration may require discussion with the MECP. If potential impacts are expected as a result of the proposed land use changes or subsequent proposed development, then engagement with MECP should occur as part of the site-specific application. Engagement with MECP is proponent led.

The following SAR and/or SAR habitat was identified within the Study Area:

- Redside Dace – endangered in Ontario;
- Butternut – endangered in Ontario;
- SAR Bats – endangered in Ontario;
- Bobolink – threatened in Ontario; and
- Eastern Meadowlark – threatened in Ontario.

A brief summary of SAR and SAR habitat identified within the Study Area is provided below.

Butternut

A total of 17 Butternuts have been identified within the Study Area (all located on Properties 1 and 2). These Butternut occurrences were largely located within the Greenbelt Plan Area and the West Humber River valleyland; however, two individuals were located within the active golf course at Property 1.

A formal health assessment was completed for the two Property 1 Butternuts on July 24, 2024. The results of that survey showed that each of the trees were Category 1 (non-retainable). A Butternut Heath Assessment report was prepared by GEI and submitted to the MECP on August 23, 2024. The MECP did not request an audit of the assessment and therefore the report's findings are deemed final. Detailed Butternut Health Assessments were not completed for the remaining 15 trees, given that they are located well within the defined valleyland.

The remaining Butternut trees are expected to be protected as part of the Greenbelt Plan Area NHS within the 30 m VPZ; however additional butternut health assessments may be required at the site-specific stage if any disturbance is proposed (above or below ground) within 50 m of any of the trees. Tree protection fencing may be required to protect butternut root zones from disturbances within this 50 m radius.

No impacts to Butternut and its associated habitat are expected as a result of the proposed Structure Plan.

Redside Dace

Occupied and contributing Redside Dace habitat was identified within the Study Area. Section 3.1.4.6 of the Phase 1 Report (GEI and SCS, 2025) determined where each habitat type was present. Impacts related to each habitat type are discussed below.

Occupied Redside Dace habitat is identified throughout the West Humber River and its associated Tributary, as well as Campbell's Cross Creek. Specifically, occupied habitat is identified within reaches CCC(2), WHT4(2)-1, WHT4(2)-2, WHT4(3)-1, WHT4(3)-2, WHT4(3)2-1a, WHT4(3)2-1b, WHT4(3)3-1. One proposed collector road crossing is identified (associated with Property 9) within occupied Redside Dace habitat. Impacts to Redside Dace as a result of this proposed collector road crossing will be evaluated as part of the MCEA. Since this is an existing watercourse crossing location associated with a golf course path, this crossing would be considered an upgrade to an existing crossing instead of development of a new crossing. Sanitary and water servicing may also be located within the

proposed collector road alignment; this reduces the number of infrastructure crossings and thus reduces the amount of impact within occupied Redside Dace habitat. If the sanitary sewers are required underneath the watercourse, trenchless drilling best management practices must be explored. This collector road crossing would require engagement with Fisheries and Oceans Canada (DFO) and MECP to confirm approval requirements.

Several SWM outfalls are expected to outlet into occupied Redside Dace habitat including within Properties 1, 3, 8, 9 and 10. Impacts associated with the proposed SWM infrastructure into Redside Dace habitat should be reviewed as part of the site-specific applications. If possible, SWM infrastructure should be located outside of occupied Redside Dace habitat. If infrastructure is required in occupied habitat, engagement with DFO and MECP may be required to confirm approval requirements.

Medium constraint watercourses, HDFs and riparian wetlands may be considered contributing Redside Dace habitat. One proposed collector road crossing is identified on Property 4. Impacts to contributing Redside Dace habitat should be reviewed as part of the MCEA. Sanitary and water servicing may also be located within the proposed collector road alignment. Impacts and mitigative approaches associated with the installation of these services should be assessed at the site-specific stage.

Several SWM outfalls are also proposed within contributing Redside Dace habitat including Property 1, 3, 4 and 11. Impacts associated with the proposed SWM infrastructure to contributing Redside Dace habitat should be reviewed as part of the site-specific applications.

The below recommendations are provided when working within Redside Dace habitat:

- Construction:
    - Construction within occupied Redside Dace habitat should occur between July 1 and September 15 and construction within contributing Redside Dace habitat should occur outside of the warmwater fisheries window (March 15 to July 15). The duration of in-water construction should be minimized;
    - Ongoing ESC monitoring during and post-construction monitoring should occur. Sediment controls should prevent sedimentation from exceeding 25 mg/L above background levels during construction;
    - Where in-water work is required, work-site isolation should occur with flows diverted around the isolated area. Fish rescues should also occur to prevent any harm or death to Redside Dace;
    - Should services be installed underneath the watercourse (i.e., using trenchless techniques), drilling must occur a minimum of 2 m below the bed of the watercourse to prevent frac-outs;
    - All disturbed habitat should be restored to equal or greater conditions using native plant materials;
- Development:
    - Contributions of flows, coarse sediment supply and allochthonous material (as appropriate) should be maintained to downstream Redside Dace habitat;
    - Site-wide and feature-based wetland water balance (as required) should be addressed;

- To address Redside Dace thermal requirements, dry SWM facilities should not be provided;
- SWM outfalls should be designed to meet erosion threshold targets;
- SWM facilities should be designed to meet or exceed the Level 1 Enhanced (80% Total Suspended Solid removal) target;
- SWM facilities should target dissolved oxygen levels of 7 mg/L or greater and discharge temperatures should be below 24°C at the outlet;
- Where watercourse crossings are proposed within occupied habitat, open bottom culverts should be installed to maintain the natural stream bed and facilitate fish passage.

These recommendations are in-line with the Guidance for Development Activities in Redside Dace Protected Habitat guidelines (MNRF 2016a). General fish and fish habitat mitigation and restoration measures identified within **Section 7.2.1.6** would also apply.

Eastern Meadowlark

While this species was recorded on Property 1 and Property 4 during breeding bird surveys, it was determined that this species was simply foraging in the area and that no suitable breeding habitat is present given the active management of each property (golf course and agricultural lands). Neither property provides suitable breeding habitat for this SAR. Refer to Section 3.1.4.6 of the SWS Phase 1 (GEI and SCS, 2025), for additional information.

This species was also recorded, and its habitat was confirmed within Property 9 by Beacon Environmental. Based on the NHE prepared by Beacon Environmental (2025)**,** approximately 2.26 ha of cultural meadow community within the property provides Eastern Meadowlark habitat; this feature is proposed for removal to accommodate the proposed land use changes. The NHE notes that habitat removals will proceed in conformity with the ESA as outlined in Section 8.10 of their NHE as follows:

"*Under the habitat regulations for these species (Section 23.2 of Ontario Regulation 242/08), it is possible to remove the habitat provided suitable habitat is created within the same ecoregion. MECP has developed species specific guidelines and regulations to address habitat removals. Prior to removal of the meadow habitat, a plan must be developed in accordance with MECP guidelines to ensure compliance with the regulations. Alternatively, compensation through the Species at Risk Conservation Fund, per Ontario Regulation 829/21, may be explored where the proponent is required to pay a species conservation charge to the MECP*."

No removal of habitat can occur between May 1 to July 31. Any potential impacts to Eastern Meadowlark or their habitat will be addressed under the ESA.

Bobolink

While this species was recorded on Property 3 and Property 4 during breeding bird surveys, it was determined that this species was simply foraging in the area and that no suitable breeding habitat is present given the active management of each property (agricultural lands). Refer to Section 3.1.4.6 within the SWS Phase 1 (GEI and SCS, 2025), for additional information.

This species was also recorded, and its habitat was confirmed within Property 10 by Beacon Environmental. Based on the NHE prepared by Beacon Environmental (2025) the meadow communities where Bobolink were identified is located within other environmental constraints associated with the Greenbelt Plan Area NHS and will be protected. Specifically, Bobolink were recorded within the significant valleyland associated with WHT(4)2-2.

No impacts to Bobolink are expected as its habitat is located well within a significant valleyland, which be protected by a minimum of 15 m setback.

SAR Bats

Candidate habitat for SAR bats was identified within the NHS associated with the Greenbelt Plan Area as the woodlands there are large, contiguous communities within immediate vicinity of water (for hydration and foraging opportunities. As discussed above within **Section 7.2.1**, all woodlands within the Greenbelt Plan Area will be retained. The noted mitigation and restoration measures identified above within **Section 7.2.1** are expected to minimize and mitigate negative impacts to the form and function of the woodland, and as such, protect any SAR bat habitat from impacts.

The following additional mitigation measures (on top of those already identified within **Section 7.2.1.1**) should be explored during the site-specific applications:

- Light should be directed away from the retained NHS to avoid impacting roosting and foraging activities; and
- Incorporation of native tree plantings such as Maple (*Acer* sp.), Oaks (*Quercus* sp.), Aspen (*Populus* sp.), Hickory (*Carya* sp.) and White Pine (*Pinus strobus*) within the vegetated buffers, dependent on the soil conditions, as these species are commonly used by bat species for roosting. Opportunities to incorporate bat rocket boxes may also be explored.

The establishment of native VPZs associated with other natural heritage features (e.g., significant valleylands, significant woodlands, PSWs) will also provide benefits to SAR bats given that it will increase the availability of roosting and foraging habitat. Enhancements within the existing NHS (e.g., restoring agricultural and golf course lands) will create a larger and more contiguous NHS within immediate vicinity of water.

Outside of the Greenbelt Plan Area, all treed vegetation communities were assessed in the field for the presence of bat habitat (snags, tree cavities, etc.). Refer to Section 3.1.3 of the SWS Phase 1 (GEI and SCS, 2025), for additional information on the results of the bat habitat and acoustic monitoring surveys. The call abundances for all stations were determined to be relatively low and it can be assumed the overall abundance of bat SAR within the Study Area is low. Furthermore, based on the low call counts, it was determined that no SAR maternity roosting habitat is likely within the treed communities within the tablelands of the Study Area.

No negative impacts are expected to SAR bats and their associated habitat within the West Humber River NHS given the above noted mitigative and restorative measures. Engagement with MECP may be warranted where tree removals are proposed during site-specific applications.

Climate Change Considerations

The proposed mitigation and avoidance measures are designed to support species habitats by minimizing disturbances, preserving critical natural features, and enhancing ecosystem functionality; these measures that are intended to support ecosystem health and climate resilience. By incorporating VPZs, targeted restoration efforts, and habitat compensation where necessary, the project maintains essential ecological functions, such as wildlife movement corridors, breeding and foraging areas, and hydrological balance. These measures also support SAR adaptation by maintaining intact, climate-resilient ecosystems that provide food, shelter, and nesting opportunities. Restoration efforts, including native plantings, invasive species management, and the enhancement of riparian and upland habitats, further support SAR populations.

The design of SWM infrastructure should consider Redside Dace habitat needs by mitigating thermal impacts, maintaining dissolved oxygen levels, and reducing sedimentation risks. Similarly, woodland retention and enhancements can provide foraging and roosting habitat for SAR bats while limiting light pollution and disturbances. Through these integrated conservation strategies, the project not only safeguards SAR and their habitats but also ensures the continued provision of critical ecosystem services, such as flood attenuation, groundwater recharge, and carbon sequestration, all of which are vital under a changing climate.

7.2.1.6 Fish Habitat

Direct and indirect fish habitat was identified within the Study Area. All high constraint watercourses were identified as direct fish habitat, and the medium constraint watercourse on Property 1 (WHT4(3)5-2) was also identified as direct fish habitat. The medium constraint watercourses on Property 1 (WHT4(3)6-1) and Property 4 (WHT4(3)4-2 and WHT4(3)6-1) were identified as indirect fish habitat. Low constraint watercourses (located within non-participating properties and the northern most extent of Property 4) were identified as indirect fish habitat. All HDFs within the Study Area were identified as providing indirect or no fish habitat. All HDFs (except HDF 3A, 3C and 4C) were assigned a Mitigation management recommendation under the HDFA Guidelines (TRCA and CVC 2014), whereas HDFs 3A and 4C were assigned Conservation management recommendations, and HDF-3C was assigned a Protection management recommendation. Finally, two Ponds within Property 9 (Ponds A and C) were identified as fish habitat given their connectivity to the West Humber River tributary. Fish habitat is shown on **Figure B-4** (**Appendix B**).

All high constraint watercourses identified within the Study Area (except for the non-participating reach near Property 4) were identified as occupied Redside Dace habitat. Medium constraint watercourses, HDFs and riparian wetlands may also provide indirect (contributing) habitat functions. Impacts associated with Redside Dace were reviewed within **Section 7.2.1.5**.

As discussed within the Phase 1 Report, two anthropogenically impacted watercourses were identified within the Study Area: (1) WHT4(3)5-2 on Property 1, and (2) WHT4(3)4-2 within the northern extent of Property 4 and a non-participating property. WHT4(3)5-2 hosts three online ponds that were created to support the golf course. WHT4(3)4-3 is a piped feature that collects drainage from Old School Road through a non-significant valleyland before daylighting at an existing farm crossing. In addition to these existing impacted conditions, several watercourse crossings were identified within

the Study Area including within Properties 1 (golf cart paths), 4 (farm crossing), 8 (driveway access) and 9 (golf cart paths).

High Constraint Watercourses

All high constraint watercourses will be protected in place as they are all located within the Greenbelt Plan Area and within defined valleylands. All high constraint watercourses within significant valleylands will be protected by a minimum of a 15 m VPZ applied from the stable top of slope or staked top of bank (whichever is the greatest constraint). The mitigation and restoration measures identified within **Section 7.2.1.6** would also assist in protecting the watercourse and its associated fish habitat functions. Minor enhancements within the high constraint watercourses may be considered in order to restore localized areas that have been historically impacted or degraded as a result of anthropogenic activities. For example, removal of in-stream barriers (e.g., the degraded driveway crossing at Property 8) would benefit fish and fish habitat by restoring connectivity to upstream habitats. Please refer to **Section 8.8.3** for additional details.

One collector road crossing is proposed across a high constraint watercourse (associated with WHT4(3)2-1b) on Property 9. The impacts associated with the proposed collector road crossing will be evaluated as part of the MCEA; however, the road is proposed at an existing watercourse crossing. Using an existing road crossing is recommended to reduce additional disturbance to and alteration of fish habitat. This upgraded crossing is also located within an actively managed golf course; thus, minimizing the amount of native vegetation that would be removed within and adjacent to fish habitat as a result of the proposed road network. Recommendations regarding the proposed collector road crossing from a fish and fish habitat perspective are provided within **Section 8.7.2**. If any in-water work is required within high constraint watercourses, Redside Dace construction mitigation measures should be followed (as discussed within **Section 7.2.1.5**).

As previously discussed, essential infrastructure (i.e., the SWM outlets) will be required in order to support the SWM strategy for the development on the tablelands. Within the proposed Structure Plan, SWM outfalls outletting into high constraint watercourses were identified on Properties 1, 3, 7, 9 and 10. The location and extent of disturbance will be reviewed at the site-specific stage; however, it is recommended that the amount of disturbance within fish habitat is minimized to the extent possible. SWM controls should be designed to meet Redside Dace requirements (as discussed within **Section 7.2.1.5)**. Should sanitary sewers be required underneath the watercourse bed, it is recommended that trenchless installation best management practices are enacted.

It is acknowledged that a trail network has been envisioned by the Town of Caledon within the significant valleylands, and thus adjacent to direct fish habitat. Refinement of the trail network is recommended to minimize the amount of disturbance to the extent possible. It is recommended that trail crossings are paired with road crossings to prevent multiple crossings of the watercourse. Where feasible, incorporation of the trail along the outer limits of the NHS is recommended.

No negative impacts to high constraint watercourses are expected as a result of the proposed Structure Plan. Impacts as a result of the proposed collector road crossing will be evaluated as part of the MCEA. Impacts associated with SWM infrastructure will be evaluated during the site-specific process.

Medium Constraint Watercourses

Medium constraint watercourses are also located within defined valleylands, with WHT4(3)4-2 and WHT4(3)5-2 located within non-significant valleylands and WHT4(3)6-1 located within a significant valleyland. It is likely that WHT4(3)6-1 is associated with a gully within the larger West Humber River valleyland.

Similar to high constraint watercourses, WHT4(3)6-1 is located within significant valleylands; thus, the feature will be retained in place. Mitigation measures associated with the protection of the significant valleyland will also assist in protecting this reach. A riparian wetland (MAM2-10) is also associated with this reach. As discussed within **Section 7.8.4**, feature-based water balance risk assessment undertaken for the wetland determined that mitigation measures will be required to support the hydroperiod of this feature. Several mitigation measures have been suggested for consideration in the site-specific application to maintain the hydroperiod requirements and ensure no negative impacts. It is acknowledged that a change in the catchment area to this feature will occur as a result of the proposed plan; however, provided the hydroperiod for the wetland (and thus the hydrology of the reach) are maintained through mitigation measures, no negative impact to fish and fish habitat are expected.

Reach WHT4(3)4-2 is located within a non-significant valleyland, which will be retained by a minimum of a 10 m VPZ from the staked top of bank or the stable top of slope (whichever is the greatest constraint). Given that the watercourse is located well within the valleyland, no impacts to the form and function of the watercourse are expected as a result of the proposed tableland development. One collector road crossing is proposed south of an existing farm crossing. The proposed impacts associated with the collector road crossing will be evaluated through the MCEA; however, it is recommended that the existing farm crossing be decommissioned, and the channel is restored using natural channel design principles. Further information on the proposed restoration strategy for this feature is provided within **Section 8.8.3**. Furthermore, since the watercourse provides indirect fish habitat no fish salvage is warranted; however, site isolation measures and implementation of flow conveyance measures are recommended during construction to ensure that there are no negative impacts to downstream (receiving) fish and fish habitat. Mitigation measures discussed below related to the realigned channel corridor would also apply for in-stream construction work within this retained watercourse. One SWM pond outfall is proposed into the watercourse. Impacts associated with the proposed SWM outfall should be reviewed at the site-specific stage; however, minimizing the amount of disturbance within and immediately adjacent to fish habitat is recommended. SWM controls should be designed to meet Redside Dace requirements (as discussed within **Section 7.2.1.5)**.

Two of the three online ponds associated with Reach WHT4(3)5-2 are proposed to be decommissioned, with the reach being realigned along the western and southern property limits within a 45 m wide realigned channel corridor (discussion on the approximated width of the realigned channel is discussed below within **Section 7.3.4**). The northerly pond (SAF community) will be retained in place with a 10 m VPZ. Mitigation measures for the protection of this feature are further discussed within **Section 7.2.2.1**. As discussed within the Phase 1 Report (GEI and SCS 2025), these ponds are highly disturbed and degraded as a result of ongoing golf course management. The ponds were created by berming portions of the watercourse, which impacts the overall connectivity of the reach

to the downstream West Humber River. Several watercourse crossings are also located along the watercourse, which further restricts the flows between the ponds. The proposal to realign the watercourse will eliminate the large ponded features, thus reducing the amount of thermal and nutrient loading to downstream fish habitat, including Redside Dace. The natural channel corridor will be designed using natural channel design principles, which will include a variety of fish habitat types (e.g., riffles, pools) to support various life processes. Additional details on the proposed restoration strategy are provided within **Section 8.8.1**. Overall, a net gain in habitat variability and channel length are expected as a result of the proposed realignment.

Unmitigated, realignment of WHT4(3)5-2 could cause negative impacts to downstream habitats such as increased flooding and erosion potential, reduced habitat availability (due to changes in flow) and reduced water quality. Potential indirect effects on fish habitat downstream that could occur from the proposed development include:

- Impaired fish habitat and/or negative impacts on aquatic biota (e.g., fish and benthic invertebrates), including deteriorated health or mortality, due to erosion and sediment from site alteration and development;
- Mortality or health impacts due to accidental spills of toxic materials during or post-construction;
- Alterations in watercourse water balance (e.g., timing and volume of flows) and associated negative impacts on fish habitat functions; and
- Long-term impairment of watercourse water quality (including chemical contaminants, suspended solids and temperature) due to surface runoff from the proposed development.

The following mitigative measures are recommended to be considered to prevent or minimize negative effects on fish and fish habitat:

- Minimize in-water work requirements and ensure downstream flows are maintained at all times. In-water work will be completed outside of the warmwater fisheries window (March 15 to July 15), dependent on the presence of *Centrarchid* species. A fish and wildlife salvage should be completed.
- Preparation and implementation of an ESC plan with associated mitigation measures to minimize the potential for negative impacts (i.e., silt fencing). ESC measures should be monitored throughout the construction period to ensure that they are functioning as designed. Where deficiencies are identified, ESC measures must be repaired immediately to prevent adverse impacts to receiving features;
- Construction equipment should be regularly maintained to prevent spills within and adjacent to the NHS. Preparation and implementation of a spill prevention and response plan to prevent or minimize the potential for spills of potentially toxic materials during construction. All spills (e.g., sediment, gasoline) must be reported to MECP's Spill Action Centre;
- Implementation of SWM infrastructure and meet all Redside Dace water quality criteria (as discussed within **Section 7.2.1.5**);
- Incorporation of thorny barrier plantings or fencing should also be considered along the limit of the NHS. This will discourage humans from interacting with the watercourse;

- Realigned channel corridor will have a 10 m VPZ applied from the created top of bank. Since the realigned low-flow channel will be located within the defined valleyland, a minimum of a 10 m buffer to adjacent development will be achieved from direct fish habitat. These vegetated buffers, when also combined with the proposed riparian vegetation in the floodplain are expected to provide a number of supporting fish habitat functions including shading of the stream, provision of organic materials (e.g., leaves, twigs) to provide a source of forage for benthos and fish and stabilization of soils to minimize erosion potential. Therefore, the proposed realigned channel buffers, when combined with additional mitigative and restorative measures, are expected to protect and support fish habitat within the realigned watercourse;
- Creation of wetland habitat within the realigned channel corridor will help provide additional enhancements that are currently not provided by the ponded habitats; and
- Incorporation of natural channel design principles to mimic natural aquatic habitats to provide a diverse range of dynamically stable habitat conditions to support potential fish habitat functions of the realigned watercourse (e.g., benthic invertebrate production, flow conveyance and sediment supply).

Mitigation and restoration measures identified within the non-significant valleyland (**Section 7.2.2.3**) would also support the form and function of the watercourse corridor, and thus provide benefits to fish and fish habitat.

No negative impacts are expected to WHT4(3)4-2 and WHT4(3)6-1 as they will be retained in place and are located within defined valleylands. Positive impacts to aquatic habitat within WHT4(3)5-2 are predicted as a result of the creation of the realigned channel corridor. No negative impacts to receiving watercourses are expected provided mitigation measures are enacted and monitored. During the site-specific stage, engagement with DFO and MECP is recommended to determine whether any approvals are required to facilitate the proposed channel realignment on Property 1.

Low Constraint Watercourses

Two low constraint watercourses were identified within the Study Area: WHT4(3)3-1a and WHT4(3)4-3. No proposed collector road crossings or SWM outfalls are proposed within the immediate vicinity of these features.

As discussed within the Phase 1 Report, Reach WHT4(3)3-1a is located within a non-participating property and has not been ground-truthed. It is possible that this feature may be a headwater drainage feature given its small upstream catchment area. For this Phase 2 Report, it is assumed that the watercourse functions similarly to an HDF, and thus, the mitigation and restoration measures presented below would apply. As a result of the proposed Structure Plan this reach would be removed and have its functions replicated. A formal impact assessment should be completed once a thorough evaluation of the feature has been completed.

Reach WHT4(3)4-3 is a piped feature that conveys flow from Old School Road into WHT4(3)4-2, which is proposed to be maintained in place within the non-significant valleyland. Reach WHT4(3)4-3 is also located within the non-significant valleyland and is located partially within a non-participating

property. This feature has been historically altered with flow conveyance being its main function. Since a portion of the reach is located within a non-participating property, opportunities to daylight the watercourse are currently not feasible. Should the property become participating, enhancement recommendations have been identified within **Section 8.8.2** to increase the overall form and function of the reach, including to incorporate natural channel design principles, restore the native bed substrates and vegetate adjacent riparian areas with native plant materials. This would provide benefits to the overall NHS and provide increased opportunity for allochthonous material contributions to downstream fish habitat. Given that currently the feature is piped, no negative impacts to the existing functions of the feature are expected as a result of the proposed structure plan.

No negative impacts to WHT4(3)3-1a and WHT4(3)4-3 are expected as a result of the proposed Structure Plan. Engagement with MECP may be warranted to determine whether any approvals are required to facilitate the removal of WHT4(3)3-1a and future perspective daylighting of WHT4(3)4-3.

HDFs

All HDFs except HDF-3A, 3C and 4C are proposed for removal from the landscape with their functions replicated. All HDFs proposed for removal were assigned a Mitigation management recommendation under the HDFA Guideline (TRCA and CVC 2014). Some HDFs contained wetland riparian vegetation; all impacts associated with non-significant wetland removals and proposed mitigative and restorative measures are discussed within **Section 7.2.2.1**. All wetlands proposed for removal will be replicated within the Study Area. The compensation ratio will be determined during the site-specific stage; however, no net loss in wetland area and functions will occur as a result of the proposed tableland development.

Other functions that the HDFs would provide would be associated with flow conveyance and contribution of allochthonous material. All HDFs proposed for removal had management recommendations of Mitigation, thus, the HDFA Guideline (TRCA and CVC 2014) recommends that their hydrological functions are replicated through lot level conveyance measures, such as SWM and LID infrastructure. Flow contributions to downstream habitats should be further reviewed as part of the site-specific stage to confirm that pre to post development flow is replicated. SWM pond locations have been generally proposed near the downstream extent of existing HDFs to demonstrate that flow replication can be achieved. Should the site-specific application refine the SWM ponds locations, lot-level controls such as vegetated swales, constructed wetland features, clean roof top drainage or other LID measures can be explored to mitigate the functions of existing HDFs. Since all HDFs ultimately connect into medium or high constraint watercourses, incorporation of native plant material along the edge of these watercourse corridors will replicate the allochthonous material function. Moreover, opportunities to incorporate large woody debris (e.g., from felled trees elsewhere in the Study Area) into the NHS enhancement areas would provide organic carbon inputs into the system.

All HDFs proposed for removal and replication should be removed when they are dry or outside of the warmwater fisheries window (March 15 to July 15) to avoid potential impacts to the downstream (receiving) drainage features. ESC measures and accidental spill prevention and response measures should be enacted and monitored throughout construction. Since all HDFs were identified as indirect fish habitat, no fish rescues are warranted.

HDF-3A and HDF-3C are located within a non-significant valleyland and thus will be protected from adjacent development. Mitigation measures associated with the protection of the valleyland (as outlined within **Section 7.2.2.3**) will also assist in protecting these reaches. Riparian wetlands (MAM2-10) are also associated with these reaches. As discussed within **Section 7.8.6.1**, a feature-based water balance risk assessment was undertaken for the wetlands and determined that mitigation measures will be required to support an appropriate hydroperiod of this feature. Several mitigation measures have been suggested for the site-specific application to consider in order to maintain the hydroperiod requirements and ensure no negative impacts.

Similarly, HDF-4C is located within the significant valleyland associated with WHT4(3)2-1a, and as a result will be protected in place as a result of the valleyland 15 m VPZ. Mitigation measures associated with the protection of the significant valleyland (as discussed within **Section 7.2.1.3**) will also assist in protecting this reach.

Engagement with MECP is recommended for HDFs that are proposed for removal and replication on the landscape to determine whether approvals are required (i.e., from a Redside Dace perspective).

Ponds A and C

Two ponds within Property 9 were assumed by Beacon Environmental to support fish given their location within the floodplain of the West Humber River tributary. These ponds are described as "offline ponds" that are not connected to the West Humber River tributary within Beacon Environmental's NHE (2025). The primary function of these ponds is to support golf course related activities, including irrigation.

Both ponds are located within the significant valleyland and will be retained in place. As discussed within **Section 7.2.1.3**, a 15 m VPZ will be applied from the staked top of bank or stable top of slope, whichever is the greatest constraint. Given that these features will be protected within the valleyland, no direct impacts are expected to the form and function of the ponds. The mitigation and restoration measures discussed within the significant valleyland section would also protect the pond habitats. Specifically, ESC measures should be installed along the outer limit of the NHS prior to any earthwork occurring to prevent excess sediment from draining into the significant valleyland, and thus into the ponds. Accidental spill prevention and response measures should be enacted and monitored throughout construction.

No negative impacts to Ponds A and C are expected as a result of the proposed tableland development provided that mitigative and restorative measures are enacted and monitored.

Climate Change Considerations

Climate change is altering aquatic ecosystems in Ontario through rising water temperatures, altered flow regimes, increased nutrient loading, and more frequent and extreme weather events. These changes pose challenges to fish populations. Warmer temperatures can create thermal stress for sensitive fish species such as Redside Dace, while changes in streamflow can impact overall habitat stability. Increased storm intensity and extreme rainfall events can lead to higher sediment loads and nutrient runoff, degrading water quality. To support fish populations in adapting to these changes, it

is essential to implement design and mitigation measures that enhance habitat resilience and maintain ecological function.

The proposed design and mitigation measures integrate multiple strategies to mitigation climate change impacts and support long-term fish habitat resilience. A notable improvement is the removal of online ponds within WHT4(3)5-2, which currently contribute to thermal loading and disrupt natural hydrological processes. By eliminating these impoundments and implementing a natural channel realignment, the measures will reduce water temperature and enhance flow connectivity, conditions that are critical to supporting fish species. The realigned channel will incorporate natural channel design principles, creating a more diverse and dynamically stable habitat with riffle-pool sequences that provide refuge areas and spawning substrates.

Buffering and nutrient management are also central to enhancing fish habitat resilience. All high constraint watercourses within the Study Area will be retained in place with a minimum 15m VPZ, ensuring that riparian vegetation remains intact to provide beneficial ecosystem and climate adaptation services such as shading, bank stabilization, and the filtration of runoff. LID and SWM design should consider fish species habitat needs by implementing techniques and controls that mitigate thermal impacts, maintain dissolved oxygen levels, and reduce sedimentation risks. These measures collectively reduce the risks of temperature spikes, habitat fragmentation, and degraded water quality, creating a more resilient and adaptive aquatic ecosystem.

7.2.2 Non-Significant Natural Heritage Features

7.2.2.1 Other Wetlands

All wetlands located outside of the Greenbelt Plan Area and within the tablelands of the Study Area were screened based on core OWES criteria to determine whether a full evaluation was required. Only two wetlands underwent a full OWES evaluation based on this screening, and ultimately no wetlands outside of the Greenbelt Plan Area were evaluated as significant. Refer to Section 3.1.4.1 of the Phase 1 SWS (GEI and SCS, 2025), for additional details on the OWES evaluation.

The following non-significant wetlands were identified within the Study Area:

- Reed-canary Mineral Meadow Marsh (MAM2-2);
- Forb Mineral Meadow Marsh (MAM2-10);
- Common Reed Graminoid Mineral Meadow Marsh (MAMM1-12);
- Cattail Graminoid Mineral Meadow Marsh (MAMM1-2);
- Cattail Mineral Shallow Marsh (MAS2-1);
- Red-osier Dogwood Mineral Thicket Swamp (SWT2-5); and
- Duckweed Floating-leaved Shallow Aquatic (SAF1-3).

All non-significant wetland features appear to be riparian wetlands due to their proximity to HDFs and/or regulated watercourses. Riparian wetlands may provide indirect (contributing) Redside Dace habitat functions. Please refer to **Section 7.2.1.5** for discussion on Redside Dace.

Retained Wetlands

Some of the non-significant wetlands located on Properties 1, 4, 5 and 9 will be retained in place with VPZs applied. Specific context on each retained feature and its associated VPZ width is provided below:

- SAF1-3 unit on Property 1 will be retained in place with the realigned channel corridor beginning immediately downstream (south) of the SAF unit. This feature is anticipated to be retained since it is partially located on an adjacent non-participating property and supported significant numbers of turtles. During the site-specific development application, it should be confirmed whether grading is required within the 10 m VPZ of the SAF to connect the realigned channel and the SAF community. Should any grading be required, mitigative and restorative measures should be detailed within the appropriate technical reports to minimize and indirect impacts on the feature.
- MAM2-2 unit on Property 4 and MAM2-10 unit on Property 9 will be retained in place with a minimum of a 10 m VPZ. These wetland units are located within non-significant valleylands, which are also proposed to be retained in place with a 10 m VPZ (as discussed below within **Section 7.2.2.3**).
- MAM2-2 unit on Property 5 will be retained with a 30 m VPZ, since it is partially located within the Greenbelt Plan Area. This feature will be retained since it is partially located on an adjacent non-participating property; however, the feature itself does not warrant protection in place.

A feature-based water balance risk assessment was completed in accordance with the TRCA's Wetland Water Balance Risk Evaluation (2017) for the several of the retained wetlands to ensure that there would be no impact to the hydroperiod of the wetlands. The results of this feature-based water balance risk assessment are summarized within **Section 7.8**. Several of the wetlands have catchment areas which extend largely into the development areas of the Study Area. As a result, several of the wetlands may experience a high magnitude in hydrological change. Detailed studies will be completed at the Draft Plan stage in order to quantify the water balance and ensure no negative impacts to the wetlands. A fulsome description of the wetland water balance impacts and recommended further steps are included in **Section 7.8**.

All VPZs will be planted with native plant materials. Additional discussions surrounding buffer plantings is provided below within **Section 8.6.5**. In addition to the VPZs, physical barriers such as physical fencing or installation of thorny barrier plantings along the limit of the NHS and/or trail alignment will be reviewed.

To mitigate against negative impacts to retained wetlands, ESC measures should be installed prior to construction along the limit of the retained features. ESC measures should be monitored throughout the duration of construction and be removed promptly upon construction completion. Additionally, winter maintenance standards should be created in accordance with the Town of Caledon's *Salt Management Plan* (2020a). Snow should be stored away from natural features and melt water will be conveyed into the storm sewer network, where feasible.

Wetland Removals

Direct removal of 1.65 ha of wetland habitat is proposed to accommodate the proposed structure plan. None of the wetlands proposed for removal are located within the Greenbelt Plan Area, and all removals are located outside of valleyland features. As shown within Table 2.3.5.5 of Part B of the Scoped SWS (Wood et al. 2022b), the removal of MAM, MAS, SWT and SAF communities may occur based on the FSA Structure plan. A review of the Mitigation Hierarchy was provided above within **Section 6.4.2**, which demonstrated that given the nature of these wetlands (i.e., non-significant, lower quality, commonly occurring and/or easily replicable) protection in place was not warranted.

As previously noted, some of these wetland habitats are associated with anthropogenic ponds or agricultural drainage features that have since begun to naturalize. According to the TRCA's *Guideline for Determining Ecosystem Compensation* (2023), it must be ensured that any losses to the land area of a natural system due to wetland ecosystems be addressed by adding new lands to the natural system such that the overall physical extent of the natural system is not reduced.

Where features are proposed for removal, recommendations for compensation/offsetting are described in more detail in **Section 8.3**. In general, wetland creation is proposed adjacent to the existing natural heritage features within the Greenbelt Plan Area. All wetland creation is proposed within the Greenbelt Plan Areas and is proposed to be compensated on a property-by-property basis. Compensation ratios should be finalized as part of detailed design, but it is expected that to align with the net gain mitigation hierarchy that a minimum 1:1 replication ratio should be considered. Given that the above noted non-significant wetlands that are proposed to be removed and replicated are not associated with densely treed communities (e.g., SWD), increased compensation ratios are not appropriate as demonstrated within Section 2.1 of the TRCA's *Guideline for Determining Ecosystem Compensation* (2023). Approximate locations of wetland compensation are highlighted on **Figure B-5** (**Appendix B**) – the areas depicted in **Figure B-5** are intended to demonstrate that a minimum of 1:1 compensation can be achieved within the Study Area, however this figure is not intended to demonstrate final size/location of offsetting. The exact location and size of wetland compensation will be determined as part of the site-specific application. This figure demonstrates that there is area available for wetland compensation within the designated Greenbelt Plan Area. Consideration of final compensation area locations in comparison to the proposed trail alignment will be required in future stages.

In addition to compensating for the 1.65 ha of non-significant wetland proposed for removal, the realignment of WHT4(3)5-2 will facilitate the creation of additional wetland habitat within its floodplain. It is assumed that the majority of the floodplain within the realigned channel corridor will support seasonally wet wetland habitats. These wetlands will provide several biophysical benefits to the system while adding additional wetland habitat in a property where wetland habitat is currently limited on the tablelands. This net gain in wetland area is further discussed below within **Section 10**.

The creation of wetlands within the Study Area will increase habitat diversity on the landscape for various wildlife, including amphibians, reptiles, birds, and insects. These created wetlands will be designed to replicate the riparian wetland communities that are proposed for removal, while providing enhanced ecological functions. The existing wetlands are degraded as a result of the ongoing agricultural management and other anthropogenic activities pertaining to gold course management,

the majority of non-significant wetlands are monocultural in nature. The created wetlands will be planted with a variety of native plant species to provide increased wildlife function and habitat availability.

All created wetlands will be protected with VPZs, specifically, a 30 m VPZ will be applied to wetlands that are created within the Greenbelt Plan Area and a 10 m VPZ will be applied to wetlands that are created within the tablelands (outside of the Greenbelt Plan Area). Currently all wetlands proposed for removal are located within the tablelands and thus would necessitate a 10 m VPZ if they were retained in place; therefore, a net gain in buffer area is also expected as a result of the increased VPZ requirement for compensation in the Greenbelt Plan Area.

It is expected that with appropriate compensation considerations there will be no negative impact as a result of non-significant wetland removal and offsetting.

The following mitigation measures are proposed to minimize potential adverse impacts associated with wetland removal and construction:

- Wildlife screenings and rescues within wetland units proposed for removal to occur ahead of removal of the features;
- Removal of the wetlands should occur during the summer months when the features are expected to be dry (or contain lesser water) to minimize water management requirements and limit potential mobilization of sediment to downstream habitats;
- Any dewatering activities associated with the removal of these features to not outlet to downstream aquatic habitats, if possible. Since all drainage features are also identified as providing direct or indirect fish habitat, removal of these features should be completed outside of the spring fisheries window (March 15 to July 15) to avoid adverse effects to downstream habitats. Dewatering activities should occur slowly to avoid excess sediment input to downstream habitats with water treatment used as necessary; and
- Opportunities for phasing will be considered to recreate wetlands ahead of the removal of existing wetlands within the Study Area. This may not be feasible given that the hydroperiod of created wetlands may be reliant in part from the roof-top contributions; however, this will be explored further during the site-specific application to determine if creation of the wetland is feasible ahead of the proposed removal of the existing wetland units. Efforts to reduce the lag time between wetland removal and replication will be explored.

A water availability assessment will be completed during the site-specific applications for all created wetlands to confirm ways that the hydroperiod of the created wetlands can be supported. Several design measures have been recommended to be explored during the site-specific stage to support this assessment (as discussed further within **Section 7.8.3**). The created wetland ecosites will also be selected to cover a variety of moisture regimes, since some ecosites have longer hydroperiods and others have shorter hydroperiods. The extent and locations of created wetland ecosites will be determined during the site-specific stage design once the water availability assessment has been completed.

Flows will continue to be conveyed to downstream wetland communities; thus, no negative impacts to receiving wetlands and their associated hydrology are expected.

No negative impacts to non-significant wetlands are anticipated as a result of the proposed mitigative and restorative measures, however, detailed feature-based water balances will be required for all retained wetland features to ensure that their existing hydroperiods can be maintained through a mixture of mitigation measures. No loss in wetland habitat will occur; an increase in wetland habitat and its associated diversity will be provided. Wetland habitats will be incorporated into the larger NHS corridor, which will create a more connected and established NHS. The exact location and sizing of the created wetlands will be explored further as part of the site-specific application.

Climate Change Considerations

Additional measures can be considered during wetland replication to support climate resilience:

- Use a wide variety of native, climate-resilient plant species adapted to current and projected climate conditions to increase habitat diversity and enhance ecological stability including species tolerant to both drought and flooding.
- Design wetland habitats that enhance carbon storage in soils and vegetation, contributing to climate change mitigation.
- Create microhabitats within the wetland compensation areas, such as shaded zones, open water, and vegetative cover, to support diverse species that may need to adapt to shifting climate conditions.

These measures can collectively enhance the functionality, diversity, and resilience of the wetland ecosystems, ensuring they can continue to provide critical adaptation and mitigation services in the face of climate change.

Overall, the proposed restoration concept should ensure that there is no loss in wetland area or function as a result of the proposed structure plan; rather, an increase in wetland function and diversity will be provided as part of the restoration plan.

