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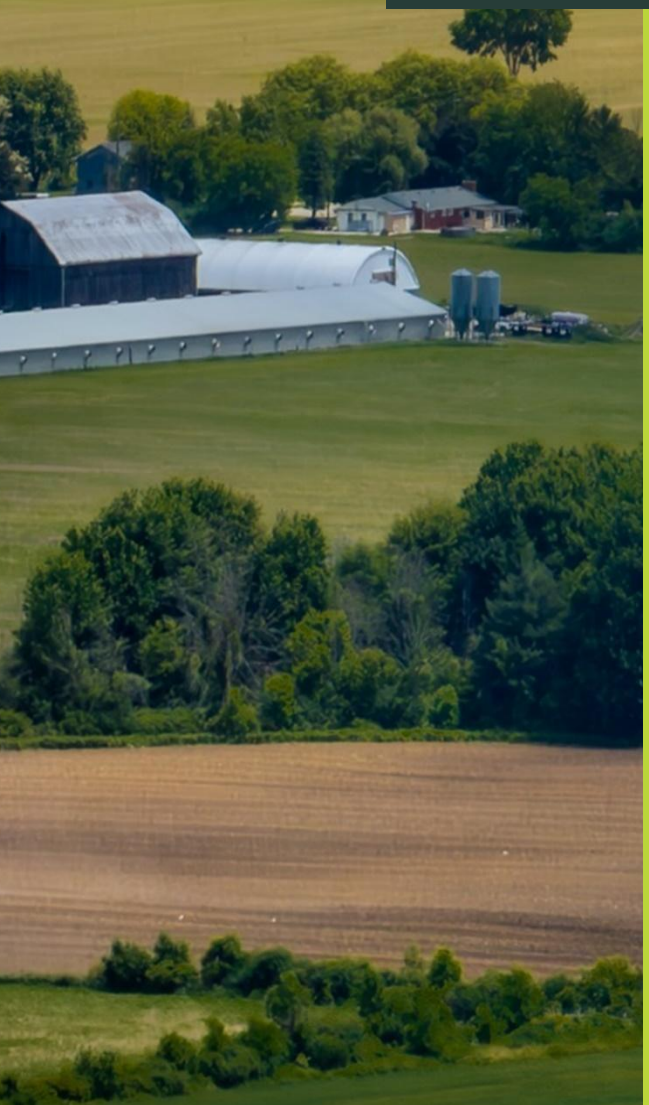

LOCAL SUBWATERSHED STUDY FOR THE ALLOA SECONDARY PLAN AREA & ASSOCIATED SUBCATCHMENTS

Town of Caledon
Region of Peel

Prepared For:
Alloa Landowners Group

Prepared By:
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CROZIER

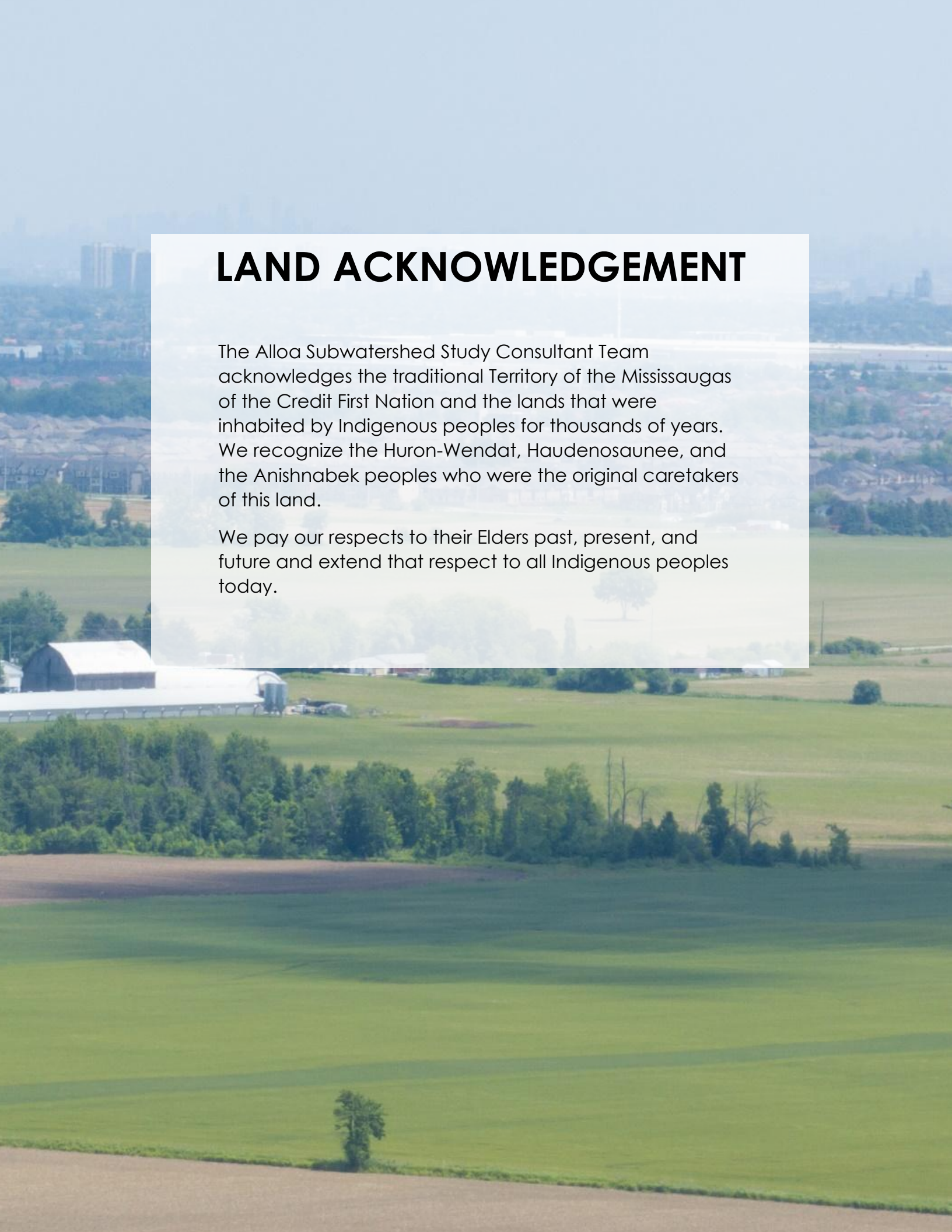
1st Submission: July 2024
2nd Submission: August 2025

(Crozier File No. 2448-6683)

ACKNOWLEDGEMENTS

This Local Subwatershed Study was prepared cooperatively and in collaboration with other organizations.

1. Cooperation of the Alloa Landowner Group
2. Collaboration with and input from the Technical Advisory Committee members representing:
    - Region of Peel
    - Town of Caledon
    - Toronto and Region Conservation Authority
    - Credit Valley Conservation
3. Collaboration with other consultants providing supporting related studies to the Alloa Secondary Plan



LAND ACKNOWLEDGEMENT

The Alloa Subwatershed Study Consultant Team acknowledges the traditional Territory of the Mississaugas of the Credit First Nation and the lands that were inhabited by Indigenous peoples for thousands of years. We recognize the Huron-Wendat, Haudenosaunee, and the Anishnabek peoples who were the original caretakers of this land.

We pay our respects to their Elders past, present, and future and extend that respect to all Indigenous peoples today.

Executive Summary

As a part of the Secondary Plan process, the Alloa Local Subwatershed Study (LSS) is required to provide the environmental base and context of the natural heritage and water resource features and functions to support the land use and infrastructure planning for the Alloa Planning Area. The LSS is a multidisciplinary approach that integrates hydrogeology, hydrology/hydraulics, fluvial geomorphology, groundwater, water quality, biological and ecological assessments, and land use analysis.

The Alloa Lands are subject to a Secondary Plan area known as the Alloa Planning Area and for the purposes of this LSS are divided into the Primary Study Area and the Secondary Study Area. The Primary Study Area is bounded by Chinguacousy Road to the east, Mayfield Road to the South and is framed along its westerly and northern limits by the proposed highway 413 alignment. The lands comprise an area of approximately 725 ha (1,800 acres) and are legally described as Part of Lots 18, 19, 20, and 21, Concession 3, 4, and 5, WHS (Chinguacousy), Town of Caledon, Regional Municipality of Peel.

The Alloa Secondary Study Area surrounds the Primary Study Area lands, and covers an additional 1,438ha of land (~2,178ha total). The Secondary Study Area is bounded by the extent of topographically derived subcatchments within jurisdictions of the Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC) which flow into or out of the Primary Study Area.

STUDY SCOPE

The LSS has been prepared and presented in three Phases. Phase 1: Characterization and Integration provides a characterization of the existing conditions, natural heritage and water resources within the Primary and Secondary Study Areas. Phase 2: Subwatershed Impact Assessment describes the potential impacts to the Primary and Secondary Study Areas as a result of future development. Phase 3: Management Strategies, Implementation, and Monitoring Plan provides an evaluation of the proposed land use plan and the management strategies to achieve the identified goals and objectives. As a part of Phase 3, a long-term monitoring plan has been prepared to evaluate the management strategies once development of the Primary Study Area has occurred. The evaluation factors must be consistent with the Planning Objectives for the Alloa Secondary Plan which include:

a) Support climate change mitigation and adaptation;
b) Conserve and incorporate cultural heritage resources into community design;
c) Support and achieve a high standard of urban design;
d) Facilitate a sustainable, environmentally sound and diverse local economy;
e) Achieve a broad mix and range of housing types, including affordable housing;
f) Provide adequate community service facilities;
g) Provide an inter-connected multi-modal transportation network;
h) Provide adequate municipal services;
i) Design a stormwater management system that protects the natural environment system;
j) Provide financially sustainable services, public facilities, and infrastructure;
k) Protect and enhance the natural environment system; and,
l) Provide a well-connected, accessible public open space recreation system; and,
m) Provide a well-connected, cohesive and publicly accessible system of parks, open

spaces, trails and community facilities that provide a range of multi-seasonal recreational, leisure and social opportunities for people of all ages, abilities and interests.

FIELD WORK AND INVENTORIES

In-season field inventories commenced in 2022 through 2024 and groundwater monitoring continues in 2025. Field work and inventories completed and ongoing includes:

- Aquatic
- Terrestrial
- Wildlife
- Birds
- Amphibians
- Headwater Drainage Feature Assessment
- Groundwater and Surface Water Monitoring
- Water Quality

While some field work and inventories are ongoing, it is anticipated that the additional data will only reinforce the conclusions made in this report.

KEY FINDINGS

One of the major challenges within the plan area was confinement of the sprawling existing floodplain across the site. It was determined that through creation of reconfigured flood containment corridors, flood management can be achieved and at the same time the creation of opportunities for significant expansion of the Natural Heritage System are provided. Woodland and wetland areas were confirmed in large part through joint field staking exercises with agencies (Town of Caledon, TRCA, and CVC) and members of the Consultant Team. The results of vegetation and wildlife related field inventory protocols completed to date indicate that there are no findings that would preclude development however authorizations and permitting from agencies will be required. Through careful consideration of both the hydrogeological and hydrological regimes, it has also been confirmed that the pre to post development site and feature based water balance can be achieved through the analysis of existing conditions and confirmation of requirements for flood confinement an enhanced Natural Heritage System has been identified.

LAND USE

The land uses proposed within the overall Secondary Plan Area have been fitted to the enhanced Natural Heritage System designed to accommodate regional storm conditions while also providing and celebrating the extensive greenway corridors that are central to the proposed Land Use Plan. The greenway corridors provide opportunities for flood control, significant increase in natural cover, habitat diversity, and active transportation. The significant land base of the plan dedicated to greenlands shall consider climate adaptation during the detailed design phase of Draft Plans of Subdivision so that the sustainability and resilience of the corridors is ensured over time.

CONCLUSIONS

Phase 1 of this LSS includes a comprehensive inventory of existing natural features and conditions from the Alloa Secondary Plan area. Data collection commenced in 2022 and was completed in 2024. Groundwater monitoring continues in 2025. The information gained through Phase 1established the NHS framework to which the proposed Land Use Plan was fitted.

Phase 2 of this LSS assesses the potential impacts of the proposed land use change on the area's resources. An evaluation of the proposed Land Use Plan for compatibility with both the natural heritage features and water resource considerations, concludes that the proposed Land Use Plan respects all identified constraints to development and provides opportunities for creating an enhanced Natural Heritage System. It was also concluded that the proposed Land Use Plan provides significant opportunities for ecological enhancement of the existing condition thus creating a net ecological gain.

Phase 3 of this LSS establishes the performance measures by which each component of the environmental system was evaluated and will be monitored for compliance with the objectives. Post development adaptive management responses were identified where possible to improve performance where required.

We believe that the land use plan recommended herein has had full regard for the Planning Objectives established for the Alloa Secondary Plan and policies applicable the Alloa Secondary Plan Area and achieves both community planning objectives and net ecological benefit.

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Phase 1: Characterization and Integration

1.0 Introduction

"The LSS report is a multi-disciplinary study and a collaborative effort between all Consultant Team members with input from the TAC"

Crozier Consulting Engineers (Crozier) was retained by the Alloa Landowners Group to direct and manage a team of consultants in the preparation of a Local Subwatershed Study (LSS) as a part of submissions to support the Alloa Secondary Plan. The Consultant Team includes Urbantech (civil and water resources engineering), GEO Morphix Ltd. (fluvial geomorphology), Azimuth Environmental Consulting Inc. (Azimuth) and Cunningham Environmental Associates (Cunningham) (wildlife, fisheries, and terrestrial), Crozier (hydrogeology), and Pratus Group Inc. (climate). The Consultant Team has worked in collaboration with a Technical Advisory Committee (TAC) which includes members from Region of Peel (Region), Town of Caledon (Town), Toronto and Region Conservation Authority (TRCA) and Credit Valley Conservation (CVC). The Town of Caledon's Draft Local Subwatershed Study Terms of Reference (May 2023) was revised with input from the Consultant Team to be tailored specific to the Alloa Secondary Plan and was used as a guide to complete the study scope. The Terms of Reference were approved by the Town in March 2025. Regular bi-weekly meetings were held with the TAC and the Consultant Team to discuss the status of ongoing field work, the completed field work, proposed development constraints, and review of any comments received from TAC members on the Terms of Reference.

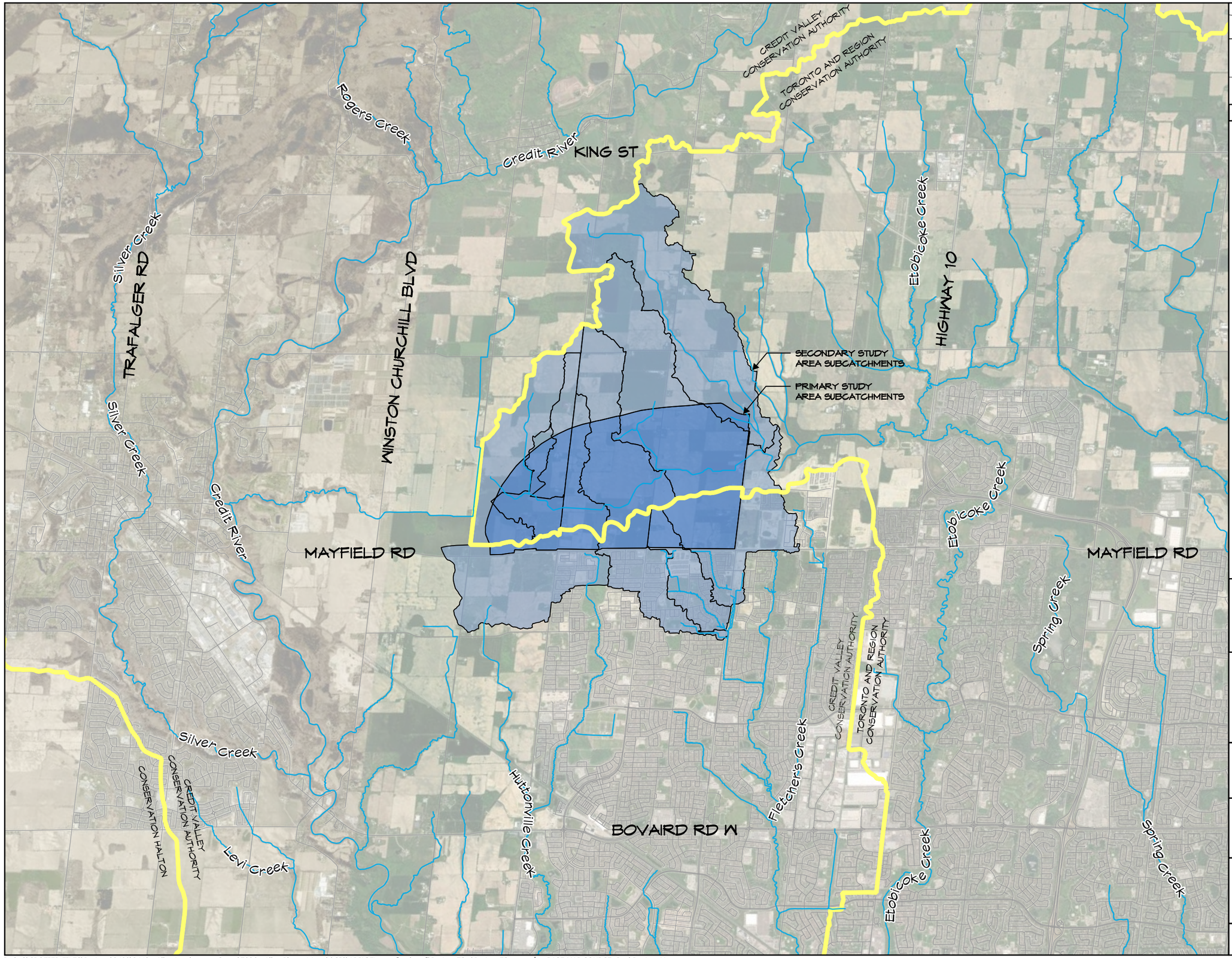
The LSS report is a multi-disciplinary study and a collaborative effort between all Consultant Team members with input from the TAC that establishes a baseline characterization of the ecological features and functions, assesses the impacts from development, and confirms the management approach to protect, rehabilitate, and enhance the natural heritage system features and functions.

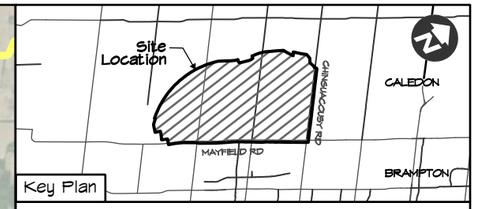
2.0 Study Area

The Alloa Lands are located within a Secondary Plan area known as the Alloa Planning Area which, for the purposes of this LSS, are divided into the Primary Study Area and the Secondary Study Area (see Figure 1). It should be noted that references throughout this report to the Primary Study Area are interchangeable with references to the Alloa Secondary Plan Area.

The Primary Study Area is bounded by Chinguacousy Road to the east, Mayfield Road to the South and is framed along its westerly and northern limits by the proposed highway 413 alignment (see Figure 1). The lands comprise an area of approximately 725 ha (1,800 acres) and are legally described as Part of Lots 18, 19, 20, and 21, Concession 3, 4, and 5, WHS (Chinguacousy), Town of Caledon, Regional Municipality of Peel.

The Alloa Secondary Study Area surrounds the Primary Study Area lands, and covers an additional 1,438ha of land (~2,178ha total). The Secondary Study Area is bounded by the extent of topographically derived subcatchments which flow into or out of the primary study area (see Figure 1).





LEGEND

- CONSERVATION AUTHORITY JURISDICTION BOUNDARY

SUBCATCHMENTS

- PRIMARY STUDY AREA SUBCATCHMENTS
- SECONDARY STUDY AREA SUBCATCHMENTS
- WATERCOURSE

NOTES:

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Project:

Alloa Subwatershed Study

Alloa Landowners Group

Title:

Alloa Local Subwatershed Study Area

CROZIER

70 Huron St Suite 100, Collingwood, ON (705) 446-3510

Date:	Drawn By:	Approved By:	
2025-08-19	M.M.	T.M.	**Figure 1**

Path: \\CROZIER-FILES\Projects\2400\2448 - Alloa Landowners Group\7006 - Alloa Phase 1 Lands\GIS\ARPX\Figures [updates]\Project Files\Project Files.aprx | BASE MAP SOURCE: Peel Region, Maxar

The establishment of the Secondary Study Area boundary is directly tied to two quaternary tier watersheds of Etobicoke Creek and Huttonville Creek – Credit River. These quaternary tier watersheds include various Subwatershed areas which have been established and adopted by the TRCA and CVC. Within the subwatersheds, subcatchments were delineated by Urbantech using local LIDAR data and further refined through edge matching to TRCA and CVC established subwatersheds. The maximum extent to which the subcatchments extend represents the limits of the Secondary Study Area as these subcatchments represent the extent to which land use changes within the Primary Study Area can impact each subcatchment. Beyond the eleven subcatchments, inputs are independent of land use changes implemented within the Primary Study Area.

A review of watershed mapping revealed the northern portion of the Alloa Secondary Plan Study Area lies within the Etobicoke Creek watershed (TRCA) while the southeastern portion is located within the Credit River Watershed. Accordingly, the subwatershed drainage divide represents the location in which typical surficial drainage moves either to the north and east, into the Etobicoke Creek Watershed, or south and east, to the Credit River Watershed.

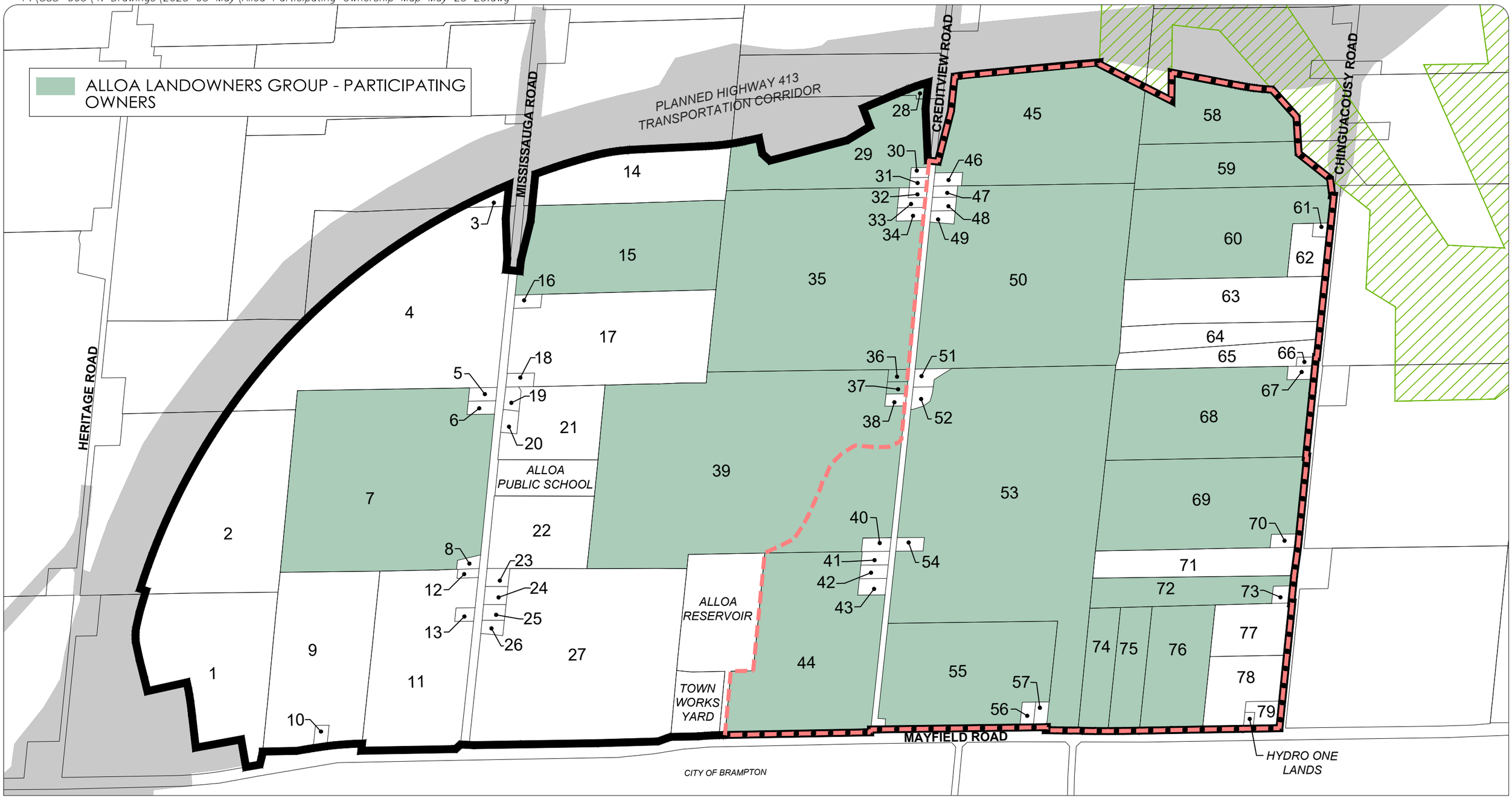
The northern part of the Secondary Study Area is located within the Etobicoke Creek watershed which is heavily urbanized through to its lake outlet. Containing eight subwatersheds, the Alloa Secondary Plan Study Area is located within the Headwaters subwatershed of the greater Etobicoke Creek watershed. The entire Etobicoke Creek watershed forms on the western edge of the TRCA jurisdiction, starting just south of the Oak Ridges Moraine in the Town of Caledon. Flows within the watershed continue through Brampton, Mississauga, and Toronto, prior to being discharged into Lake Ontario. A large amount of the watershed has commercial and industrial land uses, with the remainder of the agricultural land falling within the Headwaters Subwatershed (Etobicoke Creek Watershed Characterization Report, TRCA 2021). The south portion of the site is within the Huttonville Creek Subwatershed within the CVC jurisdiction (see Figure 1).

Lands within the Alloa Planning Area are owned by multiple landowners consisting of a total of 33 "participating" and "co-operating, non-participating" landowners as well as non-cooperating, non-participating landowners (no access to land) (see Figure 2). For the purposes of this LSS, the "overall study area" comprises the participating and co-operating, non-participating properties as well as the non-participating properties within the Primary Study Area, as well as the Secondary Study Area lands outside the Primary Study Area.

3.0 The Secondary Planning Process

All New Community and Employment Areas within the Town of Caledon's 2051 New Urban Area require secondary planning to implement the Town structure and to build on the direction of the Future Caledon Official Plan to guide future development. This is achieved by applying land use designations and policies to enable and support a range of appropriate urban land uses and to protect, restore, and enhance natural features and areas including water resource systems and to provide parks, open spaces, and stormwater management. For field inventory work, Consultant Team members had free access to participating and co-operating, non-participating landowner properties.

P:\888-003\4. Drawings\2025 05 May\Alloa Participating Ownership Map May 23 25.dwg



ALLOA PLANNING AREA OWNERSHIP PLAN

TOWN OF CALEDON, REGION OF PEEL

ALLOA SECONDARY PLAN AREA | PHASE 1 BOUNDARY | GREENBELT PLAN AREA | PLANNED HIGHWAY 413 TRANSPORTATION CORRIDOR

SCALE NTS
MAY 27, 2025

GSAI
Glen Schnarr & Associates Inc.

There was no access provided to non-participating properties therefore second source information was relied upon The Future Caledon Official Plan identifies the Alloa Planning Area as a future Secondary Planning Area (Area A1, per Figure F3 of the Official Plan, see Appendix A). It is intended that future development may only occur in this area in accordance with an approved Secondary Plan, which would set out a planning framework for development. As such, an Official Plan Amendment was prepared to implement a new Secondary Plan in the Alloa Planning Area to facilitate future development on these lands.

The Alloa Secondary Plan was prepared in accordance with the policies and requirements of the Future Caledon Official Plan and was approved on July 8, 2025. Per the Official Plan, several supporting studies and technical analyses are required as foundation to a Secondary Plan, including a Local Subwatershed Study.

4.0 The Local Subwatershed Study Process

Through the Secondary Planning Process for Alloa, a Subwatershed Study is required to characterize the natural heritage resources that could be impacted by future urban development within the Primary and Secondary Study Areas and to identify constraints and opportunities associated with the proposed land use changes. The results from the characterization and impacts assessment will provide results to identify management approaches to mitigate anticipated impacts and enhance existing conditions in both the Primary and Secondary Study Areas. The Local Subwatershed Study (LSS) process is a comprehensive and integrated approach to understanding and managing the natural heritage and water resource features and functions within a subwatershed. The study process for this LSS is collaborative in scope and has been integrated and completed concurrently with other studies for the Secondary Plan including the Planning Justification, Functional Servicing, and Transportation Master Plan for consideration of future land use.

5.0 Local Subwatershed Study Objectives

The purpose of this Local Subwatershed Study (LSS) is to inform and support land use and infrastructure planning as a part of the Alloa Secondary Plan process. The main objectives for each Phase of the LSS are to provide information about the natural heritage resources within the Primary and Secondary Study Areas, evaluate impacts of the proposed land uses, and to provide strategies associated with meeting the various targets as required by the review agencies. As noted in the Alloa Secondary Plan Terms of Reference (TOR), the Local Subwatershed Study for the Alloa Secondary Plan will:

- Identify the location, extent, present status, significance, and sensitivity of the existing natural environment;
- Identify environmentally sensitive areas and natural hazards, including constraints and opportunities;

- Confirm or refine the natural environment system(s) (i.e., natural heritage and water resource systems) to protect, rehabilitate, and enhance the water quality/quantity, ecological form, function and the interactions and interdependencies between the system within the Secondary Plan Area and local environs;
- Identify lands where development may be considered, and determine how existing and future land uses can be developed to be compatible with the natural environment system(s);
- Undertake an iterative Impact Assessment based on an initial Secondary Plan Land Use Plan (LSS first submission), followed by a second refined land use concept (LSS second submission) developed through the feedback from the initial testing, including input from other technical studies and feedback from stakeholders;
- Provide direction on best management practices (BMPs) to manage impacts from the urbanization proposed through the Secondary Plan (from an environmental and water management perspective), and, where there are established BMPs for infrastructure, these are considered a minimum requirement;
- Provide direction on future study requirements (i.e., Environmental Impact Report (EIR) or equivalent), infrastructure needs (i.e., planning and implementing servicing and transportation infrastructure from an environmental and water management perspective);
- Establish an implementation and management strategy and requirements for environmental systems monitoring;
- Support the Class Environmental Assessment (EA) processes if required as part of the infrastructure planning for the Secondary Plan, specific to constraints and opportunities associated with the natural and water-based systems.