7.2.2.2 Non-Significant Woodlands

Six non-significant woodland communities were identified within participating properties within the Study Area (refer to **Section 3.1.4.3** of the Phase 1 report for additional context):

- One Manitoba Maple lowland community (FODM7-7; 0.447 ha) was identified along the northwestern tributary of the West Humber River, in between two of the golf course ponds (Property 1);
- Four Norway Spruce communities (CUP3-14; 0.46 ha, 0.479 ha, 0.408 ha, and 0.249 ha) are associated with a tributary of the West Humber River and associated riparian habitats to the north of the Study Area (Property 4); and

- One Sugar Maple/Ironwood community (FOD5-4; 1.61 ha) is present in the southern portion of the Study Area, and it overlaps with both participating and non-participating properties (Properties 6 and 11).

As discussed within Section 3.1.4.3 of the Phase 1 SWS (GEI and SCS, 2025), the CUP and FOD communities identified within the tablelands of the Study Area did not meet the significant woodland criteria in accordance with the NHRM (2010). Non-significant woodlands are shown on **Figure B-1** (**Appendix B**).

Based on the proposed Structure Plan, The FOD5-4 community is partially located within a non-participating landholding and therefore will be retained in place with a 10 m VPZ. This community is naturally occurring, was more naturally diverse in comparison to the other non-significant woodlands within the Study Area and provides SWH for Eastern Wood Pewee. However the eastern edge of this feature did appear to contain more non-native/invasive species such as buckthorn. By retaining this feature in place and applying a 10 m VPZ, this will ensure that there are no direct impacts to the woodland form and function. The VPZ will be planted with native species to enhance the existing functions of the community. Opportunities to incorporate wildlife enhancement structures should be explored to further increase the habitat availability surrounding the woodland. Additional details on the proposed buffer plantings are provided within **Section 8.6.5**. It is acknowledged that this woodland will be disconnected from the larger NHS; however, given its size it is still expected to act as a stepping stone habitat and will support localized wildlife. The structure plan (**Figure 3-1**) also shows a north-south portion of the collector road alignment adjacent to the FOD5-4 feature. At this stage, final alignment is still to be determined through the MCEA however this road may encroach on the proposed minimum VPZ for this feature. Should there be encroachment, the impact assessment should address potential impacts and propose mitigative measures to protect critical root zones where possible, and restore the system where feasible

The Structure Plan proposes the removal of the FODM7-7 community on Property 1 and encroachment into the CUP communities on Property 4. It is the project team's opinion that these features do not need to be retained on the landscape as they are non-significant, would qualify as supporting features under the Caledon Future OP (Draft, 2024a), and are anthropogenically influenced. As shown within Table 2.3.5.5 of Part B of the Scoped SWS (Wood et al. 2022b), the removal of CUP, FOD and FOM communities were contemplated as part of the conceptual SABE land-use plan.

A total of 0.83 ha of woodlot habitat will be removed as a result of the proposed development application. It is understood that trees provide a variety of functions including canopy cover, energy conservation, mental health benefits and wildlife habitat, to the overall community and are integral to minimizing impacts to air pollution and climate change, as well as enhancing biodiversity. As such, compensation for the removed trees within these woodland habitats will occur. Specifically, compensation for the removal of the FODM7-7 community on Property 1 will likely occur within the realigned channel corridor and compensation for the encroachment into the CUP communities on Property 4 will occur within the Greenbelt Plan Area. No net loss in woodland area will occur within the properties. Exact compensation ratios will be explored during the site-specific stage. Additional discussion on the proposed restoration concept is provided within **Section 8.3**.

Impacts associated with individual tree removals (i.e., outside of the woodlands) should be assessed at the site-specific stage.

As noted within the Phase 1 SWS, the FOMD7-7 was a lowland deciduous forest that primarily consisted of Manitoba Maple and European Buckthorn, both of which are Category 1 invasive species. Buckthorn was specifically noted throughout the subcanopy, understory and groundcover suggesting that the invasive species is quite dominant and pervasive within the community. Areas of additional tree planting were noted along the perimeter of the community, suggesting that the golf course was revegetating the area. Given the ongoing anthropogenic interference as a result of active golf course management, it is recommended that this feature should be removed and replicated. The compensation woodland would be planted with a mixture of native plant species and wildlife enhancements would be incorporated into the design to create additional habitat diversity within the system. The created woodland will likely be located within the realigned channel corridor and have a minimum of a 10 m VPZ applied to the feature (**Figure B-5**, **Appendix B**).

The proposed encroachment into the CUP communities on Property 4 will occur outside of the non-significant valleyland and its associated 10 m VPZ. The CUP is a non-native Norway Spruce plantation that is not a naturally occurring community. All portions of the CUP within the valleyland and its associated VPZ will be retained; however, the additional CUP areas outside of the valleyland and its VPZ are proposed for removal and compensation. Given that this is a non-native community that was historically planted, the removal and compensation of this woodland is supportable. The compensation woodland would be planted with native species, increasing the native woodland cover within the Study Area as compared to the existing monculture. Additionally, the created woodland would have a 30 m VPZ applied to the feature since it will be compensated within the Greenbelt Plan Area. This will result in an additional VPZ that is applied to the non-significant woodland, since any woodland within the Greenbelt Plan Area would have a 30 m VPZ applied from the feature limits. The proposed compensation area and adjacent Greenbelt Plan Area, under existing conditions, has minimal woodland area. The addition of natural tree cover to this portion of the Greenbelt Plan Area will provide many benefits to the system including incorporation of allochthonous and carbon materials, thermal benefits and incorporation of different types of habitat.

Additionally, the proposed collector road alignment will result in removal of a portion of the CUP communities. The exact area of impact associated with the proposed collector road alignment will be reviewed as part of the MCEA. Finally, a review of the proposed trail alignment will be required to understand whether there may be any impacts to the non-significant woodlands. Currently no trails are proposed within the non-significant woodlands; however, should they be proposed nearby the features it is recommended that the trails are located in the outer limits of the VPZ.

Where trees are proposed for removal, arboricultural best management practices should be undertaken to prevent damage to retained trees. Tree removals should be completed outside of the migratory bird breeding period (generally April 15 to August 15) and outside of the bat active period (generally April 1 to September 30), where possible.

Potential impacts to the retained CUP communities could be associated with edge effects from tree removal (e.g., sunscald, windthrow, increased light penetration). In addition, any retained woodlands (CUP and FOD5-4) could potentially be negatively impacted by site grading and machinery (e.g., soil compaction, invasive colonization, stress/dieback) if mitigation measures were not in place.

All compensatory woodland plantings will consider moisture regimes based on ultimate grading conditions; thus, woodland plantings located immediately adjacent to wetland limits (existing within the Greenbelt Plan Area, or proposed within the Property 1 channel realignment) will be planted with species that have a lower coefficient of wetness, whereas other woodland plantings in upland areas or within the slopes of the realigned watercourse will be planted with higher coefficient of wetness. Moreover, the initial VPZs that would be applied to retained and created features (wetland, woodland, realigned channel corridor) would not typically be planted to woodland densities. By overlapping the created woodland plantings within these VPZs this will increase the density of tree and shrub plantings than are typically warranted. The details of the created woodlands will be further defined within the during the site-specific process.

Tree protection fencing and ESC measures will be installed adjacent to all retained trees at the edge of the buffer zone to mitigate against excessive disturbance caused by the proposed vegetation removals, ground disturbance and dislodgement of sediment. This will also protect the integrity of the NHS and aide in preventing adverse effects from ground disturbance. Permanent fencing and thorny plantings may also be installed along the edge of the VPZs to define the NHS boundary.

It is acknowledged that bats were recorded within the FODM7-7 community. Relatively low call abundance was recorded within the community from all bat species, especially given that this community was located immediately adjacent to two larger pond features. It is likely that the bat calls recorded during the acoustic surveys were associated with foraging activity given that only five potentially suitable snags were documented within the community. It is recommended that removal of the FODM7-7 occur outside of the active bat maternity roosting window (April 1 to September 30) to avoid potential impacts to roosting bats. Moreover, the inclusion of bat rocket boxes should be considered within the realigned channel corridor design. This is further discussed within **Section 7.2.1.5**.

Other indirect impacts as a result of disturbance within or immediately adjacent to the retained and created communities could include noise and light disturbance, as well as the introduction of invasive and non-native plants along the disturbed margins of the development footprint. The proposed mitigative measures are recommended to reduce and/or minimize these negative impacts:

- Construction activities adjacent to the retained woodland should be timed outside of the nighttime and early morning periods during the bat breeding seasons (April 1 to September 30). Some localized movement of wildlife out of these edge areas may still occur during the construction phase; however, refuge habitats exist within the broader landscape;
- New lighting should be directed away from the woodland to avoid impact to wildlife activities. Lighting should follow the City of Toronto's Best Practices for Effective Lighting strategy (2017) to incorporate bird friendly solutions;

- Construction equipment should be regularly cleaned to reduce the potential for transportation of invasive material within and outside of the site; and
- To slow the spread of invasive species (such as Emerald Ash Borer), all trees (not just Ash) should be disposed of locally to reduce transportation to other local municipalities.

As a result of the proposed mitigative and compensation measures discussed above, no negative impacts to the non-significant woodlands are expected. Exact woodland compensation ratios will be determined during the site-specific applications; however, no loss in woodland habitat is expected to occur and an increase in native woodland habitat is expected as a result of the proposed restoration approach. Impacts associated with the proposed collector road crossing should be reviewed as part of the MCEA. Impacts associated with the proposed trail network will be reviewed in subsequent submissions.

Climate Change Considerations

The woodland plays a vital role in moderating local microclimates, reducing ambient temperatures, and mitigating thermal stress on adjacent aquatic habitats. Beyond climate regulation, woodlands also contribute to carbon sequestration, acting as a long-term carbon sink that helps mitigate greenhouse gas emissions. To support greater woodland resilience to climate change, the compensation plan should incorporate key measures that enhance ecosystem adaptability and stability. Diverse native plantings should prioritize species that are tolerant to drought, flooding, and temperature extremes, ensuring adaptability to shifting climatic conditions. Incorporating a mix of canopy, understory, and ground cover species will create structural diversity, enhancing habitat complexity and providing redundancy in ecological functions to withstand disturbances. Carbon sequestration potential can be maximized by including tree species with high biomass storage capacities, such as native conifers and fast-growing deciduous species, contributing to climate mitigation efforts. Integrating pollinator-friendly species can support biodiversity, sustain food sources for insects and wildlife, and ensure the woodland ecosystems remain vibrant and functional in the face of climate change. The retention of the FOD5-4 woodland community further enhances the resilience of the Study Area. The naturally occurring, diverse woodland will remain in place with a 10m VPZ. These measures will create a robust and adaptable woodland network, providing long-term ecological and climate resilience.

7.2.2.3 Non-Significant Valleylands

Non-significant valleyland communities were identified outside of the Greenbelt Plan Area (as shown on **Figure B-3**, **Appendix B**). Please see Phase 1 SWS Section 3.1.4.4 (GEI and SCS, 2025), for more information pertaining to the valleyland evaluation. Based on the findings of the Phase 1 SWS, the valleylands on Properties 1, 4 and 9 were identified as non-significant valleylands. Based on the findings of the Phase 1 SWS, the valleylands on Properties 1, 4 and 9 were identified as non-significant.

As discussed within **Section 6.3.4**, the valleylands within Property 1 and 4 would be considered local linkages, whereas the valleyland within Property 9 would be considered a site-scale linkage.

The non-significant valleylands identified on Properties 4 and 9 will be retained in place and buffered with a minimum of a 10 m VPZ applied from the greater of stable top of slope or staked top of bank. These valleylands contain other natural heritage features including drainage features and non-

significant wetland units. The valleylands are generally the greatest constraint, except for some areas on Property 4 where portions of the non-significant woodland and its associated VPZ are greater. As a result, the form and function of the non-significant valleylands on Properties 4 and 9 will not be disturbed or directly affected, except for one collector road crossing. This watercourse crossing is a new crossing location and is proposed downstream of an existing farm crossing. The existing farm crossing would be decommissioned and replaced with the updated collector road to facilitate movement across the property. The impacts associated with the proposed collector road crossing will be evaluated as part of the MCEA. Recommendations regarding the proposed collector road crossing from a wildlife perspective are provided within **Section 8.7.2**.

Alteration of one non-significant valleyland associated with WHT4(3)5-2 on Property 1 will occur as a result of the proposed realigned channel corridor (as discussed within **Section 7.2.2.3**). As previously noted within the Phase 1 Report (GEI and SCS 2025), this non-significant valleyland is highly degraded and has been anthropogenically influenced to the point where TRCA was unable to easily identify a clear top of bank along portions of the valleyland corridor during the feature staking exercise. Reconfiguration of this valleyland into a new realigned channel corridor is recommended to restore the natural functions of this system. A 10 m VPZ will be applied from the newly created top of bank within the realigned channel corridor. The newly created top of bank will be stable and designed by a group of geotechnical and water resources engineers, as well as fluvial geomorphologists. The newly created top of bank will be the greatest constraint, as all other natural hazards (erosion, flood) will be located within the created top of bank. Additional restoration details on the realigned channel corridor are provided below within **Section 8.8.1**. Reconfiguration of this local linkage will result in a smaller linkage corridor; however, as noted above, a significant increase in overall ecological form and function is expected from the renaturalization and restoration of this corridor. The current size of the linkage is anthropogenically influenced given ongoing alteration to support the golf course.

As previously discussed, essential infrastructure (i.e., the SWM outlets) will be required in order to support the SWM strategy for the development on the tablelands. The exact location and extent of disturbance will be reviewed at the site-specific stage; however, it is recommended that the amount of disturbance within the non-significant valleylands are reduced to the extent possible. Currently the Structure Plan contemplates two SWM ponds into the non-significant valleylands: one on Property 1 and one on Property 4.

It is acknowledged that a trail network has been envisioned within the NHS by the Town of Caledon. Refinement of the trail network is recommended to minimize the amount of disturbance within the NHS to the extent possible. Where feasible, incorporation of the trail along the outer limits of the NHS is recommended.

Unmitigated, the following indirect impacts could occur to the form and function as a result of the proposed development:

- Erosion of banks as a result of uncontrolled flows from the development (during and post construction);
- Human interactions with the valleyland resulting in disturbance or illegal dumping within the corridor; and

- Impacts to wildlife behaviours as a result of construction and permanent development along the corridor.

The establishment and regular monitoring of ESC measures during construction will minimize the potential for negative impacts to occur within the valleylands. The following ESC measures are recommended to minimize against potential impacts to downstream (receiving) natural features:

- Limit the size of disturbance;
- Limit the duration of soil exposure and prioritize restabilizing areas once construction is completed in an area;
- Preserve overland sheet flow and micro-drainage (avoid concentrated channel flows);
- Break and redirect flows to lower gradients;
- Design and implement staged stripping;
- Prevent disturbance of previously stripped and stabilized areas;
- Accumulated sediment shall be removed, as part of a maintenance program, from all control measures when accumulation reaches 50% of the height or volume of the control structure; and
- Stabilize stripped areas with temporary ESC controls (e.g., vegetative or mechanical controls).

ESC measures should follow the TRCA's Erosion and Sediment Control Guide for Urban Construction (2019). Following construction, all bare soils should be revegetated with native plant materials.

Removal of anthropogenic influences (e.g., existing cart paths and farm crossings, etc.) should occur to create a contiguous natural corridor will revitalize and restore natural linkage functions within the corridor. The proposed naturalization and restoration measures (as presented below within **Section 8**) will create a more connected and naturalized system throughout the Study Area. The valleyland corridors provide secondary linkages within the landscape and also contain many different natural heritage feature types. By increasing plant and vegetative diversity it will create a variety of habitats to host various species life processes. The addition of specialized wildlife habitat structures and enhancements will add or enhance additional habitats that are currently limited, degraded or not present within the corridor. The increased natural cover and removal of anthropogenic features (e.g., cart paths, sand traps, golf course holes, agricultural fields, farm crossings) will support the local linkages within the Study Area. Both the local and site-scale linkages are expected to have enhanced functions and connectivity as a result of the proposed restoration activities.

The establishment of physical barriers such as thorny native plant material or fencing along the edge of the NHS should be explored to discourage residents from interacting with the non-significant valleylands. The usage of educational materials (e.g., signage and brochures) to the Mayfield Tullamore residents could be reviewed to explain the importance of maintaining the significant valleyland corridors in its enhanced condition.

As a result of the proposed mitigative and restorative measures, no negative impacts to the non-significant valleylands are expected. Please refer to **Section 7.6** for the geotechnical impact assessment review. Impacts associated with the proposed collector road crossing should be reviewed as part of the MCEA. Impacts associated with the proposed trail network will be reviewed in

subsequent submissions. Impacts associated with proposed SWM infrastructure within the valleylands will be explored as part of the site-specific applications.

Climate Change Considerations

Non-significant valleylands provide beneficial climate-related ecosystem services that contribute to adaptation and mitigation efforts. As climate change alters temperature and precipitation patterns, species must shift their ranges to find suitable habitat and climate refugia. Valleylands serve as natural corridors that enhance biodiversity by facilitating wildlife movement and habitat connectivity. Maintaining and restoring these corridors ensures that species have the ability to adapt to changing conditions, preventing habitat fragmentation and supporting ecological resilience. Valleylands can support groundwater recharge, helping sustain water availability during dry periods. They stabilize slopes, prevent erosion, and reduce sedimentation, protecting water quality amid more frequent and intense storms that are occurring under a changing climate. Valleylands can assist in mitigating flooding by absorbing and dissipating stormwater and managing increasing extreme precipitation. Retention, buffering, and restoration measures ensure they continue to function as climate buffers.

7.2.2.4 Other Natural Heritage Considerations

In addition to the mitigation and restorative measures identified within the above noted sections, the following general mitigation measures may be considered during detailed design.

Exclusionary Fencing

Exclusion fencing could be installed prior to working in or around natural areas, to prevent wildlife from entering work zones. If wildlife does enter a work zone it should be carefully relocated prior to commencing work. In general, wildlife should not be trapped for relocation but should be either allowed to relocate of their own volition, or should directed away from the area. If it is determined that they are injured or unable to move, a biologist or wildlife rescue organization should be contacted to assist.

Further information on exclusionary fencing is discussed within **Section 8.7.3.**

Invasive Species Management

Invasive species were recorded within the Study Area. Disturbance activities can promote the spread of invasive plant species which could substantially alter the structure and function of mature vegetation communities that will be retained in a post-development scenario. The introduction of invasive and non-native plant species along disturbed margins of the development footprint may also displace some native flora.

It is not always possible or even desirable to completely remove all non-native species; however, as part of the site-specific process an invasive species review should be completed to understand whether management of existing populations is warranted. Additionally, all created natural heritage features will be monitored in an effort to detect the presence of invasive species early. Management may be warranted within created features in the early years while plants are establishing to reduce the competition.

To further mitigate the spread of invasive species during construction, the following recommendation measures are proposed:

- Equipment working in identified invasive species locations must be thoroughly cleaned prior to moving from the site into retained or created habitats;
- Soil removed from sites with high incidence of non-native species should not be re-used for any vegetation restoration sites unless it is placed in an area that will be actively and regularly managed. Otherwise, such soil should be buried below impervious surfaces (e.g., developed areas); and
- Herbicide applications may be considered by the Project Ecologist following construction and post-construction monitoring as part of the adaptive management strategy. Any herbicide application should be applied by a licensed applicator. The preferred application method would be with an applicator that directly applies the herbicide with a wicking device/wand to mitigate spray drift onto the targeted species.

Additional discussion on invasive management is provided within **Section 8.6.6**.

Vegetation Clearing Measures

Vegetation removal shall be restricted to the areas identified within approved drawings and permits. These boundaries should be clearly delineated on construction specifications and plans in the field. Appropriate vegetation clearing techniques should be used. Efforts to minimize clearing and grading should occur.

Felled trees may be left onsite within natural areas to decompose, where approved by the Project Ecologist, or should be taken to be mulched. Where trees are proposed to be mulched, this should occur as soon as possible to prevent wildlife from occupying them. Compaction of soil and root zones around trees within retained features should be avoided through the installation of temporary fencing as per the Arborist Report.

An Arborist Report should be prepared during the site specific stage to support any tree removals.

Salt Management and Snow Storage Measures

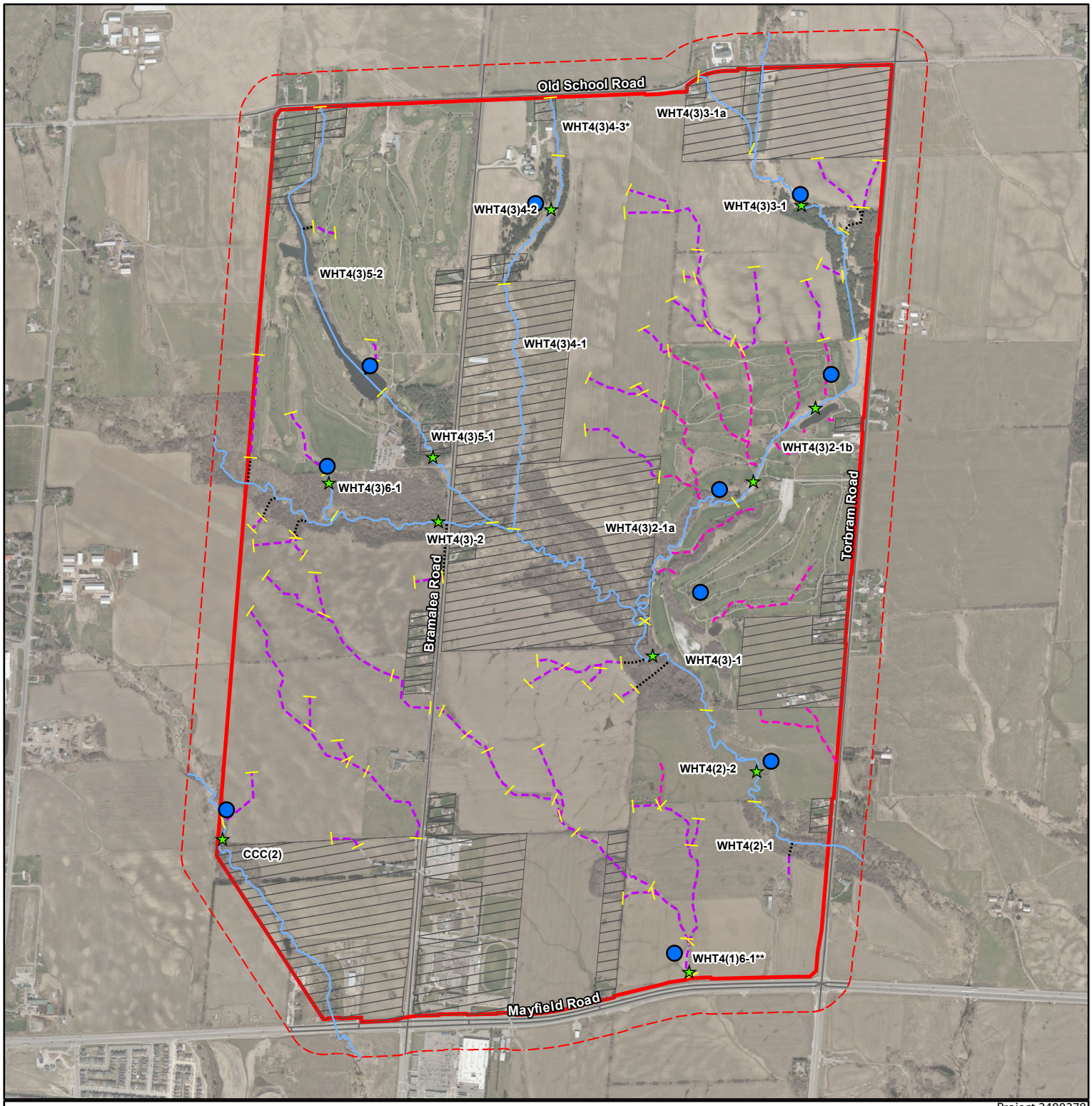
Salt impacts are a recognized impact with the proposed development and urbanization. While they cannot be fully avoided, efforts to reduce the amount of salt entering into the NHS should be undertaken. Winter maintenance standards and other strategies explored in accordance with the municipal standards.

7.3 Stream Morphology

In natural systems, watercourses regularly see flows that entrain and transport sediment. This is part of the natural process that maintains natural channel form (TRCA 2012, CVC 2015). The erosion threshold represents the magnitude of flow at which bed and/or bank sediment within a reach is entrained. Specifically, the erosion threshold provides a depth, velocity, discharge, or shear stress at which sediment of a particular size (usually the median grain size) may potentially begin to move. This does not necessarily mean systemic erosion (i.e., widening or degradation of the channel); it simply indicates a flow which may potentially entrain sediment (CVC 2015).

Ten outfalls are proposed to outlet to several tributaries of the West Humber River. The locations of these outfalls are presented in **Figure 7-1**. These receiving tributaries were selected for further assessment, to assist in the development of a SWM plan for the Study Area.

Figure 7-1. Erosion Threshold Locations



Project 2400278

NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2025, © Town of Caledon, 2025, © Toronto and Region Conservation Authority, 2025, © Peel Region, 2025.
3. Orthoimagery © First Base Solutions, 2025. Imagery taken in 2022.

Legend
- Study Area
- Study Area + 120m
- Non-Participating Property
- Watercourse

Headwater Drainage Feature (GEI 2024)
- Feature within defined valleyland
- Headwater Drainage Feature
- Assumed HDF within Non-Participating Property
- Reach Breaks
- Headwater Drainage Feature (Beacon)
- Proposed Outfall Locations
- Erosion Threshold Location

* GEI defined reach break differs from SABE
** GEI defined as HDF but showing SABE watercourse naming

Mayfield Tullamore Landowner Group
Phase 2 - Subwatershed Impact Assessment

Figure 7-1
Erosion Threshold Location

0 400 m
1:18,000

GEI Consultants

7.3.1. Detailed Geomorphic Assessment

Detailed geomorphic assessments were completed for the receiving tributaries of the West Humber River between October 28 and October 31, 2024, and consisted of the collection of a topographic survey of the receiving watercourses in the Study Area at a sufficient level of detail to allow the measurement of the longitudinal profile of the watercourse and cross-sectional geometry. RGA results from a previous field assessment, performed in March 2024, were referred to identify the dominant geomorphic process, to help identify whether the critical erosion threshold would be based on the bed or bank materials.

Where possible, in-situ documentation of bankfull stage indicators was also undertaken, as well as riparian vegetation cover and general site conditions. The characteristics of bed and bank materials (e.g., composition, grain size, etc.) was also recorded. The Manning's roughness coefficient was estimated using a visual method, as outlined by Arcement & Schneider (1989). Cross-sectional measurements and bankfull dimensions, the estimate of Manning's roughness, and the gradient, were used to back-calculate bankfull hydraulics. The surveyed cross sections were entered into FlowMaster (hydraulics software) along with the estimated Manning's roughness, to obtain the relevant bankfull hydraulics. The results from the detailed geomorphic assessment are summarized below and in **Table 7-1**.

Table 7-1. Detailed Geomorphic Assessment Results, West Humber River and Campbell's Cross Creek

Parameter	WHT4(2)-2	WHT4(3)-1	WHT4(3)2-1a	WHT4(3)2-1b	WHT4(3)3-1	WHT4(3)-2	WHT4(3)4-2	WHT4(3)5-1	WHT4(3)6-1	WHT4(1)6-1	CCC(2)
Channel gradient (%)	0.3%	0.6%	0.9%	0.8%	0.3%	0.6%	0.9%	N/A	4.2%	N/A	0.3%
Average bankfull width (m)	7.53	5.70	3.57	3.65	2.35	6.36	3.42	N/A	1.74	N/A	4.50
Average bankfull depth (m)	0.69	0.55	0.38	0.51	0.42	0.51	0.21	N/A	0.18	N/A	0.44
Maximum bankfull depth (m)	0.94	0.77	0.52	0.72	0.55	0.69	0.29	N/A	0.26	N/A	0.74
Average hydraulic radius (m)	0.54	0.44	0.26	0.37	0.30	0.38	0.16	N/A	0.11	N/A	0.39
Manning's roughness	0.04	0.04	0.04	0.04	0.04	0.04	0.04	N/A	0.04	N/A	0.04
Bankfull velocity (m/s)	0.96	1.06	0.96	1.17	0.56	1.02	0.70	N/A	1.36	N/A	0.88
Bankfull discharge (m^3/s)	4.11	3.07	1.01	1.96	0.48	2.70	0.39	N/A	0.36	N/A	1.81
Shear stress (N/m^2)	27.66	45.03	45.76	56.23	16.31	40.48	25.96	N/A	106.8	N/A	21.86

Reach delineation established for the Scoped SWS for the SABE (Wood Environmental and Infrastructure Solutions Inc., November 2022) and adjusted in Phase 1 of the SWS were used for this assessment. The results for each reach are shown below.

Reach WHT4(2)-2

Overall, reach WHT4(2)-2 had an average profile gradient of 0.30%. The channel displayed a moderate degree of entrenchment. Bankfull channel widths within the surveyed sections ranged between 3.5 m to 12.2 m, averaging 6.1 m. The average bankfull depth ranged between 0.69 m to 0.99 m, and averaged 0.87 m. The Manning's roughness was estimated to be 0.035. The back-calculated velocity was 0.96 m/s, which corresponded to an average bankfull discharge of 4.11 m^3/s. Bed material in the reach was found to be in the gravel range based on the pebble counts completed in the field (sample size of 200 particles). The D_{50} (median grain size) was determined to be 21 mm. Bank materials consisted of cohesive silt and clay. Riparian vegetation consisted of sparse trees, shrubs, grasses and other herbaceous species.

Reach WHT4(3)-1

Overall, reach WHT4(3)-1 had an average profile gradient of 0.60%. The channel displayed a low degree of entrenchment. Bankfull channel widths within the surveyed sections ranged between 4.9 m to 6.6 m, averaging 5.7 m. The average bankfull depth ranged between 0.61 m to 0.98 m, and averaged 0.77 m. The Manning's roughness was estimated to be 0.040. The back-calculated velocity was 1.12 m/s, which corresponded to an average bankfull discharge of 3.54 m^3/s. Bed material in the reach was found to be in the gravel range based on the pebble counts completed in the field (sample size of 200 particles). The D_{50} (median grain size) was determined to be 25 mm. Bank materials consisted of cohesive silt and clay. Riparian vegetation consisted of dense trees, shrubs, grasses and other herbaceous species.

Reach WHT4(3)2-1a

Overall, reach WHT4(3)2-1a had an average profile gradient of 0.90%. The channel displayed a moderate degree of entrenchment. Bankfull channel widths within the surveyed sections ranged between 2.7 m to 4.9 m, averaging 3.9 m. The average bankfull depth ranged between 0.48 m to 0.66 m, and averaged 0.57 m. The Manning's roughness was estimated to be 0.040. he back-calculated velocity was 0.97 m/s, which corresponded to an average bankfull discharge of 1.01 m3/s. Bed material in the reach was found to be in the gravel range based on the pebble counts completed in the field (sample size of 200 particles). The D_{50} (median grain size) was determined to be 23 mm. Bank materials consisted of cohesive silt and clay. Riparian vegetation consisted of shrubs, grasses and other herbaceous species.

Reach WHT4(3)2-1b

Overall, reach WHT4(3)2-1b had an average profile gradient of 0.80%. The channel displayed a moderate degree of entrenchment. Bankfull channel widths within the surveyed sections ranged between 2.8 m to 4.4 m, averaging 3.7 m. The average bankfull depth ranged between 0.60 m to 0.89 m, and averaged 0.75 m. The Manning's roughness was estimated to be 0.040. The back-calculated

velocity was 1.2 m/s, which corresponded to an average bankfull discharge of 1.96 m^3/s. Bed material in the reach was found to be in the gravel range based on the pebble counts completed in the field (sample size of 200 particles). The D_{50} (median grain size) was determined to be 20 mm. Bank materials consisted of cohesive silt and clay. Riparian vegetation consisted of grasses and other herbaceous species.

Reach WHT4(3)3-1

Overall, reach WHT4(3)3-1 had an average profile gradient of 0.30%. The channel displayed a moderate degree of entrenchment. Bankfull channel widths within the surveyed sections ranged between 2.3 m to 3.8 m, averaging 2.6 m. The average bankfull depth ranged between 0.54 m to 0.76 m, and averaged 0.60 m. The Manning's roughness was estimated to be 0.040. The back-calculated bankfull velocity was 0.56 m/s, which corresponded to an average bankfull discharge of 0.48 m^3/s. Bed material in the reach was found to be in the gravel range based on the pebble counts completed in the field (sample size of 200 particles). The D_{50} (median grain size) was determined to be 6 mm. Bank materials consisted of cohesive silt and clay. Riparian vegetation consisted of grasses and other herbaceous species.

Reach WHT4(3)-2

Overall, reach WHT4(3)-2 had an average profile gradient of 0.60%. The channel displayed a low degree of entrenchment. Bankfull channel widths within the surveyed sections ranged between 4.6 m to 8.0 m, averaging 6.7 m. The average bankfull depth ranged between 0.30 m to 1.00 m, and averaged 0.56 m. The Manning's roughness was estimated to be 0.040. The back-calculated velocity was 0.87 m/s, which corresponded to an average bankfull discharge of 1.92 m^3/s. Bed material in the reach was found to be in the gravel range based on the pebble counts completed in the field (sample size of 200 particles). The D_{50} (median grain size) was determined to be 20 mm. Bank materials consisted of silt and clay loam. Riparian vegetation consisted of trees, shrubs, grasses and other herbaceous species.

Reach WHT4(3)4-2

Overall, reach WHT4(3)4-2 had an average profile gradient of 0.90%. The channel displayed a low degree of entrenchment. Bankfull channel widths within the surveyed sections ranged between 2.9 m to 3.4 m, averaging 3.3 m. The average bankfull depth ranged between 0.24 m to 0.30 m, and averaged 0.27 m. The Manning's roughness was estimated to be 0.040. The back-calculated velocity was 0.70 m/s, which corresponded to an average bankfull discharge of 0.39 m^3/s. Based on a textural analysis, bed material in the reach was estimated to be represented by silt loam. Riparian vegetation consisted mainly of grasses and herbaceous species.

Reach WHT4(3)5-1

At the time of assessment, reach WHT4(3)5-1 presented as a diffuse wetland in a confined valley, with no defined bed or banks. Material throughout the reach consisted of loose loam. Riparian vegetation existed in the form of grasses and herbaceous species.

Reach WHT4(3)6-1

Overall, reach WHT4(3)6-1 had an average profile gradient of 4.2%. The channel displayed a low degree of entrenchment. Bankfull channel widths within the surveyed sections ranged between 1.3 m to 8.1 m, averaging 3.0 m. The average bankfull depth ranged between 0.18 m to 0.46 m, and averaged 0.26 m. The Manning's roughness was estimated to be 0.035. The back-calculated velocity was 1.36 m/s, which corresponded to an average bankfull discharge of 0.36 m^3/s. Based on a textural analysis, bed material in the reach was estimated to be represented by fine gravel. Riparian vegetation consisted of trees, shrubs, grasses and herbaceous species.

Reach WHT4(1)6-1

Reach WHT4(1)6-1 was previously identified as a headwater drainage feature through Phase 1 of the SWS (HDF H8). At the time of the assessment, this reach presented as a drainage feature in an agricultural field, with no defined bed or banks. Material throughout the reach consisted of loose loam. Riparian vegetation existed in the form of grasses and herbaceous species.

Reach WHT4(2)-2

Overall, reach WHT4(2)-2 had an average profile gradient of 0.30%. The channel displayed a moderate degree of entrenchment. Bankfull channel widths within the surveyed sections ranged between 3.5 m to 12.2 m, averaging 6.1 m. The average bankfull depth ranged between 0.69 m to 0.99 m, and averaged 0.87 m. The Manning's roughness was estimated to be 0.035. The back-calculated velocity was 0.96 m/s, which corresponded to an average bankfull discharge of 4.11 m^3/s. Bed material in the reach was found to be in the gravel range based on the pebble counts completed in the field (sample size of 200 particles). The D_{50} (median grain size) was determined to be 21 mm. Bank materials consisted of cohesive silt and clay. Riparian vegetation consisted of sparse trees, shrubs, grasses and other herbaceous species.

Reach CCC(2)

Overall, reach CCC(2) had an average profile gradient of 0.30%. The channel displayed a moderate degree of entrenchment. Bankfull channel widths within the surveyed sections ranged between 2.9 m to 5.6 m, averaging 4.7 m. The average bankfull depth ranged between 0.52 m to 0.81 m, and averaged 0.70 m. The Manning's roughness was estimated to be 0.035. The back-calculated velocity was 0.96 m/s, which corresponded to an average bankfull discharge of 4.11 m^3/s. Bed material in the reach was found to be in the gravel range based on the pebble counts completed in the field (sample size of 200 particles). The D_{50} (median grain size) was determined to be 30 mm. Bank materials consisted of ordinary firm loam. Riparian vegetation consisted of trees, shrubs, grasses and other herbaceous species.

7.3.2. Erosion Threshold Analysis

As noted previously, erosion and deposition are natural processes that occur within watercourses. Issues arise when changes in the watershed's hydrology result in an increase or decrease in the frequency of period of erosive events. The objective, therefore, is to minimize the risk of exacerbating existing rates of erosion in the watercourse in the post-development condition and under changing precipitation regimes as a result of climate change.

There are several approaches that may be applied to determine the erosion threshold for a reach. These require information regarding the mean channel slope, cross-sectional dimensions, assessment of roughness, and substrate information (e.g., grain size), as obtained from the detailed geomorphic assessment. The TRCA (2012b) Stormwater Management Criteria document provides a brief list of methods and resources for estimating thresholds for a range of conditions. The CVC (2015) Fluvial Geomorphic Guidelines document provides a similar list of methods and resources. These methods may be based on the critical shear stress or the critical velocity. These parameters refer to the shear stress or velocity, based on the sediment size or class, at which sediment is entrained. For the shear stress approaches, when the mean shear stress in the channel exceeds the critical shear stress, sediment entrainment can be expected to occur. Similarly, for the velocity approaches, sediment entrainment occurs when the mean velocity in the channel exceeds the critical velocity. Critical shear stress or velocity for a given grain size can be calculated using empirical methods (e.g., Neill, 1967; Miller et al., 1977; Komar, 1987, etc.), or by graphical analysis, by referring to a chart (e.g., Hjulstrom, 1935; Chow, 1959). Authors such as Fischenich (2001), Julien (1998), Chang (1988), etc., provide tables of compiled permissible shear stresses and velocities for a range of sediment sizes

Of the assessed channels where bed substrate consists of gravel, the method outlined by Komar (1987) was used. Komar presents an empirical relationship based on a function of the grain size, applicable to gravel in the 1 – 500 cm range:

$$V_{cr} = 57\ D^{0.46}$$

where V_{cr} is the critical velocity at which sediment is entrained (in cm/s), and D is the particle diameter to be entrained (in cm).

For the assessed channels with material finer than gravel, Julien (1998) and Fischenich (2001) provide permissible velocities that correspond to bed or bank material type (e.g. silt loam, ordinary firm loam, shale).

The reference cross-sections obtained from the detailed geomorphic assessments are used in the analysis to determine the corresponding erosion threshold, whereby the depth of flow in the cross-section is increased iteratively until the mean velocity exceeds the permissible velocity of the sediment. The results from the detailed geomorphic assessment are summarized below and in **Table 7-2.**

Table 7-2. Erosion Threshold, West Humber River and Campbell's Cross Creek

Parameter	WHT4(2)-2	WHT4(3)-1	WHT4(3)2-1a	WHT4(3)2-1b	WHT4(3)3-1	WHT4(3)-2	WHT4(3)4-2	WHT4(3)5-1	WHT4(3)6-1	WHT4(1)6-1	CCC(2)
Representative. Particle Size (mm)	21	FL	23	20	6	FL	SL	SL	FG	SL	FL
Critical velocity (m/s)	0.80	0.76	0.84	0.78	0.45	0.76	0.61	0.61	0.76	0.61	0.76
Maximum water depth* (m)	0.68	0.46	0.43	0.33	0.37	0.46	0.22	0.40	0.10	0.26	0.52
Average water depth* (m)	0.48	0.31	0.28	0.25	0.30	0.31	0.16	0.30	0.07	0.19	0.40
Shear stress (N/m^2)	14.22	18.43	24.53	19.72	8.81	18.46	13.94	6.42	29.68	9.71	11.88
Critical discharge (m^3/s)	2.18	0.96	0.62	0.40	0.21	1.08	0.21	2.67	0.03	3.40	0.91
Critical Fraction	0.52	0.37	0.61	0.22	0.47	0.50	0.54	N/A	0.13	N/A	0.53
Notes (Julien, 1998): SL = silt loam FL = ordinary firm loam FG = fine gravel											

Reach WHT4(2)-2

The RGA effort had identified that the reach was in regime. As the banks are heavily vegetated, the erosion of the bed material was considered to be the critical erosion threshold.