In addition, the LSS will identify preliminary candidate Key Natural Heritage Features (KNHFs) present in the study area for a subsequent assessment of potential impacts to those KNHFs as part of finalizing the LSS. A review of existing background information, concomitant with a detailed, three-season field program was undertaken in spring/summer 2024 to identify KNHFs. Supplementary surveys for Species at Risk (SAR) that may occupy structures *(e.g*. SAR bats) were completed, with targeted surveys occurring in June-July 2025. Azimuth's 2024 comprensive field program was supplemented, where appropriate, with fieldwork completed by Beacon Environmental (Beacon) in 2022 and 2023 (Beacon, 2023a, b). Specifically, vegetation community mapping and plant inventory existing conditions data (refined/modified as needed by CEA), evening calling amphibian, benthic invertebrate, and incidental wildlife field data collected by Beacon has also been integrated into this report. The balance of the wildlife field data reported here was collected by Azimuth and CEA. This Local Subwatershed Study also presents an initial examination of potential for SAR protected under Ontario's *Endangered Species Act,* 2007 (ESA) in the study area. General environmental mitigation, enhancement recommendations, and potential policy update implications are also provided.

6.0 Background Information

Various sources of background information and guidance have been provided to the Consultant Team for use in this report, particularly as second source data for use to characterize the Secondary Study Area. The information and data received and used in this report from the Town of Caledon, Region of Peel, Toronto and Region Conservation Authority and Credit Valley Conservation Authority has been listed in the references in Section 22 of this report.

As part of the background review, which forms a substantial component of this report, natural features data/information for the Secondary Study Area are sourced and discussed throughout this report. The background data used includes natural heritage records/mapping, plus natural heritage inventory data provided by the Region of Peel, TRCA and CVC, in addition to natural heritage records/mapping related to the Primary Study Area collected through comprehensive field investigations to date.

A combination of background information/mapping, field data collected in 2022-2023 by Beacon (2023a, b) and field data collected in 2024/2025 by Azimuth and CEA were used to characterize KNHFs associated with lands encompassed by the Primary and Secondary Study Areas. Part of the characterization of KNHFs included a detailed background review and summary. The approach used to summarize the detailed review of municipal, regional, and provincial background information/mapping sources, natural areas inventory data from CVC, TRCA and Region, and Aquatic Resource Area (ARA) data pertaining to the network of watercourses/drainage features and fish habitat found within the Primary and Secondary Study Areas is described below.

6.1 Detailed Background Review

6.1.1. Municipal, Regional and Provincial Background Information

The detailed background review included a search of the Town, Region, Ministry of Natural Resources (MNR), Ministry of the Environment and Conservation and Parks (MECP) and other provincial mapping/data records (Appendix B) to obtain available background mapping and other information, including current information related to SAR in the Primary and Secondary Study Areas. The following documents and data sources provided information on the characteristics, habitat, wildlife, rare species and communities, and general cultural/historic aspects of the lands:

- Ministry of Natural Resources (MNR) Natural Heritage Information Centre (NHIC; MNRF, 2024a)
- Land Information Ontario (LIO) MNR ARA Line Segment Interactive Mapping (MNR, 2024b)
- Ontario Ministry of Natural Resources (OMNR) Natural Heritage Reference Manual (NHRM; OMNR, 2010)
- Atlas of the Breeding Birds of Ontario (OBBA; Cadman *et al.*, 2007)
- iNaturalist (NHIC) Rare Species of Ontario (iNaturalist, 2024)

- Ontario Reptile and Amphibian Atlas (ORAA; Ontario Nature, 2020)
- MECP's Species at Risk Ontario list (MECP, 2024)
- Air photos available for the study area (Google, VuMap)
- Government of Canada's Species at Risk Public Registry
- Atlas of the Mammals of Ontario (Dobbyn, 1994)
- Aquatic/fisheries SAR interactive mapping (Fisheries and Oceans (DFO), 2024)
- Alloa Phase I Lands existing conditions data (Beacon, 2023a)
- Alloa Phase II Lands existing conditions data (Beacon, 2023b)
- Region OP (Region, 2022a)
- Future Caledon OP (Town, 2024)
- Region Natural Areas Inventory data (Region, 2022b, c)
- CVC natural areas inventory data (CVC, 2022a, b)
- TRCA natural areas inventory data (receipt of data pending)
- Huttonville and Fletcher's Creek SWS (2010)
- Regional Settlement Area Boundary Expansion (Region, 2022)
- Etobicoke Creek Watershed Plan (TRCA, 2024)

The fulsome characterization of background KNHF data is summarized in Table 1.

6.1.2. Natural Areas Inventory Background Data

Part of the detailed background review included a review and summary of CVC (CVC, 2022a, b), Region (Region, 2022b, c) and TRCA natural areas inventory data and associated reports corresponding to KNHFs identified in both the Primary and Secondary Study Areas. The natural areas inventory is a field-based documentation of KNHFs, including an inventory of plant and wildlife species that occur in the inventory area. Methodologies used by the CVC, Region and TRCA included provincial protocols for Ecological Land Classification (ELC) vegetation community mapping for Southern Ontario, breeding bird monitoring and monitoring of evening calling amphibians. Table 1 summarizes the background review based on NHIC, OBBA, ORAA, iNaturalist, VuMap (Appendix B) and LIO, as well as CVC, Region and TRCA natural areas inventory data.

Combined with municipal, regional and provincial information/mapping, the purpose of the compiled background dataset is to provide a comprehensive context of possible environmental sensitivities within which to understand the existing conditions documented in the field and the development proposed.

TABLE 1: DETAILED BACKGROUND REVIEW SUMMARY, PRIMARY AND SECONDARY AREAS

DATA SOURCE	Natural Heritage Feature	Primary Study Area - Phase I Lands[1]	Primary Study Area - Phase II Lands[2]	Secondary Study Area
OBBA, ORAA iNaturalist and NHIC*	SAR	Bank Swallow (Threatened) Blue-spotted Salamander Unisexual (Endangered) Bobolink (Threatened) Eastern Meadowlark (Threatened) Eastern Wood-pewee (Special Concern) Jefferson Salamander (Endangered) Jefferson Salamander Unisexual (Endangered) Northern Map Turtle (Special Concern) Snapping Turtle (Special Concern) Wood Thrush (Special Concern)	Bank Swallow (Threatened) Blue-spotted Salamander Unisexual (Endangered) Bobolink (Threatened) Eastern Meadowlark (Threatened) Eastern Wood-pewee (Special Concern) Jefferson Salamander (Endangered) Jefferson Salamander Unisexual (Endangered) Northern Map Turtle (Special Concern) Snapping Turtle (Special Concern) Wood Thrush (Special Concern)	Bank Swallow (Threatened) Black Ash (Endangered) Blue-spotted Salamander Unisexual (Endangered) Butternut (Endangered) Bobolink (Threatened) Eastern Meadowlark (Threatened) Eastern Wood-pewee (Special Concern) Golden-winged Warbler (Special Concern) Jefferson Salamander (Endangered) Jefferson Salamander Unisexual (Endangered) Northern Map Turtle (Special Concern) Snapping Turtle (Special Concern) Wood Thrush (Special Concern)
OBBA (Additional species not in NHIC)*	SAR	Barn Swallow (Special Concern)	Barn Swallow (Special Concern)	Barn Swallow (Special Concern)
NHIC* and VuMap 2.0 (see main text for details)	Wetlands - PSW	Present (Wetlands #4-7) (note: wetland #7 re-evaluated as non-significant in 2024)	Present (Wetlands #2-3)	Present (Wetlands #10-15)
	Wetlands - non-PSW	Wetland #7 (see above)	Present (Wetland #1)	Present (Wetlands #8, 16-17)
	Wetlands - Unevaluated	Not Present	Not Present	Present (Wetland #9)

DATA SOURCE	Natural Heritage Feature	Primary Study Area - Phase I Lands[1]	Primary Study Area - Phase II Lands[2]	Secondary Study Area
	Woodlands	Present (Woodlands F-I)	Present (Woodlands A-E)	Present (Woodlands J-S)
	Candidate Significant Valleylands	Not Present	Not Present	Potential (northern region)
	Candidate Significant Wildlife Habitat	Present	Present	Potential
	ANSI - Life Science	Not Present	Not Present	Not Present
	ANSI - Earth Science	Not Present	Not Present	Not Present
	Watercourses/Drainage Features	Present	Present	Present
LIO Data[3] (ARA Identifier in Subwatershed, Thermal Regime and Fish Community)	Watercourses/Drainage Features	Name: Alloa Drain, Tributaries #1-5 (Turquoise system on Appendix O)Thermal Regime: Primarily warmFish Community: Blacknose Dace, Bluntnose Minnow, Brook Stickleback, Common Shiner, Creek Chub, Fathead Minnow, Goldfish, Largemouth Bass, Northern Pearl Dace, Pumpkinseed, White Sucker (see main report text)	Name: Alloa Drain, Lyons Drain, Tributaries #6-9 (Turquoise system on Appendix O)Thermal Regime: Primarily warmFish Community: Considered to be same as Alloa Drain due to proximity (see main report text; Blacknose Dace, Bluntnose Minnow, Brook Stickleback, Common Shiner, Creek Chub, Fathead Minnow, Largemouth Bass, Northern Pearl Dace, White Sucker)	Name: Segments #1-9 (Yellow System on Appendix O)[6]Thermal Regime: Primarily warm-coolFish Community: Blacknose Dace, Blackside Darter, Bluegill, Bluntnose Minnow, Brassy Minnow, Brook Stickleback, Brown Bullhead, Carps and Minnows, Central Mudminnow, Central Stoneroller, Common Carp, Common Shiner, Creek Chub, Emerald Shiner, Etheostoma sp., Fathead Minnow, Finescale Dace, Hornyhead Chub, Iowa Darter, Johnny Darter, Johnny Darter x Tesselated Darter, Largemouth Bass, Longnose Dace, Mottled Sculpin, Northern Pearl Dace, Northern Redbelly Dace, Pumpkinseed,

DATA SOURCE	Natural Heritage Feature	Primary Study Area - Phase I Lands[1]	Primary Study Area - Phase II Lands[2]	Secondary Study Area
				Rainbow Darter, River Chub, Rock Bass, Rosyface Shiner, Round Goby, Smallmouth Bass, White Sucker, Yellow Perch
	--	--	--	Name: Segment #10 (Pink System on Appendix O)[7] Thermal Regime: Cold Fish Community: Blacknose Dace, Bluntnose Minnow, Brassy Minnow, Brook Stickleback, Carps and Minnows, Central Mudminnow, Coho Salmon, Common Shiner, Creek Chub, Fantail Darter, Fathead Minnow, Golden Shiner, Johnny Darter, Largemouth Bass, Longnose Dace, Northern Redbelly Dace, Pumpkinseed, Rainbow Trout, Redside Dace, White Sucker
	--	--	--	Name: Segment #11 (Turquoise System on Appendix O)[8]Thermal Regime: WarmFish Community: American Brook Lamprey, Blackchin Shiner, Blacknose Dace, Blacknose Shiner, Bluntnose Minnow, Brassy Minnow, Brook Stickleback, Brown Bullhead, Brown Trout, Carps and

DATA SOURCE	Natural Heritage Feature	Primary Study Area - Phase I Lands[1]	Primary Study Area - Phase II Lands[2]	Secondary Study Area
				Minnows, Central Mudminnow, Common Shiner, Creek Chub, Etheostoma sp., Fantail Darter, Fathead Minnow, Golden Shiner, Johnny Darter, Johnny Darter x Tesselated Darter, Longnose Dace, Longnose Sucker, Mottled Sculpin, Northern Hog Sucker, Northern Pearl Dace, Northern Redbelly Dace, Pumpkinseed, Rainbow Darter, Rainbow Trout, River Chub, Rock Bass, Spottail Shiner, Stonecat, Unidentifiable, White Sucker
CVC/Region Natural Areas Inventory Data[4]	Physiography Mapping	South Slope[9]	South Slope[9]	South Slope[9]
	River System Name	Etobicoke Creek	Mostly Etobicoke Creek, part of Credit River	Etobicoke Creek and Credit River
	Ecoregion	6E	6E	6E
	SAR/SAR Habitat	Present (Peel Region)	Present (Peel Region)	Present (Peel Region)
	Vascular Plants of the NAI Study Area	Reviewed (Peel Region)	Reviewed (Peel Region)	Reviewed (Peel Region)
	Fauna of the NAI Study Area	Reviewed (Peel Region	Reviewed (Peel Region	Reviewed (Peel Region
	Significant Wildlife Habitat	Not Present	Not Present	Highly Diverse Areas
	Habitat Connectivity Mapping	Low, Moderate, and High Probability of Facilitating Terrestrial Species Movement	Low, Moderate, and High Probability of Facilitating Terrestrial Species Movement	Low, Moderate, and High Probability of Facilitating Terrestrial Species Movement

DATA SOURCE	Natural Heritage Feature	Primary Study Area - Phase I Lands[1]	Primary Study Area - Phase II Lands[2]	Secondary Study Area
TRCA Natural Areas Inventory Data[5]	River System Name	Etobicoke Creek	Mostly Etobicoke Creek, part of Credit River	Etobicoke Creek and Credit River
	Woodlands	Present	Present	Present
	Wetlands	Present	Present	Present
	Fish Habitat & Water Resources	Reviewed (Alloa SSA)	Reviewed (Alloa SSA)	Reviewed (Alloa SSA)
	Terrestrial Flora (L1-L4)	Reviewed (Alloa SSA)	Reviewed (Alloa SSA)	Reviewed (Alloa SSA)
	Terrestrial Fauna (L1-L4)	Reviewed (Alloa SSA)	Reviewed (Alloa SSA)	Reviewed (Alloa SSA)
	SAR/SAR Habitat	Reviewed (Flora & Fauna Inventories for Alloa SSA)	Reviewed (Flora & Fauna Inventories for Alloa SSA)	Reviewed (Flora & Fauna Inventories for Alloa SSA)
	Significant Wildlife Habitat	Other Rare Vegetation Communities, Seeps and Springs, Special Concern and Rare Wildlife Species	Other Rare Vegetation Communities, Seeps and Springs, Special Concern and Rare Wildlife Species	Amphibian Movement Corridor, Other Rare Vegetation Communities, Seeps and Springs, Special Concern and Rare Wildlife Species, Woodland Area-Sensitive Bird Breeding, Amphibian Breeding Habitat (Woodland), Terrestrial Crayfish Habitat
	Habitat Connectivity	Forest-Forest	Forest-Forest	Forest-Forest, Forest-Wetland
	Natural Heritage System	Existing Natural Cover, Potential Natural Cover, Contributing Area	Existing Natural Cover, Potential Natural Cover, Contributing Area	Existing Natural Cover, Potential Natural Cover, Contributing Area
	Road and Valley Crossing Data (Fish)	Priority Road Crossings	Priority Road Crossings	Priority Road Crossings

*See Appendix A.
[1]Primarily bound by Chinguacousy Road (east), Old School Road (north), Creditview Road (west) and Mayfield Road (south). See main report text and Figure 1 for further details.
[2]*Primarily bound by Creditview Road (east), Old School Road (north), Heritage Road (west) and Mayfield Road (south). See main report text and Figure 1 for further details.*

[3]Land Information Ontario (LIO) Aquatic Resource Area (ARA) Line Segment Interactive Mapping Data (MNRF, 2024b). Includes ARA watercourse/drainage feature identifier code, thermal regime and fish community data for feature segments (as available).
[4]Natural Areas Inventory data and Credit River Watershed and Region of Peel Natural Areas Inventory Report Volume 1 (CVC 2022a, b; Region, 2022b, c)
[5]Natural Areas Inventory data,
[6]ARA Identifiers (Yellow watercourses/drainage features on Appendix O): AU-0001-WHI; AU-0013-CRE; AU-0014-DUF; KV-0001-MUI; MH-5267-GOU; PB-0001-HAW; PB-0001-SUC; PS-0011-EAO; SL-9115-SLK (MNRF, 2024b).
[7]ARA Identifiers (Pink system on Appendix O): AU-0015-CRE (MNRF, 2024b).
[8]ARA Identifiers (Turquoise system on Appendix O): AU-0015-ETD (MNRF, 2024b).
[9]South Slope Physiography: Typified by low-lying, fine-grained ground moraine and knolls; till part of Halton Till Layer; fertile soils with high agricultural value; low permeability soils and limited groundwater infiltration (Section 3.2.8 in CVC, 2022b; Region, 2022c).

7.0 Baseline Inventory

7.1 Hydrogeology

The hydrogeologic component of the Alloa Local Subwatershed Study (LSS) focuses on establishing a comprehensive geological conceptual model for the study area. Themodel characterizes the key attributes of both the bedrock and overburden systems, with particular attention to their roles in governing groundwater movement, availability, and quality within the greater subwatershed.

A central aspect of the analysis involves evaluating the interactions between the groundwater and surface water systems. Understanding these interactions is essential for interpreting their ecological functions and contributions to the broader subwatershed ecosystem. The study also considers the potential impacts of future development on local groundwater resources, with the aim of informing strategies to maintain water balance and protect long-term resource sustainability.

The LSS work builds upon the foundational insights developed through the SABE Scoped Subwatershed Study. By integrating new field monitoring data and applying refined modeling tools, the Alloa LSS enhances spatial and temporal resolution in assessing the groundwater system. The refined analysis supports the achievement of the LSS Study's primary objectives and deepens understanding of several key hydrogeologic considerations, including:

- Groundwater recharge and discharge dynamics
- Aquifer vulnerability and protection
- Seasonal and long-term variability in groundwater levels
- Connectivity between groundwater and surface water features
- Implications for water quality and ecosystem health

7.1.1.

7.1.1. Study Basis

The Hydrogeological Analysis completed as a part of the LSS include:

- Evaluation of existing literature and regional studies;
- Characterization of soils and geological units;
- Installation of groundwater monitoring wells and monitoring of groundwater levels;
- Installation of shallow piezometers and wetland staff gauges;
- Assessment of hydraulic conductivity values to define aquifers and aquitards;
- Groundwater chemistry sampling;
- Assessment of groundwater recharge and discharge areas; and,
- Development of sitewide conceptual model.

The information and data within the LSS is considered suitable to support baseline characterization of conditions in both the Primary Study Area and Secondary Study Area. For the Secondary Study Area, the principal characterization source was desktop material.

For future studies, additions to the field program are recommended to support analyses at detailed design , refining existing data collection sources, and enhancing the understanding of the hydrogeological system. The items that may support detailed design include:

- Surface water flow monitoring stations at identified groundwater recharge and discharge areas but also channelized wetland areas where an enhanced understanding of flow through quantities is required;
- Supplemental wells and piezometers in areas (and wetlands) where groundwater dynamics characterization could be better supported;
- Guelph permeameter testing of surface soils at locations of proposed infiltration and/or LID implementation; and,
- Further qualitative evaluations of infield observations aimed to bolster system understanding and identify novel considerations.

Both feature-based and site-wide pre- and post-development water balance assessments have been undertaken by the Alloa Consultant Team to support the LSS. These analyses are described below and provide information on the potential change in overall water balance post-development. Future LID design measures are recommended where feasible to mitigate any infiltration reduction based on the hydrogeological conditions for the site.

Data collection within the Primary Study area begun with establishment of the groundwater monitoring network on the Phase 1 lands in the Summer of 2023 and the groundwater monitoring network on the Phase 2 lands in the Winter of 2024. Seasonal and hourly groundwater monitoring has been ongoing on the Alloa lands since Fall of 2023 to present. The surface water monitoring

network inclusive of piezometers and staff gauges was established in Spring/Summer of 2024 to present.

The level of data presented in this report is considered to be sufficient to establish a site-wide conceptual model capable of supporting this LSS. The first year of data collection (2023) occurred during a historically wet season, and the subsequent year (2024) demonstrates a typical seasonal pattern.

Literature Review

Numerous studies have been previously undertaken which are associated directly with the Primary and Secondary Study Areas. Key documents reviewed and referenced in the preparation of this Report include:

- Mayfield West, Phase 2 Secondary Plan Comprehensive Environmental Impact Study and Management Plan (AMEC Environment and Infrastructure, 2014)
- Mayfield West, Phase 2 Secondary Plan Comprehensive Environmental Impact Study and Management Plan (Hensel Design Group Inc., 2019)
- Hydrogeological Assessment and Feature Based Water Budget Report (Palmer Environmental Consulting Group, 2019)
- Etobicoke Creek Watershed Characterization Report (Toronto and Region Conservation Authority, 2021)
- Settlement Area Boundary Expansion, Scoped Subwatershed Study (The Regional Municipality of Peel, 2022)

Supplementing material above, a Hydrogeological Assessment and Feature Based Water Budget Report, completed by Palmer Environmental Consulting Group in 2019, followed the development of the Mayfield West Secondary Plan. The Mayfield West Secondary Plan Area is located immediately east of the Alloa Secondary Plan Area and given its proximity to the Primary Study Area, the findings of the Palmer Report provide direct insight into the function of the local hydrogeological system. The purpose of the Palmer Report was to support the planning applications and technical studies for the Mayfield West Development.

The following is a summary of important findings from the Palmer Report completed for the Mayfield West Secondary Plan Area:

- Surficial soils are primarily silty clay to clayey silt glacial till overlying sand and silt materials. The silty clay/clayey silt till is interpreted to be consistent with the Halton Till hydrostratigraphic unit and the sand/silt below is interpreted to be representative of interstadial lenses within the till.
- Weathered bedrock was encountered at a depth of approximately 4.1 to 10.2 m or at an elevation of 252.7 to 253.9 meters above sea level (masl).
- Shallow groundwater levels were measured to be 0.93 to 3.35 mbgl in Spring 2017 and groundwater flow is in general north-west towards Etobicoke Creek.

- Wetlands function as swamp communities with periods of accumulation in the spring and late fall and dry periods in the summer.
- Vertical gradients suggest that the wetland features on the Mayfield lands are intermittently groundwater fed.
- Hydraulic conductivities determined via in-situ testing were determined to be 3.9 x 10^{-9} m/s to 1.7 x 10^{-6} m/s and between 1.5 x 10^{-9} m/s to 1.2 x 10^{-6} m/s via grain size analysis.

7.1.2. Groundwater Monitoring Network

In 2023 and 2024, groundwater and surface water monitoring programs were implemented to establish existing hydrogeological and surface water conditions, and their inherent connectivity, across the Alloa Lands. Wells were equipped with automatic level loggers, set to measure water levels on an hourly basis; this was augmented with periodic manual measurements. The full monitoring network can be found in Figure 3.

Phase 1 Groundwater Monitoring Network

In August 2023 fifty-eight (58) boreholes were installed across the Alloa Phase 1 lands in concert with DS Consultants Limited as part of a joint geotechnical and hydrogeological endeavor (see Figure 3). Boreholes, with a select number being converted to monitoring wells, were drilled across several properties, as listed below.

- 12455 Creditview Road: 14 boreholes, 6 converted to monitoring wells.
- 12306 Chinguacousy Rd: 10 boreholes, 4 converted to monitoring wells.
- 12156 Chinguacousy Rd: 3 boreholes, 1 converted to monitoring well.
- 12697 Creditview Rd: 11 boreholes, 6 converted to monitoring wells.
- 12101 Creditview Rd (North Parcel): 13 boreholes, 5 converted to monitoring wells.
- 12101 Creditview Rd (South Parcel): 7 boreholes, 3 converted to monitoring wells.

Comprehensive borehole records and monitoring well construction logs can be found in Appendix C.

The majority of the monitoring wells were installed to a depth of 6.1 meters below ground level (mbgl) and were screened between 262.01 - 251.04 masl. The monitoring wells were mainly screened within clayey silt/silty clay till, and sandy silt till. Where possible, screened intervals were placed such that they intersected a single aquifer unit. All wells constructed as part of the August 2023 program were installed with a 50 mm diameter Schedule 40 PVC pipe with #10 slot PVC screens complete with a sand pack spanning the screened interval and bentonite plug to the ground surface.

HERITAGE RD
MISSISSAUGA RD
CREDITVIEW RD
CHINGUACOUSY RD
MAYFIELD RD
Fletcher's Creek

PZ7
PZ8
MW24-7 (S/D)
MW24-11
MW405
MW409 (S/D)
PZ1
WOODLAND G
WETLAND 6
MW403
SG2
PZ2
WOODLAND F
WETLAND 5
WOODLAND D
WETLAND 3
MW109
MW411 (S/D)
WOODLAND A
WOODLAND C
WETLAND 2
MW-5
PZ3
WOODLAND E
WETLAND 4
PZ6
MW106
MW24-6
MW101 (S/D)
MW24-1
MWD
MW24-10
MW24-12
MW202
PZ9
PHASE 2
PZ5
MW204
MW210
WOODLAND B
WETLAND 1
WOODLAND H
WETLAND 7
MW24-2
MW509
MW24-13
(S/D)
PHASE 1
MW506
PZ10
MW208
MW501
MW303
MW24-3 (S/D)
MW504
MW9
MWC
MW505

MW104 S/D
PZ4
SG1
WEATHER
STATION

Site
Location
CALEDON
BRAMPTON
MAYFIELD RD
CHINGUACOUSY RD

Key Plan

LEGEND
- PRIMARY STUDY AREA
- PHASE BOUNDARY
- STAFF GAUGE
- PIEZOMETER
- MONITORING WELL
- WEATHER STATION
- ROAD
- WETLAND (LIO)
- WOODED AREA (LIO, 2024)
- WATERBODY
- WATERCOURSE

NOTES:
Groundwater monitoring wells were installed in summer 2023 and winter 2024; piezometers installed in spring 2024; staff gauges installed in summer 2024; weather station established in spring 2024.

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Project:
Alloa Subwatershed Study
Alloa Landowners Group

Title:
Groundwater & Surface Water Monitoring Network

CROZIER
70 Huron St Suite 100, Collingwood, ON (705) 446-3510

Date:	Drawn By:	Approved By:	
2025-08-19	C.M.	E.F.	Figure 3

Path: J:\2400\2448 - Alloa Landowners Group\6683 - Alloa Development Area\Design\GIS\6683 - Alloa | BASE MAP SOURCE: Peel Region, Maxar, Peel Region, Town of Oakville, Maxar, Microsoft

Phase 2 Groundwater Monitoring Network

In January 2024, Walker Drilling Ltd. was retained for the drilling of fourteen (14) additional boreholes across the Alloa Phase 2 lands, all of which were converted to monitoring wells (see Figure 3). The boreholes were drilled across several properties, as listed below.

- 12300 Mississauga Rd: 4 boreholes, 4 converted to monitoring wells
- 12515 Mississauga Rd: 3 boreholes, 3 converted to monitoring wells
- 12679 Mississauga Rd: 1 borehole, 1 converted to monitoring well
- Mayfield Rd (Next to 1248 Mayfield Rd.): 1 borehole, 1 converted to monitoring well
- 12240 Creditview Rd: 4 boreholes, 4 converted to monitoring wells
- 12458 Creditview Rd: 1 borehole, 1 converted to monitoring well

Comprehensive borehole records and monitoring well construction logs can be found in Appendix D.

The wells completed in January 2024 ranged in depth from 4.6 – 7.6 mbgl. Silty clay/clayey silt, silty sand, and sand were the most common materials observed during drilling. All wells constructed as part of the Phase 2 program were installed with a 50 mm diameter Schedule 40 PVC pipe with #10 slot PVC screens complete with a sand pack at the screened interval and bentonite plug to the ground surface.

Site Wide Wetland Monitoring Network

The shallow surface water monitoring network was established in March and June 2024 across the Alloa Study Area. Piezometers were installed within key wetlands and woodlots identified on the property to support the feature-based water balance models for the Alloa lands. All piezometers were installed to a depth of approximately 0.74 mbgl to 0.82 mbgl, such that the screen was completely sealed under the ground. Piezometers were equipped with automatic level loggers, set to measure water levels on an hourly basis.

7.1.3. Topography & Drainage

The topography of the Alloa Secondary Plan Area is primarily flat and ranges from approximately 254 to 273 masl based on provincially published mapping (Ministry of Natural Resources and Forestry, 2024). Topographic highs are situated at the western extremes of the Primary Study Area along Mississauga Road and topographic lows were observed in the east along Chinguacousy Road and in the southeast corner along Mayfield Road. Regionally, the Secondary Study Area follows a similar trend with the most northern and upgradient catchments falling from approximately 289 masl to about 254 masl at Mayfield Road.

A review of existing watershed mapping revealed the northern portion of the Primary Study Area lies within the Etobicoke Creek watershed while the southern portion is located within the Credit River Watershed. The Subwatershed drainage divide is located south of and adjacent to the Alloa Drain; this can be observed in the pre-development drainage catchments (Urbantech, 2024). North of the drainage divide, surface water runoff generally flows towards the Alloa Drain

and other tributaries of Etobicoke Creek. South of the drainage divide, catchments drain southwards towards the tributaries of Huttonville Creek in the west and Fletcher's Creek in the east, conveyed across Mayfield Road by a network of culverts.

Peripheral upgradient catchments to the north of the Primary Study Area and making up the Secondary Study area flow southwards towards and across the boundary of the Alloa Secondary Plan Area. The northern contributions to the Primary Study Area originate from within the Etobicoke Creek watershed which extends up to Highway 9 then eastward. Catchments on the downgradient boundary and to the south of the Primary Study Area flow to the south into a managed system within the Credit River watershed.