The critical velocity for the bed materials in reach WHT4(2)-2, based on the D_{50} of 21 mm, was calculated to be 0.80 m/s, using Komar's (1987) relationship. The corresponding discharge in the cross section at the point that sediment is entrained is 2.18 m^3/s. This discharge represents a value that is approximately 52% of the bankfull flow. The average shear stress acting on the channel bed at this stage is approximately 14 N/m^2. Due to the vegetative control and compact nature of the bank materials, the erosion threshold on the banks is not likely exceeded under the threshold conditions for the bed materials. Therefore, the most appropriate critical discharge for this reach was identified to be that of the bed materials (i.e., 2.18 m^3/s).

Reach WHT4(3)-1

The RGA effort had identified that widening and planimetric form adjustment (i.e., bank erosion) was the dominant geomorphic process. Therefore, the erosion of the bank material was considered to be the critical erosion threshold.

As the bank material within this reach consisted of ordinary firm loam, a permissible velocity method as per Julien (1998) was chosen to establish a critical velocity for the substrate. The critical velocity for the dominant bed material in this reach was calculated to be 0.76 m/s. The corresponding discharge

in the cross section at the point that sediment is entrained is 0.62 m^3/s. This discharge represents a value that is approximately 61% of the bankfull flow. The average shear stress acting on the channel bed at this stage is approximately 25 N/m^2.

Reach WHT4(3)2-1a

The RGA effort had identified that downcutting (i.e., vertical scour) was the dominant geomorphic process. Therefore, the erosion of the bed material was considered to be the critical erosion threshold. Additionally, due to the vegetative control and compact nature of the bank materials, the erosion threshold on the banks is not likely exceeded under the threshold conditions for the bed materials.

The critical velocity for the bed materials in reach WHT4(3)2-1a, based on the D_{50} of 23 mm, was calculated to be 0.84 m/s, using Komar's (1987) relationship. The corresponding discharge in the cross section at the point that sediment is entrained is 0.62 m^3/s. This discharge represents a value that is approximately 61% of the bankfull flow. The average shear stress acting on the channel bed at this stage is approximately 25 N/m^2. Due to the vegetative control and compact nature of the bank materials, the erosion threshold on the banks is not likely exceeded under the threshold conditions for the bed materials. Therefore, the most appropriate critical discharge for this reach was identified to be that of the bed materials (i.e., 0.62 m^3/s).

Reach WHT4(3)2-1b

The RGA effort had identified that the reach was in regime, with a moderate degree of entrenchment. Therefore, the erosion of the bed material was considered to be the critical erosion threshold. Additionally, due to the vegetative control and compact nature of the bank materials, the erosion threshold on the banks is not likely exceeded under the threshold conditions for the bed materials.

The critical velocity for the bed materials in reach WHT4(3)2-1b, based on the D_{50} of 20 mm, was calculated to be 0.78 m/s, using Komar's (1987) relationship. The corresponding discharge in the cross section at the point that sediment is entrained is 0.40 m^3/s. This discharge represents a value that is approximately 22% of the bankfull flow. The average shear stress acting on the channel bed at this stage is approximately 20 N/m^2. Due to the vegetative control and compact nature of the bank materials, the erosion threshold on the banks is not likely exceeded under the threshold conditions for the bed materials. Therefore, the most appropriate critical discharge for this reach was identified to be that of the bed materials (i.e., 0.40 m^3/s).

Reach WHT4(3)3-1

The RGA effort had identified that downcutting (i.e., vertical scour) was the dominant geomorphic process. Therefore, the erosion of the bed material was considered to be the critical erosion threshold. Additionally, due to the vegetative control and compact nature of the bank materials, the erosion threshold on the banks is not likely exceeded under the threshold conditions for the bed materials.

The critical velocity for the bed materials in reach WHT4(3)3-1, based on the D_{50} of 6 mm, was calculated to be 0.45 m/s, using Komar's (1987) relationship. The corresponding discharge in the cross section at the point that sediment is entrained is 0.21 m^3/s. This discharge represents a value that is

approximately 47% of the bankfull flow. The average shear stress acting on the channel bed at this stage is approximately 9 N/m^2. Due to the vegetative control and compact nature of the bank materials, the erosion threshold on the banks is not likely exceeded under the threshold conditions for the bed materials. Therefore, the most appropriate critical discharge for this reach was identified to be that of the bed materials (i.e., 0.21 m^3/s).

Reach WHT4(3)-2

The RGA effort had identified that widening and planimetric form adjustment (i.e., bank erosion) were the dominant geomorphic processes. Therefore, the erosion of the bank material was considered to be the critical erosion threshold.

As the bank material within this reach consisted of ordinary firm loam, a permissible velocity method as per Julien (1998) was chosen to establish a critical velocity for the substrate. The critical velocity for the dominant bed material in this reach was calculated to be 0.76 m/s. The corresponding discharge in the cross section at the point that sediment is entrained is 1.08 m^3/s. This discharge represents a value that is approximately 50% of the bankfull flow. The average shear stress acting on the channel bed at this stage is approximately 18 N/m^2.

Reach WHT4(3)4-2

The RGA effort had identified the reach was in regime. As the banks are heavily vegetated, the erosion of the bed material was considered to be the critical erosion threshold. Due to the vegetative control and compact nature of the bank materials, the erosion threshold on the banks is not likely exceeded under the threshold conditions for the bed materials.

As the substrate for this reach consisted of silt loam, a permissible velocity method as per Julien (1998) was chosen to establish a critical velocity for the substrate. The critical velocity for the dominant bed material in this reach was calculated to be 0.61 m/s. The corresponding discharge in the cross section at the point that sediment is entrained is 0.21 m^3/s. This discharge represents a value that is approximately 54% of the bankfull flow. The average shear stress acting on the channel bed at this stage is approximately 14 N/m^2.

Reach WHT4(3)5-1

No defined channel could be discerned for this reach within the Study Area. Therefore, this reach was deemed to not be sensitive to erosion. In lieu of a detailed erosion assessment it is recommended that the minimum on-site retention requirements outlined within the TRCA (2012b) Stormwater Management Criteria document be applied to the proposed outfall on this reach.

Reach WHT4(3)6-1

The RGA effort had identified that the reach was in regime. Some evidence of degradation was noted throughout the reach. Therefore, the erosion of the bed material was considered to be the critical erosion threshold.

As the bed material within this reach consisted of ordinary firm loam, a permissible velocity method as per Julien (1998) was chosen to establish a critical velocity for the substrate. The critical velocity for the dominant bed material in this reach was calculated to be 0.76 m/s. The corresponding discharge in the cross section at the point that sediment is entrained is 0.03 m^3/s. This discharge represents a value that is approximately 13% of the bankfull flow. The average shear stress acting on the channel bed at this stage is approximately 16 N/m^2.

Reach WHT4(1)6-1

No defined channel could be discerned for this reach within the Study Area. Therefore, this reach was deemed to not be sensitive to erosion. In lieu of a detailed erosion assessment it is recommended that the minimum on-site retention requirements outlined within the TRCA (2012b) Stormwater Management Criteria document be applied to the proposed outfall on this reach.

Reach CCC(2)

The RGA effort had identified that widening and planimetric form adjustment (i.e., bank erosion) were the dominant geomorphic processes. Therefore, the erosion of the bank material was considered to be the critical erosion threshold.

As the bank material within this reach consisted of ordinary firm loam, a permissible velocity method as per Julien (1998) was chosen to establish a critical velocity for the substrate. The critical velocity for the dominant bed material in this reach was calculated to be 0.76 m/s. The corresponding discharge in the cross section at the point that sediment is entrained is 0.91 m^3/s. This discharge represents a value that is approximately 53% of the bankfull flow. The average shear stress acting on the channel bed at this stage is approximately 12 N/m^2.

7.3.3. Erosion Exceedance Analysis

In order to understand the potential impacts of the proposed development plan on channel morphology, an impact assessment is proposed to be undertaken with respect to the SWM plan for the Study Area. As noted previously, in natural systems, watercourses regularly see flows that entrain and transport sediment. This is part of the natural process that maintains natural channel form (TRCA 2012, CVC 2015). The key to maintaining natural channel function is to match the frequency of exceedance or cumulative effective work in the post-development condition (TRCA 2012). Pre- to post-development exceedance can be evaluated using several criteria. The simplest is the cumulative time of exceedance or the number of exceedances (TRCA 2012, CVC 2015). Although these provide a simple comparison, they do not provide information on the work or erosive force of flows once erosion thresholds are exceeded. To provide a more stringent assessment, an approach involving three analyses was performed, including the cumulative effective erosion index (velocity exceedance), cumulative effective discharge index, and the cumulative effective work index. The cumulative effective velocity (CEV) is calculated as:

$$\mathrm{CEV} = \sum (\mathrm{V} - \mathrm{V_c})$$

The cumulative effective discharge (CED) is calculated as:

$$\mathrm{CED} = \sum(\mathrm{Q} - \mathrm{Q_c})$$

The cumulative effective shear stress (CESS) is calculated as:

$$\mathrm{CESS} = \sum(\tau - \tau_c)$$

where V is the mean channel velocity, V_c is the critical (permissible) velocity, Q is the channel's discharge, Q_c is the critical discharge, τ is the instantaneous shear stress, and τ_c is the threshold shear stress.

The cumulative effective work index (W_i) describes the cumulative effective work or stream energy expended above the critical value. W_i is calculated as:

$$\mathrm{W_i} = \sum(\tau - \tau_c)\mathrm{V}\,\Delta t$$

where Δt is the timestep used in the analysis.

The TRCA Stormwater Management Criteria (2012b) document notes that the cumulative effective work index is the preferred method when assessing potential impacts, as the velocity will increase as flood stage increases, which means that the cumulative effective work parameter will be more sensitive to extreme floods.

In order to identify sensitive reaches that would require the exceedance analysis completed, a sensitivity analysis was completed for each reach downstream of the proposed outfalls, in accordance with the TRCA (2012) guidelines. The sensitivity analysis consisted of an evaluation of the reach in terms of the RGA score, detailed geomorphic assessment and erosion threshold results (i.e., a comparison of the bankfull discharge and threshold discharge), as well as the drainage area contributions to the watercourse (i.e., a comparison of the total drainage area and contributing drainage area from the site).

The results of the sensitivity analysis are outlined in **Table 7-3** below.

Table 7-3. Erosion Sensitivity Analysis, West Humber River and Campbell's Cross Creek

Parameter	WHT4(2)-2	WHT4(3)-1	WHT4(3)2-1a	WHT4(3)2-1b	WHT4(3)3-1	WHT4(3)-2	WHT4(3)4-2	WHT4(3)5-1	WHT4(3)6-1	WHT4(1)6-1	CCC(2)
RGA Score	0.19	0.42	0.19	0.19	0.22	0.43	0.18	N/A	0.07	N/A	0.37
Critical discharge (m^3/s)	2.18	0.96	0.62	0.40	0.21	1.08	0.21	2.67	0.03	3.40	0.91
Bankfull discharge (m^3/s)	4.11	3.07	1.01	1.96	0.48	2.70	0.39	N/A	0.36	N/A	1.81
Sub-Catchment Area (ha)	10.5	276.9	39.5	90.7	-	1047.7	101.4	N/A	18.7	N/A	1248.9
Total Catchment Area - Existing (ha)	2234.8	2446.7	1002.2	962.7	872.0	1066.4	101.4	N/A	18.7	N/A	1248.9
Sensitivity Results (Y/N)	N	N	Y	N	N	N	Y	N	N	N	N

The reaches identified as being sensitive to erosion were identified for further assessment, with erosion exceedance analyses to be completed for these reaches to determine the potential impacts. For the reaches identified as not sensitive to erosion, minimum on-site retention requirements in accordance with the TRCA's Stormwater Criteria (2012) guidelines will be followed, and evaluated for impacts. Additional considerations for stormwater retention should be evaluated during stormwater management facility design.

The erosion exceedance analysis is ongoing and will be presented as an addendum to the Phase 2 SWS.

7.3.4. Natural Channel Realignment Design Principles

Reach WHT4(3)5-2 within Property 1 is proposed to be realigned along the western and southern property boundary. The realignment will result in the decommissioning of two online ponds (identified as OAO vegetation communities), which currently support various wildlife including fish, waterfowl, amphibians and reptiles. The main objective of the channel and corridor design is to restore a more natural form and function to the disturbed portion of the West Humber Tributary.

This Phase 2 Report introduces the concept of natural channel corridor realignment on this property with the expectation that detailed modelling and designs will be completed during the site-specific application. Preliminary details have been provided to support the initial delineation of corridor width and approximate block alignment to support the preparation of the proposed structure plan. A 45 m wide realigned channel corridor has been shown on the Structure Plan (**Figure 3-1**) in support of this SWS process; however, the exact width of this corridor will be refined during the site-specific stage.

The realigned channel corridor will ensure a 10 m setback is applied from the greatest of the natural hazards (e.g., flood, erosion and slope).

When realigning a watercourse, several design considerations should be taken into account, including environmental and engineering requirements. Key considerations are discussed below:

- **Environmental Impact:** A review of potential environmental impacts on the local wildlife and flora should be undertaken, as removal of the existing ponds and realignment of the watercourse could cause several direct impacts, such as flow disruption and habitat removal, as well as potential for erosion, sedimentation and water quality changes. Consideration of fish and wildlife passage, as well as overall connectivity to the landscape should be considered. The channel should be designed to support fish and wildlife passage, as well as maintain flow conditions to support downstream natural features. It should also be designed using natural channel design principles to create variability of in-stream habitat (e.g., existing in-stream habitat is all ponded, whereas proposed in-stream habitat can include riffle, pool and run morphologies). An environmental impact review was completed within **Section 7.2** of this report, which addressed concerns from various related natural heritage feature types (e.g., fish habitat, valleylands, SAR, etc.).
- **Natural Hazard Impact:** A review of potential natural hazards, such as flood and erosion, must be considered to ensure that the removal of the ponds does not negatively impact the receiving watercourse and downstream natural features. The realigned channel corridor should be designed to convey larger storm events (e.g., regional storm events) and include all natural hazard limits (e.g., flood, erosion, slope hazards). Preliminary hydrologic modelling has been completed to support the design and is summarized within **Section 8.8.1**. The realigned channel corridor would be maintained as an open corridor with a meandering swale throughout the floodplain, which would closely mimic a natural channel corridor. The watercourse corridor banks must also be stable to prevent future erosion and could include more natural stabilization measures instead of engineered solutions (e.g., retaining walls or armoured banks).
- **Geomorphic Considerations:** The channel design must balance hydraulic efficiency, flow capacity and stability. Using natural channel design principles will ensure that the channel is being responsibly designed and will not be designed as a “channelized” and unnatural drainage feature. In addition to designing the feature as a natural channel corridor with a meandering channel, the channel should be designed understanding sediment dynamics. Specifically, realignment of a watercourse could cause scour or deposition in other areas, which could alter the local ecosystem and water quality. Incorporation of biodegradable erosion control blankets or bioengineering materials (e.g., live stakes and brush mattresses) may be considered to stabilize the corridor during the interim and final conditions.
- **Slope Stability Considerations:** In areas where the watercourse is realigned, the slope stability must be carefully assessed to prevent geotechnical failures. Please refer to **Section 7.6.5** for preliminary geotechnical recommendations.

- **Climate Change Considerations:** The key considerations noted above contribute will enhance stream resilience to climate change by improving flood capacity, stabilizing erosion-prone area, and restoring natural hydrologic processes. By accommodating larger storm events and maintaining floodplain connectivity, the proposed channel design considerations can reduce downstream flood risk while supporting baseflow during dry periods, mitigating the impacts of extreme precipitation and variable precipitation regimes. The transition from stagnant ponded areas to a dynamic, meandering channel with diverse in-stream habitat features (e.g., riffles, pools, and runs) supports climate-adaptive fish and wildlife populations, fostering greater ecological resilience to changing temperatures and hydrologic conditions. The restoration of native riparian vegetation along the corridor provides beneficial climate mitigation ecosystem services through carbon sequestration. This nature-based approach supports long-term ecosystem health and through design measures that ensure the realigned channel remains functional and sustainable.

The realigned channel corridor is expected to be naturalized and incorporated into the Proposed NHS (as shown on **Figure 8-1**). No long-term maintenance is expected within the feature; rather, this channel is expected to naturalize over time. Materials and natural channel designs should require minimal intervention over time.

With respect to construction, please refer to the mitigative measures identified within **Section 7.2.1.6** (Fish Habitat). Further discussion on the proposed alignment and naturalization of the corridor is provided within **Section 8.8.1**.

7.3.5. Redside Dace SWM Outfall Design Considerations

HDFs, watercourses and riparian wetlands within the Study Area are either identified as occupied Redside Dace habitat or contribute flows to sensitive Redside Dace habitat. As a result, design considerations to support this species must be reviewed in order to reduce the impact to this species.

Redside Dace SWM conditions as per the Guidance for Development Activities in Redside Dace Protected Habitat (MNRF 2016) are discussed within **Section 7.2.1.5**. With respect to SWM outfalls in occupied Redside Dace, GEI recommends that outfalls are designed as stone-cored pocket wetlands, which consist of an excavated pool, lined with a mix of granular materials and soil. The granular materials are intended to provide stability, while the soil will provide a medium for vegetation establishment. Additionally, subsurface filtration is possible as flows pass through this soil and granular medium. Flow from the stone-core wetlands would be able to naturally disperse into the floodplain of the associated watercourse.

SWM outfalls in contributing Redside Dace habitat may consider other SWM outfall structures (e.g., considerations for a pocket wetland, or a swale with appropriate lining materials).

7.3.6. Collector Road Impacts

As depicted in **Figure 3-1**, two collector roads have been proposed and will require stream crossings. A preliminary review of crossing considerations from a fluvial geomorphology perspective is outlined below. More detailed analyses will be required as part of future studies to confirm sizing and design requirements, assess impacts, and provide mitigative measures to ensure long-term protection of the reaches.

Following best management practices and taking the TRCA's *Crossings Guideline for Valley and Stream Corridors* (TRCA 2015), a risk-based approach was taken to review the proposed crossing structures within the subject property, from a fluvial geomorphic perspective. This approach involves the following parameters:

- Channel size;
- Valley setting;
- Meander belt width;
- Meander amplitude;
- Dominant geomorphic processes; and
- 100-year migration rate.

The TRCA (2015) *Crossings Guideline for Valley and Stream Corridors* notes that the most preferred crossing span for new crossings in both large, rapidly eroding, or unstable watercourses, as well as small, stable watercourses, is the meander belt. This is followed by the 100-year erosion limit, in order of preference. A preliminary assessment of potential crossing spans was completed for the two proposed crossings.

The crossings are proposed to cross two reaches: WHT4(3)4-2 and WHT4(3)2-1a.

In the case of Reach WHT4(3)4-2, where defined, the bankfull width ranged between 0.9-2.1 m. The reach was situated in a confined valley. The RGA score of 0.18 identified this reach as 'in regime', with widening as the dominant geomorphic process within the watercourse. The erosion hazard for confined watercourses consists of the stable slope allowance and toe erosion allowance. However, the maximum meander amplitude for this reach is 17 m. A 100-year migration rate was established for the bends in the vicinity of the proposed crossing, which was determined to be 13 m. Due to the limited risk of migration for this reach and relatively low RGA score, from a geomorphic perspective, a crossing span that accommodates the 100-year migration rate of 13 m would be appropriate. This span accommodates the maximum bankfull width of 2.1 m and includes a factor of safety of approximately 6.2 times the bankfull width.

In the case of Reach WHT4(3)2-1a, the bankfull width ranged between 2.7-4.4 m. The reach was situated in a confined valley. The RGA score of 0.19 identified this reach as 'in regime' with widening as the dominant geomorphic process. The erosion hazard for confined watercourses consists of the stable slope allowance and toe erosion allowance. However, as this reach is occupied habitat for Redside Dace, a meander belt was delineated for this reach, of 34 m. A 100-year migration rate was

established for the bends in the vicinity of the proposed crossing, which was determined to be 21 m. Due to the limited risk of migration for this reach and relatively low RGA score, from a geomorphic perspective, a crossing span that accommodates the 100-year migration rate of 21 m would be appropriate. This span accommodates the maximum bankfull width of 4.4 m and includes a factor of safety of approximately 4.8 times the bankfull width.

As the valley for both crossing locations is confined, geotechnical requirements and impacts should also be considered (see **Section 7.6**).

In general, adherence to TRCA Crossing Guidelines (2015) should be used as a guiding tool when siting and designing stream crossings to ensure best practices are upheld and impacts on the stream are minimized and mitigated were possible. Additional considerations for stream crossings and impact mitigation as it relates to Redside Dace are discussed in **Section 7.2.1.5,** and fish habitat in general is discussed in **Section 7.2.1.6**.

It is expected that more detailed impact assessments of these crossings will take place as part of the MCEA.

7.4 Hydraulics and Hydrology

As discussed in **Section 4.1.1**., in order to determine the hydrologic impact of the proposed Structure Plan (**Figure 3-1**) on surface water resources, the peak flow to i) the existing culverts anticipated to be utilized as SW facility outlets, ii) each of the watercourses through the Secondary Plan area, and iii) the downstream Main Humber River flood vulnerable area, were determined utilizing the Visual Otthymo Version 6.2 (VO6) hydrologic model. The most recent calibrated hydrologic model for the Humber River watershed was obtained from the TRCA in January 2024 and discretized to establish existing conditions peak flows. This same model has now been utilized to complete the proposed conditions hydrologic assessment of peak flows for this Phase 2 Local SWS. The VO6 models and parameters are provided in **Appendix D3**. The updated existing peak flows and the proposed conditions peak flows are provided in **Table D1-1**, in **Appendix D1**.

The proposed conditions peak flows for each catchment, as well as at downstream key flow nodes identified in the Phase 1 Local SWS (SCS and GEI, December 2024), are compared to the updated existing conditions flow rates established in the Phase 1 Local SWS (SCS and GEI, December 2024). As shown in **Table D1-1** in **Appendix D1**, the proposed conditions uncontrolled peak flows for each watercourse typically did not exceed the existing condition peak flows within the immediate vicinity of the Secondary Plan area. Campbell Trib P – Reach 1C was the only local tributary with an increase in Regional peak flow in the proposed conditions scenario. Refer to **Section 7.4.1** for Preliminary Management Recommendations regarding the increase in Regional peak flow.

Existing culverts located at the southern limit of the Secondary Plan underneath Mayfield Road are anticipated to be used as outlets for Catchments 29.13 and 32.26 under proposed conditions. Under existing conditions, the Regional peak flows to the existing 1390 mm by 750 mm CSP arch culvert and the existing 2440 mm by 1750 mm CSP arch culverts are 3.706 m^3/s and 8.895 m^3/s, respectively. Under proposed conditions, the Regional peak flows to both existing culverts are 7.099 m^3/s and

13.254 m^3/s, respectively. Refer to **Section 7.4.2** for Preliminary Management Recommendations regarding the increase in Regional peak flow.

As discussed in **Section 2.3**, one FVA applies downstream of the Study Area, the Main Humber River FVA at the confluence with the West Humber River, located in the City of Toronto. The Humber River hydrology model has been updated to determine the impact of the proposed conditions at the Main Humber River FVA (Node 1631 within the Humber River hydrology model). Note that all FVA peak flows listed below account for an aerial reduction factor of 73.3% per the Humber River Hydrology Update – Final Report (TRCA, 2018).

Under existing conditions, the Regional Storm peak flow, to Node 1631 is 1215.570 m^3/s. The existing conditions model was then updated to account for the proposed development of the Study Area. Under this proposed condition, the Regional Storm peak flow to Node 1631 is 1228.025 m^3/s (increase of approximately 1.0%). Given the minor increase in peak flow, it can be concluded that the proposed development within the Study Area will not have a significant impact at the Main Humber River FVA.

Under future conditions, assuming the future build-out scenario noted in the Humber River Hydrology Update – Final Report (TRCA, 2018) the Regional Storm peak flow to Node 1631 is 1464.893 m^3/s (increase of approximately 20.5% from the existing condition).

As outlined in the Phase 1 Local SWS, in addition to the Regional Storm event peak flows being refined, channel and crossing geometry, and Manning's n-values were refined based on the detailed topographic survey and orthographic imagery, where warranted. West Humber River tributaries that were determined to not have floodplain constraints were not updated. Detailed topographic survey of Campbell's Cross Creek and West Humber River reaches WHT4(2)-1, WHT4(3)-1, and WHT4(3)-2 could not be obtained due to access constraints where they passed through participating landowners. It is not anticipated that the limits of development will be governed by the floodplain constraints along these reaches, therefore the HEC-RAS geometry has not been updated. The HEC-RAS model for all watercourses (including associated arterial road crossings) was updated using the greater of the updated existing condition, or proposed condition Regional Storm event peak flows **Table D1-1**, in **Appendix D1**. The updated HEC-RAS model and model results are provided in **Appendix D3**.

Floodplain mapping throughout the Secondary Plan has been prepared based on the updated hydraulic modelling. The existing Regional Storm floodplain and proposed Regional Storm floodplain have been illustrated on **Figures D2-3B** to **D2-8B** (**Appendix D2**). Where the existing Regional Storm event peak flow was the governing flow, a proposed floodplain was not plotted.

Culvert inspection reports were obtained from the Region of Peel and Town of Caledon for the existing culverts crossing Mayfield Road, Bramalea Road, Torbram Road, and Old School Road along the frontage of the Secondary Plan. The culvert inspections reports are provided in **Appendix D4**. In general, all culverts were noted as being in fair or good condition with minor repairs required (e.g. minor ditching, patch repairs to concrete, minor restoration, etc.). A culvert capacity analysis has been prepared for the existing arterial road culverts, and proposed internal collector road culverts in both existing and proposed hydraulic scenarios to confirm if they meet design criteria or if modifications are required through planned road improvements, refer to **Figure A1-1**, and **Table A1-1** in **Appendix**

A1. Existing culverts upstream of the Secondary Plan were not analyzed as the proposed development would not impact their capacity.

As shown in **Table A1-1**, under existing conditions Culvert #1 and Culvert #2 on Bramalea Road do not meet minimum freeboard criteria and Culvert #2 does not meet the minimum HW/D ratio. Additionally, Culverts #1 (Bramalea Road), #2 (Bramalea Road), #5 (Torbram Road), and #6 (Mayfield Road) have water depths greater than 0.3 m above the deck low point during the Regional Storm event. These culverts were identified as part of the SABE SWS (2022) as experiencing backwater and/or overtopping during the Regional storm event (relevant excerpts provided in **Appendix A3**), therefore the analysis presented in this report is consistent and the existing culverts noted above require improvements to meet the design criteria.

As noted earlier in this section, the proposed Regional Storm event peak flows are typically less than existing Regional Storm event peak flows for all watercourses. Therefore, the conveyance issues outlined above will not be exacerbated by the development of the Secondary Plan Area.

Two proposed collector road culvert crossings are required in support of the Secondary Plan located on the TACC Developments (Armstrong) Ltd. (Culvert #7) and Mayfield Golf Course Inc. (Culvert #8) developments. As outlined in **Section 7.3.6**, the minimum recommended span from a fluvial geomorphology perspective is 13 m for Culvert #7, and 21 m for Culvert #8. Preliminary sizing of the proposed culverts was prepared utilizing the HEC-RAS model discussed above to meet crossing design criteria. A 13.4 m wide concrete arch open-bottom culvert and a 14.9 m wide concrete arch open-bottom culvert are proposed for Culverts #7 and #8, respectively. As West Tributary 4(3)4-2 was observed to be an intermittently defined watercourse, fish passage requirements were not applicable to Culvert #7. Both proposed internal collector road culverts (Culverts #7 and #8) meet or exceed the minimum design storm freeboard requirement. A minimum clearance from the Regional Storm water surface elevation to the Culvert #7 and Culvert #8 obverts is greater than the required 0.3 m. Additionally, the flood depth HW/D ratio was calculated for both Culvert #7 and Culvert #8 to determine if they met the requirement of ≤ 1.5. Both culverts were determined to have a ratio of ≤ 1.5, refer to **Table A1-1** in **Appendix A1**.

7.4.1 Preliminary Management Recommendations

As discussed in **Section 7.4**, the floodplain mapping through the Secondary Plan for West Humber Tributary 4(3)5-2 - Campbell Trib P North, West Humber Tributary 4(3)5-1 - Campbell Trib P, West Humber Tributary 4(3)4-2 - Campbell Trib O and West Humber Tributary 4(3)3-1 and West Humber Tributary 4(3)2-1 - Campbell Trib J have been prepared based on the updated existing and proposed hydraulic modelling. Through the Secondary Plan area, the limit of development is not governed by the updated proposed Regional floodplain setback, therefore the limit of development will follow the other Natural Heritage Features and Natural Hazards and their setbacks. Proposed collector road culvert #7, discussed in **Section 7.4**, does not impact the proposed floodplain for West Humber Tributary 4(3)4-2. The proposed collector road culvert #8, discussed in **Section 7.4**, does impact the proposed floodplain for West Humber Tributary 4(3)2-1. A slight backwater at an approximate elevation of 248.93 m extending approximately 125 m upstream of culvert #8 is observed, however the limit of development is not governed by the proposed Regional floodplain at this location.

Therefore, no management recommendations are required based on the proposed Regional floodplain.

As discussed in **Section 7.4**, existing culverts located at the southern limit of the Secondary Plan underneath Mayfield Road are anticipated to be used as outlets for catchments 29.13 and 32.26 under proposed conditions. No mitigation measures for these existing culverts are required in the proposed condition, as all proposed SWM facilities will be controlled to unit release rates for the 2-100 year return period storms and will be controlled to pre-development peak flow rates in the Regional Storm event. In an emergency scenario where the existing culvert outlets are blocked, Regional flows will overtop Mayfield Road and continue draining southwards. For the existing 1390 mm by 750 mm CSP arch culvert, emergency flows will overtop Mayfield Road and will drain overland via a future municipal road through a Block 48-2, before ultimately draining to Campbell's Cross Creek (2), refer to the Block 48-2 storm drainage plan provided in **Appendix D4**. For the existing 2440 mm by 1750 mm CSP arch culvert, emergency flows will overtop Mayfield Road and will drain southwards overland via the existing drainage feature, before ultimately draining to a tributary of the West Humber River.

As shown in **Table A1-1** in **Appendix A1**, Culverts #1, #2, #5, and #6 require upgrades under existing conditions to meet the design criteria and/or reduce the flow depth over the crossing deck during the Regional Storm event. Per the hydrologic modelling discussed in **Section 7.4**, peak flows during the Regional Storm event decrease in comparison to existing conditions at the existing arterial road culverts, therefore additional improvements to the existing culverts are not required due to the development of the Secondary Plan Area and no management recommendations are required.

7.5 Hydrogeology

The TOR for the hydrogeological impact assessment under Phase 2 of the SWS outlines the following:

- The main goal of the hydrogeological assessment is to establish a geological and hydrostratigraphical conceptual model for the Study Area and assess what would be impacted by development activities;
- One full year of monitoring data will be collected to inform the SWS Phase 2 submission (May 2024 – April 2025); conservative assumptions will be used to support the Phase 2 assessments. If the climatic conditions during the year of monitoring are not considered representative of normal conditions, additional baseline monitoring may be undertaken; if additional years of baseline monitoring are required, subsequent years may be completed as part of site-specific work plans;
    - At the time of submission of this Phase 2 report, the full year of monitoring has not been completed. However, the majority of the one-year monitoring program has been completed and the assessments provided in this report have been based on the monitoring data collected to date. Where data is missing, conservative assumptions have been used to support the Phase 2 assessments. The Phase 1 LSS report concluded that data collected in 2024 is considered representative of normal conditions, and therefore additional baseline monitoring beyond April 2025 is not required.

- The hydrogeological assessment data and conceptual model will be reviewed in the context of other disciplines and policy frameworks (such as the Source Water Protection Plan) to provide an impact assessment of areas that may be more sensitive to development, may be less developable due to significant constraints or may require additional mitigation to be feasible for the planned land uses. The impact assessment will address:
    - Seepage and discharge observations;
    - Fish habitat;
    - Phreatic observations;
    - Streambed composition;
    - Low flow analysis and water quality;
    - The impact assessment will also address the overall groundwater budget model along with the surface water components for the Study Area will estimate precipitation, evapotranspiration, runoff and infiltration, and groundwater recharge and discharge;
    - Groundwater supported features; and
    - The baseline water balance assessment will be updated to reflect the proposed land use scenarios, and potential impacts to groundwater recharge will be assessed.

7.5.1 Dewatering Assessment

The Structure Plan is described in **Section 3**. It includes community areas for medium density residential development, urban corridors, a neighborhood centre for mixed use and commercial development, schools, a firehall, parks, environmental features and SWMFs.

Detailed information (e.g., final grades, building footprints, road/servicing alignments, etc.) is not currently available. Therefore, to support the dewatering assessment and subsequent discussion, assumptions were made regarding typical dimensions and depths of excavations.

The following is an overview of those assumptions:

- Site servicing trenches:
    - Dimensions: 30 m long by 3 m wide by 3 m deep
- SWM Ponds:
    - Dimensions 70 m long by 70 m wide by 4.5 m deep (approximately 0.5 ha in size)
- Large Structure in Urban Corridor:
    - Dimensions 75 m long by 25 m wide by 7 m deep to accommodate underground parking structures or multi-level basements
- Houses (i.e., single detached dwellings)
    - Dimensions 10 m wide by 20 m long and 1.8 m deep

Estimates were prepared for two modes: the first to address seepage inflows of groundwater from shallow soils and a second for potential depressurization requirements for excavations in areas where artesian conditions exist.

For the estimation cases, conservative assumptions were made regarding the soil and groundwater conditions as follows:

- For seepage inflow from shallow soils:
  - Hydraulic Conductivity of $5.5x10^{-6}$ m/s (based on the maximum recorded hydraulic conductivity in Halton Till as obtained in single well response testing at MW17).
  - Groundwater level at ground surface.
  - Drawdown equal to the depth of excavation plus a buffer of 0.5 m.
- For depressurization flows in artesian conditions:
  - Hydraulic Conductivity of $1x10^{-5}$ m/s (based on assumed hydraulic conductivity associated with coarse ORAC deposits).
  - Aquifer thickness of 5 m
  - Artesian water level of 1 m above ground surface.
  - Drawdown
    - For excavations less than 4.5 m deep: drawdown was taken to be equal to the depth of excavation plus 1 m
    - For excavations greater than 4.5 m deep: drawdown was taken to be equal to the depth of excavation plus 1.5 m

It is noted that single-well response testing at monitoring wells screened in ORAC indicated hydraulic conductivity on the order of 10^{-7} m/s or less. However, it is also noted that single well response tests have not been completed at the artesian wells that intersect ORAC. As such, a more conservative estimate has been made based on the material description of ORAC materials encountered at NW31D (gravel and sand, some silt, trace clay).

It is also noted that due to the variability of conditions that exist across the Study Area, this assessment is limited to a screening level analysis: additional investigation at the draft plan of subdivision and/or site plan stage should be undertaken to provide more detailed, site-specific parameters for the estimation of dewatering, the assessment of impacts, the selection of monitoring and mitigation measures, and the obtainment of appropriate approvals.

A summary of the screening-level construction dewatering estimates is provided in **Appendix E1** including water-taking quantities and anticipated radius of influence. Detailed calculation worksheets for each dewatering case are provided in **Appendix E2.**

Generally, most excavation types would involve dewatering rates less than 400,000 L/d.

Exceptions include SWM ponds and large urban corridor buildings with deep basements, both of which may potentially require dewatering exceeding 400,000 L/d.

Construction of individual houses (i.e., basement excavations) are expected to require dewatering less than 50,000 L/d.

7.5.2 Construction Dewatering

Impacts related to construction dewatering generally fall into two categories: impacts related to water-taking and impacts related to management of discharge.

7.5.2.1 Impacts Related to Water-Taking

Depending on excavation type and location on-site, construction dewatering activities may involve water-taking in excess of 700,000 L/d. However, construction dewatering is typically temporary in duration, which reduces the potential for the development of negative impacts associated with the water-taking.

For shallow excavations occurring within the Halton Till aquitard and which do not require depressurization of the ORAC aquifer, the likelihood of impacts is expected to be low.

Where depressurization of the ORAC aquifer is necessary, potential for impacts related to water-taking may be increased due to the following reasons:

- the pumping of confined aquifers typically results in a larger zone of influence, which indicates a greater potential for influencing or affecting a receptor such as a water supply well or a sensitive ecological feature;
- drawdowns of an artesian aquifer may result in decreased groundwater discharge to ecological features that rely on such discharge; and
- drawdown of a confined aquifer may result in dewatering induced settlement.

Where these depressurization requirements are temporary (i.e., for construction dewatering) it is expected that the potential for impacts would be low or could be mitigated. However, structures built in such conditions have the potential to require long-term drainage, which may have greater risks depending on the receptors. Those impacts are addressed in **Section 7.5.3**.

7.5.2.2 Impacts Related to Discharge Management

For many dewatering projects, the most likely means of impact is related to the handling of discharge. Water taken up from excavations typically contains a substantial concentration of total suspended solids or elevated turbidity. These parameters may result in problems in receiving systems, such as degraded surface water quality, the clogging of sewers, or the loss of effective storage volume in SWM ponds.

Similarly, the uncontrolled release of discharge may result in erosion of the ground surface, damage to vegetation, and/or the entrainment of sediment in the discharge stream.

However, potential issues related to sediment and suspended solids can be effectively mitigated through the implementation of typical erosion and sediment control practices.

Site- or project-specific water quality may require other mitigation measures. For example, the dissolved phase concentrations of certain metals parameters may be found to exceed the Provincial Water Quality Objectives. Dissolved metals may not be amenable to removal by typical erosion and

sediment control and may require additional discharge management approaches, such as the implementation of measures that encourage adsorption or precipitation of the dissolved metals species. Groundwater sampling and testing against PWQO metals during the Phase 1 investigation revealed exceedances of Cobalt, Iron, Aluminum, Copper, Uranium, Vanadium, Zinc, Lead, and Zirconium in unfiltered groundwater samples. With the exception of one groundwater sample taken on Property 11, filtered groundwater samples showed no exceedances of PWQO metals, therefore filtration is anticipated to be an effective treatment method for PWQO metal exceedances.

7.5.3 Post Construction Dewatering

Where buildings extend below the phreatic surface (i.e., into soil saturated by groundwater), foundation or basement drainage may be required over the long-term for the maintenance or operation of the structure. In some cases, post-construction drainage may also be necessary to maintain the stability of a liner for a SWMF.

Where high groundwater levels persist or occur seasonally, post-construction drainage may be required for most types of buildings unless the subsurface portions are "waterproofed" per the *Ontario Building Code.* However, throughout much of the Mayfield Tullamore Study Area, especially the areas south of the stream corridor WHT4(2)-1/-2 and WHT4(3)-1/-2, high groundwater levels are also usually accompanied by soils of low hydraulic conductivity in the shallow subsurface. In those areas, foundation drainage for shallow basements (e.g., for single-detached dwellings, townhouses) are not expected to require a Permit to Take Water (PTTW) as the water taking rates for foundation drainage will be relatively low. Though the potential for impacts associated with these types of developments is considered to be low, a detailed impact assessment should be conducted on a case-by-case basis (e.g., at Draft Plan).

It is expected that urban corridor buildings with deep basements (e.g., underground parking structures) would require substantial quantities of long-term drainage at rates similar to those estimated for construction dewatering (see **Appendix E1**). The impacts of these water-takings should be evaluated on a case-by-case basis at Draft Plan or Site Plan stage as there may be potential for impacts to the water balance of nearby ecological communities.

In the northeastern portion of the Study Area where artesian conditions have been observed or are probable (e.g., Property 8, the northern part of Property 9 and potentially part of Property 7), post-construction drainage has the potential to cause aquifer mining of the ORAC. Unless further detailed study (i.e., at Draft Plan and/or Site Plan) confirms that such post-construction drainage will not be detrimental to ORAC or cause dewatering-related impacts (e.g., to ecological features relying on springs/seeps; dewatering-induced settlement), buildings in these areas should be constructed without basements or should be constructed with waterproofed basements to avoid reliance on foundation drainage. SWMFs built in these areas should be designed with the objective of avoiding reliance on subdrains to maintain liner stability.

7.5.4 Long-Term Passive Drainage

Passive drainage of groundwater may occur over the long term where infrastructure is constructed below the phreatic surface. These structures, such as sewers and watermains, may not require drainage for their operation but their construction may create preferential paths of groundwater flow in the subsurface. This may result in the lowering of groundwater levels across much of the developed area of the Study Area.

However, the impacts associated with this drainage may vary in significance depending on the sensitivity of nearby ecological communities, their dependence on groundwater, and the hydrogeological conditions. For example, these impacts may be minimal where soils of low hydraulic conductivity persist because the zone of influence of the drainage effect may be limited by the soil conditions.