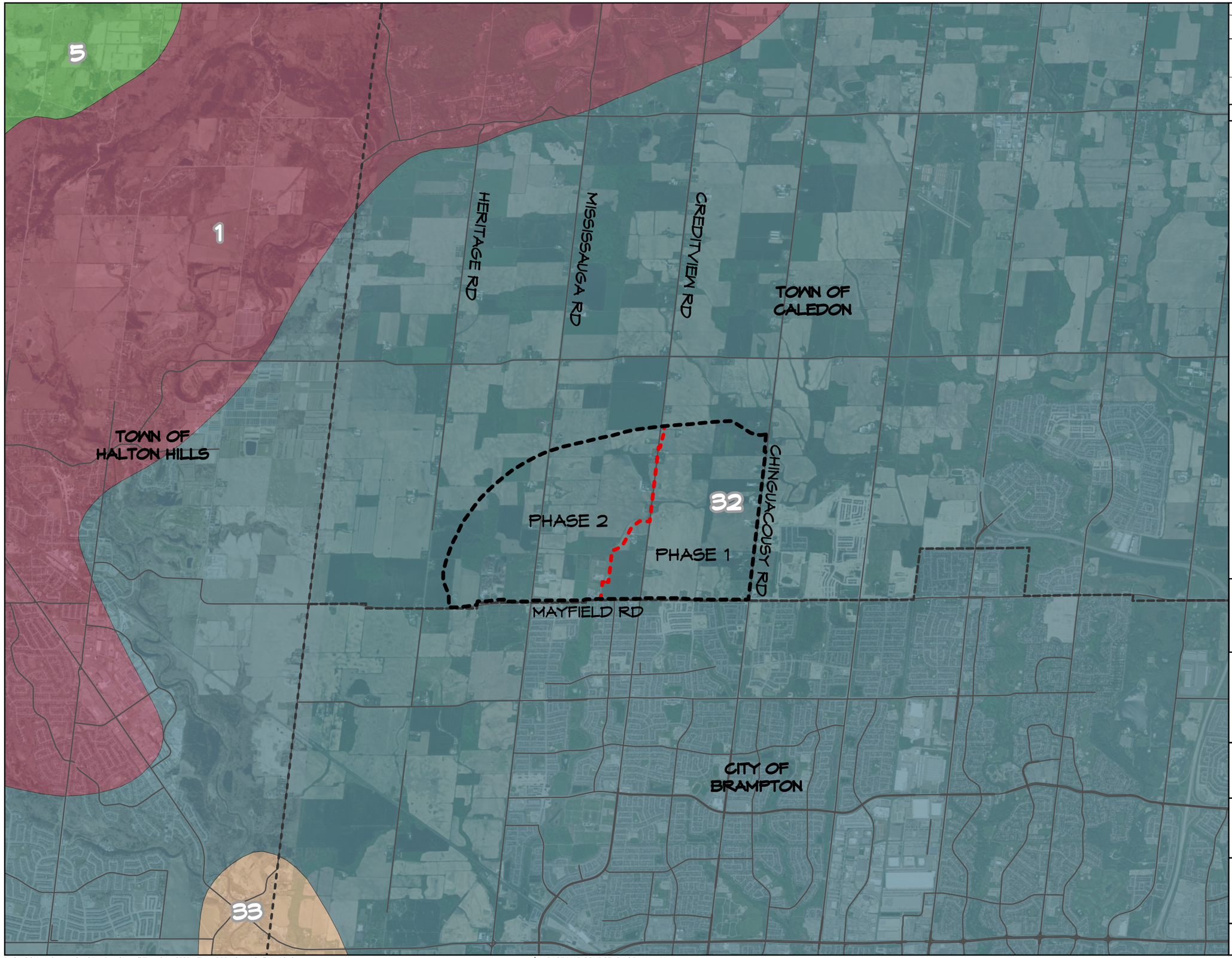
The majority of the Alloa Secondary Plan Area falls within the TRCA's jurisdiction within the Etobicoke Creek watershed. The TRCA portion of the Alloa Secondary Plan Area is located within the Headwaters Subwatershed where surface water moves east with the Etobicoke Creek, through urban and industrial areas ultimately south to Lake Ontario. A large amount of the watershed has commercial and industrial land uses, with the remainder of the agricultural land falling within the Headwaters Subwatershed (Etobicoke Creek Watershed Characterization Report, TRCA 2021). The remainder of the lands are within the Credit River watershed, more specifically the Fletcher's Creek and Huttonville Creek Subwatersheds. Surface water drainage from these watersheds are directed south towards Lake Ontario.

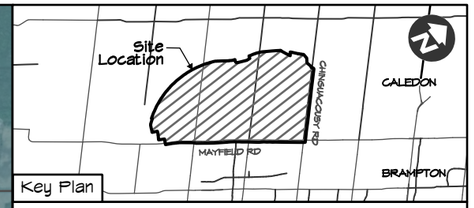
7.1.4. Physiography

The Alloa Study Area is situated between Lake Ontario in the South and the Niagara Escarpment in the North. Intertwining with the Niagara Escarpment to the north and northeast is the Oak Ridges Moraine, a significant physiographic landform. The area between the shoreline and escarpment toe is divided into three physiographic regions: the Iroquois Plain, the Peel Plain, and the South Slope. The Primary Study Area and Secondary Study Area are both fully encapsulated within the South Slope Physiographic Region.

The South Slope extends from the Trent River in the east, to the Niagara Escarpment in the west, covering an area of approximately 2,434 km^2. This region rises to a line of contact with the Oak Ridges Moraine at approximately 244 to 305 masl, just south of Caledon East and Humber (Chapman and Putman, 1984). On a more refined scale, the south slope in both the Primary and Secondary Study Areas is bounded by a finger of the Niagara Escarpment which extends from Terra Cotta to Caledon East and entirely by the Peel Plain in the south. Please refer to Figure 4 for mapping of the physiographic regions in the Primary and Secondary Study Areas.

The South Slope lies across limestones of the Lindsay and Verulam Formations, the grey shales of the Georgian Bay Formation, and the red shales of the Queenston Formation. The area is characterized by a flat to gently rolling drumlinized till plain. Soil types vary across the South Slope but are typical of tills with sandy conditions in the east, and clay conditions in the west. The soils observed on the Alloa Lands are representative of the higher content of fines typical of clayey till.





LEGEND

- PRIMARY STUDY AREA
- ROAD
- MUNICIPAL BOUNDARY
- PHASE BOUNDARY

PHYSIOGRAPHIC REGION

- 1: NIAGARA ESCARPMENT
- 5: HORSESHOE MORAINES
- 11: GUELPH DRUMLIN FIELD
- 32: SOUTH SLOPE
- 33: PEEL PLAIN

NOTES:

0 750 1500m

1:45,000

Project:

Alloa Subwatershed Study

Alloa Landowners Group

Title:

Physiography

CROZIER

70 Huron St Suite 100, Collingwood, ON (705) 446-3510

Date:	Drawn By:	Approved By:	
2025-08-19	C.M.	E.F.	**Figure 4**

Path: C:\Users\cmacphee\AppData\Local\Temp\ArcGISProTemp28044\Untitled\Untitled.aprx | BASE MAP SOURCE: Peel Region, Maxar

Drumlins are long, thin, and scattered throughout the region, pointing up the South Slope. Streams in the region flow down the slope which has led to sharp cut valleys in the till (Chapman and Putman, 1984).

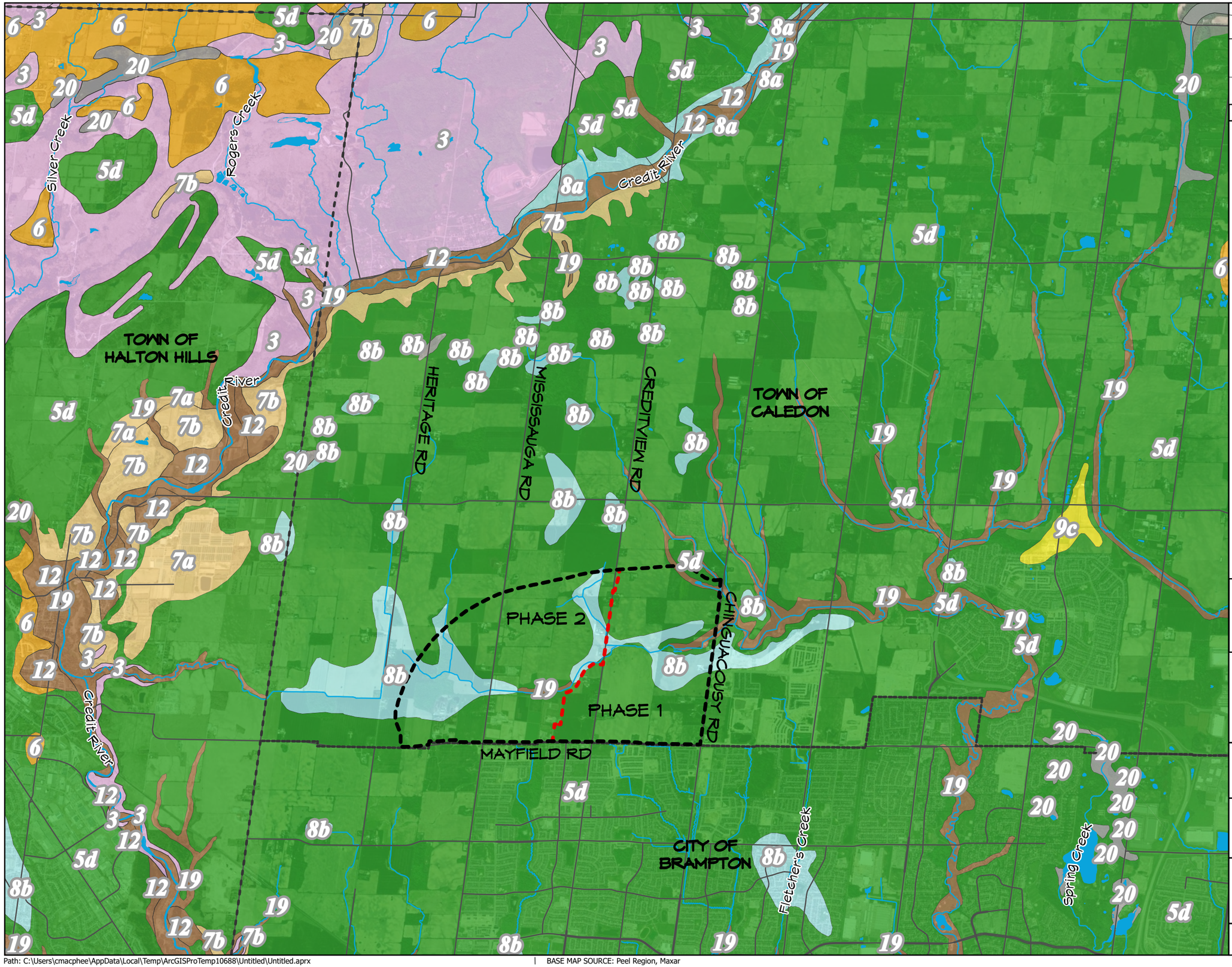
7.1.5. Surficial & Bedrock Geology

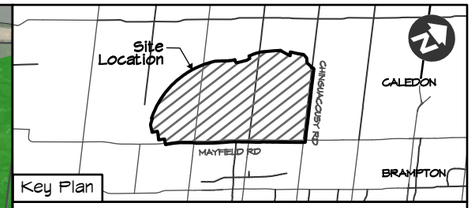
According to published Ontario Geological Survey (OGS) mapping, regional surficial geology is characterized by Halton Till – a clay to silt-textured till unit derived from glaciolacustrine deposits (OGS, 2024). Halton Till is the most recently deposited till unit that represents the last ice-contact deposits underlying the site. The increased content of fines, specifically clays, tends to reflect incorporation of earlier glaciolacustrine deposits. The texture and reddish brown colour characteristic of the Halton Till reflects the erosional impact of glaciation on the underlying Queenston shale.

While the vast majority of the Alloa Secondary Plan Area is mapped as Halton Till, areas consistent with historic surface water flow pathways are mapped as fine-textured glaciolacustrine deposits and modern alluvial deposits. The fine-textured glaciolacustrine deposits consist of silt and clay, minor sand, and gravel; interbedded silt and clay and gritty, pebbly flow till and rainout deposits. The modern alluvial deposits include clay, silt, sand, gravel, and may contain organic remains. These auxiliary units are believed to have been detected along the Alloa Drain through site specific drilling in the form of distinctly coarse complexes of sands, gravels, and even cobbles. The representation of the Alloa Secondary Plan Area's surficial geology is shown on Figure 5.

The Alloa Secondary Plan Area is mapped atop the shales, limestones, dolostone and siltstone of the Queenston Formation. Depth to bedrock is variable and has previously been observed to be approximately 10 to 40 mbgs according to MECP well records. At the bedrock surface, the weathered Queenston Formation is variable in depth due to the relatively soft nature of the material and undulations in the basal bedrock surface. Please see Figure 6 for a representation of modelled overburden thickness, Figure 7 for the bedrock geology, and Figure 8 for the bedrock elevation map. The paleo channel known as the Laurentian channel has also been mapped along the Etobicoke Creek. This ancient channel directed glacial melt towards Lake Ontario and has since collected thousands of years of fluvial sediment ranging from sands and gravels at its base to clays and silts towards its surface. In the area of the Laurentian Channel, overburden deposits can range up to 270 m (Etobicoke and Mimico Creeks Watersheds Technical Update Report, TRCA 2010).

The Oak Ridges Moraine Groundwater Program was referenced to estimate depth to bedrock and significant aquifers on the Alloa Lands. According to the mapping, the top of bedrock is located between 260 masl at Mississauga Road to 220 masl at Mayfield and Chinguacousy Road. The presence of the Oak Ridges Moraine Aquifer is mapped at an elevation of 270 masl at Mississauga Road to 240 masl at Hurontario Street.





LEGEND

- PRIMARY STUDY AREA
- ROAD
- MUNICIPAL BOUNDARY
- PHASE BOUNDARY
- WATERBODY
- WATERCOURSE

SURFICIAL GEOLOGY

- 20: ORGANIC PEAT, MUCK AND MARL
- 19: MODERN FLUVIAL GRAVEL, SAND, SILT
- 12: OLDER FLUVIAL SILT, CLAY
- 9A: GLACIOLACUSTRINE SAND, GRAVEL
- 9C: GLACIOLACUSTRINE SAND
- 8A: GLACIOLACUSTRINE SILT, CLAY
- 8B: GLACIOLACUSTRINE SILT, CLAY, TILL
- 7: GLACIOFLUVIAL SAND, GRAVEL
- 7A: GLACIOFLUVIAL SAND
- 7B: GLACIOFLUVIAL GRAVEL
- 6: ICE-CONTACT SAND, GRAVEL
- 5B: STONE-POOR, SANDY SILT TO SAND SILTY TILL
- 5D: CLAYEY SILT TO SILTY CLAY TILL
- 4: PALEOZOIC BEDROCK-DRIFT COMPLEX
- 3: PALEOZOIC BEDROCK

NOTES:

0 750 1500m

1:45,000

Project:
Alloa Subwatershed Study
Alloa Landowners Group

Title:
Surficial Geology

CROZIER
70 Huron St Suite 100, Collingwood, ON (705) 446-3510

Date:	Drawn By:	Approved By:	
2025-08-19	C.M.	E.F.	Figure 5

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TOWNSHIP OF ADJALA-TOSORONTIO

TOWNSHIP OF GUELPH/ERAMOSA

HIGHWAY 124

TOWN OF ERIN

TOWN OF CALEDON

TRAFALGAR RD

CHINGUACOUSY RD

KING ST

TOWNSHIP OF KING

PRIMARY STUDY AREA

PHASE 2

PHASE 1

MAYFIELD RD

TOWN OF MILTON

TOWN OF HALTON HILLS

CITY OF BRAMPTON

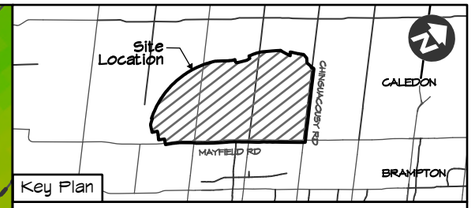
CITY OF VAUGHAN

STEELES AVENUE

CITY OF BURLINGTON

CITY OF MISSISSAUGA

CITY OF TORONTO



Key Plan

LEGEND

- PRIMARY STUDY AREA
- ROAD
- MUNICIPAL BOUNDARY
- PHASE BOUNDARY
- 255
- 0

NOTES:

0 2400 4800 m

1:150,000

Project:

Alloa Subwatershed Study

Alloa Landowners Group

Title:

Drift Thickness

CROZIER

70 Huron St Suite 100, Collingwood, ON (705) 446-3510

Date:	Drawn By:	Approved By:	
2025-08-19	C.M.	E.F.	Figure 6

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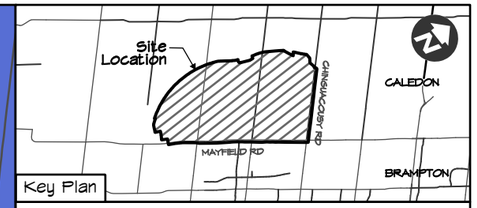
BASE MAP SOURCE: Peel Region, Earthstar Geographics

Silver Creek
Roberts Creek
Credit River
TOWN OF CALEDON
TRAFALGAR RD
Credit River
TOWN OF HALTON HILLS
PHASE 2
PHASE 1
CHINGUACOUSY RD
MAYFIELD RD
Credit River
Etobicoke Creek
CITY OF BRAMPTON
Fletcher's Creek
Spring Creek