Particular attention should be paid where structures are proposed to be built at elevations that intersect saturated ORAC deposits and in areas where artesian conditions are identified in ORAC. The potential for soils of elevated hydraulic conductivity to exist within the ORAC deposit may result in large quantities of unintended flows along preferential flow paths created by or during construction of subsurface structures.

Future study should assess the significance of potential impacts of passive drainage and recommend mitigation measures where applicable.

For example, the formation of preferential flow pathways can be minimized by constructing subsurface infrastructure with trench plugs (also referred to as “clay cutoffs” or “clay collars”) at an appropriate spacing based on the hydrogeological conditions and pipe slope.

In areas where artesian conditions exist, proponents should examine the potential for seepage-related phenomena such as critical gradients, internal erosion, or hydraulic fracture which may result in future instability of the structures (e.g., sinkholes) or unintended impacts to groundwater flow patterns and receptors.

7.5.5 Regulatory Consideration for Water Taking

Different regulatory considerations apply depending on whether a dewatering activity is for construction (i.e., temporary) or operation (i.e., long-term, such as for foundation drainage).

Construction dewatering is regulated jointly under the Environmental Protection Act (via O. Reg. 63/16 and the Environmental Activity and Sector Registry or EASR) and the Ontario Water Resources Act (via the PTTW Program). In determining the applicable regulatory framework, the main criterion is the maximum daily water taking amount:

- PTTW is applicable for construction dewatering involving…
    - The taking of groundwater exceeding 400,000 L on any one day from a single source

- The taking of groundwater exceeding 400,000 L/d on any one day from multiple sources where the zones of influence of those sources overlap.

- EASR is applicable for construction dewatering involving…
  - the taking of groundwater or a combination of groundwater and stormwater where the groundwater portion exceeds 50,000 L on any one day but never exceeds 400,000 L (all water-takings from sources with overlapping zones of influence must be counted together toward these limits).
- Neither EASR nor PTTW are applicable for construction dewatering where…
  - the water taking is only of stormwater; or
  - the dewatering is to remove water enclosed between coffer dams or that may seep under or through coffer dams during work within water bodies or watercourses ("in-stream diversion" exemptions per O. Reg. 387/04).

Based on the estimated water-taking rates presented in **Section 7.5.1**, there is potential for projects within the Mayfield Tullamore Study Area to require a PTTW, especially where SWM ponds or large urban corridor buildings are constructed in areas where groundwater levels are high.

Projects where the construction work is limited to the installation of shallow linear infrastructure (e.g., watermains, storm sewers, sanitary sewers) are likely to require EASR.

Construction dewatering for individual house basements is not expected to require dewatering exceeding 50,000 L/d and is therefore not expected to require EASR or PTTW.

In some parts of the Study Area, groundwater levels are noted to be very deep below ground surface (e.g., Property 1). Some projects in these areas may not require EASR or PTTW, however it is recommended that a discharge management plan be developed to address any incidental dewatering that may be required during such projects.

The above is provided based on a general understanding of the soil and groundwater conditions of the Study Area and on assumed construction details (e.g., sizes of excavation). Therefore, the exact regulatory requirements should be determined on a project-by-project basis following detailed hydrogeological investigation and subsequent preparation of project-specific estimates for construction dewatering quantities.

Additional construction dewatering assessment may be required per "TRCA Technical Guidelines for the Development of Environmental Management Plans for Dewatering," dated September 2013. During future development stages, an ecologist may need to be retained to review the ROIs and estimated water taking rates previously described, relative to the potential NHS on or near the Study Area. A Natural Heritage Evaluation may be required, along with consultation with TRCA to determine if an Environmental Management Plan (EMP) is required for construction dewatering.

Permanent (long-term) dewatering or drainage is regulated under the PTTW program. A PTTW is required where the water taking rates exceed 50,000 L/day. As each neighbourhood-area residential lot is expected to be a freehold property, the water taking rates can be assessed individually (i.e., on a lot-by-lot basis). Based on the estimates discussed above, a PTTW is not anticipated for residential lots for single-detached dwellings.

However, a PTTW may be required for long-term drainage in the following circumstances:

- foundation drainage for large structures with deep basements (e.g., underground parking levels) as may be constructed in the urban corridor areas; and
- for SWM ponds where artesian pressures require a subdrain system to be constructed to relieve artesian pressures to maintain liner stability or to achieve target permanent pool elevations.

The requirement for PTTW could be avoided in some cases by construction of the subsurface portions (e.g., basements, parking structures) as waterproofed structures and thereby avoiding reliance on drainage. Where long-term drainage is expected to be required for operation of a given structure, proponents should consider pre-consultation with MECP to confirm the long-term dewatering approach and requirements. Approval from the Town and possibly TRCA may also be necessary for this long-term dewatering approach.

As with construction dewatering approvals, the regulatory requirements associated with long-term dewatering and drainage of groundwater must be assessed further during future development stages, once detailed site plans are available and additional field investigation is completed.

7.5.6 Potential Impacts to the Natural Environment

The potential impacts discussed below must be assessed in more detail and addressed during future phases of development.

The majority of surface water features in the Study Area are primarily supported by surface water and, as such, are not expected to be impacted by dewatering.

The features that are supported by groundwater (detailed in **Table 1, Table 2, and Figure F-2**, **Appendix F2**) have the potential to be impacted if the construction dewatering ROI intersects the feature and reduces baseflow or draws down the surface water. Ecological communities with seasonal reliance on groundwater must be considered in impact assessments for any proposed dewatering activities.

Future reports must investigate the potential for dewatering and drainage to impact natural features and provide recommendations for appropriate monitoring and mitigation plans to reduce or prevent the impacts. Monitoring and mitigation plans should also consider the discharge of water from dewatering systems, including temperature, chemistry, total suspended solids and volume of the discharged water. Erosion and sediment control methods must be incorporated into any dewatering plans to prevent quality impacts and reduce potential for erosion within the features.

Construction dewatering has the potential to locally lower the groundwater table, but the impact is likely minor due to the short-term nature of the construction dewatering. Also, groundwater taken by dewatering is typically discharged a short distance away, usually within the catchment of the receiving feature: this provides an opportunity to attenuate water quantity impacts to sensitive receivers by selecting an appropriate discharge location and allowing the discharged water to re-infiltrate or flow overland into the feature, as appropriate.

Post-construction drainage related to foundation drainage of low-density residential basements (i.e., single-detached dwellings, townhouses) across the Study Area may have an impact on the prevailing groundwater table by lowering it deeper below grade compared to the seasonal levels observed during Phase 1 LSS monitoring. The effect of this drainage may be moderated by the low hydraulic conductivity of the surficial soils (i.e., Halton Till), which may limit the lateral extent of drawdown (i.e., small zone of influence). However, where site-specific studies reveal that the effects of foundation drainage would impact natural features (e.g., groundwater-supported wetland features), then monitoring and mitigation plans should be developed and the SWM design should be adapted to minimize the impacts.

Post-construction foundation drainage for large buildings with deep basements (i.e., urban corridor buildings with underground parking) may carry greater potential for impacts to the natural environment due to the likelihood of larger drawdowns and/or penetration into strata of higher hydraulic conductivity at depth. Both of these factors would result in larger zones of influence and larger drainage rates: site-specific studies should evaluate the proposed block layouts and/or building designs in the context of soil and groundwater conditions and ecological receptors (e.g., discharge-reliant features, groundwater supported features) to determine whether the subdivision layout should be revised or whether buildings should be designed with waterproof basements to avoid reliance on long term drainage.

The SWM design, informed by the feature-based water balance for applicable features, would seek to mitigate impacts by maintaining the water balance of the wetlands/features that are to be retained. The details of basement designs and the mitigation (e.g., LID measures) will be determined through the Phase 3 LSS and subsequent design stages (e.g., draft plan, site plan). Proposed constructed wetlands should also be accounted for in these impact assessments and mitigation plans.

The proposed collector roads within the Secondary Plan Area are associated with a Greenbelt Plan Area NHS crossing (Property 9) and a non-significant valleyland/NHS crossing (Property 4). One wetland unit within Property 9 will be bisected by the proposed road crossing. This road crossing has been designed to utilize an existing crossing associated with a golf course path. However, one wetland unit consisting of a MAM2-1 community will be removed and/or encroached into as a result of the proposed road alignment. As final crossing design, including total crossing widths have not been assessed yet (as part of an MCEA), impacts associated with the wetland removal as a result of the proposed collector road alignment will be further explored as part of the MCEA. Where possible, it is recommended to minimize and avoid impacts to the candidate PSW unit. As part of the transportation planning process, the preferred road alignment will require a MCEA. The alignment will be evaluated based on set criteria points, which may include the anticipated costs, property acquisition, construction feasibility and timelines, archaeological and cultural heritage impacts, climate change

and environmental impacts (to terrestrial ecosystems, fish and fish habitat, and SAR and their habitats). Detailed impact assessments are required during the site-specific stages to confirm that the hydroperiods of the wetlands will not be impacted by the changes to the pre to post development catchment areas and as a result of potential dewatering activities (e.g., under artesian conditions). Further, it is understood that any installation of servicing along the road alignment under a watercourse will be constructed using trenchless drilling methods to avoid impacts due to dewatering.

Consultation between different technical experts such as natural heritage / ecology teams and hydrogeologists are recommended during future design stages to make sure the appropriate long-term groundwater conditions are understood and accounted for. For example, if constructed wetlands are designed using current groundwater levels, but the proposed design may lead to a lowered groundwater table (e.g., due to increased impervious area, due to drainage by preferential flow paths), the effects must be understood and addressed in the design, with appropriate mitigation measures being included as applicable. During future development stages, studies are required to assess the potential amount of drawdown, the spatial area of impact, and any potential environmental effects or impacts to the NHS.

7.5.6.1 Restoration and Relocation of Surface Water Features

As discussed in **Section 7.2.1.6**, the watercourse which crosses Property 1 (WHT4(3)5-2) is proposed to be re-located to the western border of Property 1. This watercourse is expected to intersect the permeable ORAC sediments, and baseflow in this watercourse and associated wetlands is expected to be maintained by the water table where the features are deep enough (discussed further in **Section 7.8**).

The following mitigation measures are proposed to minimize potential adverse impacts associated with wetland removal and construction:

- Removal of the wetlands should occur during the summer months when the features are expected to be dry (or contain lesser water) to minimize water management requirements and limit potential mobilization of sediment to downstream habitats;
- Any dewatering activities associated with the removal of these features should not outlet to downstream aquatic habitats, if possible. Since all drainage features are also identified as providing direct or indirect fish habitat, removal of these features should be completed outside of the spring fisheries window (March 15 to July 15) to avoid adverse effects to downstream habitats. Dewatering activities should occur slowly to avoid excess sediment input to downstream habitats with water treatment used as necessary; and
- Opportunities for phasing will be considered to recreate wetlands ahead of the removal of existing wetlands within the Study Area. This may not be feasible given that the hydroperiod of created wetlands may be reliant in part from the roof-top contributions; however, this will be explored further during detailed design to determine if creation of the wetland is feasible ahead of the proposed removal of the existing wetland units. Efforts to reduce the lag time between wetland removal and replication will be explored.

Mitigation measures identified within **Section 7.2** of this report would also apply.

7.5.7 Potential Impacts to Future Storm Water Infrastructure

Due to the hydrogeological conditions of the Study Area, which include artesian conditions and high groundwater levels, there is potential for unintended flows to enter the stormwater system. This may lead to poor performance or other negative effects due to higher-than-expected throughput.

Possible sources of such unintended or additional flows may include:

- Construction dewatering;
- Foundation drainage;
- Preferential flow pathways due to construction of subsurface linear infrastructure; or
- Upwellings or increased seepage due to exposure of or decreased cover over artesian aquifers.

Where construction dewatering occurs after site servicing is completed, it may be that the most appropriate receiver is the storm sewer. In these cases, the water-taker will need to verify that the expected flows can be safely conveyed by the storm sewers and in accordance with all relevant criteria and by-laws. If not, an appropriate discharge plan will need to be prepared and implemented to limit potential impacts to receivers.

Where houses are constructed in areas with high groundwater (i.e., groundwater levels above the footing), it is recommended that the basements be provided with foundation drains having a passive outlet (i.e., do not rely solely on the operation of a sump pump). Town of Caledon standards prohibit connection of foundation drains to storm sewers, so in areas where basements will be constructed below groundwater the servicing plans must accommodate a "third pipe" system for foundation drainage (i.e., a weeping tile collector). It is noted that the detailed design of some blocks (e.g., multi-level commercial or residential with underground parking in urban corridor lands) may occur well after the construction of the major elements of the SWM system. To account for this, the draft plan application should specify limits for allowable foundation drain discharge rates for each block. These limits should also be developed in conjunction with hydrogeological and ecological review to confirm that the limits will not lead to negative impacts to the water balance or to ecological features. If subsequent detailed investigation of the block areas reveals that the drainage quantities will exceed the specified limits, then those structures shall be constructed with waterproof basements to avoid the potential for impacts due to excessive drainage.

A groundwater contour map is provided within Appendix E of the Phase 1 LSS; this figure should be referred to as a guide to where basements may require permanent drainage. Based on available data, it is expected that basements would likely extend below groundwater at most basements constructed on properties 5, 6, 7, 8, 9, 10, and 11, and potentially in some areas of property 4 (northeastern portion near property 7). During detailed Draft Plan investigations, it is expected that a higher resolution of groundwater table elevation data will be obtained, and a greater certainty of constraints on basement elevations can be provided. Based on the assumption within the Phase 1 LSS dewatering calculations that basement elevations will be constructed to 1.8m below existing grade, areas where the water table elevation is shallower than 1.8 m below existing grade form preliminary locations where permanent basement drainage may be needed. Based on current groundwater table and topography data, these conditions appear to exist within Properties 9 and 10. It should be noted that these

locations are preliminary and the grading and construction details will determine which basements will in fact be constructed below the water table, and greater resolution of water table data will be collected at Draft Plan stage.

Linear infrastructure (e.g., watermains, sanitary sewers, storm sewers) constructed below the water table has the potential to cause unintended drainage of groundwater. Such infrastructure is commonly built with free-draining aggregate bedding, which may become a preferential pathway for groundwater flow. Such flows occurring along storm sewers ultimately enter SWM ponds. To avoid such impacts, designers should consider providing linear infrastructure with trench plugs (also referred to as clay collars or trench cutoffs) to prevent the development of these preferential flow pathways.

Artesian conditions have been observed on the northeastern part of the project area. SWMFs often require deep excavations to provide sufficient storage for flow attenuation and sufficient depth of permanent pool and forebay to meet treatment/ quality objectives. Where deep excavations reduce the thickness of confining cover over an artesian aquifer, the rate of groundwater discharge often increases due to the resulting increase in hydraulic gradients. In the worst case scenario, perforation of the cover may lead to the development of an artesian spring or seep which may be difficult to repair, leading to an irremediable change in the water balance of the aquifer. SWMFs on Properties 7, 8 and 9 should be supported by careful hydrogeological investigation and should be designed to minimize the potential for these impacts.

7.5.8 Potential Impacts to Land Stability and Settlement

For construction dewatering and long-term drainage, settlement of the soil within the radius of influence must be calculated based on the increase in effective stress from reducing the pore water pressures. Settlement has the potential to damage buried utilities, building foundations, or cause subsidence in adjacent lands. The settlement must be assessed in reports during future development stages, and if concerns are noted, mitigation measures must be provided.

Another cause of significant dewatering-related settlement is due to pumping of fines through the dewatering system (i.e., ground loss by internal soil erosion). Future reports supporting site development should provide recommendations on filtering techniques or other methods to ensure soil is not conveyed through the dewatering systems. Low-density dwellings (e.g., townhouses, single-detached units) with basements below seasonal high groundwater and relying on foundation drainage should consider the use of appropriate granular material as backfill around weeping tile and filter fabrics to limit internal soil erosion, which could lead to ground loss and clogging of drains.

In the previous section, it was noted that deep excavations in areas with artesian conditions may result in changes to rates of groundwater discharge or to the development of artesian springs or seeps. Where such effects are allowed to occur, they can result in significant aquifer mining and result in land subsidence in the long-term. As such, developments proposed for the northeastern part of the Study Area, especially Properties 7, 8 and 9, shall seek to avoid causing such impacts and shall be supported by appropriate hydrogeological investigation to assess the potential for these impacts and, in turn, inform design of grades, services, and structures.

7.5.9 Water Supply Wells

The potential impacts discussed below must be assessed in more detail and addressed during future phases of development.

As discussed previously in the Phase 1 LSS (GEI and SCS, 2024), the Study Area is not located within a Wellhead Protection Area Zone A to D or Q1/Q2, Intake Protection Zone, Oak Ridges Moraine, or the Niagara Escarpment.

Development in the Study Area is not expected to impact the quality or quantity of groundwater taken from active municipal wells given that the radius of influence is estimated to be less than 100 m from the excavation for the worst-case short term and permanent dewatering scenario. The nearest active municipal wells are located approximately 6.5 km northeast and 9.3 km west of the Study Aarea.

Since the Study Area is not within a WHPA Q2, impacts to municipal wells for groundwater quantity are not expected even if the water balance cannot be maintained due to lower permeability soils and a high groundwater table.

LID measures are expected to be implemented on site where possible. If only clean or pre-treated runoff will be infiltrated, the quality of groundwater available to nearby domestic wells is not likely to be impacted. The low permeability silt and clay till deposit (Halton Till) across the Study Area also limits the amount of water infiltrating deeper below grade as recharge and helps reduce the potential for contamination entering the deeper drinking water aquifers.

It is noted that areas within the north and central portions of the Study Area have been identified as Highly Vulnerable Aquifer (HVA) areas under the local source protection plan (CTC SPR, 2015). An HVA is an aquifer that has the potential for increased risk of contamination due to its proximity to the ground surface or the presence of surrounding geological materials with high permeability. For instance, materials like sand and fractured bedrock are highly permeable and allow water to infiltrate from the surface into deeper strata, potentially impacted aquifers, whereas clay layers provide a natural barrier due to their low permeability and offer protection to underlying aquifers.

It is noted that the HVA mapping provided in the source protection plan was developed through desktop studies based on existing data (e.g., water well records, surficial geological mapping). However, site specific information helps to provide actual stratigraphic and hydrogeological conditions.

Typically, within the Study Area the groundwater level is near surface which is contributing to portions of the Study Area being classified as HVAs. Based on field investigations conducted within the Study Area under Phase 1 of this study, the general stratigraphy in the areas mapped as HVAs are mainly clay and silt glacial till (Halton Till) at surface, which is considered relatively low permeability material and represents an aquitard setting. It is noted that the Halton Till is fractured in this area, which could create a preferential flow path between the ground surface and the ORAC where fractures are present. However, during the Phase 1 LSS fractures within the till were not noted in the Study Area. Consequently, based on information obtained during the Phase 1 LSS, the presence of Halton Till would be considered to reduce the vulnerability of the local aquifer(s). In other areas, the HVA appears

to overlap with drainage channels and places where ORAC may be exposed or have reduced cover due to the erosion the led of the formation of the channel. In these cases, the Halton Till may not be thick enough to provide sufficient cover to mitigate aquifer vulnerability, thus resulting in the areas being identified as HVAs.

Regardless of whether these areas remain HVAs or not, the potential for contamination as a result of development activities must be considered as part of subsequent phases of development studies. For example, the risk associated with activities such as the application, handling and storage of road salt, fuel and snow must be evaluated in those future reports.

It is noted that areas throughout the central and northwest portion of the Study Area have been identified as Significant Groundwater Recharge Areas (SGRAs) under the local source protection plan (CTC SPR, 2015). An SGRA is an area that is determined to have an annual rate of recharge that is higher than the average annual rate of recharge reported for the Source Protection Area in which it is located. These areas are typically associated with conditions that encourage the infiltration of precipitation and runoff, such as areas of permeable soils (e.g., sand and gravel) or the occurrence of closed depressions. . It is noted that the SGRA mapping provided in the source protection plan was developed through desktop studies based on existing data (e.g., water well records, surficial geology mapping). However, site specific information helps to provide actual stratigraphic and hydrogeological conditions.

Typically, within the Study Area, Halton Till is present at surface which restricts the amount of infiltration that reaches the underlying ORAC. Based on field investigations conducted within the Study Area under Phase 1 of this study, the general stratigraphy in the areas mapped as SGRAs are mainly clay and silt glacial till (Halton Till) at surface, which is considered relatively low permeability material and represents an aquitard setting. It is noted that the Halton Till is fractured in this area, which could create a preferential flow path between the ground surface and the ORAC where fractures are present. However, during the Phase 1 LSS fractures within the till were not noted in the Study Area. Consequently, based on information obtained during the Phase 1 LSS, the area would not be considered an SGRA. Furthermore, a portion of the Study Area is noted to feature artesian conditions: this indicates upward hydraulic gradients which are not favourable for groundwater recharge.

Regardless of whether these areas remain SGRAs or not, best efforts should be made to maintain the pre-development infiltration rates on site. The potential use of LIDs to maintain the site-wide water balance must be evaluated in future reports.

Any existing monitoring wells or domestic drinking water wells within the Study Area that are no longer in use will need to be decommissioned per Ontario Regulation 903. This will prevent potential contamination from entering the deeper groundwater system through unused wells, especially for domestic wells screened within deeper drinking water aquifers.

MECP water well records mapped within 500 m of the Study Area were reviewed to assess the general nature of groundwater usage in the vicinity of the Study Area. Within the well record search area, most water well records indicating supply usage were for domestic purposes, with one public well and one municipal well. The public use well was drilled in 1975 on the Mayfield Golf Club property, and the municipal well use record is associated with “Brampton Well #3”, drilled in 1965 and

decommissioned in 2017 (see MECP well record 7280479). Of the wells indicating supply usage with geological information recorded, 18% (nine wells) were identified as bedrock wells, having an average depth of 27 m, while the remainder were overburden wells with an average depth of 25 m. Overburden wells were noted to typically be screened in sand and gravel deposits between 8 and 47 m below existing grade. Based on the well records with available stratigraphic information, the deeper sand and gravel units are interpreted to be part of the ORAC.

Within the well record search area, most of the supply wells identified as being overburden wells were relatively deep (i.e., over 14 mbgs), and located within or south of the Study Area. Deeper wells are less susceptible to changes in water level, and wells located within and south of the Study Area would eventually be provided with municipal water service as part of the proposed development and the development that is taking place to the south of the Study Aarea, indicating a lesser need for long-term reliance on those supply wells. These factors generally indicate that the proposed development has low potential to impact the water quantity available to overburden well users, except possibly with respect to deep structures (e.g., deep basements in the urban corridor, trunk sewers) if such structures would require or induce long-term dewatering.

Bedrock wells within the search area are generally relatively deep (most greater than 15 m) and as such are not likely to be impacted in terms of water quantity. However, water quality may be affected depending on proposed SWM details. The potential for water quality impacts should be assessed as part of detailed design to determine whether mitigation measures should be implemented, such as lined ponds or quality requirements for water to be infiltrated (e.g., whether is should be limited to “clean” sources such as rooftops and rear-yards, or whether other sources can be used based on the provision of pre-treatment).

As previously noted, relatively little recharge from the Study Area is expected to reach the ORAC based on the general stratigraphy consisting of clay and silt to sandy silt glacial till (Halton Till) at surface which is considered relatively low permeability material and represents an aquitard setting. Furthermore, areas where the ORAC is present close to surface in the eastern portion of the Study Area, or where surface water features intersect the ORAC, groundwater discharge or artesian gradients have been observed, indicating that surface water would not infiltrate downwards into the ORAC in these areas. A reduction in groundwater quantity to nearby wells is expected to be minimal to negligible even if pre-development quantities of recharge cannot be maintained post-development.

Even if impacts to nearby domestic wells are not anticipated, future reports should include a contingency plan with measures to implement during construction in case private well owners issue complaints about potential well water shortages or other interference with their well. This could include investigating the complaint, assessing ongoing data collected from the Study Area during construction, addressing the complaint, and providing a temporary supply of potable water until the groundwater levels recover or the complaint is addressed.

7.5.10 Climate Change Impacts on Groundwater

Climate change will have implications for the natural environment, as increased precipitation and more intense storms are expected to further alter the distribution of runoff and infiltration in the Study Area. Increased temperatures and evapotranspiration may result in more extensive or prolonged seasonal drying of soils and a wider range of groundwater level fluctuations. These changes may in turn affect ecological communities, particularly wetlands, which are sensitive to hydroperiod, consistency of soil moisture, and/or depth to groundwater.

Climate change may affect water availability at water wells in the vicinity of the Study Area since increased temperatures and shift in storm patterns toward more intense events may result in widespread reductions in net groundwater recharge. Increased temperatures and evapotranspiration may also result in increased water-taking by well users for irrigation or other purposes. As the proposed development will be municipally serviced via the Lake-based municipal water supply system, the latter effect is not expected to be exacerbated by the proposed development. However, the former effect (i.e., reductions in groundwater recharge) may be exacerbated by the proposed development due to the increased impervious area that would be associated with the developed area. Most water wells in the area are low intensity uses (e.g., domestic) and on average have a substantial water column (average water column above bottom of well is approximately 14 m). Therefore, it is expected that the potential for water quantity impacts to nearby well users is limited, though some users may be more susceptible, such as those with shallow wells or with wells installed in poorly productive formations (e.g., shale, till) which require large drawdowns to produce sufficient flows. In terms of groundwater quality, it is not expected that climate change will impact water quality available to local wells, except potentially insofar as it may affect the rates of application of road salt for winter road maintenance.

7.6 Geotechnical

Based on the subsurface conditions and slope stability assessment, potential impacts were assessed in relation to the proposed structure plan. Mitigation measures are prepared to support future works for the proposed development.

The preferred structure plan was prepared by MGP and is shown as **Figure 3-1**. It is noted that this is a high-level and conceptual plan, and it is expected that the development concept will change during subsequent submissions and detailed design, with the assumption that the overall concept of the development will stay relatively consistent. A summary of land use conditions assumed from this plan that are the basis of the geotechnical impact assessment are below.

- The development will be of mixed use, with a majority of the area to comprise of low-density residential, with other areas consisting of commercial blocks, medium-density residential and community use (schools, firehalls, neighborhood centre, parkland, etc.)
- The majority of the buildings are assumed to consist of either slab on grade buildings with no basements, or buildings with one underground / basement level.
- SWMFs are located across the Study Area.

- Most roadways are expected to consist of local urban profiles. Some roadways are shown to be collector roads. The collector roads are proposed to cross a watercourse and confined valley on Properties 4 and 9.
- The development will be serviced with municipal water, sanitary and storm sewers. It is understood that a deep sanitary trunk sewer, extending as deep as an estimated 20 m, will extend through many of the properties.
- Confined valley systems containing slope and erosion hazards extend through various parts of the Study Area.
- Parks and open space are generally located along the boundaries with or within the natural heritage corridors and the Greenbelt Plan Area.
- An existing watercourse (WHT4(3)5-2) will be re-aligned as a new channel in the northwestern property in the Study Area (Property 1).
- General earthworks (cut and fill) is expected across the Study Area as part of the development, with the understanding that preference will be given to matching the existing topography as much as practically possible and promoting a cut/fill balance.

The major and unique considerations from a geotechnical perspective at this particular subwatershed Study Area beyond what is normally completed for all developments, is the importance of the confined valley systems, the impact of deep sanitary sewers, and potential interactions between earthworks and groundwater. It is noted that there is significant overlap between geotechnical and hydrogeological impacts, and that **Section 7.4** goes into more detail on items that are primarily hydrogeological in nature that are briefly discussed below.

Site-specific geotechnical engineering reports will be required to support future development phases, such as Draft Plan of Subdivision and detailed design. The reports should include standard engineering recommendations, plus address the potential impacts noted below. Other geotechnical recommendations would apply during subsequent stages of development (such as foundations, pavements, seismic site classifications, lateral earth pressures, temporary excavation stability, etc.), but are not included below as they do not have any appreciable impact to the overall subwatershed.

Additional considerations may need to be added if the structure plan changes, if other conditions become apparent as future design and reporting progresses, or if the reviewing agencies provide specific details to be included within the reports. The list below is not considered exhaustive and additional geotechnical recommendations above and beyond those listed below should be expected during future design phases. Potential impacts would be mitigated by geotechnical engineering review and reporting during future design phases, and with geotechnical engineering oversite during construction.

It is noted that adaptive strategies considering the inherent uncertainty of subsurface conditions and evolving regulatory requirement need to be considered as time progresses.

7.6.1. Slope Stability and Erosion Hazards

As part of the Phase 1 LSS report, a slope stability study and erosion hazard assessment was completed to determine the LTSTOS position for confined valley systems in the Study Area for development planning purposes. The study followed TRCA's *The Living City Policies for Planning and Development in the Watersheds of the Toronto and Region Conservation Authority* (2014) and included the 10 m erosion access allowance to determine the overall Erosion Hazard Limit from which all development is to be set beyond. Based on the structure plan as it is currently envisioned, the proposed development (residential lots, roadways, SWMFs, commercial and urban corridor blocks, etc.) are outside of the Erosion Hazard Limit for the slope stability hazards. This complies with TRCA's policy for slope hazards, and impacts are generally not expected for the typical site development provided this does not change. Passive use parkland consisting of Minor Recreational Use (per TRCA's *The Living Cities Policies*; 2014) or recreational trails may be permitted by TRCA within the Erosion Hazard Limit, but additional reporting to the satisfaction of TRCA may be required to justify that there is no increased risk to the hazard, active erosion zones are avoided, etc.

The structure plan is a higher-level drawing, so it should be confirmed that proposed development is outside of the Erosion Hazard Limit during future design phases, such as Draft Plan of Subdivision and detailed design. If buildings with high foundation loads, or with loads distributed over a large area (such as raft slabs), are planned near the confined valleys, additional slope stability analysis may be required to confirm that there will be no impacts to the slope, even for buildings outside the Erosion Hazard Limit.

The SWM strategy and grading plans should prevent uncontrolled and concentrated runoff down any of the valley slopes on site. SWMF outfalls should be designed to prevent long-term erosion within the valleys. General sheet drainage down the slopes from parkland or open space is typically acceptable and poses a low risk for surficial erosion leading to slope instability, but this should be confirmed during future design phases. Alternatively, concentrated flows can be allowed provided appropriate engineering controls are incorporated, such as level spreaders, rip-rap channels/splash pads to mitigate erosive energy, etc.

7.6.2. Collector Road Crossings at Confined Valley Systems

The proposed collector roads on Properties 4 and 9 may cross the existing watercourses and confined valley systems on those properties. A preliminary site grading plan is included in **Figure A2-2 (Appendix A)** showing that the crossings could consist of concrete arch open-bottom culverts, set into constructed embankments.

A detailed review of impacts will be evaluated as part of the MCEA, and engineering recommendations should be provided in site-specific geotechnical reports. This could include a review of local subsurface conditions with existing or new boreholes, and providing recommendations for: removal of organics / unsuitable soils, foundations and subgrade details for the culvert and embankment, engineered fill materials and compaction for the embankment, stability analysis for the embankment, settlement considerations, integration into the surrounding confined valley (which has long-term setbacks) for the embankment approaches, etc.

Coordination with others, such as a civil engineer and fluvial geomorphologist, should be considered for expected flows, scour and erosion protection of the culvert footings and embankment. The recommendations should follow any requirements from the Canadian Highway Bridge Design Code or TRCA policies, as applicable.

7.6.3. Earthworks

Earthworks will be supported by site-specific geotechnical engineering reports to address soil compaction, engineered fill, suitability of soil re-use for fill, expected subgrade conditions, and other geotechnical considerations.

TRCA typically does not permit filling within the Erosion Hazard Limit and all grading must be conducted beyond the Erosion Hazard Limit. If filling is needed to reach desired grades at the rear of lots along the valleylands, grades sloped at 3 horizontal to 1 vertical (H:V) or flatter are typically acceptable from a slope stability perspective unless unique situations are encountered. Alternatively, retaining walls could be considered along the hazard boundary. Retaining walls more than 1 m in height must be designed by an engineer per the Ontario Building Code. A holistic review of all grading should be conducted by the geotechnical engineer during detailed design as part of a general conformance review of the civil drawing set.

7.6.4. Stormwater Management Facilities

Site-specific geotechnical reports should include recommendations to support design of the SWMFs. This could include slope inclinations for the insides of ponds, surficial erosion protection measures, stability analysis for berms retaining water, and discussion on pond liners to prevent infiltration and exfiltration with consideration for hydrostatic uplift from groundwater.

Cohesive glacial till (Halton Till) was generally encountered at or near surface across the Study Area, but the thickness of the Halton Till unit varied. Several boreholes advanced in or near the SWMF locations in the north half of the Study Area as shown on the structure plan encountered wet sands, silts, and gravels at depth below the Halton Till. Artesian groundwater conditions were encountered in several locations, particularly along the watercourse or near a Headwater Drainage Feature on Properties 8 and 9. These conditions would need to be addressed in terms of dewatering and constructability, as well as pond liner design and resistance to hydrostatic uplift pressure.

7.6.5. Pond Decommissioning, Channel Re-Alignment, and Pipe Daylighting

A series of ponds on Property 1 will be decommissioned and replaced with residential blocks. A watercourse (WHT4(3)5-2) running though Property 1 (with the online ponds) will be re-aligned to the western and southern areas of the property. Site-specific geotechnical reports should provide recommendations for pond decommissioning, such as subgrade conditions, backfill requirements, and discussion on settlement where deep fill will be placed. Recommendations should be provided for the channel re-alignment, such as excavation details and groundwater control, long-term stability of cut side-slopes or engineered side-slopes, and details for setbacks from the top of the channel slopes following TRCA policies.

WHT4(3)4-3 is a piped watercourse feature located partially within a non-participating property and within Property 4. Evidence of the piping of this feature was noted from Old School Road and at its outlet location on Property 4. Since a portion of this piped feature is located within a non-participating property, daylighting of this feature is not currently possible. If the non-participating property considers development in the future, it is recommended that this watercourse be daylighted (see **Section 8.8.2** for more details). In this case, the slope stability assessment completed in the Phase 1 LSS report would need to be updated to include a toe erosion allowance along the daylighted area. An assessment of potential erosion hazards and slope stability setbacks would also be recommended for the non-participating property in that case.

7.6.6. Site Servicing

The development will be municipally serviced, and one of the most critical geotechnical challenges will be the construction of a deep sanitary trunk sewer that could extend up to 20 m in depth through many properties. Geotechnical reports should include detailed constructability assessments, addressing whether an open-cut method or tunnel-boring approach is most appropriate given the anticipated subsurface conditions. In particular, the reports must evaluate the potential for encountering wet sands and gravels that are interbedded with or confined beneath glacial till deposits.

These layers, especially in zones where artesian groundwater conditions have been measured in the northern half of the Study Area, could significantly impact both the excavation process and long-term stability of the structure. Detailed analysis of groundwater pressures, dewatering requirements, and potential impacts on adjacent structures is essential to develop effective mitigation measures and ensure the safe, efficient installation of the sewer system.

7.6.7. Future Subsurface Investigations

It is expected that additional subsurface investigation (e.g. boreholes, monitoring wells) will be needed to support Draft Plan of Subdivision and detailed design, and that the level of detail currently completed was sufficient solely for the SWS reports. Additional coverage may be needed for locations such as the SWMFs, schools, urban corridors, neighbourhood centres, mixed use and commercial blocks, collector road valley crossings, deep sewer alignments, or in locations with soil conditions deemed necessary to investigate further (e.g. locations with potential artesian groundwater conditions, areas with deeper earth fill, etc.).

7.7 Surface Water Quality

The TOR for the surface water quality impact assessment under Phase 2 of the SWS are as follows:

- Based on the results of the quality analyses from Phase 1, an assessment of potential land use impacts on surface water quality, water quality improvement strategies, with particular attention to Redside Dace water quality requirements (Dissolved Oxygen, Total Suspended Solids, Turbidity) and mitigation strategies and BMPs for urban SWM will be addressed.

7.7.1 Land Use Impacts

The proposed development will introduce a significant amount of impervious surfaces to the Study Area. Increased impervious cover results in an increase in the volume of rain and snowmelt that flows overland as runoff and results in higher peak event runoff rates. 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, phosphorus, bacteria and viruses.

When end-of-pipe SWM solutions (e.g., extended detention outfalls) are required, they should be designed and located to avoid and/or minimize impacts (i.e., sediment, temperature) to fish habitat. LID measures or end treatments such as oil/grit separators or wet ponds will also help to remove suspended solids and other contaminants in runoff prior to conveying the flows off site, especially when a treatment train approach is taken for SWM. The proposed SWM strategy for the Study Area will be discussed in the Phase 3 LSS.

7.7.2. Existing Sources of Pollution

Several existing sources of pollution exist in the Study Area as a result of the current land uses and surrounding infrastructure. Roads, related SWM infrastructure, and drainage features are expected to act as point sources of pollution to the Study Area, while overland flow from the Study Area lands and groundwater discharge to the watercourses are expected to act as non-point sources of pollution.

The Study Area is bordered by Mayfield Road to the south, a six-lane road which conveys large volumes of traffic past the Study Area. The remainder of the Study Area is surrounded by two-lane roads: Old School Road borders the Study Area to the north; Torbram Road borders the Study Area to the east, and Bramalea Road runs north-south through the western portion of the Study Area **(Figure F-1, Appendix F).** Based on site observations, Old School Road and Torbram Road also serve as major travel routes in the area. Untreated stormwater from road surfaces is linked to increasing sediment loads and concentrations of contaminants such as salt, hydrocarbons, and heavy metals.

Stormwater servicing has been installed on Mayfield Road, such that the majority of drainage from Mayfield Road will enter the SWM system and is not expected to impact the Study Area. Minor amounts of stormwater runoff are expected to over-top the stormwater culverts during significant precipitation events and enter the roadside ditches which run along the southern border of the Study Area. No stormwater servicing has been installed along Torbram Road, Bramalea Road or Old School Road, and therefore all road runoff from these roads will be directed to the roadside ditches which run along and through the Study Area. During snow events, snow clearing activities along Mayfield Road, Torbram Road, Bramalea Road, and Old School Road are expected to result in snow being pushed to the roadside, where snow and snowmelt is anticipated to enter the roadside ditches running along and through the Study Area. Roadside ditches located within the Study Area may overflow into the adjacent lands during major storm and snowmelt events, and all flow through roadside ditches is expected to enter local watercourses and HDFs where the ditches intersect the drainage pathways.

The roadside ditch on the south side of Old School Road intersects four West Humber Tributaries (WHT4(3)5-2, WHT4(3)4-3, WHT4(3)3-1a, and WHT4(3)3-1) and several wetlands and natural features associated with the tributaries. Each of the watercourses cross Old School Road and flow south through the Study Area, supporting a variety of wetlands and wooded natural features within the Study Area. Therefore, road runoff from Old School Road is expected to have a direct impact on the natural features within the Study Area. Pollutants are expected to be most concentrated adjacent to Old School Road, and become diluted downstream.

The roadside ditch running along the west side of Torbram Road on the east border of the Study Area intersects two tributaries of the West Humber River (WHT4(3)2-1b and WHT4(2)-1), one drainage feature (H22-S1), one HDF (HDF-12), and several wetlands and natural features to be retained along the West Humber River tributaries. The West Humber River Tributary WHT4(3)2-1b and drainage feature H22-S1 intersect the roadside ditch along Torbram Road in the northeast portion of the Study Area, and then flow south through the Study Area, supporting several wetlands surrounded by a variety of wooded areas. Therefore, road runoff in the northeast portion of the Study Area is expected to have a direct impact on WHT4(3)2-1b and the natural features associated with the downstream channel. Tributary WHT4(3)2-1b is also expected to have additional impacts due to the upstream intersection with Old School Road. Pollutants are expected to be most concentrated adjacent to Torbram Road, and become diluted downstream. Dilution in this area is expected to be greater due to the groundwater discharge which occurs in the surface water features in this portion of the Study Area. The HDF-12 and West Humber Tributary WHT4(2)-1 intersect Torbram Road and then flow east away from the Study Area. Therefore, road runoff in the southeast portion of the Study Area is expected to have minimal impact on the natural features and channels within the Study Area, excepting the natural features located adjacent to Torbram Road, where pollutants may be most concentrated. The natural features associated with the West Humber Tributary should be especially considered due to the large valley feature associated with this reach, which is expected to convey large volumes of storm runoff into this channel.