Key Plan

LEGEND

- PRIMARY STUDY AREA
- ROAD
- MUNICIPAL BOUNDARY
- PHASE BOUNDARY
- WATERBODY
- WATERCOURSE

BEDROCK GEOLOGY

- 19 AMABEL FORMATION: WHITE TO BLUE-GREY,THICK-TO MASSIVE-BEDDED, DOLOSTONE, INCLUDING CRINOIDAL GRAINSTONES AND BIOHERMAL DOLOSTONE
- 17 CLINTON-CATARACT GROUP: THIN UNITS VARIOUSLY SHALE-, SANDSTONE-, DOLOSTONE- OR LIMESTONE-DOMINATED
- 16 QUEENSTON FORMATION: RED SHALE AND SILTSTONE, MINOR GREEN SHALE AND SILTSTONE, AND VARIABLE CALCAREOUS SILTSTONE TO SANDSTONE AND LIMESTONE INTERBEDS
- 14 GEORGIAN BAY FORMATION: INTERBEDDED GREY-GREEN TO DARK GREY SHALE AND FOSSILIFEROUS CALCAREOUS SILTSTONE TO BIOCLASTIC LIMESTONE

NOTES:

0 750 1500m

1:45,000

Project:
Alloa Subwatershed Study
Alloa Landowners Group

Title:
Bedrock Geology

CROZIER
70 Huron St Suite 100, Collingwood, ON (705) 446-3510

Date:	Drawn By:	Approved By:	
2025-08-19	C.M.	E.F.	Figure 7

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TOWNSHIP OF ADJALA-TOSORONTIO

HIGHWAY 124

TOWNSHIP OF GUELPH/ERAMOSA

TOWN OF ERIN

TOWN OF CALEDON

TRAFALGAR RD

CHINGUACOUSY RD

KING ST

PRIMARY STUDY AREA

PHASE 2

PHASE 1

MAYFIELD RD

TOWNSHIP OF KING

TOWN OF MILTON

TOWN OF HALTON HILLS

CITY OF BRAMPTON

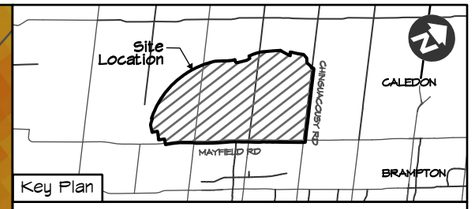
CITY OF VAUGHAN

STEELES AVENUE

CITY OF BURLINGTON

CITY OF MISSISSAUGA

CITY OF TORONTO



Key Plan

LEGEND

- PRIMARY STUDY AREA
- ROAD
- MUNICIPAL BOUNDARY
- PHASE BOUNDARY
- 255
- 0

NOTES:

0 2400 4800 m

1:150,000

Project:
Alloa Subwatershed Study
Alloa Landowners Group

Title:
Bedrock Topography

CROZIER
70 Huron St Suite 100, Collingwood, ON (705) 446-3510

Date:	Drawn By:	Approved By:	
2025-08-19	C.M.	E.F.	Figure 8

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7.1.6. Subsurface Geological Conditions

The stratigraphic framework for the Etobicoke and Fletcher's Creeks watershed are presented within the Etobicoke and Mimico Creeks Watersheds Technical Update Report (TRCA, 2010). From youngest to oldest, the following units are present within these two watersheds:

1. Glaciolacustrine Deposits: Fine sands, silts, and clays.
2. Halton Till: Sandy silt to clayey silt till interbedded with silt, clay, sand, and gravel.
3. Oak Ridges Deposits/Mackinaw Interstadial: Discontinuous sands and gravels.
4. Newmarket (Northern) Till: Dense, silty sand till.
5. Thorncliffe Formation: Sand and silty sand, pebbly silt.
6. Sunnybrook Diamict: Dark grey clayey silt with scattered rounded stones.
7. Scarborough Formation: Coarse deltaic sands, silts, and muds.
8. Don Formation: Gravel, sand, and clay.
9. York Till: Dense clayey to sand till

While all of these layers are present within the two watersheds, local variations in geologic material is expected. The subsurface geological investigation completed in 2023 in cooperation with DS Consultants Limited for the Alloa Phase 1 Study Area (lands east of Creditview Road) and the subsequent 2024 investigation completed by Crozier for the Alloa Phase 2 Study Area (lands west of Creditview Road) provide further insight into the local geology across the Primary Study Area.

The geology encountered in the investigations is mostly consistent with, Glaciolacustrine Deposits, the Halton Till unit and Mackinaw Interstadial Sediments, though limited in extent. Based on previous studies and the age of deposition, the stratigraphic progression to bedrock in the Primary Study Area is also believed to be inclusive of Newmarket Till and the Thorncliffe and Sunnybrook Formations prior to weathered bedrock and the Queenston Formation. It is believed that in several boreholes, at near termination depth the Newmarket Till was detected in the form of a relatively denser, grey till. While the Halton Till unit can be generally described as noted above, observations from site specific works show distinct variations within the units that exist across the Primary Study Area.

The Oak Ridges Moraine Aquifer Complex is interpreted to be discontinuous within the Primary Study Area and was not encountered during the 2023 or 2024 drilling programs on the site. Borehole logs from both the Phase 1 and Phase 2 study area can be found in Appendix C and Appendix D.

Topsoil and Fill (Modern Deposits)

Topsoil ranged in thickness from 0.2 to 0.4 m at the borehole locations. Beneath the topsoil, disturbed native soil (fill) consisting of clayey silt with trace organics was noted, typically around 0.8 - 0.9 meters below ground level (mbgl) but also up to depths of 2.3 mbgl. In the east, between Creditview and Chinguacousy, numerous boreholes noted fill consisting of silty clay

and silty sand up to depths of 2.3 mbgl. This uppermost unit is representative of years of agricultural activity.

Fine Sand and Sandy Silt (Glaciolacustrine Deposits)

Layers of fine sand and sandy silt were noted in boreholes across the Primary Study Area, starting at depths between 1.7 to 7.5 mbgl and carrying through to the full depth of the borehole. These layers were found to typically underly the topsoil and fill and overly till units but were also noted in the absence of till. These soils may be representative of interstadial deposits or lenses within the till and are interpreted to be discontinuous, as such they are not considered to be a significant aquifer unit.

Medium to Coarse Sand with Some Gravel and Cobbles (Modern Alluvial Deposits)

Trending with areas adjacent to watercourse channels, and more specifically the Alloa Drain, the sands and coarse rounded gravels of the units in these areas were found at depths of approximately 1.5 mbgl and beyond and were typically about 1.0 m thick and believed to be discontinuous. These units are interpreted to be representative of former watercourse meander belts and represent modern alluvial deposits. The coarse layers typically overlie the Halton Till Unit but were also found to underly the modern deposits noted.

Silt, Sand and Gravelly Sand (Mackinaw Interstadial)

Sandwiched within the layers of Halton and Newmarket Till and discontinuous across the Study Area were thin lenses (less than 0.5 m thick) and occasional layers (up to 1.5 m thick) of coarser sediments of silt, sand, and gravelly sand. These layers were grey, wet, and compact and believed to be a primary transmitter of horizontal groundwater in the area. These layers also tended to trend with areas that are currently understood to be intermittently groundwater discharge zones where the gradient allows. This unit is considered to be distinct from the modern alluvial deposits as the spatial trends were not consistent and it was generally detected within the Halton Till versus overlying.

Clayey Silt Till (Halton Till)

Clayey silt to silty clay till was noted below the fill material layer and interspersed with layers of primarily silt and sand content. The till material was encountered across the Phase 1 and 2 lands and is characterized as moist and very stiff. The clayey silt till was observed to be inclusive of silty sand seams are observed throughout the unit. The unit is noted to be moist and grey below a depth of 2.3 mbgl to termination. This till unit was found to be massive and generally weathered throughout the full depth. The till unit encountered as described above is representative of the Halton Till Formation.

Silty Sand Till (Newmarket Till)

At excessive depths nearing borehole termination, or about 6.0 mbgl and beyond, a silty sand till was detected periodically across a majority of the Study Area. This unit was found to be relatively dense, brown, and wet with trace clay and gravel. The top extent of the unit was in contact with the lower extent of the overlying clayey silt till, with some instances showing transitory zones inclusive of silt to sandy silt. This unit is believed to be representative of the

Newmarket Till in the Study Area. Due to the depth of this layer, the bottom extent was not fully characterized across the study area.

Please refer to Figure 9 for the cross-section location map, Figure 10 for the north-south cross section and Figure 11 for the east-west cross section.

7.1.7. Interpreted Hydrogeologic Setting

Hydrostratigraphic units are divided into two distinct groups based on their capacity to allow the movement of groundwater. Aquifers are defined as layers of soil that are permeable enough to permit a usable supply of water to be extracted. Aquitards are layers of soil that inhibit the movement of groundwater due to low permeability.

The Halton Till forms a regional aquitard limiting infiltration and groundwater flow within the Primary Study Area. Groundwater flow through these soils is predominantly downwards (vertical), providing recharge (albeit limited) to deeper aquifers. Shallow groundwater flow tends to mimic site topography and generally flow towards major creek valleys through the varved sediments. Sand lenses are known to occur with the Halton Till along with coarser isolated units mentioned above, which can provide sufficient water for domestic supply and provide localized areas of groundwater discharge to support streams and wetlands.

The Etobicoke Creek Watershed is known to have four major aquifers as shown in Table 2:

- The Shallow Overburden System
- The Oak Ridges Moraine Aquifer
- The Thorncliffe Aquifer
- The Scarborough Aquifer

The Queenston Shale Bedrock forms a regional aquitard unit that limits deep groundwater movement. However, certain zones of the bedrock can conduct significant volumes of water. These include upper weathered and fractured zones within the shale, commonly found in the upper 10 m of the bedrock.

HERITAGE RD
MISSISSAUGA RD
CREDITVIEW RD
CHINGUACOUSY RD
MAYFIELD RD

A
A'
B
B'

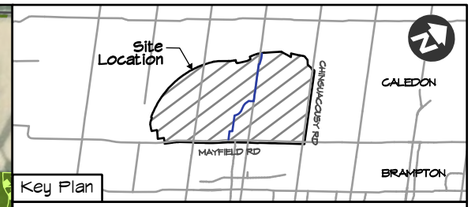
PZ7
PZ8
PZ9
PZ10
PZ1
PZ2
PZ3
PZ4
PZ5
PZ6

MW405
MW24-11
MW24-7 (S/D)
MW-5
MW24-6
MW24-1
MW24-12
MW24-10
MW101 (S/D)
MWD
MW24-2
MW24-3 (S/D)
MW24-13 (S/D)
MW509
MW501
MW9
MWC
MW109
MW409 (S/D)
MW403
MW411 (S/D)
MW106
MW104 (S/D)
MW202
MW204
MW210
MW506
MW208
MW504
MW303
MW505

SG1
SG2
WEATHER STATION

WOODLAND A
WOODLAND B
WETLAND 1
WOODLAND C
WETLAND 2
WOODLAND D
WETLAND 3
WOODLAND E
WETLAND 4
WOODLAND F
WETLAND 5
WOODLAND G
WETLAND 6
WOODLAND H
WETLAND 7

PHASE 2
PHASE 1



Key Plan

LEGEND

- PRIMARY STUDY AREA
- PHASE BOUNDARY
- STAFF GAUGE
- PIEZOMETER
- MONITORING WELL
- WEATHER STATION
- ROAD
- WETLAND (LIO)
- WOODED AREA (LIO, 2024)
- WATERBODY
- WATERCOURSE
- CROSS SECTION LINE X - X'

NOTES:
Cross section include information from borehole logs prepared by DS Consultants and Crozier.

0 270 540 m
1:15,000

Project:
Alloa Subwatershed Study
Alloa Landowners Group

Title:
Cross Section Location Plan

CROZIER
70 Huron St Suite 100, Collingwood, ON (705) 446-3510

Date:	Drawn By:	Approved By:	
2025-08-18	C.M.	E.F.	Figure 9

Path: J:\2400\2448 - Alloa Landowners Group\6683 - Alloa Development Area\Design\GIS\6683 - Alloa | BASE MAP SOURCE: Peel Region, Town of Oakville, Maxar

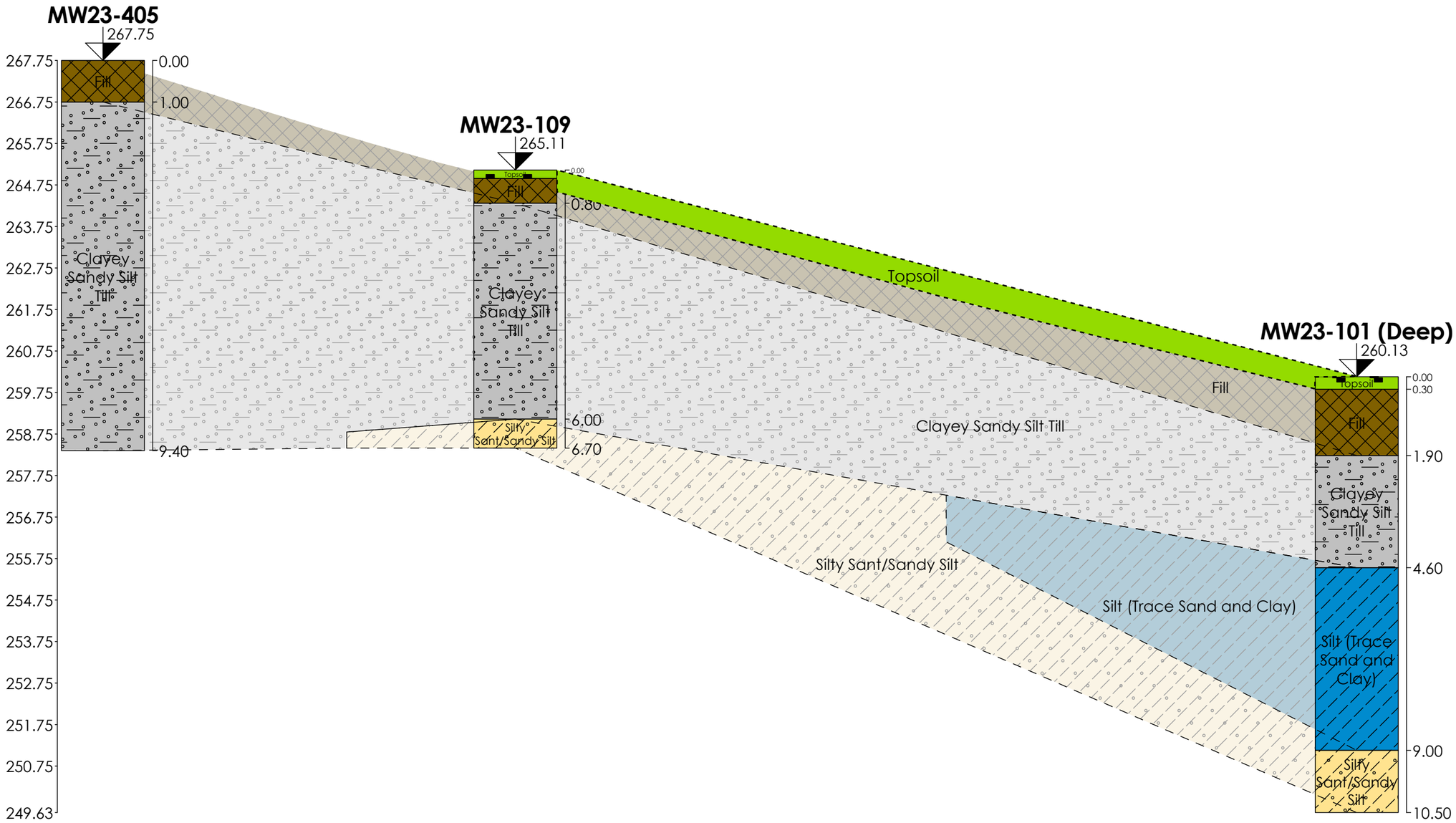


Figure 10

N-S Cross Section S 1:3000/100

[GEO5 - Stratigraphy (64 bit) | version 5.2024.111.0 | hardware key 31371 / 1 | Crozier | Copyright © 2024 Fine spol. s r.o. All Rights Reserved | www.finesoftware.eu]

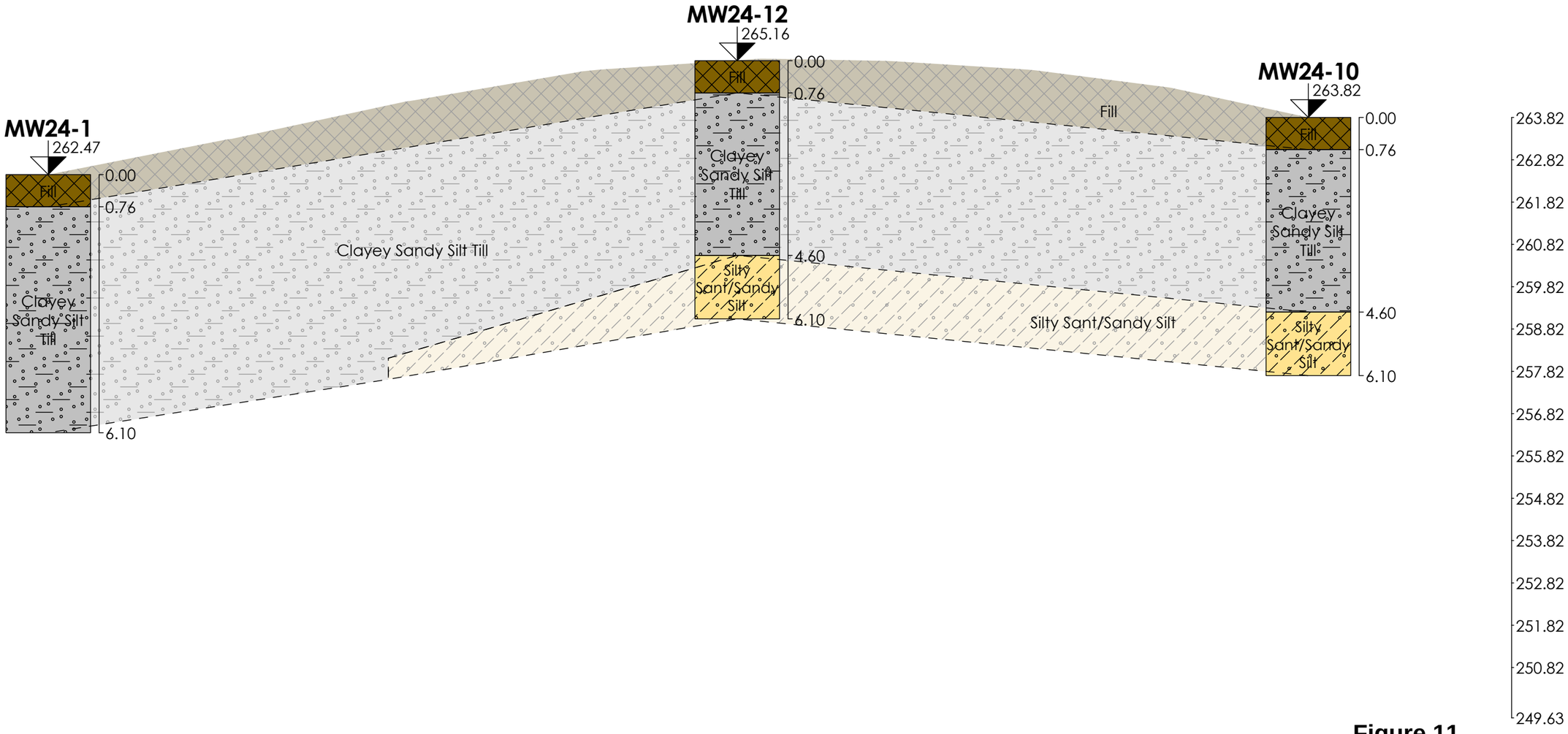


Figure 11

E-W Cross Section S 1:5000/100

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TABLE 2: SUMMARY OF THE HYDROSTRATIGRAPHY OF THE ETOBICOKE CREEK WATERSHED

Layer	Name	Function	Elevation (masl)	Thickness (m)
Youngest – 1	Recent Sediment Deposits	Aquitard	305-300	5
2	Halton Aquitard	Aquitard	300-270	30
3	Oak Ridges Aquifer	Aquifer	270-250	30
4	Newmarket Aquitard	Aquitard	250-230	20
5	Thorncliffe Aquifer	Aquifer	230-180	50
6	Sunnybrook Aquitard	Aquitard	180-170	10
7	Scarborough Aquifer	Aquifer	170-140	30
Oldest - 8	Bedrock	Aquifer	140	-

The thickness and composition of each hydrostratigraphic unit varies across the Etobicoke Creek Watershed. In the area of the Alloa Lands south of Boston Mill Road and north of Mayfield Road, the primary water supply aquifer is the Oak Ridges Aquifer which underlies the Halton Aquitard (synonymous with the Halton Till unit). This is supported by cross section Figure 3-4 of the Etobicoke and Mimico Creeks Watersheds Technical Update Report, (TRCA, 2010) along Etobicoke Creek. The Newmarket Aquitard was also encountered in limited extent as indicated by the presence of dense, moist sandy silt/silty sand near the termination of several boreholes.

Hydrostratigraphy

Groundwater flow within the Alloa Secondary Plan Area is primarily influenced by two key hydrostratigraphic units: Halton Till Aquitard and Queenston Shale Bedrock. Each are described below:

- The Halton Till Aquitard is silty clay to clayey silt till with hydraulic conductivities ranging from about 10^{-9} m/s to 10^{-6} m/s (Gerber and Howard, 2000). Differences in hydraulic conductivities result from spatial differences in matrix composition, interstitial lenses of sand, and degree of weathering. On a regional scale, the Halton Till Aquitard acts as a surficial aquitard, inhibiting local groundwater recharge and reducing the exposure of underlying aquifers to contamination (Sharpe et al.., 1996). Isolated lenses of silt and fine sand within the till however collect groundwater and often provide sufficient water for residential use. Within the till soils, groundwater flow is typically downwards towards the more permeable, bedrock aquifer units. The water table is commonly perched within the till due to the poorly drained nature of the soil.

Hydraulic Conductivity

In-situ hydraulic conductivity testing has been conducted at three locations within the Primary Study Area: MW24-6, MW24-9 and MW405. Rising head and falling head tests were conducted at each location using a 3-ft standard slug. Water levels were monitored manually and automatically using a level logger. It should be noted that MW24-6 was screened from 4.57 - 6.09m (15-20 ft) in silty-sand with a vein of coarse sand at 5.03m (16.5 ft), MW23-405 was screened from 6.09 - 9.15m (20-30 ft) in sandy-silt till, and MW24-9 was screened from 4.57 - 6.09m (15-20ft) in sandy silt.

The slug test data was analyzed using the Bouwer-Rice and Cooper-Greene mathematical methods. The Bouwer-Rice method is used primarily to analyze data within unconfined conditions or leaky confined conditions. This equation is only used to analyze rising head test data since the test well is screened within the water table. The Cooper-Greene method is used to analyze low-permeable soils. The Van der Kampe equation is primarily used for highly permeable materials such as gravels and coarse sands, which in the case of the Alloa Lands does not apply. A summary of the analysis results is provided below in Table 3.

TABLE 3: IN-SITU HYDRAULIC CONDUCTIVITY TESTING RESULTS

Equation	MW24-6		MW24-9		MW405	
	Falling-Test (m/s)	Rising-Test (m/s)	Falling-Test (m/s)	Rising-Test (m/s)	Falling-Test (m/s)	Rising-Test (m/s)
Bouwer-Rice	9.5×10^{-6}	9.5×10^{-6}	9.3×10^{-6}	8.9×10^{-6}	1.12×10^{-6}	1.15×10^{-6}
Cooper-Greene	6.3×10^{-7}	5.9×10^{-7}	1.1×10^{-7}	1.1×10^{-7}	1.3×10^{-7}	1.9×10^{-7}
Geometric Mean						2.1×10^{-5}

The measured hydraulic conductivity values ranged from 9.5×10^{-6} to 1.1×10^{-7} m/s with a geometric mean of 2.1×10^{-5} m/s. These values are considered high compared to literature values for silts and tills. This is likely due to the sandy lenses within the till, driving the results high. It should be noted that the results of the hydraulic conductivity testing are representative of the hydraulic conductivity of the soils immediately around the well screen, approximately 15-20 ft below surface.

Based on the grain-size analysis results obtained by DS Consultants, hydraulic conductivity ranged from 3.59×10^{-8} m/s to 1.3×10^{-7} m/s using the Kozeny Carmen method, assuming a porosity of 0.41. This is closer to the results obtained Mayfield West (Geometric Mean K = 8.2×10^{-8} m/s).

Hydraulic conductivity values for mitigative purposes across the Primary Study Area should be taken as 3.59×10^{-8} to 1.3×10^{-7} m/s based on the slug testing and grain-size results. It is recommended that in-situ infiltration testing (using a Guelph permeameter) be completed in the areas of proposed infiltration features in the detailed design or individual site plan stages of development, if necessary.

Groundwater Levels

Following the installation of the wells in 2023 and 2024, periodic manual measurements have been collected. Tables 4 and 5 present the manual groundwater elevations collected to date by Crozier for Phase 1 and Phase 2 of the Primary Study Area. Additionally, automatic water level loggers were installed within each monitoring well to collect continuous groundwater levels on an hourly basis. Data generated from these manual measurements and automatic loggers can be used to form a potentiometric surface and determine conservative seasonal groundwater highs for design. Please refer to Appendix E for monitoring well hydrographs.

A summary of the recorded data through the deployed loggers is provided in Table 6 and Table 7. Seasonally recorded maximums through manuals and logger data are provided.

It should be noted that a number of locations were recorded as having flowing conditions. At these locations, the static water level was observed above the height of the casing therefore an accurate water level could not be obtained manually during early rounds of water level monitoring. Crozier staff installed devices at these locations to allow for measurement of static pressures at each well in the Spring of 2024 to allow for accurate data collection going forward.

Peak Groundwater Conditions

The peak groundwater elevations in 2023-2024 for the Phase 1 Alloa Lands typically ranged from approximately 2.44 mbgl to 0.91 metres above ground level (magl) based on manual measurements. The outliers include MW23-204 and MW23-505 with seasonal highs of 2.44 and 1.51 mbgl, respectively. MW23-403, MW23-411 Deep and Shallow, and MW23-101 Deep were all measured above grade; therefore the elevations were measured to top of casing. These wells were equipped with pressure gauges to estimate the potentiometric surface in these areas.

Peak groundwater elevations in 2023-2024 for the Phase 2 Alloa Lands typically ranged from approximately 0.91 mbgl to 0.75 magl based on manual measurements. Only MW24-10 was observed to be flowing (water level above the top of the casing) and has been equipped with a pressure gauge to measure true water levels.

TABLE 4: PHASE 1 MANUAL GROUNDWATER LEVELS (MBGL)

MW Locations	Ground Elevation (masl)	Groundwater Level (mbgl)								
		2023-09-27	2024-03-15	2024-05-01	2024-05-15	2024-06-12	2024-08-14	2024-10-2024	2025-03-18	2025-06-20
101 (Deep)	260.13	**Flowing**	**Flowing**	**Flowing**	**Flowing**	**-1.42**	**-**	**-2.98**	**Flowing**	**-**
101 (Shallow)	260.13	0.1	**-0.32**	**-0.05**	**-0.26**	**-0.15**	**-0.14**	**0**	**-0.31**	**-**
104 (Deep)	260.14	**-0.16**	**-0.61**	**-0.69**	**-0.42**	**-0.48**	**-**	0.01	**-0.51**	**-0.28**
104 (Shallow)	260.14	0.25	**-0.36**	**-0.33**	0.21	**-0.19**	**-**	0.96	**-0.27**	**-0.01**
106	261.95	0.64	**-0.27**	**-0.39**	**-0.53**	**-0.08**	**-**	0.69	**-0.17**	0.22
109	265.11	0.53	-	0.25	0.23	0.13	-	0.24	**-0.35**	0.23
202	257.98	0.74	0.23	0.26	0.45	0.6	-	0.51	0.09	0.69
204	262.53	4.3	2.92	4.69	2.44	2.55	-	3.81	2.7	2.59
208	260.96	2.01	0.42	1.08	0.32	0.47	-	3.91	0.55	0.66
210	261.55	1.4	0.86	3.09	1.19	1.10	-	0.93	0.8	1.45
303	259.43	-	-	-	1.22	2.80	-	2.16	2.02	1.80
403	263.57	**Flowing**	**Flowing**	**Flowing**	**Flowing**	**Flowing**	**-**	**Flowing**	**Flowing**	-
405	267.75	2.01	1.62	1.43	-	2.23	-	-	1.4	1.77
409 (Deep)	265.51	0.89	0.36	0.22	0.42	0.59	-	0.88	0.1	0.77
409 (Shallow)	265.51	0.84	0.71	0.40	0.69	0.83	-	1.02	0.49	0.97

411 (Deep)	261.45	**Flowing**	**Flowing**	**Flowing**	**Flowing**	**-3.55**	-	**-2.48**	**Flowing**	-
411 (Shallow)	261.45	**Flowing**	**Flowing**	**Flowing**	**Flowing**	**-0.71**	-	**0**	**Flowing**	-
501	262.96	**-0.1**	1.11	1.27	1.20	1.44	**-0.21**	1.32	0.48	2.11
504	259.78	1.66	1.29	1.09	0.60	1.07	1.61	1.06	1.56	1.24
505	257.14	2.23	1.83	1.94	1.51	2.08	1.82	2.32	2.15	1.86
506	262.29	1.74	0.07	2.85	0.79	0.71	1.01	1.72	0.98	-
509	262.46	1.20	0.32	1.31	1.18	1.54	1.43	1.94	1.02	0.87
601 (MWA)	-	-	0.44	0.61	-	-	-	-	-	-
606 (MWC)	260*	-	**-0.63**	**-0.59**	**-0.6**	-	-	0.2	-0.04	**-0.23**
607 (MWB)	260*	-	0.44	0.61	-	-	-	1.33	0.71	1.40

BOLD *– Above Grade.*
**estimated*

TABLE 5: PHASE 2 MANUAL GROUNDWATER LEVELS (MBGL)

MW Locations	Ground Elevation (masl)	2024-03-15	2024-05-01	2024-05-15	2024-06-17	2024-08-14	2025-03-18	2025-06-18	
MW24-1	262.47	0.88	0.63	0.8	1.04	-		0.49	0.75
MW24-2	261.56	0.74	0.6	0.79	0.58	-		0.59	0.97
MW24-3 (D)	262.23	1.1	0.91	1.14	1.22	-		0.65	1.32
MW24-3 (S)	262.30	1.07	0.91	1.14	0.59	-		0.1	1.25
MW24-5	265.86	-	**-0.46**	**-0.4**	0.01	0.08		**-0.12**	0.05
MW24-6	264.85	**-0.19**	**-0.29**	**-0.31**	0.01	0.19		**-0.7**	0.16
MW24-7 (D)	265.33	**-0.16**	**-0.19**	**-0.14**	0.27	1.3		**-0.23**	0.24
MW24-7 (S)	265.34	0.27	0.34	0.55	0.92	0.07		0.19	0.91
MW24-9	263.87	0.53	0.41	0.11	0.83	-		0.46	0.83
MW24-10	263.82	**Flowing**	**Flowing**	**Flowing**	**Flowing**	**Flowing**		**-0.72**	**-0.65**
MW24-11	263.31	1.38	1.26	0.48	1.59	1.68		1.22	1.7
MW24-12	265.16	0.35	0.27	0.69	0.97	1.39		0.27	0.95
MW24-13 (D)	263.58	0.59	0.49	0.45	0	-		0.71	1.1
MW24-13 (S)	263.59	0.68	0.64	0.58	0	-		0.87	1.16

BOLD *– Above Grade.*

Groundwater Flow Direction

The water table within the Primary and Secondary Study Area, is expected to be a shallow and perched condition due to limited drainage through the low permeability overburden soils. Horizontal groundwater flow within both the groundwater systems is minor due to flat hydraulic gradients and low permeability clay till soils at the site. Interflow occurring within the unsaturated zone of the shallow weathered soils and till is not considered significant and is typically limited to valley lands with steeper topography and localized areas near low-lying wetlands.