Bramalea Road intersects two West Humber River tributaries (WHT4(3)5-1 and WHT4(3)-2), four drainage features (H1-S1, H8-S10, H8-S9, H7-S1), several wetlands and wooded features associated with the West Humber tributaries, and one meadow marsh associated with the drainage feature H8-S9. Both tributaries flow through culverts under Bramalea Road and then join together east of Bramalea Road, continuing to flow southeast through the Study Area and support various wetlands and other natural features. Therefore, it is expected that road runoff from Bramalea Road has a direct impact on the two tributaries and their associated ecological features located adjacent to and downstream of Bramalea Road. Pollutants are expected to be most concentrated at the Bramalea road crossings, and become diluted downstream; upstream reaches of the tributaries are not expected to be impacted by runoff from Bramalea Road. Drainage feature H8-S9 and the associated meadow marsh are located on the downstream side of the Bramalea Road crossing, and therefore road runoff is expected to directly impact this drainage feature and wetland, with pollutants becoming more dilute downstream. The remaining three drainage features are located on the upstream side of Bramalea Road, and therefore minimal impacts due to road runoff are anticipated, excepting immediately adjacent to the road where pollutants would be most concentrated.

The ditching running along the north side of Mayfield Road on the southern border of the Study Area intersects one tributary of the West Humber River (CCC(2)), one drainage feature (H8-S1), and one meadow marsh wetland associated with the drainage feature H8-S1. The watercourse and drainage feature flow to the southeast, away from the Study Area, and therefore road runoff from Mayfield Road is expected to have minimal impact to the Study Area, excepting features adjacent to Mayfield Road where pollutants would be most concentrated. No retained wetlands are located along Mayfield Road.

The Phase 1 LSS results showed PWQO exceedances of iron and tungsten in surface water across the Study Area, which could be related to road runoff. However, groundwater samples taken also showed consistent exceedance of PWQO iron, and therefore, it is possible that iron is naturally occurring in this area. It is anticipated that as stormwater infrastructure is installed throughout the Study Area, the majority of road runoff will be controlled and treated before being discharged into the local watercourses.

The existing land use within the Study Area is predominantly agricultural, with some residential dwellings, and a variety of natural features. Two large golf courses are also located in the Study Area on Properties 1 and 9. The golf courses and agricultural operations present in the Study Area are expected to contribute nutrient pollution to the watershed through the application of fertilizers and pesticides. Numerous drainage features and HDFs convey overland flow from the agricultural and golf course properties into the West Humber River tributaries, discharging into the tributaries as point sources. Therefore, discharge points of smaller drainage features into larger HDFs or watercourses are considered to be point sources of any pollution present in the drainage features. As land uses change, these pollution sources will no longer exist. Further, due to the implementation of a SWM strategy, overland flow into drainage features and eventually to watercourses will be greatly reduced and therefore less pollution concentration at drainage feature confluences is expected.

It is expected that the majority of residential dwellings in the Study Area do not have municipal sanitary servicing installed, and instead utilize private septic tanks. Transport of septic effluent through groundwater and into surface water features via groundwater seepage is a major source of nutrient pollution, specifically phosphorus and nitrogen. While the Halton Till was found to have a low hydraulic conductivity in the Study Area and therefore minimal migration of contamination is expected, it is possible that fractures exist in the Study Area which would serve as a preferential pathway for groundwater flow and allow contamination to spread at a higher velocity than expected. In addition, overland flow into low-lying areas may convey pesticides and fertilizers into drainage features, watercourses, and wetlands, acting as a non-point source of nutrient pollution.

Phase 1 LSS study results showed consistent PWQO exceedance of total phosphorus and E.Coli in surface water across the Study Area. It is expected that as sanitary servicing is installed within the Study Area, the source of groundwater nutrient contamination will be removed. Since legacy impacts may still exist following the removal of septic tanks, the maintenance of clean surface water inputs may help to dilute nutrient pollution from groundwater. Clean sources of water such as roof runoff should be prioritized during the design of water balance mitigation measures. As discussed previously, due to the implementation of a SWM strategy and change of land use, overland flow will be reduced and contributing land uses such as golf courses and agriculture will be removed.

7.7.3. Redside Dace Water Quality Requirements

Occupied and contributing Redside Dace habitat was identified within the Study Area. Section 3.1.4.6 of the Phase 1 Report (GEI and SCS, 2025) determined where each habitat type was present.

Occupied Redside Dace habitat is identified throughout the West Humber River and its associated Tributary, as well as Campbell's Cross Creek. Specifically, occupied habitat is identified within reaches CCC(2), WHT4(2)-1, WHT4(2)-2, WHT4(3)-1, WHT4(3)-2, WHT4(3)2-1a, WHT4(3)2-1b, WHT4(3)3-1. Several SWM outfalls are envisioned into occupied Redside Dace habitat including within Properties 1, 3, 8, 9 and 10. Impacts associated with the proposed SWM infrastructure into Redside Dace habitat should be reviewed as part of the site-specific applications. If possible, SWM infrastructure should be located outside of occupied Redside Dace habitat. If infrastructure is required in~~to~~ occupied habitat, engagement with DFO and MECP may be required to confirm approval requirements.

Medium constraint watercourses, HDFs and riparian wetlands may be considered contributing Redside Dace habitat. Several SWM outfalls are proposed within contributing Redside Dace habitat including Property 1, 3, 4 and 11. Impacts associated with the proposed SWM infrastructure to contributing Redside Dace habitat should be reviewed as part of the site-specific applications.

In general, development within the Study Area has the potential to impact the thermal regime of the watercourses designated as occupied or contributing Redside Dace habitat by decreasing infiltration which would supply cold groundwater discharge to the watercourses and increasing warm surface water inputs to the watercourses. Best management practices and mitigation measure recommendations identified within **Section 7.2.1.5** will aid in the reduction of thermal loading as a result of construction and development activities.

When end-of-pipe SWM solutions (e.g., extended detention outfalls) are required, they should be designed and located to avoid and/or minimize impacts (i.e., sediment, temperature) to fish habitat. Refer to TRCA's Stormwater Management Criteria Document (2012b) and the Guidance for Development Activities in Redside Dace Protected Habitat (MNRF 2016a) for more details.

7.7.4. Best Management Practices

As discussed in **Section 7.2.2.3**, potential indirect impacts on surface water quality associated with stormwater runoff will be addressed through the implementation of an ESC plan, which will be prepared at the site specific stage. The ESC plan should be informed by the *Erosion and Sediment Control Guide for Urban Construction* (TRCA, 2019). Installation of ESC measures along the outer edge of the VPZ (or the limit of any ground disturbance associated with swale construction) is recommended to ensure that surface water features are protected and will limit disturbance caused by construction through ground disturbance and dislodgement of sediment.

In order to mitigate the potential for adverse effects on surface water quality due to accidental spills during construction, it is recommended that appropriate spill prevention and response measures (e.g., material handling and storage protocols, mitigation measures (e.g., spill kits on-site), monitoring measures and spill response procedures) (i.e., emergency contact procedures, including Spills Action

Centre, and response measures including containment and clean-up) be in place and implemented as necessary during construction. Implementation of an effective spill prevention and response plan is anticipated to be largely effective in preventing adverse effects on surface water quality due to accidental spills during construction.

With the implementation of these mitigation measures, no negative impacts to surface water quality is expected.

As discussed in **Section 7.2.3.1**, winter maintenance standards should be created in accordance with the Town of Caledon's *Salt Management Plan* (2020a). Snow should be stored away from surface water features and melt water will be conveyed into the storm sewer network.

As discussed in **Section 7.2.1.5**, the following stormwater management practices are recommended to address stormwater quality:

- To address Redside Dace thermal requirements, dry SWM facilities should not be provided;
- SWM outfalls should be designed to meet erosion threshold targets;
- SWM facilities should be designed to meet or exceed the Level 1 Enhanced (80% Total Suspended Solid removal) target;
- SWM facilities should target dissolved oxygen levels of 7 mg/L or greater and discharge temperatures should be below 24°C at the outlet.

These recommendations are in-line with the Guidance for Development Activities in Redside Dace Protected Habitat guidelines (MNRF 2016a). General fish and fish habitat mitigation and restoration measures identified within **Section 7.1.1.6** would also apply. Within the proposed Structure Plan, SWM outfalls outletting into high constraint watercourses were identified on Properties 1, 3, 7, 9 and 10. The–location and extent of disturbance will be reviewed at the site-specific stage; however, it is recommended that the amount of disturbance within fish habitat is minimized to the extent possible. SWM controls should be designed to meet Redside Dace requirements (as discussed within **Section 7.2.1.5)**. Further, as discussed in **Section 7.3.5**, GEI recommends that SWM outfalls are designed as stone-core wetland pockets to dissipate energy and incorporate dissolved oxygen into the water. SWM outfalls in contributing Redside Dace habitat may consider other SWM outfall structures.

As detailed in **Section 12.1.4**, the Phase 3 LSS will include development of a SWM strategy including LID measures and end of pipe SWM facilities that achieves the SWM criteria for water quality.

7.7.5. Climate Change Impacts on Surface Water

Climate change poses potential challenges for surface water availability, quality and flow patterns. These changes are anticipated to result in periods of extended dry conditions interspersed with extreme rainfall events, increasing the risk of both drought-like conditions at times and flash flooding. Rising temperatures may lead to increased evapotranspiration rates, reducing surface water availability and altering seasonal flow regimes.

Shifts in precipitation patterns may have implications for surface water quality and hydrology as a result of potential higher runoff volumes, leading to greater transport of contaminants such as

sediment, nutrients, road salt, and other pollutants into waterbodies. Urbanization compounds this issue by increasing impervious surfaces, reducing natural infiltration, and accelerating stormwater runoff. These climate-driven changes necessitate strategies such as enhanced SWM systems, improved watershed-scale planning, and the integration of LID practices to mitigate pollution and maintain ecological integrity under a changing climate and development and changes in land use.

7.8. Water Balance and Groundwater Recharge

7.8.1. Water Balance Components

A water balance is an accounting of the water resources within a given area. The water balance equates the precipitation (P) over a given area to the summation of the change in groundwater storage (ΔS), evapotranspiration/evaporation (ET), surface water runoff (R) and infiltration (I) using the following equation:

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

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 (i.e., rainfall intensity, land slope, soil hydraulic conductivity and vegetation). For example, runoff occurs at a higher percentage during periods of snowmelt when the ground is frozen or during intense rainfall events.

Precise measurement of the water balance components is difficult, and as such, approximations and simplifications are made to characterize the water balance of a property. Field observations of the drainage conditions, land cover and soil types, groundwater levels and local climatic records are important inputs to the water balance calculations.

Precipitation (P): For the purposes of approximating the annual precipitation at the Study Area, the monthly rainfall between 1981 and 2010 was used based on Environment Canada historical weather data for the Albion Field Center climate station (Climate ID 6152695, Latitude 43°55' N, Longitude 79°50' W, Elevation 281.9 metres), which is located about 13 km north of the Study Area.

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.

Evapotranspiration/Evaporation (PET): The evapotranspiration and evaporation components vary based on the characteristics of the land surface cover (i.e., type of vegetation, soil moisture conditions, perviousness of surfaces, etc.). Potential evapotranspiration refers to the water loss from a vegetated surface to the atmosphere under conditions of an unlimited water supply. Evaporation occurs from a hard surface (such as flat rooftops, asphalt, gravel parking areas, etc.).

Water Surplus (R + I): The difference between the mean precipitation and evapotranspiration is referred to as the water surplus. The water surplus is divided into two parts: as surface or overland runoff (R) and the infiltration into the surficial soil (I). The infiltration is comprised of two end member components: one component that moves vertically downward to underlying aquifers (referred to as percolation, deep infiltration or net recharge) and a second component that moves laterally through the near surface soil profile or shallow soils as interflow that re-

emerges locally to surface (i.e., as runoff) at some short distance and time following precipitation

7.8.1.1 Approach and Methodology

A site-wide annual water balance was calculated according to the methodology provided by Thornthwaite and Mather (1957). This methodology involves monthly estimates of soil-moisture balance to determine the pre- and post-development infiltration volumes. The detailed water balance calculation is provided in **Appendix F1,** which is summarized in this and subsequent sections of the report. The following assumptions were used as part of the soil-moisture balance calculations:

- A soil moisture balance approach 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. Considering the nature of the near surface soils (generally clay and silt glacial till), a soil moisture storage capacity of 75 mm was used for the Study Area to account for the post-construction green spaces consisting mostly of grass lawns or parkland.
- Once the soil moisture deficit is overcome, the remaining excess water is considered to be available to enter the soil as infiltration and either become runoff or recharge (deep infiltration).

Monthly potential evapotranspiration calculations accounting for latitude, climate and the actual evapotranspiration and water surplus components of the water balance based on the monthly precipitation and soil moisture conditions were calculated. The proportioning of water surplus into its components runoff (R) and infiltration (I) was estimated by the method provided by the Ministry of Environment SWM Planning and Design Manual (2003). That method involves the selection of an infiltration factor based on topography, soil type and land cover in the catchment area. This approach was used to obtain a corresponding infiltration factor for pre- and post-development conditions. To obtain the quantity of infiltration in a given scenario, the water surplus is multiplied by the appropriate infiltration factor. Runoff is then the difference between the water surplus and the infiltration computed above.

7.8.2 Site-Wide Pre and Post-Development Water Balance

The Phase 1 LSS (SCS and GEI, February 2025) included the detailed site-wide pre-development water balance calculations. Preliminary water balance calculations for existing (pre-development) conditions found the average annual runoff volume ranged from about 12,302 to 151,856 m^3/year for the participating properties, and the average annual infiltration volume ranged from about 16,500 to 103,400 m^3/year for the participating properties. The total yearly target for infiltration across the Study Area (including participating and non-participating properties) is 841,346 m^3/year.

For the post-development water balance, the developable area and overall percent imperviousness were calculated based on data obtained through communication with SCS and MGP and are subject to change as detailed plans progress. Due to the preliminary nature of the structure plan, estimates were made regarding the vegetation composition of the proposed NHS. It was assumed that the total wetland and treed area within the NHS would remain equal to the pre-development areas. At the time

of writing this report, no details were available for Property 6 (Torchia) and therefore a property-specific post-development water balance could not be completed. The water balance should continue to be updated to reflect the detailed site plan at Draft Plan stage. The site-wide post-development water balance results are included in **Appendix F1**. Based on a review of the Oak Ridges Moraine Groundwater Program and the online water budget mapping, the average infiltration across the Study Area ranges from 110 to 120 mm/year with three small, isolated areas of infiltration greater than 400 mm/year (associated with the natural heritage features) and linear areas of infiltration less than 100 mm/year (associated with roads). This is consistent with the pre-development site-wide water balance results, where infiltration was calculated to be 146 mm/year.

Comparing the pre- to post-development conditions, the following is observed for the Study Area:

- Runoff increases by 129% and infiltration decreases by 42%
- The infiltration deficit is 352,878 m^3/year, meaning this volume would need to be infiltrated via enhanced recharge facilities, LID structures, or other mitigation measures each year to maintain the water balance.

7.8.3 Potential Impacts to the Natural Environment

Urban 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, rooftops). Impervious surfaces prevent infiltration of water into the underlying soils and the removal of the vegetation reduces the evapotranspiration component of the natural water balance. The evaporation component from impervious surfaces is relatively minor (estimated to be 15% of precipitation) compared to the evapotranspiration component that occurs with vegetation in this area (up to two thirds of precipitation). Therefore, the net effect of the urbanization of the Study Area is that most of the precipitation that falls onto impervious surfaces increases the surplus water resulting in more direct runoff from developed areas and reduced natural infiltration. In conjunction with increased runoff, there is a reduction in infiltration to the shallow groundwater system. A reduction in infiltration can potentially lead to a lowering of the local groundwater table and reduce the potential for this seasonal water table intersection and discharge into natural features on or off site.

The increases in surface water runoff that will occur with urban development and mitigation of the potential impacts to the local water table due to reduction of infiltration may be minimized by using appropriate SWM and using LID measures to promote infiltration, where possible.

The basic premise for LID is to try to minimize changes to runoff and infiltration. As outlines in the MOE SWMP Design Manual (2003) and Low Impact Development Stormwater Management Planning and Design Guide published by the CVC and TRCA (2010), there are a suite of techniques that may be considered to promote infiltration and reduce runoff.

The post-development infiltration target for the whole Study Area is estimated at 935,451 m^3/year. LIDs or other methods to increase post-development infiltration and maintain the water balance as best as possible must be explored in future design phases. It is recognized that infiltration at some properties within the Study Area may be challenging, based on low infiltration rates and high groundwater table measured as part of the Phase 1 LSS.

It is noted that areas throughout the central and northwest portion of the Study Area have been identified as SGRAs under the local source protection plan (CTC SPR, 2015). Typically, within the Study Area, Halton Till is present at surface which restricts the amount of infiltration that reaches the underlying ORAC. Based on field investigations conducted within the Study Area under Phase 1 of this study, the general stratigraphy in the areas mapped as SGRAs are mainly clay and silt glacial till (Halton Till) at surface, which is considered relatively low permeability material and represents an aquitard setting. It is noted that the Halton Till is fractured in this area, which could create a preferential flow path between the ground surface and the ORAC where fractures are present. However, during the Phase 1 LSS fractures within the till were not noted in the Study Area. As more detailed site investigations are completed, the Study Area surficial geology characterization should be further refined to identify any areas where increased infiltration may occur. LID placement should take this characterization into account, and increasing infiltration in these areas should be a priority.

7.8.4 Groundwater and Surface 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, phosphorus, bacteria and viruses. For groundwater, generally except for the dissolved constituents such as nitrogen and salt, most contaminants are attenuated by filtration during groundwater flow through the soils.

LID measures or end treatments such as oil/grit separators or wet ponds will also help to remove suspended solids and other contaminants in runoff prior to infiltration or conveying the flows off site, especially when a treatment train approach is taken for SWM. The proposed SWM strategy for the Study Area will be discussed in the Phase 3 LSS.

Runoff from residential developments (e.g., rooftops, landscaped areas) is typically considered “clean” and should be prioritized for infiltration where infiltration is required to maintain groundwater recharge. Infiltration-based practices could potentially be permitted for impervious areas such as roads and driveways for the low-density residential neighbourhood areas, but this must be confirmed during future design stages with the Town and TRCA. Infiltration of runoff from commercial areas may require pre-treatment prior to infiltration or may not be permitted for infiltration, to be determined in future design stages.

If only clean or pre-treated runoff will be infiltrated, the groundwater quality will not be downgraded and will not impact on-site surface water features being maintained or created, or other nearby environmental features.

7.8.5 Wetlands to be Removed and Compensated

As described within **Section 7.2.2.1,** non-significant wetlands within Properties 2, 3, 5, 6, 8, 9 and 11 are proposed for removal and compensation.

These features will be replicated within the Study Area on site to ensure that there is no loss in both form and function within the Study Area as a result of the proposed Structure Plan development. As previously noted within **Section 7.2.1.6**, HDFs with Mitigation management recommendations (as

defined within the HDFA Guideline; TRCA and CVC 2014) are permitted to be removed with their functions replicated. A detailed assessment of each wetland's hydrological function is given in **Table 1, Appendix F2**. The wetland locations are shown on **Figure F-1, Appendix F2**.

The hydrology of the majority of the wetlands to be removed and compensated appear to be dominated by surface water processes rather than groundwater flow. The occurrence of water in these features is understood to be mainly due to the combination of topography, which focuses runoff from the surrounding areas into these depressions, and the Halton Till soils, which limits seepage outflows and allows for periods of prolonged water retention. Site-specific groundwater level data, both at the existing wetland locations and the proposed compensation area, should be considered when establishing grades for the constructed wetlands.

The hydrology of the non-significant cattail mineral shallow marsh wetland within Property 8 appears to be primarily supported by groundwater flow. This wetland appears to intersect the confined ORAC sediments, and upwards hydraulic gradients and artesian conditions were measured consistently at nearby NW 33S/33D. Shallow marsh communities tend to form where there is consistent standing water, and groundwater discharge is expected to help maintain these conditions. Site-specific geology, groundwater level data and the potential role of groundwater in the ecological function of this wetland should be considered when establishing grades for the compensation wetland.

Consideration of created wetland hydroperiod requirements are discussed within **Section 8.6.4** and will be reviewed as part of the site-specific application once the exact location, size and shape of the wetland is determined.

7.8.6 Wetlands to be Maintained

Surface water wetland features planned to be maintained on site include:

- Wetland 1: Duckweed Floating-Leaved Shallow Aquatic (SAF1-3) (Property 1)
- Wetland 2: Reed-Canary Grass Mineral Meadow Marsh (MAM2-2) (Property 4)
- Wetland 3: Forb Mineral Meadow Marsh (MAM2-10) (Property 12)
- Wetland 4: Cattail Mineral Shallow Marsh (MAS2-1) (Property 12)
- Wetland 5: Pondweed Mixed Shallow Aquatic (SAM1-4) (Property 12)
- Wetland 6: Willow Mineral Thicket Swamp (SWt2-2) (Property 12)
- Wetland 7: Meadow Marsh (MAM) (Property 12)
- Wetland 8: Reed-Canary Grass Mineral Meadow Marsh (MAM2-2) (Property 5)
- Wetland 9: Meadow Marsh (MAM) (Not within participating property)
- Wetland 10: Red-Osier Dogwood Mineral Thicket Swamp/Disturbed (SWT2-5/DIST) and Cattail Mineral Shallow Marsh (MAS2-1) (Property 1)
- Wetland 11: Cattail Mineral Shallow Marsh (MAS2-1) (Property 2)
- Wetland 12: Reed-Canary Grass Mineral Meadow Marsh (MAS2-1) (Property 1, 2)
- Wetland 13: Forb Mineral Meadow Marsh (MAM2-10) (Property 1, 2)
- Wetland 14: Red-Osier Dogwood Mineral Thicket Swamp (SWT2-5) (Property 1, 2)

The locations of these features are illustrated on **Figure F-1, Appendix F**. A detailed assessment of each wetland's hydrological function is given in **Table 2, Appendix F2**.

Based on the data available from the Phase 1 SWS, which included the staff gauges, mini piezometers and nested monitoring wells to measure gradient, surface flow, and potential groundwater-surface water interaction, the hydrology of most of these features is considered to be dominated by surface water processes, while six (6) of the fourteen (14) retained wetlands are considered to be supported primarily by groundwater. If development induces reduced infiltration or the lowering of the groundwater table over time, impacts to the features are not expected as they do not primarily rely on groundwater discharge. However, the stormwater strategy will need to maintain the availability of runoff to these features post-development, ideally in a way that maintains the pre-development flow pattern (e.g., distributed flow versus point outlet) and peak flows. Site specific designs could consider mitigation measures including but not limited to roof leaders and swales to direct additional surface water to these features.

The hydrology of Wetlands 5, 6, 10, 11, 12, and 14 appears to be primarily supported by groundwater. These wetlands are identified on Figure F-2, Appendix F2. These wetlands exist in locations where they intersect saturated or confined ORAC sediments, and support vegetation communities which require consistently saturated conditions which are expected to be provided by the groundwater table. In general, groundwater on site flows towards the southwest. Therefore, infiltration to the permeable ORAC sediments north of the wetlands should be maintained in order to continue to support the wetland functions post-development. Site specific designs could consider mitigation measures including but not limited to infiltration trenches and infiltration chambers to increase groundwater infiltration in appropriate locations. Potential long-term dewatering or reduced infiltration in the drainage area of these wetlands should be assessed in detail at the draft plan stage to avoid impacts to the wetland's ecological function. A water balance risk evaluation was completed for each of the fourteen (14) retained wetlands, and is described in detail in **Section 7.8.6.1**.

7.8.6.1. Wetland Screening and Water Balance Risk Evaluation

A wetland water balance risk evaluation (TRCA 2017) was completed for each of the fourteen (14) retained wetlands. The wetland risk evaluation compared pre-development conditions with post-development conditions without mitigation. The risk level (low, medium, high) was assessed based on the potential magnitude of hydrological change and sensitivity of the wetland.

The existing conditions wetland catchment areas were delineated by SCS for each of the wetlands to be retained. Refer to **Figure F-1, Appendix F2** for the wetland IDs and locations and **Figure F-3, Appendix F2** for the existing wetland catchment areas. The proposed conditions wetland catchment areas were also estimated by SCS for each of the wetlands to be retained, based on the preliminary land use information available. The expected amount of imperviousness proposed to be introduced within each wetland catchment area was estimated by SCS and is summarized in **Table 3a, Appendix F2**. The proposed catchment size changes are summarized in **Table 3b, Appendix F2** and the resulting magnitude of hydrological change is given in **Table 3c, Appendix F2**. Ecological sensitivity of each wetland was assessed by GEI ecological staff based on available field and background data, presented within the Phase 1 Report (GEI and SCS, 2025). Where there was incomplete ecological data, due to site access, the precautionary principle was applied, and the wetland sensitivity was assessed as high.

The ecological sensitivity of each wetland is given in **Table 3d, Appendix F2.**, and the resulting overall risk assessment for each wetland is given in **Table 3e, Appendix F2.**

The wetland water balance risk evaluation (**Table 3e, Appendix F2**) assessed eight (8) wetlands as high risk (Wetlands 1, 2, 5, 8, 10, 11, 13, 14), four (4) wetlands as medium risk (Wetlands 3, 7, 9, 12) and two (2) wetlands as low risk (Wetlands 4, 6). The Phase 3 LSS will examine the feature based water balance analysis requirements and explore suitable LID mitigation to maintain the hydroperiod of each of the medium and high risk wetlands. It is recommended that the required feature based water balance analyses are carried out as part of site specific investigations in order to complete a detailed assessment and provide the opportunity to design LID measures specific to the conditions and needs of each property.

7.8.7 Climate Change and Wetland Water Balance Risk Evaluation

Climate change is altering precipitation patterns, increasing temperatures, and intensifying extreme weather events. These changes can lead to periods of excessive flooding, prolonged drought, and shifts in groundwater recharge, impacting the hydrology and ecological function of the wetlands. Increased impervious surfaces due to development can exacerbate these impacts by altering runoff patterns and reducing infiltration rates. As a result, wetlands may face hydrological imbalances that threaten their ability to support biodiversity, regulate water quality, and provide critical ecosystem services, like flood mitigation and carbon sequestration.

The wetland water balance risk evaluation provides a framework to address the above-noted challenges. By categorizing wetlands into low, medium, and high-risk levels based on potential hydrological changes and sensitivity, appropriate hydrological modelling methods are applied to ensure a detailed understanding of each wetland's needs. The precautionary principle ensures that in cases of incomplete data, conservative assessments guide mitigation planning. The use of continuous hydrological models for medium and high-risk wetlands, including those with groundwater interactions, allows for the prediction of hydrological responses under various scenarios. Additionally, the integration of LID measures and adaptive SWM strategies can assist in maintaining natural hydrological functions post-development. This approach supports wetlands in continuing to adapt to climate variability, preserving their resilience and capacity to provide essential ecosystem services in a changing climate. At the site-specific stage, mitigation measures will be reviewed to ensure that the hydroperiod requitements of medium and high-risk wetlands are maintained, allowing for the continued support of wetland hydrology and ecological functions under a changing climate.

8. Proposed Restoration and Enhancement Strategy

A conceptual restoration approach is outlined in this section to show how ecological features and functions will be replicated and/or enhanced within the Proposed NHS. This NHS has expanded upon the Existing NHS presented within the *Mayfield Tullamore Local Subwatershed Study Phase 1* (GEI and SCS, 2025.) and incorporates additional components identified within the *Scoped Subwatershed Study, Part B: Detailed Studies and Impact Assessment* (Wood et al. 2022b), such as further details on linkages and enhancements).

For the purposes of this Phase 2 SWS, the **Existing NHS** refers to that NHS outlined in the Phase 1 SWS (GEI and SCS, 2025), the **SABE NHS** refers to the NHS outlined in the Wood SWS (Wood et al., 2022b), and the **Proposed NHS** refers to new NHS that is being proposed herein as part of this Phase 2 SWS. Minor refinements to the Proposed NHS are permitted during the site-specific application process based on additional investigations and/or modelling efforts.

8.1 Overview of SABE NHS

As discussed within Section 2.6.3.1 *of the Scoped Subwatershed Study, Part B: Detailed Studies and Impact Assessment* (Wood et al., 2022b), the SABE NHS includes the following system components with the goal of creating a resilient and connected NHS:

- Key Features;
- Supporting Features;
- Other Features;
- Linkages; and
- Enhancements.

While it is expected that further refinements to the SABE NHS will occur as a result of the local SWS, the intent is that there no loss in total NHS area, rather a gain in ecological function and/or area is achieved.

The following sections outline the proposed NHS based on the work completed in Phase 1, an analysis of the SABE NHS system components (**Section 6.3**), the initial net gain mitigation hierarchy assessment (**Section 6.4.2**) and the impact assessment (**Section 7**). These sections also speak to high-level goals and best practices related to compensation and offsetting, restoration, and enhancement opportunities.

8.2 Overview of Proposed NHS

At a high level, the Proposed NHS consists of:

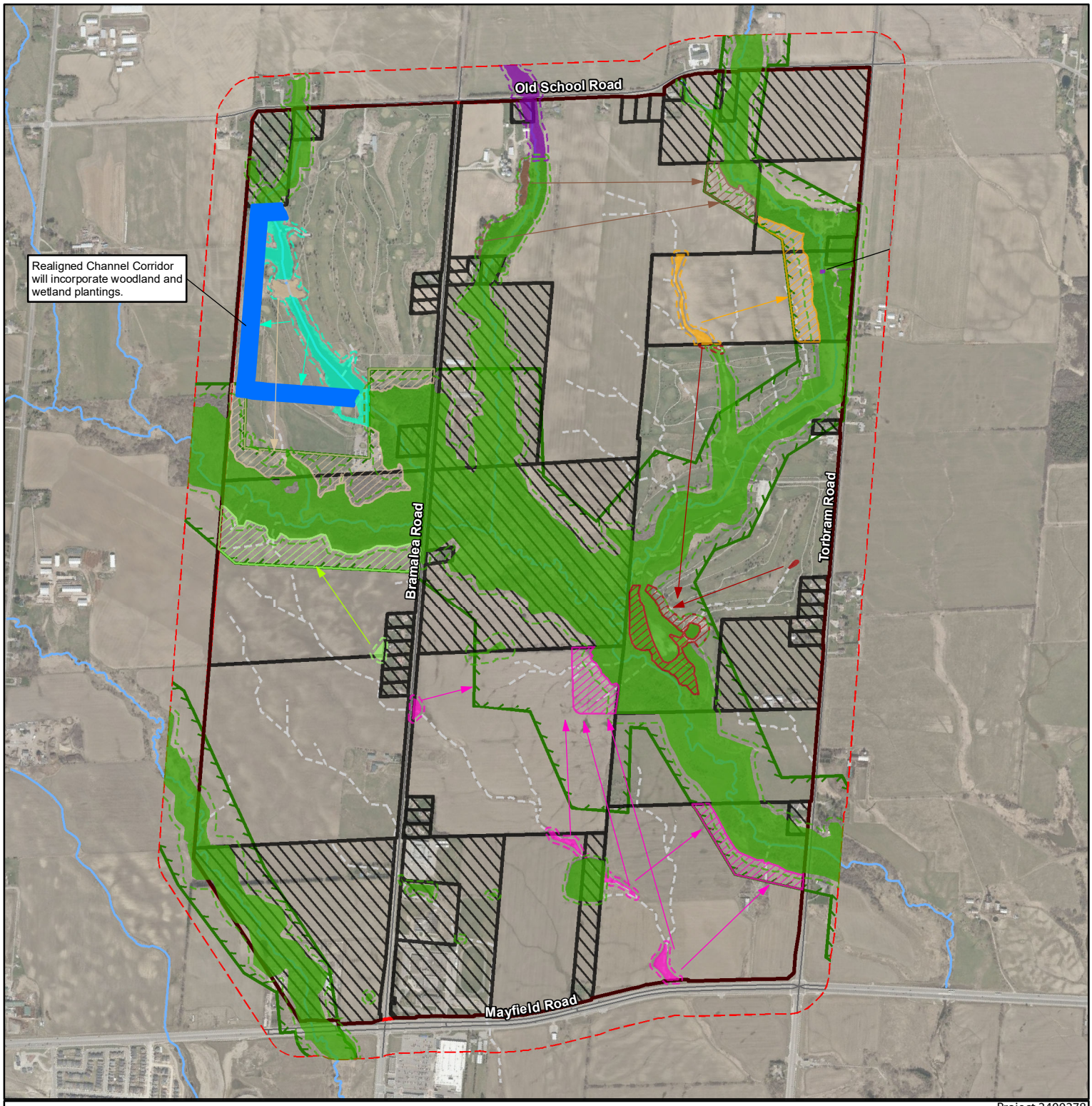
- Watercourse corridors, which consists of the retained watercourses (all high constraint watercourses, WHT4(3)6-1 and WHT4(3)4-2) and a realigned watercourse (WHT 4(3)5-2);
- Retained and created wetlands; all wetlands located within the Greenbelt Plan Area will be retained as well as the SAF1-3 wetland on Property 1 and the MAM2-2 wetland on Property 4; created wetlands, as part of ecosystem offsetting for nonsignificant feature removals, will be located within the immediate vicinity of the NHS;
- Retained woodlands within the Greenbelt Plan Area, retained woodland a, b and c (**Figure B-1**, **Appendix B**), and one created woodland immediately adjacent to the watercourse corridors;
- Natural hazard limits and regulatory setbacks including valleylands, watercourses, and floodplain limits; and
- Vegetated buffers applied to Key Natural Heritage and Key Hydrologic Features and setbacks applied to Natural Hazards (as outlined within **Table 8-1**, below).

The Proposed NHS will be designed around the three main linkages within the Study Area: the two high constraint watercourses associated with the West Humber River (and its associated tributary) and Campbell's Cross Creek. Supporting linkages within the Study Area are associated with medium constraint watercourses (WHT 4(3)5-2 and WHT 4(3)4-2). The West Humber River tributaries flow through the majority of the Study Areas, whereas Campbell's Cross Creek only crosses the southwestern corner and thus is not the main focus of the NHS Strategy since this feature will be retained and protected in place. The West Humber River watercourse corridors will consist of retained and created wetlands and woodlands. These created and retained features will support various wildlife including SAR and SWH by providing a diversity of habitat types and structures to varying wildlife groups. The interspersion of created habitats along the watercourse corridors add to the mosaics of habitats that are currently present within the Study Area, while adding diversity in maturity and structure on the site. The inclusion of habitats along the existing NHS will continue to encourage a connected NHS.

While the West Humber River corridors are present within the landscape, portions are highly degraded given historic alterations and disturbances associated with the watercourse, valleyland and cultural vegetation communities. Removal of non-significant natural heritage features within the tablelands of the Study Area will also occur in order to facilitate the proposed developments; however, replication and recreation of these habitats must occur to ensure no net loss in ecosystem functions.

The Proposed NHS is illustrated in **Figure 8-1** below. The below sections outline how the Proposed NHS was identified and what site-specific applications must review in order to confirm ecosystem compensation locations.

Figure 8-1. Proposed Natural Heritage System



NOTES:
1. Coordinate System: NAD 1983 UTM Zone 17N.
2. Base features produced under license with the Ontario Ministry of Natural Resources and Forestry © King's Printer for Ontario, 2025, © Town of Caledon, 2025, © Toronto and Region Conservation Authority, 2025, © Peel Region, 2025.
3. Orthoimagery © First Base Solutions, 2025. Imagery taken in 2022.

*This is for demonstration purposed only and is intended to show general areas where compensation could be located with a 30m VPZ.
*This does not include potential impacts associated with the road and trail network.
*The final location, size and extent of compensation will be determined based on site-specific studies. The figure provided identifies potential compensation locations only.

Legend
Study Area
Study Area + 120m
Non-Participating Property
Participating Property
Greenbelt Plan Area
Watercourse (GEI 2024)
Headwater Drainage Feature (GEI, Beacon)

Retained Natural Heritage Features
Natural Heritage Features and Natural Hazards
Natural Features and Natural Hazard Setbacks
Proposed Enhancement Areas
Proposed Enhancement Area
Proposed Enhancement Area Setback
Removals and Compensation
Property 1
Removal
Removal Setback
Proposed Realigned Channel
Available Compensation (including setback)
Woodland Removal
Woodland Removal Setback
Property 2/3
Removal
Removal Setback
Available Compensation (including setback)
Property 4
Removal
Removal Setback
Available Compensation (including setback)
Property 5/6/11
Removal
Removal Setback
Available Compensation (including setback)
Property 7/8
Removal
Removal Setback
Available Compensation (including setback)
Property 9
Removal
Removal Setback
Available Compensation (including setback)

Project 2400278

Mayfield Tullamore Local Subwatershed Study
Phase 2 - Subwatershed Impact Assessment

Figure 8-1
Proposed Natural Heritage System

0 400 m
1:18,000

GEI Consultants

Path: \\corp.pzsc.ca\Data_Storage\Working\MAYFIELD TULLAMORE LOCO\2400278 Mayfield Tullamore Subwatershed Study\09_GIS\figures\report_figures\2025-01_SWS_phase2_rs_text_figures\2400278_rpt_fig08_1_proposed_natural_heritage_system.mxd Date Saved: Friday, March 28, 2025 Last Modified by: kcorrea.ca

As demonstrated within **Figure 8-1**, ecological offsetting is proposed within the Study Area. Specifically, where non-significant wetland and woodlands are proposed for removal within the tablelands, consideration of potential compensation areas have been explored. These compensation areas are high-level areas shown within the Greenbelt Plan Area that are currently agricultural or golf course lands that will be re-naturalized and incorporated into the Proposed NHS. All recreated features will be buffered with a VPZ from the proposed development. Created features may be created immediately adjacent to existing features (provided there are no impacts to the natural feature as a result of the habitat creation); no VPZ between natural features is warranted rather the VPZ should be applied to the outer limit of the Proposed NHS. The proposed ecological offsetting approach is further discussed below within **Section 8.3**.

Table 8-1. Natural Heritage and Natural Hazard Constraints and Minimum Recommended VPZs/Setbacks

Natural Heritage/Hazard Constraint	Minimum Recommended VPZ/Setback	
	Phase 1 SWS (Existing NHS)	Phase 2 SWS (Proposed NHS)
Significant wetlands	30 m	30 m
Significant woodlands within the Greenbelt Plan Area	30 m	30 m
Significant woodlands outside the Greenbelt Plan Area	20 m	20 m
Significant valleylands	15 m	15 m
Non-significant wetlands	10 m	10 m
Non-significant woodlands	10 m	10 m
Non-significant valleyland	10 m	10 m
Meander belt width and Floodplain	10 m	10 m
Fish habitat (direct, warmwater baitfish)	15 m	15 m
Fish habitat (direct, cool or cold water)	30 m	30 m

8.3 Natural Features Proposed for Ecological Offsetting

Ecological offsetting is a mitigation strategy that is often considered in an effort to achieve a net ecological benefit to projects, subject to the approval of the planning authority. This compensation strategy quantifies the loss of natural features in order to provide compensation through habitat re-creation or alternative consultation process. Ecological offsetting approaches are typically applied as a last resort (after avoidance and mitigation have been considered). In this case, ecological offsetting is proposed as a means to achieve additional ecological benefit by meeting and/or exceeding the replication requirement.

8.3.1 Overview of Features to be Removed

Preservation of all existing natural heritage features within the Study Area is not required based on the assessment of significance and the proposed restoration and mitigation measures. A Net Gain Mitigation Hierarchy was completed within **Section 6.4** and determined that that all significant natural heritage features would be retained in place, however, non-significant features within the tablelands may be removed and replicated within the Proposed NHS elsewhere within the Study Area. These non-significant features were generally invaded and/or common communities with their form and functions being easily replicated elsewhere. Compensation of these features should occur within proximity to the Proposed NHS, where feasible, to ensure connectivity to the overall NHS and reduce the possibility of genetic isolation.

As described within **Section 7.2.2**, the following non-significant features are proposed for alteration and/or removal:

- Removal of non-significant wetlands within Properties 2, 3, 5, 6, 8, 9 and 11 (1.65ha);
- Removal of a non-significant woodland within Property 1 (0.45 ha) and Property 4 (0.38 ha); and
- Realignment of a medium constraint watercourse (WHT4(3)5-2) within Property 1.

These features will be replicated within the Study Area to ensure that there is no loss in both form and function as a result of the proposed Structure Plan. As previously noted within **Section 7.2.1.6**, HDFs with mitigation management recommendations are permitted to be removed with their functions replicated.

8.3.2 Municipal Offsetting Guidelines

Neither the Town of Caledon, nor the Region of Peel have a formal ecological offsetting guideline. Within the Draft Caledon Official Plan (2024a), Section 13.9.2 outlines that ecosystem replication and compensation may be considered in limited circumstances within the SABE, only after consideration is given to preceding steps in the hierarchy. Replication of features may also be considered through SWS in "*circumstances where retaining the feature in-situ in an urbanizing landscape matrix will result in an impact to its form or function that cannot be reasonably mitigated"* (Section 13.9.9 of the Draft Caledon Official Plan, 2024a). Based on Section 13.4.2.(d), ecosystem compensation should be considered in accordance with Town ecosystem compensation guidelines. Although this guidance document it not yet available for use, Section 13.3.4 references it along with applicable conservation authority requirements for ecosystem compensation.

Within **Section 2.6.3.1** *of the Scoped Subwatershed Study, Part B: Detailed Studies and Impact Assessment* (Wood et al., 2022b), two types of ecosystem compensation are outlined. Like-for-Like Compensation is where the same habitat type is created, and Alternative Habitat Compensation is where alternative habitat types are created. Similar to the Draft Caledon Official Plan (2024a), compensation should only be considered where all reasonable alternatives (to avoid, mitigate, retain with mitigation measures in place, replication, etc.) have been considered, and where compensation presents an improved condition for the system.

8.3.3 Toronto and Region Conservation Authority Offsetting Guidelines

The *Guideline for Determining Ecosystem Compensation* (TRCA) was adopted in 2018, with the most recent update in June 2023. This guideline was prepared to address the increasing pressures the Greater Toronto Region faces with respect to population growth, and its unique challenge of conservation of natural features in an urban context. This guideline has helped inform the proposed offsetting policies for this report.

The TRCA's guidelines follow the same hierarchy discussed in **Section 6.4**, where avoidance, minimization, and mitigation should be the first steps considered for natural features (2023). Where unavoidable loss still remains, the guideline further discusses how to determine compensation, apply compensation, and monitor compensation.

Compensation amounts are determined based on two key factors: replication of the ecosystem structure and land base. The TRCA's guideline uses 'basal area' to establish ecosystem restoration replacement ratios; this is to help address time lags associated with community regrowth by aiming to establish the same level of basal area within 10 years of compensation implementation (2023). In general, it is expected that replacement of a meadow marsh community will require a lower compensation ratio than a woodland. As noted when replicating land base, land is expected to be compensated at a 1:1 ratio to ensure no net loss in natural area.

8.3.4 Proposed Ecosystem Offsetting Plan

As discussed within the SABE and as summarized within **Section 6.2**, general targets were set for the Preliminary NHS to be used to inform land-use planning and decision making in achieving a net benefit to the NHS. The SABE recognized that certain types of habitats, such as open/early successional, wetland and woodland vegetation types, may be removed. These vegetation habitats are identified within Table 2.3.5.5 of the Part B Scoped SWS (Wood et al. 2022). The SABE states that significant features are identified for protection as part of the NHS, whereas, opportunities for protection and/or enhancement will be explored for supporting habitat and/or functions, where feasible.

Specific ecosystem compensation requirements have not been provided within this SWS; rather, they are deferred to site specific applications to determine appropriate on-site compensation. To be consistent with the SABE NHS targets, no net loss in wetland and woodland cover is permitted; thus, cash-in-lieu compensation is not recommended within the Study Area. If cash-in-lieu is a method that is explored during site-specific applications, the TRCA's Ecosystem Compensation Protocol as it relates to accounting for both the cost of restoring ecosystem structure and land base should be considered and discussed with reviewing agencies. The intention of cash-in-lieu compensation is to support the implementation of a compensation project to continue to prioritize overall net gain within the overarching NHS within the Town of Caledon.

A key area identified for the implementation of ecosystem offsetting is within the Greenbelt Plan Area as this will provide added benefit of increasing connectivity and ecosystem diversity within the existing linkage corridors of the NHS. Where natural heritage feature compensation is provided within the Greenbelt Plan Area (i.e., outside of existing natural heritage features but within VPZs and natural hazard setbacks and the Protected Countryside) an increased compensation ratio may be required

since it is assumed that all VPZs will be naturalized with native vegetation as part of the development process. This will also help achieve Greenbelt Plan policies that require developable areas be at a minimum 30% naturalized. Additional enhancements and creation of differing habitats within the Greenbelt Plan Area VPZ are a benefit in comparison to uniform native buffer plantings; however, since a gain in NHS area would not be provided significant gains must be demonstrated to support compensation within the VPZs.

The following management recommendations focusing on proposed compensation, habitat enhancements and restoration:

- TRCA's Guideline for Determining Ecosystem Compensation (dated June 2023) should be used to inform compensation requirements. As discussed above, the compensation ratio requirements could be higher than 1:1 depending on the type of natural feature being removed, in order to replicate both ecosystem structure and functions. The more ecologically complex the habitat, the higher the ratio requirement will be.
- Where removal of natural features is required, opportunities to recreate those habitats adjacent to the protected NHS should be explored. This will enhance the existing NHS.
- Zoning compatible with long-term protection of natural features should be considered for areas where compensation, enhancement or restoration are proposed.
- When habitat creation is being proposed within areas that will also serve as parklands for the community, it is important that the design of the parkland takes the function of the habitats and their long-term viability and protection into consideration. So, for example, if a trail is being proposed, preference should be given to placing the trail away from the newly created habitat or other sensitive habitat; if deemed not possible, and the trail is being proposed close to where habitat was constructed, then the use of low-impact designs should be considered (e.g., boardwalk with fences).
- Consider providing wildlife habitat structures for a variety of wildlife (e.g., reptiles, mammals, birds) to increase breeding, roosting, nesting, refugia opportunities.
- For impacts to habitat of threatened and endangered species, specific requirements and permits under the ESA should be secured with MECP.
- The targets for the NHS outlined in the SABE report should be considered when determining enhancements to the NHS. Please refer to table below for GEI's assessment of each target outlined in the SABE report.

8.4 Restoration Goals and Objectives

The proposed restoration concept has been designed with recognition of existing landscape opportunities and constraints. The landscape scale opportunities considered providing connections through the West Humber River watercourse and valleyland corridors throughout the Study Area. The West Humber River is a primary linkage within the landscape with its tributaries acting as secondary linkages.

The restoration goals within the Study Area are:

- Replicate non-significant wetland and woodland units;
- Recreate ecological functions (including wildlife habitat);
- Replicate watercourse length within the realigned watercourse corridor on Property 1;
- Increase overall NHS connectivity by removing existing barriers;
- Enhance/create the NHS by creating a mosaic of habitats to create a resilient and diverse community;
- Increase overall natural cover in comparison to existing conditions through the establishment of the proposed NHS; and,
- Promote restoration strategies that foster climate resilience and adaptive capacity.

Ecological restoration objectives within the Study Area include:

- Enhance existing biophysical functions present within the existing NHS through the establishment of native VPZs and setbacks;
- Remove existing online ponded features within Property 1 to reduce thermal loading and replace with a robust aquatic corridor. Stream lengths will replicate and exceed existing watercourse lengths. Create more complex aquatic habitat through incorporation of natural channel design principles;
- Replicate wetland area for non-significant wetland area removed and provide a diversity of wetland vegetation types (i.e., meadow marsh, shallow marsh, thicket swamp) within the NHS corridor;
- Create additional wildlife habitats or enhance existing habitats to better support aquatic and terrestrial species. Specifically additional habitats may be through the creation or enhancement of existing vegetative communities or through the installation or creation of wildlife habitat structures to increase breeding, nesting, refugia and overwintering opportunities;
- Increase overall natural cover in comparison to existing conditions;
- Deter establishment of non-native/invasive plant species;
- Create floristically diverse and resilient vegetation communities that will support a variety of native fauna;
- Stabilize soils through the application of an annual cover crop seed mix applied in conjunction with native perennial seed mixes (along with other ESC measures, as necessary); and
- Appropriate soil management and preparation should occur prior to conducting restoration on site. Please refer to TRCA's Preserving And Restoring Healthy Soil: Best Practices For Urban Construction guideline (2012a) for the soil requirements (e.g., soil depth, porosity, pH, and organic matter content) and management techniques.

These goals and objectives should be reviewed during the site-specific applications to be refined to reflect appropriate conditions within specific properties.

8.5 Opportunities for Ecological Restoration/Enhancement

Several restoration and enhancement areas have been identified within and adjacent to the Greenbelt Plan Area and based on a review of the enhancement areas proposed in the SABE Part B (summarized in **Section 6.3.5**). These restoration and enhancement areas were specifically identified based on SABE targets and Phase 1 findings. The following restoration and enhancement areas are identified within the Proposed NHS:

- Non-significant wetland compensation at a minimum of a 1:1 ratio will occur within the Greenbelt Plan Area (Properties 1, 2, 4, 8, and 5). Exact wetland compensation ratios will be determined during the site specific application. Since compensation for non-significant wetlands will occur within the Greenbelt Plan Area, these wetlands will be buffered from development by a 30 m VPZ in accordance with the Greenbelt Plan policies.
    - The non-significant wetlands proposed for removal are highly degraded and common wetland communities. Some of these communities are monocultural stands with limited habitat value. Removal and compensation of these wetlands from the tablelands to the Greenbelt Plan Area VPZ will allow for increased native plant diversity and habitat functionality in comparison to the existing communities.
- Non-significant woodland compensation at a minimum of a 1:1 ratio will occur within the Greenbelt Plan Area (Property 4) or within the realigned channel corridor (Property 1). Exact woodland compensation ratios will be determined during the site specific application. Non-significant woodlands within the realigned channel (Property 1) will be buffered by a 10 m VPZ and non-significant woodlands within the Greenbelt Plan Area (Property 4) will be buffered by a 30 m VPZ in accordance with buffer requirements outlined within Section 4 of the Phase 1 Report.
    - The non-significant woodland within Property 1 is a moist lowland deciduous forest mostly comprised of Manitoba Maples. The non-significant woodlands within Property 4 are non-native and were historically planted. The removal of these communities and compensation within the realigned channel corridor and Greenbelt Plan Area will increase the overall plant diversity, offer variability in woodland habitat types and increase habitat availability. Specifically, within Property 1, it will also increase the amount of natural cover within the watercourse corridor providing thermal benefits and contributions of allochthonous material to downstream fish habitats.
- WHT4(3)5-2 is proposed to be realigned within a 45 m wide natural channel corridor (Property 1). This realigned channel corridor has been approximated to support the SWS process; however, the exact size of the corridor will be defined through the site-specific applications. The realigned channel corridor will include a 10 m wide floodplain with low flow channel and will be buffered by 10 m on either side of the created top of bank. The realigned channel corridor will be an open corridor that has been designed to accommodate all natural hazards (erosion and flood). The low-flow channel will be designed using natural channel design

principles, including a meandering channel with riffle-pool-run morphology. The removal of the online ponds (Ponds 1, 2) will assist with removing in-stream barriers and thermal loading to downstream occupied Redside Dace habitat. This realignment will provide an established local linkage that will be vegetated with native plant communities.

- An existing in-stream barrier (crushed culvert) within WHT4(3)3-1 will be removed and the in-stream habitat will be restored (Property 8). This in-stream barrier is associated with a former homestead driveway. Specifically, the channel beds and banks will be restored using native granular materials and revegetated with native plants. The removal of this barrier will provide increased flow and aquatic connectivity to upstream habitats that currently are inhibited as a result of the barrier.
- An existing piped low constraint watercourse WHT4(3)4-3 within Property 4 and a non-participating property) was identified within the SABE and during the Phase 1 investigations. Opportunities to daylight this watercourse will help remove an in-stream barrier and increase the amount of natural cover within the NHS. Given that a portion of this piped feature is located within a non-participating property, this enhancement may not be feasible until the non-participant participates in the development process. Also associated with this reach is an existing farm crossing. If this feature is daylighted, the existing farm crossing should be removed so that there is only one watercourse crossing on the reach.
- Existing KNHFs, KHFs and Natural Hazards that are not proposed for reconfiguration will be buffered by minimum VPZs. All VPZs will be planted with native plant materials to create additional habitat, add early successional habitat and provide buffering capabilities to the retained NHS. Most of the areas designated for VPZs are anthropogenic (golf course or agricultural), therefore, the revegetation and incorporation into the NHS will create a larger and more robust linkage throughout the Study Area.

Please refer to **Section 8.8.1** for design specifications related to the proposed channel realignment on Property 1.

The proposed compensation areas illustrated on **Figure 8-1** are large compensation areas that have been strategically selected based on various restoration conditions (e.g., soil, topography) and are best suited for ecological offsetting. The exact size and location of compensation within these areas will be determined through site-specific applications; however, these compensation areas have been sized to accommodate a 30 m VPZ between the created feature and the edge of development. A 30 m VPZ has been applied since the features will be recreated within the Greenbelt Plan Area and would thus be considered KNHF/KHFs, not because the features in their current condition are considered significant and warrant larger VPZs. The VPZs will be applied on the outer limit of these created features between the features and the proposed development. No VPZs will be applied between the created feature and retained features, as the functions of VPZs are to provide setback and buffering benefits between the feature and development/site alteration.

In general, compensation and enhancement areas are located outside of existing KNHF and KHFs, with the exception of the following:

- Property 1: natural channel tie-in location at the downstream extent may be partially located within the outer limits of the Greenbelt Plan Area given the existing location of the Pond 1. The exact tie-in location will be confirmed during the site-specific application following detailed natural channel modeling.

- Property 4: daylighting and removal of an existing farm crossing within WHT4(3)4-3.

- Property 8: removal of an existing in-stream barrier within WHT4(3)3-1 will result in some in-stream enhancements within the Greenbelt Plan Area.

- Property 9: wetland compensation will occur within the significant valleyland but within existing anthropogenic (golf course) areas.

As discussed below within **Section 10**, while these compensation and enhancement areas are located within the Greenbelt Plan Area they are providing significant benefits to the overall NHS system as a result of removing barriers and increasing natural cover within disturbed areas.

Figure B-5 (**Appendix B**) illustrates the proposed compensation and enhancements within the Proposed NHS. The proposed compensation areas for woodland and wetland are larger blocks than are likely required for compensation; however, these larger areas have been added to demonstrate that a greater than 1:1 compensation area is available nearby the proposed removal areas and can accommodate minimum VPZs.

8.6 Flora Considerations

The design process of restoring or creating ecosystems depends on the use of native reference sites to inform restoration activities (Gann et al., 2019). Reference sites are defined as ecosystems that have experienced little to no human intervention or disturbance, and that are as close to historically natural as possible (Pollock et al., 2012). In the discipline of ecosystem restoration, reference sites are a vital tool for assessing current conditions and developing restoration goals for natural areas (Gann et al., 2019). They are used to inform scientists of the best management practices to lead to a healthy recovery of a degraded ecosystem, and they can also be used to assess whether current management practices are moving the restoration of a site in the direction of recovery (Pollock et al., 2012).

In order to be used as a reference site, proposed locations must have specific characteristics. To assist ecologists in identifying appropriate reference sites, The Society for Ecological Restoration (SER) has outlined six essential reference site attributes. These attributes include: 1) absence of threats, 2) suitable physical conditions, 3) appropriate species composition, 4) ample structural diversity, 5) adequate ecosystem function, and 6) sufficient external exchanges (Gann et al., 2019).

In Southern Ontario, there are few reference sites that meet the six reference site attributes as the natural environment was highly altered >200 years ago, primarily from the removal of woodlands and other natural habitat types for agricultural practices. This is also true for Peel Region and the surrounding landscape, which can be described as containing lands heavily influenced by anthropogenic activities. When appropriate reference sites cannot be determined for a restoration project, Certified Ecological Restoration Practitioners (CERPs) will use target ecosystems as an

alternative. While reference sites are physical locations where data has been collected and it has been determined that the SER's reference site attributes are adequately met, target ecosystems are conceptual descriptions of community assemblages, such as those found in the ELC manual (Lee et al. 1998). The target ecosystem method leaves more to the discretion of the CERP; however, since the community descriptions in the ELC manual are based on data collected from actual sites within Ontario, these descriptions should serve as a fair alternative to reference sites when necessary. A combination of target and reference ecosystems should be used inform the design of restoration vegetation communities, with a focus on species selection the anticipated impacts of climate change to better foster flora resilience.

8.6.1 Physiographic Considerations

When selecting reference sites and target ecosystems CERPs must consider the physiographic conditions of the area to be restored. This approach ensures the greatest likelihood of success for communities that have been restored on the landscape.

During the site-specific applications, soil types should be considered when selecting potential restoration sites.

8.6.2 Selecting Vegetation Communities

Native upland and riparian vegetation communities should be targeted within the Proposed NHS. As previously noted, vegetative communities (Ecosites) should be defined based on the ELC Manual. Consideration should be given to ELC communities that are not currently present but where suitable soil, moisture and light conditions are available to diversity of habitat.

8.6.3 Wetland Hydroperiod Considerations

The ability to create and sustain a particular wetland hydroperiod is influenced by the soils the wetland is based in, the depth to the water table, and sources for water inputs (i.e., surface water runoff or groundwater infiltration). Exact locations where wetland habitat is proposed to be enhanced or created will be determined during site specific application, however general considerations and potential site areas are given below.

Generally, groundwater is present between 0.5 to 5 m below the ground surface, with seasonal high groundwater levels measured at 0.5 to 1.5 m below ground surface. The notable exception to this trend is the northwest portion of the Study Area, where wells were typically dry or groundwater was measured at 5 to 8m below ground surface. This is attributed to the presence of thick ORAC sediments in the northwest portion of the Study Area, allowing groundwater to drain away from the shallow subsurface. Conversely, the northeast portion of the Study Area experiences artesian conditions, with groundwater measured at an elevation of up to approximately 1 m above ground surface. This is interpreted to be due to the confinement and pressurization of the ORAC in this portion of the Study Area. It should also be noted that significant valley features and topographic differences exist on site, and therefore the water table is located much closer to the ground surface in topographic lows compared to topographic highs, where the groundwater table is located deeper under the ground

surface. When determining suitable locations to create or enhance wetland habitat, a detailed assessment of the groundwater conditions should be undertaken. Artesian conditions present in the northeast portion of the Study Area may pose construction challenges for wetland creation, however the high groundwater table and possibility of groundwater discharge into a created wetland may create suitable conditions for wetland habitat. Portions of the Study Area with a deep groundwater table and well-drained ORAC sediments may not hold the water necessary to create wetland habitat without a clay lining.

Based on field investigations conducted within the Study Area under Phase 1 of this study, the general stratigraphy is clay and silt Halton Till at surface, which is considered relatively low permeability material and limits the drainage of surface water and/or discharge of groundwater. In the northeast portion of the Study Area, permeable sands associated with the ORAC form a shallow artesian aquifer with potential for discharge of groundwater to the surface water environment. Thick deposits of dry, well-drained ORAC sediments are also present in the northwest portion of the Study Area, which allow groundwater to drain away from the shallow subsurface. Across much of the Study Area where low-permeability glacial till is present at surface, opportunities may exist to create or enhance wetland habitat since the poor drainage of the native soils will allow wet or flooded conditions to persist. Where artesian conditions exist, the permeable ORAC sediments may allow active groundwater discharge into excavated areas, and therefore groundwater-supported wetlands may be possible to sustain in this area. Where well-drained ORAC sediments are present, shallow wetland habitats would be most feasible to avoid intersecting the ORAC sediments present at depth. Deeper wetland habitats could be constructed and maintained if clay liners are used.

When determining appropriate locations for wetland enhancement or creation, it is vital to consider opportunities to direct additional water (i.e., clean roof runoff, bioswales, infiltration LIDs) to a given area. Study Area topography, proposed grading, drainage, and SWM pond locations should be considered when selecting preferred locations for wetland habitat creation. Since engineered grading and drainage is typically designed to mimic the existing natural slope, in the absence of proposed grading and drainage plans the existing topography can be used to identify potential candidate locations for wetland habitat creation or enhancement. In general, the Study Area slopes to the southeast and locally slopes towards the Humber River Tributaries. Therefore, it is expected that in general drainage will be engineered to flow towards the watercourse to take advantage of the use of gravity to convey stormwater to a SWM pond. Overall, it is expected that the portion of each property bordering the watercourse would be preferable locations to create or enhance wetland habitat, since it is anticipated that engineered SWM systems will be designed to convey flows from the Study Area towards these areas. The most likely sources of water to be conveyed to any wetland areas are expected to be roof runoff conveyed to roof leaders, bioswales, or infiltration trenches, and park overland runoff.

Specific wetland communities have unique hydroperiod requirements. A wetland hydroperiod is the frequency and length of time that a wetland experiences flooding, to specific depths required to support the vegetation associated with a specific wetland community type. Specific site conditions may be conducive to particular wetland types. Wetland community type for created or enhanced wetland areas will need to be determined as the site-specific application stage. However, considerations for specific portions of the Study Area are given below.

Mineral Meadow Marsh (MAM2) communities are tolerant to a wide range of conditions and therefore tend to be one of the most applicable communities when designing wetland habitat. MAM2 communities require frequent wet/flooded conditions during the spring and fall when precipitation is usually highest and are tolerant of periods of dry conditions throughout the summer when precipitation is typically low. Therefore, these communities may be best suited to areas of the Study Area where drainage is poor and precipitation runoff can be directed to the wetland area, such as upland areas in the portion of properties bordering the watercourse, underlain by low-permeability glacial till.

Mineral Shallow Marsh (MAS2) communities rely on near-continuous shallow (typically less than 1 m) flooded conditions with brief dry periods during the summer and therefore are best suited to areas that are continuously or frequently inundated by surface water or a seasonally high groundwater table. In areas where the wetland is underlain by low-permeability soils that limit both drainage and groundwater discharge, the constant flooded conditions would need to be created by providing consistent surface water inputs either through roof runoff or other clean water discharge. These conditions may be present in the portions of each property adjacent to the watercourse where continuous surface water flows could be directed to wetland habitats underlain by low-permeability glacial till. In areas where the wetland is underlain by high permeability soils that supply groundwater discharge, the continuous flooding conditions would need to be created by situating the wetland within the groundwater table. However, a specific location would need to be chosen carefully such that the groundwater table lowers in the summer, allowing for brief dry periods since if the wetland is inundated continuously and/or the water level is kept too high, the vegetation community may change to a shallow aquatic community (described below). The above-described conditions may be possible to achieve in the northeastern portion of the Study Area where artesian conditions are present, however the challenges associated with excavation in an artesian setting will require additional effort during the design process.

Submerged Shallow Aquatic (SAS) communities have similar requirements to an MAS2 community but require permanent flooded conditions with a depth that can exceed 1 m. SAS communities are best suited to areas where they can intersect the groundwater table to receive constant groundwater inputs, or especially groundwater support during the late summer when surface water inputs tend to be lower. Therefore, the best locations within the Study Area to target this type of community would likely be in low-lying areas where the groundwater table is located close to surface. Suitable conditions may also be present in the northeastern portion of the Study Area where artesian conditions are present, however the challenges associated with excavation in an artesian setting will require additional effort during the design process.

Mineral Swamp (Thicket/Deciduous/Coniferous/Mixed - SWT/SWD/SWC/SWM) communities have a wide range of flooding depth and duration requirements based on the dominant vegetation present, however all swamps have similar general requirements. Specific hydroperiod requirements will need to be assessed based on the specific swamp type being targeted, but in general swamps require shallow flooding in spring and fall and wet conditions in summer with shallower conditions than the spring and fall. Brief periods of deeper flooding (40+ cm) can be tolerated, especially during the spring and fall. These wetland communities require a shallow water table such that tree roots can reach the groundwater, but a water table that fluctuates seasonally is necessary to allow for the drier conditions

required in the summer. Permanently high standing water may cause trees to die and result in a change in the vegetation towards a SAS or MAS community. It is expected that these conditions may be best achieved where the Study Area is underlain by low permeability glacial till where the groundwater table is close to the ground surface and fluctuates seasonally. The quantity of runoff received by these areas would need to be controlled to avoid excessive inundation. Generally, locations in the southern portion of the Study Area may be able to achieve the above requirements, especially in portions of properties adjacent to the watercourse where it is expected clean water inputs will be available to supplement the hydroperiod where necessary.

8.6.4 Buffer Planting Recommendations

Buffer plantings will provide natural buffering functions (i.e., attenuation functions, protection from edge effects, noise, and light pollution) and allow natural successional processes to occur. The NHS buffer (and other restoration areas between the existing NHS boundary and the development limit) will serve to further protect features within NHS, increase the biodiversity of native flora and fauna, and provide breeding, rearing and foraging habitat for woodland species over the long term.

All buffer areas will be planted with native species with the exact targeted vegetation community to be determined as part of the site-specific application depending on the ultimate proposed Study Area conditions. This is further discussed below within **Section 8.6.6**. Native shrub and trees species within the NHS buffer should be selected to provide a diverse assemblage of plant species and include fast-growing and pioneer species more tolerant of harsher/variable growing conditions. A cover crop should be applied along with the native perennial seed mix to stabilize soils and to aid in the establishment of native vegetation. The exact cover crop selection depends on the timing of planting; therefore, a range of cover crop options should be explored during the site specific application.

Within the Greenbelt Plan Area 30 m setbacks, a banded planting plan approach is recommended to create additional diversity within the buffer planting zone. This is an approach that is recommended by Conservation Halton (CH) within their Guidelines for Landscaping and Rehabilitation Plans (2021). Specifically, three separate bands should be created, with Band 1 comprising the first 15 m extending from the retained feature edge, Band 2 comprising the next 7.5m in width, and Band 3 comprising the final 7.5m in width (i.e. adjacent to the development limit). Additional information on the planting prescriptions for each band are provided below:

- Plant Band 1 with 5 trees / 100m^2, 5 shrubs per tree, apply native groundcover seed mix with cover crop between the tree/shrub beds;
- Plant Band 2 with 3 trees / 100m^2, 5 shrubs per tree, apply native groundcover seed mix with cover crop between the tree/shrub beds; and
- Plant Band 3 only with native groundcover mix with cover crop.

Buffer plantings outside of the Greenbelt Plan Area will not be planted in a banded approach, rather, trees should be planted at a density of 10 trees per 100 m^2, with five shrubs planted per one tree. This planting strategy will create structural diversity and habitat variability within the buffer, including the creation of successional habitats.

Through the establishment of the vegetated buffer within the existing actively managed agricultural fields and golf courses, the proposed NHS for the Study Area will be further expanded in size and habitat functions creating a more resilient and sustainable community within a residential landscape.

8.6.5 Restoration Planting Approach

Species selection will consider specific moisture, soil and sun requirements. Some species (e.g., Ash, Elm) will not be selected due to pest and disease concerns that could impact their survivability. Native plant materials should be sourced from native plant nurseries and seed suppliers within 100 km of the Study Area, if possible, to reduce transplant shock. All plant materials will be obtained and installed in accordance with the Canadian Nursery Stock Standard. Native shrub and tree species will be selected to provide a diverse assemblage of plant species. Buffer plantings will include fast-growing and pioneer species more tolerant of harsher/variable growing conditions, while the floodplain and valley walls will contain a mixture of early and late successional species to mimic a naturally occurring vegetative community. Additionally, all locally uncommon and rare plant species will be assessed for their transplant potential and may be included within the native species selection at the detailed design stage in an effort to conserve the species on the landscape and maintain genetic diversity.

The type of planting stock is dependent on the species and their modes of reproduction, as well as practicality. The following plant stock will be considered within the NHS:

- Herbs (forbs, graminoids): seeds, plugs;
- Shrubs: 1-gallon pots, stem cuttings, rootstock cuttings; and
- Trees: seed, bareroot, ball and burlap, whips, potted seedlings.

Invasive Species Considerations

Invasive plants are those that can become (or presently are) a serious problem within a defined location. These plants reproduce and spread aggressively, reducing the local biodiversity and threatening ecological function. Depending on existing conditions, some invasive species can outcompete all other species. Urban Forest Associates (2002) provides a categorical ranking system for plants known to be invasive in southern Ontario.

Of the 142 exotic species observed on the Study Area, 14 are ranked as Category 1 by Urban Forest Associates. Category 1 plants are deemed to be the most invasive and can dominate a site indefinitely. These are a threat to natural areas wherever they occur because they have very effective reproduction and dispersal mechanisms and limit the growth and establishment of native species by out competing other vegetation for resources (light, nutrients, area).

The 14 Category 1 plants observed within the Study Area are:

- European Swallowwort (*Vincetoxicum rossicum*; also commonly referred to as Dog-strangling Vine) - present on Properties 5, 8, and 11;
- Canada Thistle (*Cirsium arvense*) – present on Properties 1, 2, 4, 5, 7, 8, and 11;
- European Black Alder (*Alnus glutinosa*) - present on Property 1;

- Showy Fly Honeysuckle (*Lonicera x bella*) – present on Properties 1, 2, 3, 4, 5, 7, 8, and 11;
- Garlic Mustard (*Alliaria petiolata*) – present on Properties 1, 2, 4, 7, 8, and 11;
- Dame's Rocket (*Hesperis matronalis*) – present on Properties 2, 8, and 11;
- Purple Loosestrife (*Lythrum salicaria*) – present on Properties 1, 2, 5, 6, 7, 8, and 11;
- European Buckthorn (*Rhamnus cathartica*) – present on Properties 1, 2, 4, 5, 6, 7, 8, and 11;
- Glossy Buckthorn (*Frangula alnus*) – present on Property 1;
- Manitoba Maple (*Acer negundo*) – present on Properties 1, 2, 3, 4, 5, 7, 8, and 11;
- European Reed (*Phragmites australis ssp. australis*) – present on Properties 1, 2, 5, and 11.
- Purple Crown-vetch (*Securigera varia*) – present on Properties 1 and 5;
- White Mulberry (*Morus alba*) – present on Properties 4, 5, and 8; and
- Curly-Leaved Pondweed (*Potamogeton crispus*) – present on Property 1.

Invasive species control is a critical factor in the successful establishment of new vegetation communities. The appropriate control measure for each species depends on the severity of the infestation, the cost and effort required to manage the species, and the time of year that the treatment can be applied. A review of BMPs to manage, and where applicable control, Category 1 invasive species should be reviewed at the site-specific stage. The Ontario Invasive Plant Council has BMPs which evaluates different management opportunities based on the size of the population with differing control techniques (e.g., mechanical, chemical). In some instances the best approach may be not to manage the existing population.

The presence of invasive species, their status within individual features, and potential management strategies, should be assessed as part of site specific studies. The information on these species and their management is changing rapidly through research, and therefore the most contemporary solutions should be brought forward at the time that designs and management plans are being prepared.

During the site specific design phase and closer to construction, detailed invasive species mapping should occur to better understand the extent of Category 1 invasive species within retained features that border created habitats. The rationale for completing this closer to construction is to accurately understand the extent of invasive colonization prior to site alteration and construction. Following the completion of the invasive species mapping, an invasive species management plan should be prepared. Additionally, site-specific applications should work to identify if in-planting is warranted dependent on the level of invasive species management required.

During grading/construction on-site, appropriate stockpile stabilization (including application of cover crop) is essential to ensure invasive species don't colonize created and retained habitats. There is potential that non-native and invasive species could colonize the created vegetation communities or invade into existing retained communities, therefore, a detailed monitoring plan is recommended to be prepared during the site specific stage. Additional details on monitoring requirements will be provided within the Phase 3 SWS.

Site Preparation

Currently, the lands where created features may be constructed are under active agricultural or golf course use. Soil testing, prior to planting, to determine the need for soil amendments for healthy plant growth is recommended. Ahead of planting, site preparation is key to ensure that soil moisture capacity and nutrient content are suitable for native plant growth. Native plants generally require low soil nitrogen content and nutrient supplementation is not expected (generally nutrient levels are high in recently farmed cash crop fields and golf course settings). The addition of targeted mycorrhizal inoculants to establish symbiotic relationship between a specific plant and mycorrhiza symbiont (I.e., *arbuscular mycorrhiza* and Maple (*Acer* ssp.) trees; *ectomycorrhizal* and Oak *(Quercus* spp.) trees*)* is generally helpful to facilitate native plant establishment (Chen et al 2016). Studies have also shown that mycorrhizal symbionts are expected to improve the host tree's adaptation to stressors associated with climate change such as high temperatures, drought, salinity and flooding (Usman et al. 2021).

Excessive application of soil amendments (i.e., fertilizers) could negatively impact the surrounding landscape as it will result in nutrient loading and could impact the NHS. In accordance with CH's *Guidelines for Landscaping and Rehabilitation Plans* (2021), should soil amendments be required, soil amendments will be sourced from sustainable practices (e.g., incorporating leaf mulch or compost that meets Category AA or A of the MECP Ontario Compost Standard Quality). The incorporation of peat moss is strongly discouraged and composted leaves used instead. Upland disturbed areas should have at least 20 cm of topsoil containing 5 to 15% organic matter (by dry weight) depending on the type of vegetation to be established, a total uncompacted soil depth of at least 30 cm and a soil pH of 6.0 to 8.0 per the TRCA's (2012a) *Preserving and Restoring Healthy Soil: Best Practices for Urban Construction*. Topsoil requirements will also follow CH's (2021) *Guidelines for Landscaping and Rehabilitation Plans*. Where soil has been compacted, a minimum of 45 cm of clean topsoil will be evenly distributed throughout the Study Area. Imported soil will be mixed with native soil to ensure soil micro-organisms are adapted to the Study Area.

Within tree pits (areas where trees will be planted), trees should have a topsoil layer of a minimum depth of 60 cm. The subsoil layer should be either tilled, scarified or excavated and replaced to a minimum depth of 30 cm. Incorporation of the upper layer into the sublayer should be included to avoid stratified layers where possible. This will produce a total of 90 cm of uncompacted soil, per the TRCA (2012a).

The planting approach should be specifically designed to fit site-specific conditions.

8.7 Fauna Considerations

8.7.1 Specialized Wildlife Habitat Structures and Enhancements

The inclusion of habitat design elements will create complementary habitat types within restoration areas that will enhance the complexity and diversity of habitat conditions to encourage the movement of fauna across the Study Area. In addition to improving habitat quality to support various species at different life stages, these types of enhancements and structures can be used as a mitigation tool to provide immediate access to habitats while other habitats are being established or may have longer

establishment periods (e.g., creation of bat habitat through rocket boxes to counteract the removal of bat snags).

Examples of wildlife habitat structures and enhancements that should be explored during the site-specific stage are discussed below. Aquatic enhancements are further discussed below within **Section 8.8**. It is acknowledged that incorporation of habitat structures and enhancements may not be necessary based on the availability and quality of habitats currently present within the property (or immediately adjacent to) that will be retained. The below noted list is not comprehensive, additional structures and enhancements may be explored during site specific applications.

Amphibian

Four amphibian species were recorded within wetland and ponded habitats throughout the Study Area. Site-specific applications should explore the creation or enhancement of amphibian breeding and overwintering habitat. For example certain types of amphibians will overwinter within terrestrial habitats (forested areas with leaf cover or under logs), while other amphibians will overwinter within deep ponds below the frost line. Some specific information for common amphibian species is provided below.

Northern Green Frog overwinter within aquatic habitats, therefore permanent pools that reach at least 1 m in depth must be present that do not fully freeze during the winter months. Mucky substrates within the bottom of the pools must be present to allow for burrowing opportunities. These permanent pools will also support these species' breeding requirements.

Northern Green Frog breeds in permanent bodies of water with an approximate depth of 1 m and minimum size of 0.25 ha, lake or pond shores, stream banks, edges of shallow permanent or semi-permanent fresh water. The species breeds from late spring to as late as August; tadpoles overwinter before transforming the following summer. In the summer Northern Green Frog occupy moist woodlands near water and riparian areas; and overwinter (both adults and tadpoles) in the breeding pond or another pond. Northern Green Frog have a home range size of 200 m^2.

American Toad, and Gray Treefrog overwinter within terrestrial habitats under leaf litter, logs, loose bark, as well as burrow into the soil below the frost line. The banks and upland portions of the NHS corridors should be designed to support overwintering opportunities for these amphibian species. Semi-permanent pools are needed for breeding habitat.

American Toad breed in ephemeral or permanent pools in woodlands, marshes, ditches, open ponds, man-made ponds, tire ruts, and pools in agricultural and urban areas. Tadpole transformation is generally complete by August. In the summer, American Toads inhabit woodlands, grassland areas and residential yards/gardens. This species hibernates terrestrially, burrowing into soil below frost line.

Gray Tree Frog breed in ephemeral or permanent pools associated with woodlands, but are also found in marshes, ponds, and other pooled water sources near their summer woodland habitats. Tadpole transformation is generally complete by August. In the summer they occupy upland areas within forested or thicket habitats and can generally be found within the tree tops, knot holes loose bark and in decaying logs. The species overwinters terrestrially within logs, tree roots or under leaf litter.

Wood Frog breed in ephemeral or permanent pools typically associated with woodlands or in proximity to wooded features, with tadpole transformation generally complete by mid July. In the summer they occupy moist woodland habitats with leaf litter, logs or hummocks. The species typically overwinters terrestrially within logs, tree roots or under leaf litter.

The created riparian wetlands should generally be designed with shallow slopes (4:1 to 8:1) to enable amphibians to move between the replicated wetlands and surrounding habitat (i.e., riparian and upland transitional areas). These shallow slopes provide a wide littoral zone to support emergent, meadow marsh and shrub vegetation. This vegetation provides egg attachment sites (e.g., emergent vegetation, branches), foraging habitat for insects (food source), shelter from predators, and overwintering habitat for some species. Deciduous trees and shrubs are recommended to provide partial shade and leaf litter that will serve to regulate wetland temperature and provide shelter sites and potential terrestrial overwintering habitat. Woody roots that interact with the littoral wetland zone can also serve as refugia and egg attachment sites.

Turtles

Both Snapping Turtle and Midland Painted Turtle were documented within the Study Area, with nesting documented within the Property 1 sand pits and basking documented within the anthropogenic ponds. Snapping Turtle was also incidentally recorded within the watercourse corridor along Property 8. Opportunities to create turtle nesting and overwintering habitat should be explored within the NHS. Specifically, overwintering habitat creation could be explored within the realigned channel corridor on Property 1.

Snapping Turtles are known to travel annually up to 3.9 km to return to overwintering sites (Brown and Brooks, 1994). Midland Painted Turtles have a home range size of 1.2 ha and have been recorded travelling approximately 70 m per day on average (Rowe, 2003). Once suitable habitat is created within the realigned watercourse corridors, these two turtle populations could potentially re-colonize the NHS.

Turtles remain in their overwintering ponds for a short period to bask and raise their body temperature (ECCC, 2016; Ernst & Lovich, 2009), they then move to foraging habitat. Scattered basking sites (e.g., large woody debris, larger boulders) will be placed near overwintering habitats to provide basking opportunities following the overwintering period.

The turtle overwintering pond requires a depth of at least 1 m to ensure the feature does not freeze through during the winter months. These ponds can be designed to support both turtle and amphibian overwintering requirements. Snapping Turtles and Midland Painted Turtles are able to overwinter in hypoxic to anoxic conditions under water (Rollinson et al., 2008; Ultsch, 2006); however, this condition cannot be tolerated for too long. Overwintering ponds should include a layer of soft, muddy substrate to bury into (ECCC, 2016; Ernst & Lovich, 2009; Ultsch, 2006), and water depth and substrate depth should vary within the pond to provide turtles a variety of overwintering microhabitat options. A mix of emergent and submergent vegetation should be included to provide cover, as well as placing logs to provide suitable basking features. The basking logs should extend from the littoral zone into the emergent/open aquatic zone. Gentle slopes are essential to allow turtles and amphibians to easily

enter and exit the pond (i.e. 5:1 to 8:1 grading). These parameters should be built into the realigned channel corridor designs.

Though turtle species can travel large distances to find suitable nesting habitat (Obbard and Brooks 1987), this is likely due to suitable nesting habitat being a limiting feature on a landscape (Paterson et al. 2013; Toronto Zoo n.d. a). Given the limited nature of high-quality nesting opportunities within the Study Area, artificial turtle nesting areas should be created within the NHS corridors. Nesting areas should be placed in close proximity to the proposed and existing overwintering ponds, while ensuring the nesting beaches will not be flooded. Artificial nesting areas should be composed of gravel and sand mixture that replicates natural turtle nesting habitat. Different depths of gravel and sand substrate are created along the length of the beach to create variations in temperature and moisture. Turtle nesting areas should be placed along a south-facing slope to receive optimal sun exposure to facilitate nest incubation (Toronto Zoo, n.d.; Buhlmann & Osborn, 2011). Turtle nesting areas should be placed above the 5-year floodline and will be situated within a mix of meadow and thicket habitat. The surrounding meadow and thicket habitats will provide vegetative cover for hatchlings for protective cover from predation and the elements (Buhlmann & Osborn, 2011; Toronto Zoo n.d. a).

Snakes

One species of snake, the Eastern Gartersnake was recorded within the Study Area.

Eastern Gartersnakes are known habitat generalist and are found within a wide variety of natural and anthropogenic habitat types (Ontario Nature 2025) across their range. This species requires two main habitats to be successful within a landscape, a suitable hibernacula (i.e., a feature that allows access below the frostline for overwintering) and a food source (i.e., available prey like habitats supporting breeding amphibians or habitats supporting fish or small mammals within the NHS; Most 2013). Otherwise, aspects to assist with the thermoregulation needs of each year (e.g., ice-off conditions, spring temperatures, amount of rain) are also important to consider, these include aspects of habitat diversity with suitable basking options, topographical variances, and shade/cover opportunities.

Natural snake hibernacula consist of crevices, tree root systems and old stone foundations reaching down below the frost line (Ernst & Ernst 2003). These features can be artificially recreated easily with cinderblocks, pipes, concrete slabs and logs. The addition of snake hibernacula within the NHS may be warranted to enhance and increase the availability of overwintering habitat on the landscape. The creation of these habitat features in close proximity to summer foraging habitat (i.e., meadow, wetland and woodland edges where food sources are likely to be) may allow snakes to concentrate home ranges and activity centers around the NHS corridors, potentially reducing travel and the risk of road crossings.

Hibernacula suitable for local species may be constructed based on currently available designs and, where possible, example structures with demonstrated success. Generally, the design includes include excavation below the frost-line but above the waterline (i.e., a 3 m depth is ideal but may vary based on site-specific conditions) and the layering of suitable materials (e.g., rocks, logs, cinderblocks, concrete, root wads, pea gravel, sand) that provide space for snakes to access interstitial spaces for overwintering. PVC pipes with holes drilled in the sides may be installed throughout the hibernaculum at various vertical heights to promote access. Where drainage is a concern, apply pea gravel and sand

to the bottom of the feature, install a French Drain or create a lip created around the "uphill" portion or the feature (at grade) to divert surface runoff flows around rather than into the hibernaculum. It is recommended that exposed stones and the entrance to the hibernaculum are situated along a south facing slope, with grass covering north facing areas to insulate the hibernaculum.

Shrubs and groundcover should be planted to the north/northeast/northwest of the hibernacula. Only groundcover should be planted along the southern exposure, where tree and shrub plantings should be located at least 10 m from the hibernacula to support thermoregulation requirements.

Ideally hibernacula should be situated below the frost line and just above the water table to ensure the feature doesn't flood and ensures adequate moisture conditions to foster successful overwintering conditions. Multiple hibernacula should be placed in the landscape to create variation and redundancy in overwintering habitat.

Pollinator Habitat

Six pollinator species were documented within the Study Area, including Monarch. Monarch breeding was documented within Properties 1, 4, 5, and 9. Some of the cultural meadow, meadow-marsh, and mineral meadow-marsh communities where Monarch have been identified are proposed for removal.

Monarchs have one genus of host plant (Milkweeds). Monarchs typically arrive in Ontario in late May and breed until the end of September before migrating south to their roosting grounds. A range of spring, summer and fall blooming plant species will be targeted to provide nectar sources throughout the breeding season.

Replacement pollinator habitat should be included within the NHS Corridors. Specifically, the VPZs would be an idealized habitat since they are long continuous areas that could be planted with a variety of nectaring species. Native groundcover seed mixes applied within the NHS should include Milkweed species and other nectaring plants to help support Monarch and local generalist pollinator insects. Selected seed mixes should provide pollinator breeding and foraging opportunities for Monarch through the targeted inclusion of nectaring species that flower from mid-spring to mid-fall.

Birds

Sixty-eight avian species were identified within the Study Area, including 2 SAR: Bobolink and Eastern Meadowlark. Each of these bird species use a variety of habitat types including woodlands, wetlands, grasslands, shrublands, etc., as well as man-made structures.

Several snags (standing-dead or declining trees) were identified within the woodland communities found within the Study Area. Snags can support various wildlife species, including cavity-nesting birds, birds that feed on insects in the decaying tree, and bats (i.e., roosting and/or overwintering opportunities).

Installation of large snags (at least 10 DBH, approximately 12 feet in height or greater) will occur within the NHS to create perching habitat for raptors and other birds. These snags can be salvaged from the

existing woodlot that is proposed for removal (e.g., dead Ash trees). The tree should be largely de-limbed to create natural perches. Snags should be located a minimum of 10 m away from each other.

Bobolink and Eastern Meadowlark are grassland bird species that can be found in various grassland habitats including wet prairie, graminoid peatlands, fallow agricultural fields, however, a suitable thatch layer must be present in order to support nesting. Bobolink and Eastern Meadowlark are also sensitive to habitat size, with their reproductive success reportedly lower in smaller habitats in comparison to larger habitats (COSEWIC 2010). Habitat creation for these types of species is likely not achievable within the Study Area; however, larger grassland habitat is present within the non-participating lands that could be enhanced or expanded to create additional habitats.

Bats

Six species of bat were identified within the Study Area, including two bats currently listed as SAR, the Eastern Small-footed Myotis and the Little Brown Myotis. Three additional species of bat, the Eastern Red Bat, the Hoary Bat, and the Silver-haired Bat have been recently uplisted, but do not yet receive protections.

Suitable bat roosting habitat (snags) were identified throughout the Study Area. To compensate for the removal of these habitat features, rocket boxes should be installed to provide immediate replacement of the habitat. Rocket boxes should be placed in a location where it will receive at least 6-8 hours of direct sunlight, ideally within a south facing location to receive the solar exposure in the morning. The rocket boxes should be placed away from possible roadways, where feasible, and placed at least 6 m away from the nearest tree branch, wires or other potential predator perches. Rocket boxes should be installed on a pole that is between 15’ and 20’ tall (or approximately 4.5 to 6.0 m tall). Finally, in an effort to reduce the potential for predation, each pole should be wrapped in 3’ metal sheets.

Tree plantings within the Study Area will provide long-term habitat replacement for removed snags. Species that provide good cavity habitat include White Pine (*Pinus strobus*), Maple (*Acer* sp.), Aspen (*Populus sp*.) and Oak (*Quercus* sp.).

General Wildlife

Additional habitat for small and medium sized wildlife (e.g., mammals, snakes, etc.) should be explored throughout the NHS to provide additional refuge and rest areas. These additional habitats can be created by installing brush and rock piles.

Woody limbs will be tightly woven together to form brush piles and should be located throughout the NHS. Brush piles will be spaced approximately 60 m apart and separated from nodal shrub plantings to provide refuge areas for smaller wildlife species. These brush piles are intended to provide additional habitat diversity within the NHS. Brush piles provide wildlife with habitat for resting, feeding, escaping predators, sheltering from weather and rearing young. Native vines (e.g., Riverbank Grape (*Vitis riparia)* and Hispid Greenbrier (*Smilax tamnoides)*) could be planted along the edge of the brush piles. The vines would continue to grow as the brush piles decompose to form a “living brush pile.” Ultimately, the vines will replace the original structure (U.S. Army Corps of Engineers, 1986).

Rock piles provide a stable thermal source that attracts ectothermic species. Rocks should be cleaned and sized from 5 cm in diameter to 60 cm with some jagged edges. Jagged edges are used by molting reptiles and provide secure footing for small mammals. Rock piles should be partially buried to promote a variety of interstitial spaces.

Both rock and brush piles should be installed in the upland areas and/or side slopes and avoid areas seasonally inundated with water. The structures should be spaced irregularly a minimum of 50 m apart and separated from nodal shrub plantings to provide refuge areas for smaller wildlife species.

8.7.2 Enhanced Wildlife Crossings

Enhanced wildlife crossings are important for several reasons including wildlife safety, biodiversity preservation, habitat connectivity and human safety. Roads can often act as barriers that separate wildlife populations and habitats, causing them to take the risk of crossing roads. This can lead to fatal accidents, both for humans and animals. By providing enhanced wildlife crossings, also referred to as ecopassages, this will help reduce wildlife-vehicle interactions by providing safe routes for wildlife to move throughout the landscape. By incorporating enhanced wildlife crossings within the Structure Plan they will support vital connections within the NHS.

Two collector road crossings of the Proposed NHS are envisioned: (1) within Property 9 across WHT4(3)2-1b and (2) within Property 4 across WHT4(3)4-2. Crossing 1 is located within occupied Redside Dace habitat and within a main tributary of the West Humber River, while Crossing 2 is located within contributing Redside Dace habitat and local landscape linkages.

Any additional watercourse crossings identified during the site-specific application should consider the below crossing recommendations to minimize impacts to the overall form and function of the Proposed NHS.

The below recommendations should be explored at site-specific applications in order to ensure that all crossings also act as enhanced wildlife crossings:

- The terrestrial and aquatic objectives highlighted on TRCA's Crossing Guidelines for Valley and Stream Corridors (TRCA, 2015) should inform the crossing location, alignment, and design during the planning phase:
    - "Terrestrial Objectives
        - Avoid sitting infrastructure in locations of existing forests, wetlands, seepage areas, and other sensitive habitats.
        - Minimize footprint impacts of crossings on important terrestrial features and their ecological functions through site selection and design.
        - Maintain terrestrial habitat and wildlife connectivity functions by avoiding the priority areas for habitat and wildlife connectivity or by siting and designing crossings to structurally connect habitat patches and to permit wildlife movement.

- Aquatic Objectives
  - Avoid sensitive aquatic habitat features (e.g., critical spawning areas, important feeding, or refuge areas for sensitive/locally rare/indicator species).
  - Avoid channel realignment, hardening, or other modifications.
  - Minimize footprint impacts of crossings on important aquatic features and their ecological functions (e.g., groundwater upwellings and discharge areas, maintaining natural sediment transport) through site selection and design.
  - Maintain aquatic habitat and fish passage functions by avoiding the priority areas or by siting and designing crossings to permit fish passage
- Further, minimizing the total number of infrastructure crossings of valleys is important to minimize cumulative impacts, and proponents are encouraged to co-locate infrastructure (including roads, rails, trails, water mains, pipelines, and other utilities etc.) wherever possible.

- When crossing over a NHS is deemed unavoidable, the infrastructure should be designed minimizing potential impacts to fish and wildlife and incorporating wildlife crossing systems. Key design considerations relate to the need to separate sensitive wildlife from human trail systems, targeting of appropriate wildlife species for safe passage (i.e., large/small mammal, amphibian, and reptile species), and design considerations to encourage use of passages by target species to avoid their exposure to the busy road network.
- In general, there are three broad crossing design options, which should be chosen according to the habitat sensitivity and connectivity function priorities:
  - In deep valleys, large spanning structures are recommended, to allow for safe passage of larger terrestrial species. This will also provide a minimum footprint disturbance in the habitat.
  - In shallow valleys, where large spanning structures are not feasible, open bottom culverts with dry passage along both watercourse banks are preferred.
  - Structures such as closed bottom culverts may be acceptable where existing and future terrestrial and aquatic ecological functionality are expected to be low and crossing design is driven by natural hazard and/or other considerations.
    - Additional openings for dedicated dry passages should be provided if the only crossing at the watercourse is inaccessible to wildlife. The recommended number of crossings and spacing between the additional openings should be based on the movement capacity of the most restrictive wildlife.
- CVC's Fish and Wildlife Crossing Guidelines (CVC, 2017) provide information regarding specific design elements needed for each target wildlife group (e.g., large mammals, mid-sized mammals, small mammals, amphibians and reptiles, and fish). This Guideline should be referenced to inform specific design elements that should be incorporated into each crossing, such as structure openness ratio, dimensions, substrate, lighting condition, moisture condition, etc.

- Best management practices that minimize wildlife-vehicular interactions and promote fish and wildlife passage should be considered at the site planning stage. This includes the use of exclusion fences (which could be temporary or permanent, depending on the specific Study Area needs), traffic calming measures, downcast lighting, and timing road construction and maintenance activities to avoid sensitive timing windows for wildlife.

8.7.3 Exclusionary Fencing

Wildlife exclusionary fencing functions by preventing animals from accessing roadways and is another tool to reduce the risk of wildlife-vehicle interactions. Exclusionary fencing is strategically placed between roads and the NHS to guide animals away from the roadway and direct them towards enhanced wildlife crossings. Specifically, exclusion fencing should be installed prior to working in or around natural areas, to prevent wildlife from entering work zones. If wildlife does enter a work zone it should be carefully relocated prior to commencing work. Permits will be required for relocation of aquatic species.

Wildlife exclusionary fencing will be installed along the extent of the NHS. The permanent wildlife exclusionary fencing solution will help to mitigate against wildlife-human interactions. It will also discourage disturbance and dumping within the NHS. Specifically, GEI has experience with the use of ERTEC fencing and it is a fencing solution that is used by a variety of other partners including municipalities (City of Kingston and Region of Waterloo), Ministry of Transportation Ontario, Environmental Non-Government Organizations and private landowners. ERTEC exclusionary fencing details are provided below. If other wildlife exclusionary fencing manufacturers are recommended at the site-specific stage, they should be reviewed by an Ecologist.

ERTEC has designed their E-Fencing solutions with anti-climb configurations, which have been demonstrated to work with a variety of species including Gray Ratsnake (*Pantherophis spiloides)* and Snapping Turtle, which are two robust species within Southern Ontario. Their “Smooth Rigid Polymer Matrix” material is designed to not separate, stretch of entrap animals, which will ensure safer wildlife interactions with the fencing material and reduce maintenance as the material has been designed to last longer (up to 10 years). Several accessories are available for the E-Fence, including the one-way escape funnels and climber barrier options. While the escape funnels are not recommended for the Study Area, climber options are recommended as they will interrupt species from navigating over the fencing outside of the natural areas.

E-Fencing installation is similar to that of other wildlife exclusionary fencing and/or silt fencing, where a portion of the fencing is installed into the ground via trenching and securing with poles. A no-trench ground seal option is available, however, GEI does not recommend use of this option for this planning application. The E-Fencing is available in different heights to accommodate various wildlife. These eights have been determined based on various vase studies. A conservative height constraint will be selected to ensure that all species that could interact with the wildlife fencing will be protected. The wildlife fencing should have a return/curve away from the road located beyond the natural heritage feature. Vegetation, fallen branches and debris should be removed adjacent to the fence or wildlife could use it as a ladder to climb over. Fencing should be placed far enough from the road to minimize

damage from snow removal, road maintenance activities and vehicular encroachment. Fencing will therefore be placed along the limits of the entire Proposed NHS.

8.8 Aquatic Considerations

8.8.1 WHT4(3)5-2 Channel Realignment

One medium constraint watercourse (Reach WHT4(3)5-2) within the Study Area will be realigned to aid in restoring the watercourse along a natural trajectory. Reach WHT4(3)5-2 has historically been significantly altered to support golf course activities, including the creation of three large online ponds. The removal of these three larger ponds and the realignment of this watercourse is recommended to improve the overall aquatic health of the system.

The watercourse will be realigned along the western property limit of Property 1 and will connect into the existing Greenbelt Plan Area. The inlet connection location was reviewed to determine what the best realignment strategy was. Specifically, two inlet locations were reviewed:

1. Begin realignment at Old School Road: this was determined not to be a feasible location given that WHT4(3)5-2 enters the Study Area through a non-participating property, then flows through Property 1 for approximately 150 m, before flowing through another non-participating property. This represented potential concerns with respect to phasing and timing since non-participating landowners would need to be supportive of realignment.

2. Begin realignment south of the northwestern non-participating property: this was determined to be the best location to collect flows as it is located downstream of the non-participating properties and will ensure channel realignment can be completed without encroaching on non-participating properties.

Once the inlet location was determined, it was recommended that the alignment continue down the western property boundary in order to reduce the number of local road watercourse crossings. Specifically, if the watercourse corridor had been aligned through the centre of Property 1 there would need to be a minimum of one east-west crossing across the watercourse in order to access the lands on the western side of the corridor. If the corridor was aligned along the western property limit, then no development would be required on the adjacent (western) lands requiring access. The alignment then continues south towards the Greenbelt Plan Area before shifting east towards the connection with WHT4(3)5-1. This outlet location is the confluence between the lower pond (Pond 1) and WHT4(3)5-1, and also coincides with the Greenbelt Plan Area boundary.

Preliminary modelling was completed by GEI's Water Resources team, who are assisting with the site-specific application for Property 1, to determine a preliminary watercourse corridor width to support the SWS. The approximately 1 km long, preliminary watercourse corridor was designed and will include a natural pool-riffle morphology. As previously noted, an average 45 m wide realigned watercourse corridor has been assumed as part of the Phase 2 report, but will be further refined during the site-specific stage during more detailed modelling. Additional details regarding the corridor dimensions are provided within **Appendix C**.

The following design parameters should be considered during the site-specific application:

- The proposed realignment should match the existing invert elevations upstream and downstream of the realignment to maintain smooth transition between the proposed and existing channel. The invert elevations also dictate the overall slope of the realigned channel, thus, the channel should be designed to maintain the existing channel slope to the extent possible for hydraulic and hydrogeological purposes (i.e., to maintain existing surface water/groundwater interactions).
- A transition from the existing channel and the upstream extent of the realignment may require a wider and deeper channel valley to convey flood flows from the existing wide floodplain to the narrower proposed valley.
- The realigned channel must be designed to convey regional storm flows and accommodate the meander belt width. This may result in an additional valley base width, which would achieve an overall net gain in the NHS and minimize flood depths.
- The valley embankments should be designed with stable side slopes.
- The low flow (bankfull) channel configurations should be based on the 1:1.5-year return period event conveyance, based on post-development conditions, as well as channel planform for channel stability.
- A 10 m setback from the constructed top of channel embankment should be applied to both sides of the realigned channel.
- The realignment provides an opportunity to replace the existing morphologically-limited channel with a naturalized shallow and deep undulating typology, with cross sectional dimensions closer to that of a naturalized watercourse conveying similar flows. A naturalized watercourse will offer significant improvements to channel form and function, per unit length, over degraded channels impacted by past golf course management.
- To maintain and enhance detention and retention functions with regards to both flow and sediment, the design will provide good communication with the floodplain as well as diversity in channel and floodplain morphology. Floodplain enhancement features in the form of offline wetlands should be explored within the channel corridor, as these enhancements provide aquatic and terrestrial habitat. They also provide functional benefits by storing and discharging water over long attenuated periods.
- The proposed realignment and naturalization will provide opportunities for improved riparian conditions and a well-developed bankfull channel with morphological variability. Improvement in morphology and function will provide additional benefits to sediment balance, floodplain storage, vegetation communities and terrestrial habitat features, edge impacts and restoration requirements, water balance, fish passage and water quality. In its existing form, WHT4(3)5-2 is a degraded feature heavily impacted by historic damming and alteration associated with the golf course management. The proposed channel design will provide an overall improvement to existing conditions.

The realignment of this corridor will provide substantial ecological benefits from an aquatic and terrestrial perspective. While the golf course ponds provide habitat for numerous species, they are anthropogenically created, are poorly connected to the overall system (i.e., barriers were identified), have limited native riparian vegetation and contribute thermal loading to downstream sensitive aquatic habitats. The re-naturalization of this corridor will lead to a more resilient, connected and responsibly designed NHS.

8.8.2 WHT4(3)4-3 Daylighting and Farm Crossing Removal

As discussed within the Phase 1 Report, WHT4(3)4-3 is identified as a low constraint watercourse since the feature has been anthropogenically influenced. Specifically, WHT4(3)4-3 is a piped watercourse feature that conveys flows from the agricultural lands north of Old School Road south into WHT4(3)4-2 and WHT4(3)4-1. WHT4(3)4-3 is located partially within a non-participating property and within Property 4. Evidence of the piping of this feature was noted from Old School Road and at its outlet location on Property 4. Since a portion of this piped feature is located within a non-participating property, daylighting of this feature is not possible. If the non-participating property considers development in the future, it is recommended that this watercourse be daylighted.

Daylighting a watercourse is where the buried pipe would be removed and restored to a natural open watercourse corridor. There are several benefits to daylighting a watercourse including:

- Enhanced biodiversity: by exposing the watercourse to the surface allows for plants and animals to interact with the watercourse. This will lead to a healthier and more connected system. The existing piped feature would also act as a barrier to movement. Allochthonous material: vegetation would be able to establish within the new watercourse corridor that would be able to contribute allochthonous material (including carbon contributions) to downstream fisheries habitats. The contribution of allochthonous material is an important component of a healthy aquatic community and would provide valued contributing benefits.
- Contribution of coarse sediment supply: flows would be able to interact with native substrates, which through natural channel processes would be able to convey coarse sediment supply to downstream (receiving) habitats, which is another component of a healthy aquatic community.
- Increased interaction with natural vegetation and native soils: the interaction with natural vegetation and native soils would help improve the water quality and provide flood attenuation opportunities. A natural watercourse in comparison to the piped feature would allow for dispersal of flows and would help reduce the risk of flash flooding (and thus erosion concerns) to downstream habitats.
- Groundwater Recharge and Baseflow Support: By reconnecting surface and groundwater systems, daylighting helps sustain baseflows during dry periods, making watercourses more resilient to droughts and long-term hydrological changes

- Climate change resilience: Open watercourses enhance the environmental resilience to climate change by reintroducing ecological functions that are often lost in engineered systems. Daylighting buried watercourses and integrating green infrastructure provides climate resilience benefits such as temperature regulation and urban heat mitigation, as open waterways help regulate local microclimates by cooling surrounding areas through evapotranspiration and shading from riparian vegetation, assisting in the mitigation of urban heat island effects.
- Similarly, natural watercourses provide improved flood management which can be advantageous as a response to an increase in extreme weather events; benefits could include reduction of runoff or overflow into adjacent stormwater or wastewater systems.

The watercourse should be designed using natural channel design principles with a low-flow channel sized to match flows at the upstream extent of WHT4(3)4-2 to prevent erosion.

Additionally, if the watercourse is daylighted then the existing farm crossing should be removed. This watercourse crossing is proposed to be superseded as a result of Crossing #2. It is recommended that the daylighting of this watercourse and decommissioning of the farm crossing occur concurrently; however, if not feasible then removal of the crossing is recommended with its footprint stored using native plant material.

8.8.3 Culvert Removal & Stream Restoration

Large-scale stream restoration activities, besides those noted above, are not recommended as the majority of the medium and high constraint watercourses identified within the Study Area are stable and in good aquatic health. Additionally, large-scale restoration activities within Redside Dace habitat would require extensive federal and provincial permitting. While large-scale stream restoration is not recommended, a few specific recommendations are provided below for potential and confirmed in-stream barriers.

A large, degraded culvert was identified in associated with providing flow for the driveway crossing at Property 8 across WHT4(3)3-1. While this feature is located within the protected Greenbelt Plan Area NHS and regulated Redside Dace habitat, this area has been identified as a potential opportunity for stream restoration and enhancement through the removal of this degraded barrier. The removal of this barrier would provide more continuous connectivity within the watercourse during various storm events and under various hydrologic regimes (i.e., under lower flow conditions during summer months). Further investigations into the feasibility of this enhancement should be explored during site-specific investigations. However, in general, restoration should apply natural channel design principles with specific focus on vegetating the riparian areas with a mixture of native cover, restoring the stream bed to native substrates (if not present below the existing culvert) and ensuring connectivity between the previously disturbed areas.

Since the entirety of the Study Area has not been surveyed for potential barriers, it is recommended that any in-stream barriers identified on non-participating properties should be removed to provide additional benefits to the overall NHS. There are several benefits to removing in-stream barriers (e.g., perched or blocked culverts), including:

- Improved fish and wildlife passage: in-stream barriers for fish and other aquatic or semi-aquatic species can limit movement within a system and impact the overall connectivity. By removing the barrier, it will allow for increased connectivity (e.g., increase the occupation of habitats by fish that were previously unnavigable), increase the overall health of the aquatic ecosystem and increase vegetative and morphological diversity.
- Increased habitat: the removal of a barrier will result in additional habitable areas for aquatic and terrestrial species. Specifically, native vegetation would be able to establish within the riparian zone, native stream beds would be able to support various life processes and provide various biophysical benefits.
- Restore flows: if barriers are impeding or reducing the amount of water that can pass through a culvert during storm events, this can impact the overall hydrology of the system. By removing the barrier, it will allow for a natural flow of water and other materials (e.g., allochthonous material) to downstream habitats. It will also help aid in restoring natural erosion and depositional elements into the natural channel.
- Increased stability: by removing the barrier it can also help reduce the risk of large storm events blowing out blocked culverts, which could negatively impact the downstream aquatic habitats (e.g., increased erosion, increased sediment transport).
- Improved water quality: standing pools of water can have poorer circulation and overall lower water quality in comparison to flowing waters.

9. Policy Review

One of the goals of the SWS is to address the proposed land use changes in the context of applicable planning policies and to clearly identify how requirements are met or exceeded. The following is a summary linking the conclusions of the above impact assessment and proposed restoration strategy to achieve conformity with federal, provincial, and municipal legislation.

9.1 Provincial Planning Statement, 2024

The *Provincial Planning Statement* (PPS; MMAH, 2024) is the guiding document providing policy direction on matters of provincial interest related to land use and development. Section 3(5) of the *Planning Act, 1990* requires that all decisions that affect planning matters be consistent with the PPS, which is issued under the Act.

The following PPS features were identified and considered as part of this SWS:

- Significant Woodlands (**Section 7.2.1.1**),
- Significant Wetlands (**Section 7.2.1.2**),
- Significant Valleylands (**Section 7.2.1.2**),
- SWH (**Section 7.2.1.4**),
- Habitat for Threatened and Endangered Species (**Section 7.2.1.5**), and,
- Direct and Indirect Fish Habitat (**Section 7.2.1.6**).

Provided that the recommended mitigation measures are implemented, and that compensation is achieved, no negative impacts to these features are anticipated. The proposed NHS in this Phase 2 SWS is anticipated to meet the intent of the policies of the PPS.

9.2 Greenbelt Plan, 2017

The Greenbelt Plan (2017, approved under the *Greenbelt Act*, 2005) works to permanently protect environmentally sensitive areas due to their ecological value within the Golden Horseshoe. It is intended to enhance the natural landscapes by working to facilitate the connection of environmentally significant areas and reduce fragmentation of the landscape. Protection is offered also to permanent agricultural areas ensuring the permanency and sustainability of natural resources.

The Greenbelt “Natural Heritage System” protects natural heritage, hydrologic and/or landform features, key hydrologic areas (KHAs), key hydrologic features (KHFs) and key natural heritage features (KNHFs) that contribute to conserving Ontario’s biodiversity and the ecological integrity of the Greenbelt itself. As described within Section 3.2 of the Greenbelt Plan (2017), the Protected Countryside contains a Natural System composed of a Natural Heritage System and a Water Resource System.

The northeastern, southeastern, central, and southwestern portions of the Study Area are identified within the Greenbelt Plan Area and are included in both the "Natural Heritage System" and "Protected Countryside" designations (Schedule 1 'Greenbelt Area' and Schedule 4 'Natural Heritage System'). KHAs include the following:

- Significant groundwater recharge areas (SGRAs);
- Highly Vulnerable Aquifers (HVAs); and
- Significant surface water contribution areas.

KHFs include the following:

- Permanent and intermittent streams;
- Lakes (and their littoral zones);
- Seepage areas and springs; and
- Wetlands.

KNHFs include the following:

- Habitat of Endangered and Threatened species;
- Fish habitat;
- Wetlands;
- Life science ANSIs;
- Significant valleylands;
- Significant woodlands;
- SWH (including habitat of special concern species);
- Sand barrens, savannahs and tallgrass prairies; and
- Alvars.

As described within Section 3.2.2 of the Greenbelt Plan (2017), new developments and/or site alterations must show that there are no negative impacts on the key natural heritage features or key hydrologic features or their functions.

Additionally, as per Section 3.2.5.1, development or site alteration is not permitted in KHFs and KNHFs within the NHS or their associated VPZs except for the following:

a.) Forest, fish and wildlife management;
b.) Conservation and flood/erosion control projects if they are demonstrated to be necessary in the public interest and all alternatives have been considered; and,
c.) Infrastructure, aggregate, recreation, shoreline and existing uses subject to Section 4.

Section 4 provides policy direction on general uses within the Protected Countryside, including the process for delivery expanded or new infrastructure (Section 4.2). As noted in this Phase 2 Report, infrastructure (such as collector roads) are subject to the Environmental Assessment process. An EA should consider minimizing the amount of NHS traversed/occupied by infrastructure, minimize impacts, and avoid KNHFs and KHFs unless it is established that there are no reasonable alternatives.

The full list of EA considerations are detailed in Section 4.2.2, and should be reviewed as part of the collector road MCEA.

Section 4.2.3, which speaks to SWM policies, prohibits SWM systems within KNHFs, KHFs and their associated VPZs. This is in alignment with the assumptions made in Section 7 noting that site alteration and development are not expected to occur within key features or their VPZs.

Ultimately, all KHAs, KHFs, and KNHFs within the Greenbelt Area and Protected Countryside will be retained, and the Greenbelt Plan Area NHS will receive a minimum 30 m VPS that will be revegetated with native species. As such, no impacts are anticipated to these features.

9.3 Region of Peel Official Plan, 2022

The *Region of Peel Official Plan* (RPOP; 2022) outlines policies to guide growth and development in the Region. In the RPOP, it defines a Regional Greenlands System that is based on natural heritage features and areas and the linkages among them. The Greenlands System is comprised of Core Areas, Natural Areas and Corridor (NACs), and Potential Natural Areas and Corridors (PNACs).

Based on the RPOP definitions, features that would be considered Core Areas within the Study Area include:

- PSWs (associated with all wetlands in the Greenbelt Plan Area);
- Significant woodlands (associated with all woodlands in the Greenbelt Plan Area); and
- Valley and Stream Corridors (associated with all medium and high constraint watercourses).

Natural Areas and Corridors (NACs) within the Study Area include:

- Non-significant wetlands (all wetlands outside of the Greenbelt Plan Area);
- Non-significant woodlands (FOD5-4 woodland and two CUP3-14 plantations);
- SWH (candidate and confirmed);
- Fish habitat (direct and indirect);
- Habitat for aquatic SAR (Redside Dace); and
- Habitat for endangered and threatened species (Butternut, Eastern Meadowlark, Bobolink, Redside Dace and candidate SAR Bats).

9.3.1 Core Areas

As per Section 2.14 of the RPOP, development and site alteration is not permitted in Core Areas. All PSWs and Significant Woodlands will be retained in place as part of the Greenbelt Plan Area NHS with a minimum 30 m VPZ; as such no development or site alteration is anticipated. In general, all medium and high constraint watercourses will also be retained in place with VPZs; the one exception is the WHT4(3)5-2 realigned watercourse corridor. As discussed in **Section 7.2.2.1**, this non-significant valleyland is highly degraded and has been anthropogenically influenced due to golf course activities;

during staking, GEI and TRCA were unable to easily identify a clear top of bank along portions of the valleyland corridor. Reconfiguration of this valleyland into a new realigned channel corridor is recommended to restore the natural functions of this system. The net gain associated with this realignment effort is briefly described in **Section 10**. This will be further detailed as part of subsequent planning stages.

9.3.2 Natural Areas and Corridors

In general, any impacts on other natural heritage features including NACs shall be mitigated through restoration and enhancement or compensation, as described previously in **Section 6.4.2**. The SWS has evaluated the ecological form and functions of the above Greenlands System features and determined that all impacts will be mitigated through the Net Gain Mitigation Hierarchy inclusive of avoidance, buffering, restoration and enhancement, or compensation as outlined in this report.

9.4 Future Caledon Official Plan, 2024 Draft

The *Future Caledon Official Plan* (Town of Caledon, 2024d; February 2024 Draft) is currently awaiting final review and approval from the Minister of Municipal Affairs and Housing. The Mayfield Tullamore Secondary Plan is anticipated to be submitted as an Official Plan Amendment to the Future Caledon OP. The Future Caledon OP (Draft 2024a) defines a Natural Environment System as a comprehensive natural heritage and water resource system that is comprised of Natural Features and Areas (NFA's) and Supporting Features and Areas (SFA's). The components of the Future Caledon OP align closely with the Region of Peel's Core Areas, NACs and PNACs.

9.4.1 Natural Features and Areas

Within the Study Area, the following Natural Features and Areas are identified:

- PSWs (associated with all wetlands in the Greenbelt Plan Area);
- Significant woodlands/Core Woodlands (associated with all woodlands in the Greenbelt Plan Area); and
- Valley and Stream Corridors (associated with all medium and high constraint watercourses).

Development and site alteration within the final NFA designation is not permitted, other than for those activities that are outlined in Section 13.3.3. All NFA's will be protected, as outlined in **Section 7**. There is one modification proposed to the medium constraint feature associated with WHT4(3)5-2 however the post-construction channel realignment is anticipated to be established as an NAF within the proposed NHS and will be protected by appropriate minimum VPZs for the watercourse, valleyland, and all riparian wetlands and woodlands integrated into the design. The design of this natural channel is anticipated to align with the considerations of Section 13.3.4 of the OP and will be further explored during site-specific applications through a formal natural channel design brief.

9.4.2 Supporting Features and Areas

The following Supporting Features and Areas were identified within the Study Area:

- Non-significant wetlands (all wetlands outside of the Greenbelt Plan Area);
- SWH (candidate and confirmed);
- Non-significant woodlands (FOD5-4 woodland and two CUP3-14 plantations FOD5-4 woodlands);
- Fish habitat (direct and indirect);
- Habitat for aquatic SAR (Redside Dace);
- Habitat or endangered and threatened species (Butternut, Eastern Meadowlark, Bobolink, Redside Dace and candidate SAR Bats)

The SFA is an overlay designation; permitted uses are those allowed based on the underling land use designations and in accordance with Provincial Legislation (e.g., Greenbelt Plan, O. Reg. 41/24, ESA (2007), etc.). Development and site alteration within SFAs is required to demonstrate that no negative impacts are proposed, as well as four other key criteria as outlined in Section 13.4.2 of the *Future Caledon Official Plan* (Draft, 2024a), in order to be permitted:

a) "there is no reasonable alternative location outside of the Supporting Feature and Areas designation and the use, development or site alteration is directed away from the Natural Feature and Areas designation to the greatest extent possible;

b) if avoidance is not possible, the impact to the feature is minimized;

c) any impact to the feature or its function is mitigated through restoration or enhancement to the greatest extent possible; and,

d) where ecosystem compensation is determined to be appropriate and feasible, including for essential infrastructure, it may be considered in accordance with Town ecosystem compensation guidelines.""

This Phase 2 SWS has evaluated the ecological form and functions of the above SFA's and determined that all impacts will be mitigated through the Net Gain Mitigation Hierarchy inclusive of avoidance, buffering, restoration and enhancement, or compensation as outlined in this report.

Additionally, **Section 8.2** provides a summary of the minimum VPZs/buffers as recommended based on existing policies, best practices, and reviewed through the impact assessment in **Section 7** as required in Section 13.9.4. and 13.9.5 of the Future OP. Final buffer widths are expected to be determined at subsequent site-specific planning stages.

9.5 Conservation Authorities Act, 1990

Under the consolidated O. Reg. 41/24: *Prohibited Activities, Exemptions and Permits*, any interference with or development in or on areas stated in the *Conservation Authorities Act, 1990* (e.g., hazardous lands, wetlands, river or stream valleys) requires permission from the TRCA.

Natural hazards found within the Study Area include:

- Wetland hazards (associated with all wetland communities);
- Flood hazards (associated with watercourses and valleylands);
- Erosion hazards (associated with unconfined valleylands and watercourses); and
- Slope stability hazards (associated with confined valleylands – includes staked top of bank and LTSTOS).

The proposed structure plan requires the removal and replication of some non-significant tableland wetland features, and one medium constraint watercourse as discussed in **Section 7.4.2** and **Section 7.4.3** respectively. The analyses in these impact assessment sections, plus the Net Gain Mitigation Hierarchy review in **Section 6.4.2**, demonstrates that the benefits of removal and compensation, along with enhancement and mitigative measures to protect new features will provide improved conditions as it relates to natural hazard control including stormwater management, flood mitigation, and channel stabilization. *The Living City Policies* (TRCA, 2014) suggests that five general tests should be applied when assessing alterations to regulated features; these include flood control, erosion, dynamic beaches, pollution, and conservation of land (however pollution and conservation of lands are no longer under Conservation Jurisdiction as per O. Reg. 41/24, and dynamic beaches to not apply to the Study Area). The above impact assessment and mitigation measures provide a high-level review to demonstrate how removals, compensation and realignment can ensure that flooding and erosion will not be affected by land use changes, and measures for future site-specific development applications to consider.

One of the primary mitigation measures is the recommendation of minimum setbacks/VPZs. Feature setbacks and VPZs as proposed in **Section 2.1.2** are based on the Future Caledon OP (Draft 2024a) and *The Living City Policie*s (TRCA, 2014). All setbacks will be vegetated; however, depending on the proposed trail alignment, a portion of these setbacks may host the pedestrian trail; preferably the outer few metres if feasible. If a trail is proposed within the setback or regulatory limit, it is recommended that it is an impervious three-season trail.

Significant valleylands (minimum 15 m setback) and candidate significant wetlands (minimum 30 m setback) are all located within the Greenbelt Plan Area; no land use changes are proposed within these minimum buffers/setbacks or the regulated limits under O. Reg. 41/24.

For non-significant valleylands a minimum of a 10 m setback will be applied, and non-significant wetlands a minimum of a 10 m setback will be applied, in accordance with *The Living City Policies* (TRCA, 2014). As the TRCA regulates areas within 15 m of valleys and 30 m of wetlands, any development or site alteration within the outer 5 m of non-significant valleylands and the outer 20 m of non-significant wetlands will require engagement with the TRCA to determine if a Section 28 Permit

for Development is also required. All TRCA regulated limits have been depicted in **Figure B-5, Appendix B**.

Further engagement will be required with the TRCA to facilitate the alteration and compensation of the regulated wetlands and for the proposed watercourse realignment as discussed in **Section 8.8.1**.

No negative impacts are predicted to regulated features; rather, the realignment of WHT4(3)5-2 will be designed to contain the natural hazard limits and is expected to result in an improved aquatic system. Wetland removal and replication will ensure that there is no loss in wetland form and function within the Study Area.

9.6 Fisheries Act, 1985

The *Fisheries Act*, 1985, administered by Fisheries and Oceans Canada (DFO) prohibits the death of fish by means other than fishing (subsection 34.4 (1)) and the harmful alteration, disruption or destruction of fish habitat (HADD) (subsection 35. (1)). A HADD is defined under the Fisheries Act as "any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat's capacity to support one or more life processes" (DFO 2019).

Further engagement with the DFO during the site-specific detailed design phase will be required ahead of any site alteration associated with the watercourses and may require the consideration of mitigation measures to prevent a HADD (harmful alteration, destruction and disturbance) and overall benefit actions.

9.7 Migratory Birds Convention Act, 1994

The *Migratory Birds Convention Act* (MBCA; ECCC, 1994) and the *Migratory Birds Regulations* (MBR; ECCC, 2022) prohibits the killing, capturing, injuring, taking or disturbing of migratory birds (including eggs) or the damaging, destroying, removing or disturbing of nests. Tree removals should be undertaken outside of the core breeding period, which is approximately April 1 to August 31. In rare circumstances where this window cannot be avoided, a nest search is recommended, and a buffer will be marked off surrounding any active nests that must be maintained until activity in the nest has ceased. The MBCA and MBR apply at all times, even outside of the peak breeding period.

9.8 Species at Risk Act, 2002, and Endangered Species Act, 2007

Section 7.2.1.5 provides a review of SAR present within the Study Area that are regulated under the *Species at Risk Act*, 2002, and the *ESA*, 2007. The SAR present within the Study Area include Redside Dace, Butternut, Bobolink, Eastern Meadowlark and Bat Species. As an aquatic SAR, the Redside Dace receives protection under both the SARA and the ESA. The remaining species receive protection under the ESA only.

Mitigative measures to reduce direct and indirect impacts on these species and their habitats are outlined in **Section 7.2.1.5**. For future site-specific development, additional efforts may be required to demonstrate compliance with the SARA and ESA. The following is a brief summary of how the intent of the SARA and ESA will be upheld within the SWS Study Area:

- All potential alterations to Redside Dace regulated habitat (as defined within Section 29 of O. Reg. 832/21) or critical habitat (as defined within the Redside Dace Recovery Strategy and Action Plan (DFO, 2024) will require consultation with the MECP and DFO. Where impacts to Redside Dace regulated or critical habitat cannot be avoided, such as for collector road crossings, further consultation with MECP and DFO will be required to determine appropriate measures for impact mitigation **(see Section 7.2.1.5**).
- For Butternut, no further actions are needed at this time. The two trees that were identified as potentially being impacted by the structure plan have been assessed and reported to MECP. Both trees were considered non-retainable (Category 1) and thus are not protected under the ESA. Any further Butternut Health Assessments of additional trees may be completed at the site-specific stage if any disturbance is proposed (above or below ground) within 50 m of any of the trees (See **Section 7.2.1.5**).
- Habitat for Bobolink was identified within cultural meadow communities associated with the significant valleylands on Property 10. As this habitat will be retained and protected by a 15 m significant valley VPZ, no action under the ESA is warranted and no impacts to this species' habitat are anticipated (See **Section 7.2.1.5**).
- Habitat for Eastern Meadowlark was identified within Property 9, and approximately 2.26 ha of habitat is proposed for removal to accommodate the proposed land use changes. **Section 7.2.1.5** provides a summary of impact mitigation recommendations, including that no removal of habitat can occur between May 1 to July 31. To facilitate removals and address any impacts on this species, engagement with the MECP is recommended. No negative impacts to Eastern Meadowlark are anticipated, provided that registration occurs prior to removal of its habitat within the Study Area.
- Habitat for bats listed under the ESA is likely present within the woodland communities within the Greenbelt Plan Area. As these woodlands are within the Greenbelt Plan Area where all key NHFs (including woodlands) will be retained and protected by a 30 m VPZ, no further actions are needed at this time. If the mitigation measures outlined in **Section 7.2.1.5** are followed, no negative impacts are anticipated. Outside of the Greenbelt Plan Area, the overall abundance of bat SAR within the Study Area was determined to be low, and SAR maternity roosting habitat is unlikely within the treed communities within the tablelands. Overall, it is anticipated that the mitigative and restorative measures proposed in **Section 7.2.1.5** will ensure that there are no negative impacts to SAR bats.

9.9 Other Legislative Considerations

The Phase 1 Report (GEI and SCS, 2025) outlined several other provincial acts related to the protection of the environment in Ontario including the *Clean Water Act* (2006), *Ontario Water Resources Act* (1990), the *Environmental Protection Act* (1990) and the *Fish and Wildlife Conservation Act* (1997). Overall, the intent of this SWS is to establish best practices and recommendations that consider these policies and their associated regulations. For example, **Section 7.5.5** outlines considerations for O. Reg 387/04 – Water Taking and Transfer under the *Water Resources Act* and O. Reg. 63/16 - Registrations Under Part II.2 of the Act - Water Taking under the *Environmental Protection Act*. As site-specific development applications progress, adherence to these policies and regulations should be demonstrated through appropriate technical reports and, if required, permit applications.

10. Predicted Net Gain

An overall net gain will be achieved by the Mayfield Tullamore SWS through using the Net Gain Mitigation Hierarchy, which is further described in **Section 6.4** above, as well as the proposed ecological offsetting further described in **Section 0** above. The Net Gain Mitigation Hierarchy ensures that conservation-first planning occurs through the avoidance, minimization and mitigation, restoration, enhancement, and replication or compensation of natural environment features. Eight net gain targets for the SABE NHS have been identified within the Wood (2022b) *Scoped Subwatershed Study, Part B: Detailed Studies and Impact Assessment*, and are shown in **Table 10-1** below. These targets will be reviewed as part of the Net Gain Mitigation Hierarchy to determine whether they can be achieved through the Mayfield Tullamore SWS and/or if they are appropriate targets for the Study Area.

Table 10-1. SABE NHS Targets

Feature Type	Target for the SABE NHS
Natural Cover	• No net loss of natural cover
Woodland	• No net loss of existing woodland cover • Increase total woodland cover through NHS enhancement with a focus on creation of table land features
Wetland	• No net loss of wetland cover • Increase total wetland cover through NHS enhancements
Valley and Stream Corridors	• No net loss of ecological and hydrologic functions provided by valleylands • Increase natural cover within valley and stream corridors through NHS enhancement
Successional / Open habitats	• Maintain important existing successional / open habitats contiguous to other features and areas of the NHS • Increase representation and quality of open country habitats across the landscape through NHS enhancement opportunities; strive to create at least one habitat area with a minimum size threshold of 5 ha
Aquatic	• Achieve 75% naturally vegetated watercourse length through protection of existing, enhancement or restoration
Sand Barrens, Savannahs, Grasslands	• Protection of all Sand Barrens, Savannahs and Grasslands where they occur
NHS Enhancement	• Identify distributed enhancement opportunities across the NHS to support the development of a robust and sustainable system • Increase natural cover by 30%
Notes: Table 2.6.3.1. from Wood et al., 2024b	

In addition to the SABE NHS targets, the International Union for Conservation of Nature (IUCN)'s Commission on Ecosystem Management and the SER released a Preliminary Report on A*chieving Net Gain for Biodiversity and Human Well-being: Integrating Ecological Restoration with other Nature-based Solutions* (June 2021) where they presented a new working definition for "net gain" and a set of metrics for evaluating net gain across the restorative continuum. Their definition of net gain was "is a measurable positive change in ecosystem integrity, native biodiversity and human wellbeing that results from a combination of sustainable resource use, conservation and restoration. Net gain should

be measurable at any scale, including the ecosystem and land/seascape scales, and sustained over time". They indicated that net gain (also called net benefit or net improvement) should be measured at "relevant timescales" for the project, recognizing that restorative actions may lead to short-term adverse effects before long-term gain is achieved. They further indicated that net gain should be "easily applicable and understandable". Metrics put forward by the IUCN and SER to evaluate net gain incorporated ecological and human wellbeing. The proposed metrics are illustrated below within **Table 10-2** below

Table 10-2. IUCN and SER Net Gain Metrics

Net Gain Metrics	
Ecologically-focused	Ecosystem functions and services are restored and sustained
	Biodiversity is restored
	Disaster risk reduced (ties with Nature-based Solutions)
Combination of Ecological and Human Wellbeing	Activities take a multi-dimensional approach (e.g., human needs and habitat/ecological conditions are improved simultaneously)
	Net gain in native species and habitat that have cultural/social value (as tied to overarching frameworks such as UN Sustainable Development Goals, Convention on Biological Diversity's Global Biodiversity Framework (GBF), Nature's Contributions to People or other appropriate sideboards)
	Communities have incentives to improve ecosystems (e.g., greater access to sustainable resources)
Human Wellbeing-focused	Communities and livelihoods, especially in vulnerable communities, are more self-sustained; do not rely on large inputs from outside the community
	Benefits are shared equitably
	Local stakeholders are engaged

This definition and above ecologically-focused metrics guided the net gain section of this report. Although the IUCN and SER metrics discussed are qualitative in nature, both quantitative and qualitative aspects of net gain are assessed in the following sections.

10.1 SABE NHS Targets

The SABE identified eight NHS targets as summarized below within **Table 10-3**. A review was completed to determine whether these NHS targets apply and/or were achievable, and if so, if these criteria were met. Where natural coverage is discussed, this is calculated independent of culturally influenced communities including cultural plantations, cultural thickets, cultural meadow, agriculture, golf courses, hedgerows, golf course drainage features, and golf course ponds. All calculations are approximate based on ELC calculations using ArcGIS. A more detailed review of natural cover and net gain should be assessed at the property-specific level. The numbers provided here are intended to provide a general overview to illustrate existing natural communities within the Study Area (37 ha; 6%), existing anthropogenically influenced communities within the Study Area (567 ha; 94%), existing NHS (78 ha; 13%), total area proposed as NHS to be protected, restored, and/or enhanced (156 ha; 26%), and total amount of new vegetative buffers proposed (32.9 ha; 5%).

Table 10-3. Study Area SABE NHS Target Review

Feature Type	Target for the SABE NHS	Mayfield Tullamore Applicability	Strategies to Achieve Target	Target Met?
Natural Cover	No net loss of natural cover	It is expected that there will be some minor loss of natural cover due to the proposed land use changes particularly as the settlement area expansion will replace agricultural land and some associated culturally influenced communities amongst the agricultural and golf course lands. For the purposes of this SWS, "no net" has been assessed independently of features such a cultural meadows, thickets and hedgerows outside of non-significant and significant valleylands.	In addition to compensating for the proposed removal of tableland woodlands and wetlands, best efforts should be made to increase natural cover through habitat enhancement, restoration, and naturalization of feature buffers.	Yes – as it relates to natural cover associated with woodlands, wetlands, and aquatic systems, there will be no net loss in natural cover. VPZs will be vegetated with native plantings that will increase native cover within existing agricultural fields and golf course lands.
Woodland	No net loss of existing woodland cover Increase total woodland cover through NHS enhancement with a focus on creation of table land features	All significant woodlands and/or woodlands located within the Greenbelt Plan Area will be retained in place; any non-significant woodlands that are proposed for removal will be compensated for, and overall restoration strategy for the Study Area will encourage a net-gain of total woodland cover.	These goals are achievable through the compensation of the woodland features to be removed according to TRCA's Guideline for Determining Ecosystem Compensation (DATE2023); and enhancement of the NHS through additional enhanced reforestation.	Yes – an opportunity to increase density of plantings within VPZs can be explored. Furthermore, non-significant woodlands will be compensated in accordance with the TRCA's Guidelines, which will result in a net gain in woodland area (should non-significant woodlands be removed as proposed).
Wetland	No net loss of wetland cover Increase total wetland cover through NHS enhancements	All significant wetlands and/or wetlands located within the Greenbelt Plan Area will be retained in place; any non-significant wetlands that are proposed for removal will be compensated for, and overall compensation and enhancement strategy for the Study Area will encourage a net-gain of total wetland cover.	These goals are achievable through the compensation of the wetland features to be removed according to TRCA's Guideline for Determining Ecosystem Compensation (2023); and enhancement of the NHS through additional wetland creation.	Yes – Non-significant wetlands will be compensated at a minimum of a 1:1 ratio in accordance with the TRCA's Guidelines. In addition, through the construction of the realigned channel corridor on Property 1, is it likely that wetland will also be created within the floodplain. As a result, it is likely that a net gain in wetland area will occur.

Valley and Stream Corridors	No net loss of ecological and hydrologic functions provided by valleylands Increase natural cover within valley and stream corridors through NHS enhancement	Significant valley corridors and all high constraint watercourses will be retained in place; one medium constraint watercourse is proposed for realignment to support improvements to feature function.	These goals are achievable through a combination of enhancements (and compensation) that will occur adjacent to the NHS, and proper SWM techniques (including LID designs) throughout the development. Several aquatic restoration efforts, as outlined in **Section 8.8** will help achieve an overall net gain in natural cover associated with these features.	Yes – Restoration and enhancement of existing valleylands that are currently anthropogenically influenced (existing agricultural or golf course lands) will result in a gain in natural cover. The realigned watercourse corridor within Property 1 will also be restored using native plantings.
Successional / Open habitats	Maintain important existing successional / open habitats contiguous to other features and areas of the NHS Increase representation and quality of open country habitats across the landscape through NHS enhancement opportunities; strive to create at least one habitat area with a minimum size threshold of 5 ha	No important successional habitats were identified within the Study Area and outside of the Greenbelt Plan Area. In general, some loss of successional and open habitats is expected to occur due to the proposed development: a settlement area expansion will replace agricultural and golf course land where small areas of successional habitat are located.	Best efforts should be made to include naturalized meadows as part of the NHS enhancements, connecting other newly created habitats, such as wetlands and woodlands. VPZs should be vegetated using a banded approach to create varying types of successional/open habitats. There are also some existing cultural meadows associated with non-participant lands within the Greenbelt Plan Area; should these be brought forward for future development consideration of these targets could be assessed.	No - however these targets are not feasible for the Study Area; efforts will be made to incorporate successional and open habitats into restoration, compensation and buffer planting.
Aquatic	Achieve 75% naturally vegetated watercourse length through protection of existing, enhancement or restoration	These targets are achievable through enhancement of the existing watercourses that are to be protected in place, in addition to utilization of natural channel design and riparian planting along the watercourse realignment.	Approximately 70% or 4,676 m of watercourses are already vegetated as part of the Greenbelt Plan Area NHS; additional vegetated length will be added to the overall NHS as part of the WHT4(3)5-2 Channel Realignment; this should result in an overall	Current conditions have approximately 70.53% of the watercourse naturally vegetated. However, with the proposed channel realignment and restoration plan the goal of 75% naturalization is expected to be achieved as the Channel Realignment will add additional length to the NHS

			increase in total naturally vegetated watercourse within the Study Area.	and will be fully vegetated; the existing WHT4(3)5-2 is generally surrounded by golfcourse landscaping so this is expected to be an improvement.
Sand Barrens, Savannahs, Grasslands	Protection of all Sand Barrens, Savannahs and Grasslands where they occur	N/A		
NHS Enhancement	Identify distributed enhancement opportunities across the NHS to support the development of a robust and sustainable system Increase natural cover by 30%	These targets are partly achievable. Many enhancements, including compensation for tableland features that will be removed, are expected to occur along the NHS. This will support developing a robust and sustainable system and will potentially result in an increase of the natural cover.	Calculation of the final net amount of natural cover will only be possible once site-specific plans are developed. However, it is very unlikely that this increase will get to 30% given the nature of the future land use as a settlement area. Based on preliminary calculations of the existing natural cover compared to the proposed natural cover protected, enhanced and restored through the proposed NHS, a net gain of 13% may be achievable at a minimum.	No - A net gain of 30% is not feasible within the Study Area; however, an increase of approximately 80 hectares of protected, restored and enhanced proposed NHS be possible through buffer vegetation, restoration, enhancement and compensation efforts. This would be approximately a 13% increase in natural cover. Also, restoration and compensation efforts will be targeted towards a net gain improvement in the quality of the NHS

10.2 IUCN and SER Ecologically Focused Net Gain Metric #1: Ecosystem Functions and Services are Restored and Sustained

To achieve a net gain on this metric, quantitative and qualitative increases in ecosystem functions and services are recommended. From a quantitative perspective, achieving net gain could occur through an increase in the overall amount of naturalized vegetation on the Study Area (e.g., through ecological restoration of existing active agricultural fields, golf courses or other disturbed areas). From a qualitative perspective, a net gain could occur through an increase in the complexity and/or diversity of habitats relative to current conditions. Such increases would be expected to increase the overall functionality of the NHS in supporting diverse plant and wildlife communities.

GEI completed a constraints and opportunities analysis, as presented within the Phase 1 SWS, which delineated all natural heritage features and natural hazards to form the Existing NHS. As discussed within **Section 6.3**, the following system components were identified:

- Key Features: PSWs (associated with all wetlands in the Greenbelt Plan Area), significant woodlands (associated with all woodlands in the Greenbelt Plan Area), and valley and stream corridors (associated with medium and high constraint watercourses), SWH (candidate and confirmed), habitat for aquatic SAR (Redside Dace), and habitat for endangered and threatened species (Butternut, Eastern Meadowlark, Bobolink, Redside Dace and candidate SAR Bats)
- Supporting Features: non-significant wetlands, non-significant valleylands, the FOD5-3 and CUP3-12 woodlands, and fish habitat (direct and indirect);
- Other Features: successional habitats (culturally influenced communities including CUP, CUM, CUT, CUW)
- Linkages: major landscape linkages associated with Campbell's Cross Creek and the West Humber tributary that runs north-south; local landscape linkage associated with the east-west tributary which ultimately provides a connection point between Campbell's Cross Creek and the West Humber River.

4. Enhancements: preliminary enhancement areas to support improved shape, size and contiguity include: WHT4(3)5-2 Channel Realignment (riparian wetland creation, naturalized buffers, etc.), opportunities for daylighting WHT4(3)4-3, potential culvert removal and stream restoration efforts, and the establishment of natural, self-sustaining vegetation buffer zones to improve conditions across the proposed NHS linkages.

As previously discussed throughout **Section 8**, NHS enhancements and ecological restoration are proposed to further expand the existing NHS. Specifically, created woodland and wetland habitat are recommended within the immediate vicinity of the existing NHS with naturalized buffers to further widen the NHS in these areas. In addition, realignment of a degraded medium constraint watercourse (WHT4(3)5-2) is recommended within Property 1 (**Section 8.8**). These compensatory activities will centre restoration and enhancement to the overall NHS to aid in building upon the existing NHS to create a resilient, diverse and connected system. These expanded areas will comprise the Proposed NHS, as presented within **Figure 8-1**.

All of the above noted elements of the proposed NHS are expected to result in both a quantitative gain in functional naturalized vegetation communities within the Study Area as well as a qualitative increase in ecological and biophysical function, relative to the existing, predominantly agricultural and manicured golf course conditions.

From a quantitative perspective, the proposed NHS is expected to increase the amount of naturalized vegetation cover in the area with approximately 32.9 ha of buffer area that will include the restoration of existing active agricultural fields and golf course lands by planting native vegetated buffers. While a net gain in wetland is unlikely based on the TRCA's Ecosystem Compensation Guideline (2023) (as discussed within **Section 8.3**), a gain in woodland area may occur with the removal of the non-significant woodland (FODM7-7) on Property 1. The exact gain in woodland area would be determined through the site-specific application as detailed basial area calculations have not been completed as part of the SWS study. It should be recognized that while a physical gain in wetland area may not be achieved on site, from a functional perspective, a net gain is expected to occur (as outlined further below).

From an aquatic habitat perspective, a net gain in watercourse length is also expected as a result of the proposed realignment of WHT4(3)5-2. The exact lengths should be confirmed during site specific applications. From a purely quantitative perspective, this will result in a substantial increase in seasonal aquatic habitat for fish and benthic invertebrates on the basis of the increased length alone. As discussed further below, a substantial net gain in the form and function of the realigned watercourse is also predicted.

As demonstrated in the preceding paragraphs, a substantial net gain in the overall area of naturalized vegetation and watercourse length is predicted as a result of the proposed restoration initiatives within the NHS. However, a net gain in the overall function is also predicted as a result of the proposed enhancements due to increased habitat complexity, biodiversity and overall connectedness of the various proposed features relative to current conditions. Through targeting various habitat types, this will provide a mosaic of habitat within the NHS that may not currently provided and/or are not functionally contributing to the existing NHS. For example, the removal of the large OA communities are currently warming the downstream reaches of WHT4(3)5 and could be limiting the range of Redside Dace and other cool to cold water fisheries in the system. By removing these large golf course ponds it will help normalize the thermal regime within the NHS. It is acknowledged that the OAs, while anthropogenic in nature, do provide habitat for various species (amphibians, turtles, aerial insectivores, birds); however, these functions will be replicated within the realigned channel corridor and elsewhere as part of the NHS corridor restoration and enhancement works.

Existing primary linkages within the Study Area will be further widened and enhanced through the proposed restoration concept. Currently movement north-south and east-west is provided within the existing West Humber River corridors; however, the proposed restoration strategy will enhance two secondary linkages on Properties 1 and 4 associated with medium constraint watercourses. While not currently located within a participating property, should the property become participating, daylighting of WHT4(3)4-3 should be considered to further expand the availability of fish and fish habitat within the corridor. In addition, within the high constraint WHT4(3)3-1, associated with Property 8, and located within the protected Greenbelt Plan Area NHS and regulated Redside Dace

habitat, there is a degraded culvert recommended for further review as a candidate for removal and riparian restoration. It is also recommended that other similar opportunities be reviewed within the Study Area, as barrier removal can support improved connectivity along the watercourse, improving flow and aquatic habitat.

Moreover, the realignment of WHT4(3)5-2 will create a more robust aquatic corridor than is currently present for both aquatic and terrestrial species. As noted within the Phase 1 Report, various barriers to fish movement are currently present within Property 1 as a result of the active golf course management. The realignment of this watercourse using natural channel design principles will rehabilitate the medium constraint watercourse by providing additional productive fish habitat and allow for a more connected system. WHT4(3)5-2 currently has a limited riparian buffer due to extensive golf course management; through the creation of the realigned channel, increased habitat functionality and linkage will be created. The realigned channel will contain various wildlife habitat structures and host various upland and lowland vegetative communities. The realigned channel, which is expected to have an increased stream length, will also be designed using natural channel design principles to enhance aquatic habitat diversity.

Moreover, as discussed within **Section 8.7.1**, wildlife enhancement structures should also be installed throughout the NHS. While the specific abundance, location and type of habitat structures will be defined within the site-specific detailed design stage, wildlife enhancement structures will attract and protect a variety of wildlife. These types of structures will provide wildlife with habitat for resting, feeding, escaping predators, sheltering from bad weather, raising young and breeding/roosting.

The variety of vegetative communities will provide age and structural diversity within the existing NHS. This is expected to lead to a more productive and resilient NHS as it continues to establish and mature over time.

The protection of natural heritage features and significant restoration efforts (wetland and woodland creation, channel realignment, naturalized plantings) will provide a significant qualitative and quantitative net gain for the Study Area. Significant ecosystem functions will be protected and enhanced, while created habitats will add ecosystem value and contribute to a self-sustaining and self-organizing NHS.

10.3 IUCN and SER Ecologically Focused Net Gain Metric #2: Biodiversity is Restored

The existing NHS is already biodiverse as it hosts a variety of locally, regionally and provincially significant species, as well as common and secure species (as discussed within the Phase 1 SWS). To further enhance the existing biodiversity, the restoration and enhancement areas should focus on providing differing habitats than is currently present within the NHS (e.g., cultural meadows, coniferous forests) to attract differing species and/or support the same species at different life stages.

As noted, approximately 94% of the Study Area is comprised of anthropogenically influenced communities including managed golf courses and agriculture. Of this, 14% are communities such as cultural plantations, cultural thickets, cultural woodlands, and cultural meadows. While there are

removals to some terrestrial habitat features, such as small meadow communities and woodlands, these features are generally interrupted by more anthropogenic uses. Isolated table land features that are proposed for removal will be compensated for, and restoration will be undertaken to support a more diverse, interconnected NHS to help restore biodiversity. Connectivity of various natural ecosystems has been identified to play a key role in mitigating biodiversity loss (UNEP, 2022). Linkages allow for improved movement between habitats, providing access for wildlife to additional resources required for life stages such as breeding, foraging, and overwintering.

Where woodlands are proposed for removal and compensation; it is expected that the compensation of these features will be at least 1:1, if not greater. Preliminary compensation locations, outlined in **Figure B-5, Appendix B,** demonstrates efforts to integrate these compensations into the NHS associated with key linkages and the retained Greenbelt Plan Area NHS.

As discussed within **Section 6.4.2**, a Net Gain Mitigation Hierarchy review was completed to determine whether natural heritage features warranted protection in place and thus should be avoided (e.g., highly sensitive and/or uncommon features within the landscape), or whether features could be removed and compensated (e.g., lower quality and common feature types), or whether features should be removed with their functions replicated (e.g., Mitigation HDFs in accordance with the HDFA Guideline). This Net Gain Mitigation Hierarchy review ensures that the most sensitive and the most uncommon features are protected within the NHS, while degraded and commonly occurring features are able to be compensated or have their functions replicated in other ways. As previously discussed, the removal and replication of features is a commonly accepted approach and will help increase habitat availability and diversity for many species, increase native flora diversity and coverage on site, and build a more resilient and robust NHS.

Tableland wetlands outside of the Greenbelt Plan Area are proposed for removal and compensation; it is expected that the compensation of these features will be at least 1:1, if not greater. Preliminary compensation locations, outlined in **Figure B-5**, **Appendix B**, demonstrates efforts to integrate these compensations into the NHS associated with key linkages and the retained Greenbelt Plan Area NHS.

WHT 4(3)5-2 (Property 1) is currently a heavily impacted watercourse with three large online ponds that provide limited fish habitat diversity (e.g., limited morphology). Through the realignment of this feature, increased habitat availability (through an overall increase in channel length) and increased functionality will be provided through the installation of riffle-pool morphology, vegetated wetland pockets, spawning and refuge areas.

Naturalized buffers, which will replace several areas that are currently dominated by agricultural and golf courses. These naturalized edges will provide additional functional habitat for edge species thereby increasing species diversity and increase the overall area, width and final size of the NHS. These buffers can also be planted strategically to support different habitat types, this increasing diversity as well.

The plant community is also quite diverse and productive within the existing forest and swamp units of the NHS, although the area is generally lacking botanical species that occupy other habitat types (e.g., cultural meadows, open wetlands). By providing varying vegetative communities, an increase in native plant diversity will be achieved. All proposed plant material for use within the NHS will be locally

sourced to reduce transplant shock and help better acclimatize to the Study Area. The flora proposed will complement the existing flora diversity. The variety of vegetative communities will provide age and structural diversity within the RNHS.

Moreover, as discussed within **Section 8.6.6**, invasive species management should occur within the Study Area for Category 1 species. The extent of colonization and feasibility of management should be reviewed at the site-specific stage. Additionally, invasive species management within created habitats should occur during construction and post-construction monitoring to encourage recently planted plants to establish. It is acknowledged that a fulsome invasive species management program within the Greenbelt Plan Area is not feasible; therefore, invasive management should be focused within the tablelands and near created features.

Other features that could be integrated into the NHS to support biodiversity are features such as nesting structures for bats and birds, and strategic shrub plantings, brush piles, and other topographic diversity to support various wildlife requirements such as foraging, sheltering and nesting. These enhancements could be explored during site-specific development applications. For example, it was noted that limited suitable turtle nesting habitat was present within the Study Area, as the only turtle nesting recorded during the field investigations was within a sand trap at Property 1. The incorporation of turtle nesting habitats in other properties connected habitats may encourage existing turtle populations to expand their nesting habitat ranges and use other habitats that may result in more productivity. Additionally, limited nectaring species were noted within the tablelands and along the boundaries of the Greenbelt NHS. A focus of adding a variety of nectaring species with varying bloom periods can support different types of insect habitats, and in turn support aerial insectivores. Finally, no suitable overwintering habitat for snakes was identified within the Study Area given its anthropogenic nature and ongoing management. Incorporation of snake hibernacula structures could attract and provide different habitat opportunities for existing snake populations within the Study Area.

Overall, the proposed NHS will enhance and increase existing flora and fauna diversity, as well as provide increased habitat opportunities for species within the overall approximately 32.9 ha increase in naturalized vegetation areas that are currently occupied by active agricultural fields or golf course lands.

10.4 IUCN and SER Ecologically Focused Net Gain Metric #3: Disaster Risk Reduced (Ties with Nature-Based Solutions)

Projected climate change poses many threats to the composition, structure, and function of ecosystems in Ontario. With increasing temperatures, shifting precipitation patterns, and the rising frequency and intensity of extreme weather events, it is essential to protect, restore, and enhance natural features that provide critical ecosystem services for climate change mitigation and adaptation. The proposed NHS is designed to enhance ecosystem resilience by integrating nature-based solutions that support flood regulation, water quality improvement, temperature moderation, and biodiversity conservation, climate refugia.

The NHS restoration and compensation strategy prioritizes natural solutions that provide a range of ecosystem services. These include provisioning services (e.g., supporting habitat biodiversity and species resilience), regulating services (e.g., enhancing flood regulation, erosion control, and carbon sequestration), and supporting services (e.g., wastewater treatment and nutrient cycling through natural filtration). By increasing the area, connectivity, and functional complexity of natural features within the Study Area, the NHS will contribute to long-term disaster risk reduction while supporting climate adaptation strategies.

Changes in the intensity, duration, and frequency of precipitation events under a changing climate is exacerbating flood risks. Natural features such as wetlands, valleylands, and vegetated buffer zones provide essential climate adaptation services by regulating floodwaters, reducing pollutants in runoff, and slowing overland flow. The proposed NHS restoration initiatives will increase the extent of wetlands and riparian buffers, improving their capacity to capture, store, and gradually release stormwater. These measures will help mitigate downstream flood risks by reducing peak flow velocities, increasing floodplain storage capacity, and stabilizing streambanks to control erosion.

Wetlands are particularly effective at improving water quality through natural filtration, capturing sediments and excess nutrients before they enter open water systems. Additionally, wetlands help maintain baseflow levels during dry periods by slowly releasing stored water, mitigating the effects of prolonged droughts. By integrating wetland restoration and expansion within the NHS, the project will enhance the natural landscape's ability to regulate hydrological processes, reducing both flood hazards and the risk of erosion-related damage to infrastructure and ecosystems.

Increasing the area of naturalized vegetation communities adjacent to watercourses and other natural features will have long-term benefits in disaster risk reduction. Compared to the existing agricultural and disturbed landscapes, naturalized vegetation supports greater infiltration, reducing surface runoff and enhancing groundwater recharge. The establishment of native vegetation in riparian corridors and buffer zones will improve soil retention, reducing erosion and nutrient loading into water systems while promoting better hydrological balance across the Study Area.

Strategic reforestation and afforestation efforts will further contribute to climate resilience by intercepting rainfall, promoting evapotranspiration, and moderating temperature fluctuations. Increased forest cover will help slow and absorb stormwater, reducing flood risks and maintaining watershed stability. By restoring and enhancing tree cover, the NHS will provide additional cooling benefits, reducing heat stress for both natural and built environments.

Connectivity between natural heritage features is crucial for mitigating biodiversity loss and ensuring ecological resilience in the face of climate change. The proposed NHS will increase the overall connectivity of various ecosystems, allowing for improved species movement, climate refugia, and genetic exchange. This enhanced network of habitats will support species adaptation to changing climatic conditions while maintaining ecological integrity.

By following the Net Gain Mitigation Hierarchy, the proposed restoration and enhancement works will ensure that the Study Area maintains its ecological integrity while supporting sustainable development and climate resilience. The NHS is designed to foster greater resilience to climate change by enhancing flood mitigation, improving hydrological function, reducing erosion risks, and providing crucial cooling effects. These nature-based solutions will help maintain essential ecosystem services, reducing disaster risks and ensuring the long-term sustainability of the Study Area's natural heritage features.

11. Requirements for Future Studies

Based on the collective findings from this Phase 2 SWS, the Phase 1 SWS (GEI and SCS, 2025), and the SABE reports (Wood et al., 2022a-c), a number of technical studies are still required to be completed, either as part of the MTLOG Subwatershed Studies or through subsequent planning application stages. Upon final approval of the Secondary Plan OPA, additional studies will also be required to support the logical and sustainable development of the Study Area.

The following technical studies are still outstanding, and will be completed as part of the MTLOG Subwatershed Studies (Phase 2-3) Reports:

- As baseline monitoring of groundwater and surface water conditions will be completed in May of 2025, at this time conservative assumptions have been included within the Phase 1 and Phase 2 SWS's. An addendum will be prepared to summarize the remaining surface and groundwater monitoring. Any conclusions within this report regarding the groundwater and surface water conditions will be confirmed or updated where necessary in the SWS as needed.
- Pedestrian trail alignments. The placement of pedestrian/multi-use has not been included within this Phase 2 SWS. Alternative alignments to the ones proposed in the Town's MMTMP (June 2024c) are currently being assessed. Once finalized, the updated impact assessment, including these features will be incorporated into the Phase 3 SWS.

The following technical studies may be required for the site-specific level to support the submission of subsequent *Planning Act* applications such as Tertiary Plans, Draft Plan of Subdivision and Site Plan Approvals:

- MESP;
- Functional Servicing and Stormwater Report (FSSR);
- Environmental Impact Study and Management Plan (EISMP);
- Restoration Plans (incorporating landscaping, planting plans and seed mixes specifications);
- Arborist Reports and Tree Preservation Plans;
- Natural Channel Design Briefs;
- Detailed Geotechnical and Hydrogeological Investigations;
- Environmental Site Assessment (Phase 1/2); and,
- Permits or applications for construction approvals through agencies such as MECP, DFO, and TRCA.

This is not intended to be an exhaustive list, additional requirements to support Planning Act applications may be identified through pre-consultation processes for site-specific applications.

11.1 Municipal Consolidated Linear Infrastructure Environmental Compliance Approvals

The Municipal Consolidated Linear Infrastructure Environmental Compliance Approvals (CLI ECA) is a single environmental permission issued under the *Environmental Protection Act* for all municipal sewage collection system components or a municipal stormwater management system (MECP, 2024). Both the Implementation and Monitoring Plan and the Adaptive Management Plan (detailed in **Section 12.1** below) are intended to incorporate details for and align with the requirements of a CLI ECA.

11.2 Municipal Class Environmental Assessment

As discussed in **Section 7** above, a MCEA will be required for the development of collector roads that cross the Greenbelt Plan Area NHS (Property 9) and a non-significant valleyland/NHS (Property 4). This MCEA would be completed outside of the SWS and Secondary Plan, and would be a municipally led project with proponent support. This MCEA should be completed prior to the finalization of the road alignments. Where available, information from the MCEA can be incorporated into the Phase 3 SWS.

11.3 Non-Participating Properties

As described in **Section 5.3** of the Phase 1 SWS (GEI and SCS, 2025), it is anticipated that a similar level of field investigations would be required for any land use changes proposed within non-participating properties. These field investigations would identify existing characteristics and conditions present and should be scoped in a similar manner as the investigations completed within this Phase 2 SWS.

12. SWS – Next Steps

The comprehensive local SWS for the MTLOG has been subdivided into three phases:

- **Phase 1** includes the characterization of existing conditions, including the natural heritage features, hydrologic features, and surface and groundwater systems. The requirements for this phase have been met through the Phase 1 SWS (GEI and SCS, 2025).
- **Phase 2** includes the analysis, impact assessment, mitigation, and recommendations. It is anticipated that the requirements for this phase have been met through the preparation of this Phase 2 SWS.
- **Phase 3** consists of a comprehensive implementation plan, monitoring plan, and adaptive management plan. Development of this reporting phase will begin upon submission of the Phase 2 SWS.

The next steps of the local SWS process include the preparation and submission of the Phase 3 SWS and finalizing all studies and reports for approval.

12.1 Phase 3 SWS

The Phase 3 SWS shall identify and set the framework for implementation and monitoring of the preferred subwatershed's management strategy building from the results of the iterative land use impact assessments. Management recommendations are required to address the objectives identified in the SABE reports (Wood et al., 2022a-c), as well as the goals, objectives and targets from the parent watershed plan for Secondary Plan Report that have been carried forward into this Phase 2 SWS (Town of Caledon, 2024c).

A Management, Implementation, and Monitoring Plan shall be developed, which sets out the requirements for phasing, operation of facilities, and monitoring to ensure that the future development(s) are in compliance with the recommendations associated with the approved Local Subwatershed Study and Secondary Plan Policies. The direction provided in the Settlement Area Boundary Expansion Scoped Subwatershed Study - Part C: Implementation Plan (Wood et. al., January 2022c) will be used as the foundation for developing the monitoring plan to further refine, develop and identify management recommendations and requirements established through the detailed subwatershed studies. The Adaptive Management and Monitoring Plan will be a multidisciplinary approach that aims to ensure compliance with each phase of the SWS, and provide strategy for corrective actions which may be necessary based on results of the monitoring program.

To support the Phase 3 SWS, GEI will:

- Identify future study requirements;
- Discuss phasing considerations;
- Set out a framework for implementation of the preferred management strategy based on the Phase 2 Impact Assessment;

- Prepare a recommended Adaptive Management and Monitoring Plan to support the technical findings;

Continue to provide input to the Secondary Plan and Preferred Land Use Scenario based on the Phase 3.

12.1.1 Adaptive Management and Monitoring Plan

The Implementation and Monitoring Plan will suggests recommendations for the phasing of development and infrastructure, will monitor the subwatershed's response to land use change and suggest adaptive responses if impacts are observed. The monitoring program will need to ensure compliance with each phase of the SWS, and a strategy for corrective actions which may be necessary based on results of the monitoring program.

The adaptive management and monitoring plan will also incorporate Climate Change considerations, particularly demonstrating compliance with the Town of Caledon's Community Climate Change Action Plan (2021) and the Peel Region's Climate Change Master Plan (2019). This will be based on the findings of the SWS, and will include a review of some of the recommended mitigation measures and management strategies for future phases of the development and will address case where results of monitoring from the initial phases suggest that changes are warranted.

The following sections outline some key discipline considerations, as outlined in the approved Terms of Reference (November, 2024) for the Phase 3 SWS.

12.1.2 Natural Heritage Considerations

The main objective for natural heritage within the Phase 3 report will be to further develop strategies and recommendations for restoration and enhancement of the NHS to improve ecological integrity, optimize biodiversity, and restore natural features. These recommendations will be based on the strategies assessed within this Phase 2 Report, and the recommended Net Gain Mitigation Hierarchy approach.

Phase 3 will also:

- Provide guidance on the implementation and management of natural heritage system buffers, linkages, wildlife corridors and trails;
- Confirm rehabilitation, restoration, and enhancement projects to be incorporated into Draft Plans; develop preliminary ecological targets to guide subsequent planning phases for site-specific restoration and enhancement;
- Provide high-level recommendations for mitigation measures (LIDs, etc.), for retained and compensation wetlands in collaboration with other disciplines;
- Identify future development application requirements for detailed feature-based water balance assessments in consultation with other disciplines;
- Outline requirements, ecological, regulatory, and policy-based, for any potential feature removal and compensation initiatives based on the recommendations provided in the SABE

Scoped SWS Part C report. Next steps for draft plan and site plan considerations will be outlined as it relates to compensation/offsetting;

- Develop a preliminary implementation and management strategy to support the timing of restoration and enhancements through subsequent planning phases; and,
- Establish recommended monitoring program for aquatic and terrestrial environments.

12.1.3 Stream Morphology Considerations

Considerations for stream morphology within the Phase 3 SWS will include:

- Coordination amongst disciplines to identify strategies to meet natural heritage and fluvial sustainability goals;
- Provide further implementation, monitoring and adaptive management recommendations for watercourse management recommendations outlined in Phase 2;
- Incorporation of restoration and optimization opportunities for headwater drainage features and streams/rivers including potential LID and Green Infrastructure opportunities to manage stormwater, protect water balance, maintain thermal regime, and support habitat creation; and,
- Further review and recommend potential detailed design projects that would support the goals of the SWS and identify future studies and priorities for subsequent planning phases that will support stormwater management, natural heritage management, and climate change goals.

12.1.4 Stormwater Management

Considerations for stormwater management within the Phase 3 SWS will include:

- Develop a Stormwater Management (SWM) strategy, including LID measures and end of pipe SWM facilities that achieves the SWM criteria for quantity, quality, and erosion control, in addition to mitigating impacts to water balance. Natural heritage, groundwater and surface water impact assessments shall be considered when developing the SWM strategy;
- Identify TRCA requirement for post-development regional peak flows to be controlled to pre-development peak flows, so that the regional control provides functional protection;
- Verify the SWM strategy conformance with the criteria developed as part of the Phase 1 Study;
- Provide a climate change assessment consisting of evaluating the hydrologic impacts for projected design storms (i.e., 2080s IDF projections applying an RCP of 8.5 (Climate Trends and Future Projections in the Region of Peel, February 2016, TRCA et al.) and four (4) local historic storms, and the formative timeseries for four (4) formative storm events which occurred in other jurisdictions, as well as applying the Humber River Watershed climate change impact assessment methodology;
- Identify additional systems such as Clean Water Collector (CWC) systems, required to support LID measures as part of the overall water balance mitigation strategy and/or any feature specific water balance mitigation strategy, where required;

- Provide general design criteria for end-of-pipe SWM facilities that will work toward mitigating the impacts from the land use plan. The criteria will provide guidance at the next stage in the development process in support of Draft Plan of Subdivisions for sizing and grading of SWM facilities; and
- Provide an overview of timing, phasing and cost sharing requirements for end-of-pipe SWM facilities.

12.1.5 Hydrogeological Considerations

The main objective for hydrogeology within the Phase 3 report will be to identify opportunities for mitigation and establish recommended monitoring and mitigation during construction and under ultimate conditions. Specifically, the Phase 3 report will:

- Provide preliminary recommendations and measures to be considered during construction to mitigate impacts to local groundwater resources such as dewatering or to the water balance caused by decreases in infiltration and increases in runoff;
- Identify potential surface water infiltration opportunities based on soils information, depth to the water table, and aquifer vulnerability;
- Identify future development application requirements for feature-based water balances in consultation with other disciplines;
- Establish a recommended monitoring program to support hydrogeological understanding of changes due to the preferred land use plan; and
- Groundwater management strategies should include Technical input (quantitative and qualitative) will be provided into the determination or refinement of hydrogeologically sensitive areas relating to both recharge and discharge, issues related to shallow water table or strong upward gradients, potential location and function of Stormwater Management facilities and other BMPs, as well as planning and policy recommendations for groundwater quantity and quality protection.

12.1.6 Geotechnical Considerations

Provide details on future studies and monitoring considerations required for subsequent planning phases including boreholes and monitoring wells to support detailed design.

12.1.7 Surface Water Quality Considerations

- Provide details on future study requirements and additional field investigations to address detailed design items such as stormwater management

12.1.8 Climate Change Considerations

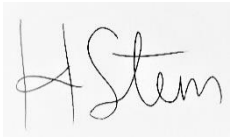
Phase 3 will integrate climate change considerations into the overall management strategy, ensuring alignment with the Town of Caledon's *Community Climate Change Action Plan* and the Peel Region's *Climate Change Master Plan*. This phase will incorporate best practices to enhance resilience in Subwatershed planning by considering projected climate impacts on natural heritage and hydrology, informing adaptive management strategies that support long-term sustainability. Key considerations will include LID measures, nature-based solutions, and stormwater management innovations to mitigation climate-related risks such as flooding, erosion and heat stress. Monitoring protocols should be established to track climate-induced changes and inform future adaptation and mitigation actions. Phase 3 will highlight resilience-focused measures to support the Subwatershed in being adaptive and proactive in responding to evolving climate conditions and extreme weather events.

13. Conclusion

If you have any comments or concerns regarding this Phase 2 SWS, please reach out to one of the undersigned.

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