Regionally, groundwater flow through the Halton Till Aquitard is predominantly downwards towards the bedrock aquifer. Within the bedrock aquifer, groundwater flow is generally southwards towards Lake Ontario.

TABLE 6: PHASE 1 SEASONAL HIGH GROUNDWATER LEVELS (MBGL)

MW Locations	Manual		Logger	
	Date	Peak	Date	Peak
101 (Deep)	2025-10-02	**-2.98**	-	-
101 (Shallow)	2024-03-15	**-0.32**	2024-01-27 12:00	**-0.52**
104 (Deep)	2024-05-01	**-0.69**	2024-04-25 9:00	**-0.83**
104 (Shallow)	2024-03-15	**-0.36**	2024-04-16 11:00	**-0.48**
106	2024-05-15	**-0.40**	2024-05-31 8:00	**-0.53**
109	2025-03-18	-0.35	2024-07-17 7:00	**-0.17**
202	2025-03-18	0.09	2025-04-04	**-0.14**
204	2024-05-15	2.49	2025-04-13 4:00	2.27
208	2024-05-15	0.31	2025-04-16 7:00	0.30
210	2025-03-18	0.80	2025-04-03 3:00	0.63
303	2024-05-15	1.22	-	-
403	2023-09-27	**-1.70**	-	-
405	2025-03-18	1.40	2025-04-05 1:00	1.19
409 (Deep)	2025-03-18	-0.10	2025-04-03 19:00	**-0.14**
409 (Shallow)	2024-05-01	0.40	2024-01-27 12:00	0.04
411 (Deep)	2024-06-12	**-3.55**	-	-
411 (Shallow)	2024-06-12	**-0.71**	-	-
501	2024-08-14	**-0.21**	2023-09-27 16:00	**-0.10**
504	2024-05-15	0.60	2024-05-15 12:00	0.60
505	2024-08-14	1.61	2024-05-15 11:00	1.51

506	2024-03-15	0.07	2024-03-15 13:00	0.06
509	2024-03-15	0.32	2024-03-07 11:00	0.31
601 (MWA)	2024-03-15	0.44	-	-
606 (MWC)	2024-03-15	**-0.63**	2024-03-24 5:00	**-0.71**
607 (MWB)	2024-03-15	0.59	-	-

BOLD *– Above Grade.*

TABLE 7: PHASE 2 SEASONAL HIGH GROUNDWATER LEVELS (MBGL)

MW Locations	Manual		Logger	
	Date	Peak	Date	Peak
MW24-1	2025-03-18	0.49	2025-03-17 14:00	0.33
MW24-2	2024-06-17	0.58	2024-04-04 22:00	0.44
MW24-3 (D)	2025-03-18	0.65	2025-04-07 2:00	0.22
MW24-3 (S)	2025-03-18	0.10	2025-03-11	**-0.42**
MW24-5	2024-05-01	**-0.46**	2024-05-04 9:00	**-0.54**
MW24-6	2025-03-18	**-0.70**	2025-04-04 19:00	**-0.81**
MW24-7 (D)	2025-03-18	**-0.23**	2024-04-16 11:00	**-0.33**
MW24-7 (S)	2025-08-14	0.07	2024-04-07 12:00	0.18
MW24-9	2024-05-15	0.11	2024-05-15 12:00	0.11
MW24-10	2025-03-18	**-0.72**	2025-03-12 2:00	**-0.94**
MW24-11	2024-05-15	0.48	2024-05-15 11:00	0.48
MW24-12	2025-03-18	0.27	2024-03-25 14:00	0.08
MW24-13 (D)	2024-06-17	0.00	2024-06-15 9:00	**-0.01**
MW24-13 (S)	2024-06-17	0.00	2024-06-15 11:00	**-0.06**

BOLD *– Above Grade.*

It should be noted that the levels presented in Tables 4, 5, 6 and 7 are interpreted to be representative of a potentiometric surface rather than true groundwater conditions. It is shown in the hydrographs that the system does not significantly respond to precipitation events suggesting that there is a significant confining layer on the property. Therefore, the water levels measured above are not necessarily where groundwater would be encountered during excavation. Peak measured potentiometric levels were captured in March 2024 and March 2025.

Figure 12 shows the interpreted groundwater contours where groundwater is expected to be encountered.

As illustrated on the inferred groundwater flow map, groundwater typically flows from areas of high potentiometric potential to areas of lower potential, where groundwater discharge may be occurring. One area where this can be observed is along the Alloa Drain and the associated Wetland 7 which is situated near adjacent to the interpreted groundwater divide and correlated to the surface water drainage system. At this location, gradients fall to near zero from the higher potential areas just to the north. This is also interpreted to be occurring at Wetlands #1, #2, #3, #4, and #6. These are areas during the spring where perched groundwater levels are higher than the rest of the year. Groundwater flows preferentially to areas with higher hydraulic conductivity than the surrounding soils and offers an opportunity for discharge. During the dry seasons, groundwater discharge to wetlands #1, #2, #3, #4, #6 is limited.

Groundwater Chemistry

As part of the AMEC (2014) report for the Mayfield West Secondary Area, water quality samples were collected from all wells within the study area and summarized. Water quality results were classified into overburden and bedrock for the purpose of discussion. The overburden water quality was further divided into the Halton Till (stratified units and massive tills) and the sand lenses. The water quality within the stratified units of the Halton Till can be classified as hard and slightly alkaline with high concentrations of Total Dissolved Solids (TDS). Major ions include calcium, magnesium, sodium, and bicarbonate. There are minor concentrations of sulphate and sodium. Water quality in the sand lenses had relatively high concentrations of total dissolved solids (TDS), principally from sodium and chloride reflecting the mixing of more saline water from the underlying bedrock.

The water quality in the upper 6 m of bedrock demonstrated both saline and relatively fresh water. The dominant ions are calcium, sulphate, sodium, and chloride. Deeper in the bedrock the water becomes more saline mainly as a result of a longer residence time.

Detectable concentrations of nitrate are common in agricultural areas and appear in a number of overburden and bedrock samples, including in intermediate and deep bedrock, along with elevated ammonia. The nitrate values vary from non-detectable to 21 parts per million (ppm) and are generally higher in the shallow bedrock/overburden contact or within the more permeable stratified silt/sand/gravel.

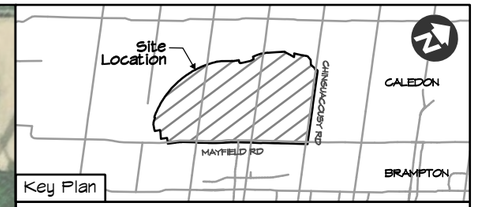
Localized groundwater sampling was conducted in May 2024 to establish baseline water quality conditions within the primary study area. Groundwater sampling was conducted using a peristaltic pump and standard groundwater sampling procedures. Three (3) samples were collected from MW101-D, MW101-S and PZ-5 to capture a representative sample from the shallow and deep aquifers and perched surface water on the Alloa Lands. These locations were selected to generate a vertical profile to be compared against historical sampling events.

Detailed sampling results are presented in Appendix F and Appendix G. Resultant concentrations were compared to the Ontario Drinking Water Quality Standards (ODWS) and Provincial Water Quality Objectives (PWQO) for reference in evaluating impacts to drinking water wells and surface water in the Study Area. Exceedances are presented in Table 8.

HERITAGE RD
MISSISSAUGA RD
CREDITVIEW RD
CHINGUACOUSY RD
MAYFIELD RD

MW409 (S/D)
MW405
MW24-11
MW24-7 (S/D)
MW403
MW109
MW-5
MW411 (S/D)
MW24-6
MW24-1
MW101 (S/D)
MW106
MWD
MW24-10
MW104 (S/D)
MW24-12
MW202
MW204
MW210
MW24-2
MW509
MW24-13 (S/D)
MW506
MW208
MW501
MW303
MW504
MW24-3 (S/D)
MW505
MW9
MWC

263
262
261
260
259
258
257
264
267
260
258
250



Key Plan

LEGEND

- PRIMARY STUDY AREA
- MONITORING WELL
- INTERPRETED GROUNDWATER SURFACE (MASL)
- INTERPRETED GROUNDWATER FLOW DIRECTION

NOTES:
Please note that the groundwater contours are representative of an interpreted groundwater surface based on the presence of a significant confining layer.

0 270 540 m
1:15,000

Project:
Alloa Subwatershed Study
Alloa Landowners Group

Title:
Interpreted Groundwater Surface & Flow Direction

CROZIER
70 Huron St Suite 100, Collingwood, ON (705) 446-3510

Date:	Drawn By:	Approved By:	
2025-08-19	C.M.	E.F.	Figure 12

Path: J:\2400\2448 - Alloa Landowners Group\6683 - Alloa Development Area\Design\GIS\6683 - Alloa | BASE MAP SOURCE: Peel Region, Town of Oakville, Maxar

TABLE 8: WATER QUALITY RESULTS

Analyte	ODWS Guideline/ Standard (mg/L)	PWQO Guideline/Standard (mg/L)	Resultant Concentration (mg/L)		
			MW101-D	MW101-S	PZ-5
Total Dissolved Solids (Tds)	500 (A)	-	804	582	**324**
Hardness	80-100 (A)	Free From Debris	426	251	407
Colour	5 (Tcu) (A)	Free From Debris	4.95	**3.21**	27.7
Turbidity	5 (Ntu) (A)	-	261	8.4	5.8
Total Sodium	20 (B)	0.3	30.1	**12.7**	29.5
Total Iron	0.3 (A)	0.1 (A)	8.32	0.381	**0.291**
Total Aluminum	0.1 (A)	0.075	4.95	0.184	0.168
Nitrate	10.0 (A)	-	**< 0.05**	**< 0.05**	14.4

The exceedances of the ODWS are exceedances of aesthetic objectives and operational guidelines except for Total Sodium and Nitrate. Total sodium could be elevated due to the monitoring well and piezometer location to the road; salt runoff could be directed towards this location. The elevated concentration of Nitrate in the piezometer sample is interpreted to be due to stagnant water sitting at the surface of the Alloa Drain and is believed to be common in agricultural areas and is likely extensive in surface water across the Primary Study Area lands.

The PWQO are related to impacts primarily to water bearing species and how exceedance can impact the health of stream and wetland communities. The objectives and interim objectives are outlined in Table 2 of MOECC (formerly MOE) documentation for Water Management: Policies, Guidelines and Provincial Water Quality Objectives. In general, water shall be free from debris, suspended solids and sediment prior to discharge.

Groundwater and surface water quality should be considered in future dewatering plans as a part of the further development applications as it relates to discharge to the environment.

Ecological Significant Groundwater Recharge Areas

According to regional mapping, ecologically significant groundwater recharge areas (ESGRAs) are located within the Primary Study Area in the northwest at Mississauga Road and Old School Road, along Creditview just east of Wetland 3 and just east of Wetlands 1 and 2. These are areas where modelling suggests that groundwater recharge is occurring.

However, due to measured hydraulic conductivity of the soils within the Primary Study Area, groundwater recharge is limited within the Primary Study Area. Therefore, significant groundwater recharge is not anticipated to be occurring within the Primary Study Area.

Recharge and Discharge

Discharge areas are where groundwater moves upward toward the ground surface and emerges as a spring, seep, or base flow of a stream. In contrast, a recharge area is where water infiltrates downward into the subsurface and recharges the water table.

In the Primary Study Area, shallow groundwater flow is generally toward the southeast, with areas near Alloa Drain following topography towards the channel. This section of the Etobicoke Creek runs perpendicular to the direction of groundwater flow which provides a preferred hydrogeological setting for groundwater discharge.

Recharge or discharge across the remainder of the Primary Study Area is limited due to the low hydraulic conductivity of the fines within the Halton Till surficial material. Regional mapping indicates that the vertical gradient within the Primary Study Area is mostly downward.

Based on the results of the surface water and groundwater monitoring conducted, it appears groundwater discharge is occurring periodically at all onsite wetlands This was observed through minor upward gradients shown in the shallow piezometers and associated near wetland monitoring wells. It is notable that flowing conditions were detected in the northeast quadrant of the Primary Study Area and standing water was observed at Wetlands #1, #3, #4, and #6 during the Spring.

Hydrographs of each monitoring well and associated borehole logs were reviewed to determine the shallow groundwater response to consistent wet conditions and significant rainfall events. Out of the thirty-two monitoring wells with hydrographs, nine wells showed faster response times to precipitation events than others. Per a review of the borehole logs, the stratigraphy of the wells with faster response times consisted of soils with greater proportions of sands and gravels and therefore higher hydraulic conductivity at various elevations, interspersed with silts and clays.

The stratigraphy of wells with muted responses times typically consisted of a thick confining clayey silt till, underlain by silty sand / sandy silt layer. It is understood that the lower soil layer of more transmissive soils is supporting the groundwater level. This layer may intersect with other local units that interact with the surface, but the amount of direct infiltration through seasonal recharge is limited.

Scenarios of spring inundation encountered at wetlands #1 - #6 are believed to be minorly supported by seasonal discharge as a result of potentiometric changes and wet antecedent conditions due to the lack of infiltration and low hydraulic conductivity in surface soils. The lack of transmissive soils underneath coupled with the change in potential result in conditions that promote the retention of surface water and inhibit infiltration due to subsurface saturation. Therefore, the combination of minor groundwater influx and surface water inputs caused by a low surface gradient are interpreted to support Wetlands #1- #6, rather than consistent groundwater discharge.

Water Well Records

Based on a search of the Ministry of the Environment and Climate Change (MOECC) Water Well Database, there are approximately 94 water well records within 500 m of the Primary Study Area (see Appendix H). Please refer to Figure 13 for a representation of mapped MECP wells in the Study Area. These records confirm the presence of clay till soil to significant depth across the site. Some wells located near the Alloa Drain indicate the presence of sand and gravel, which may be associated with the modern alluvial deposits. Shale or limestone bedrock was encountered within some deeper wells at depths ranging from 15 to 37 mbgl.

In general, the following observations about the well records can be made:

- Of the 94 identified well records, 50 are used as domestic water supply, 19 are noted to be abandoned, decommissioned, or unused, 13 are used for monitoring or observation purposes, 6 are used for livestock, 1 for school water supply and 1 for commercial water supply, and the remaining 4 do not have an indicated use.

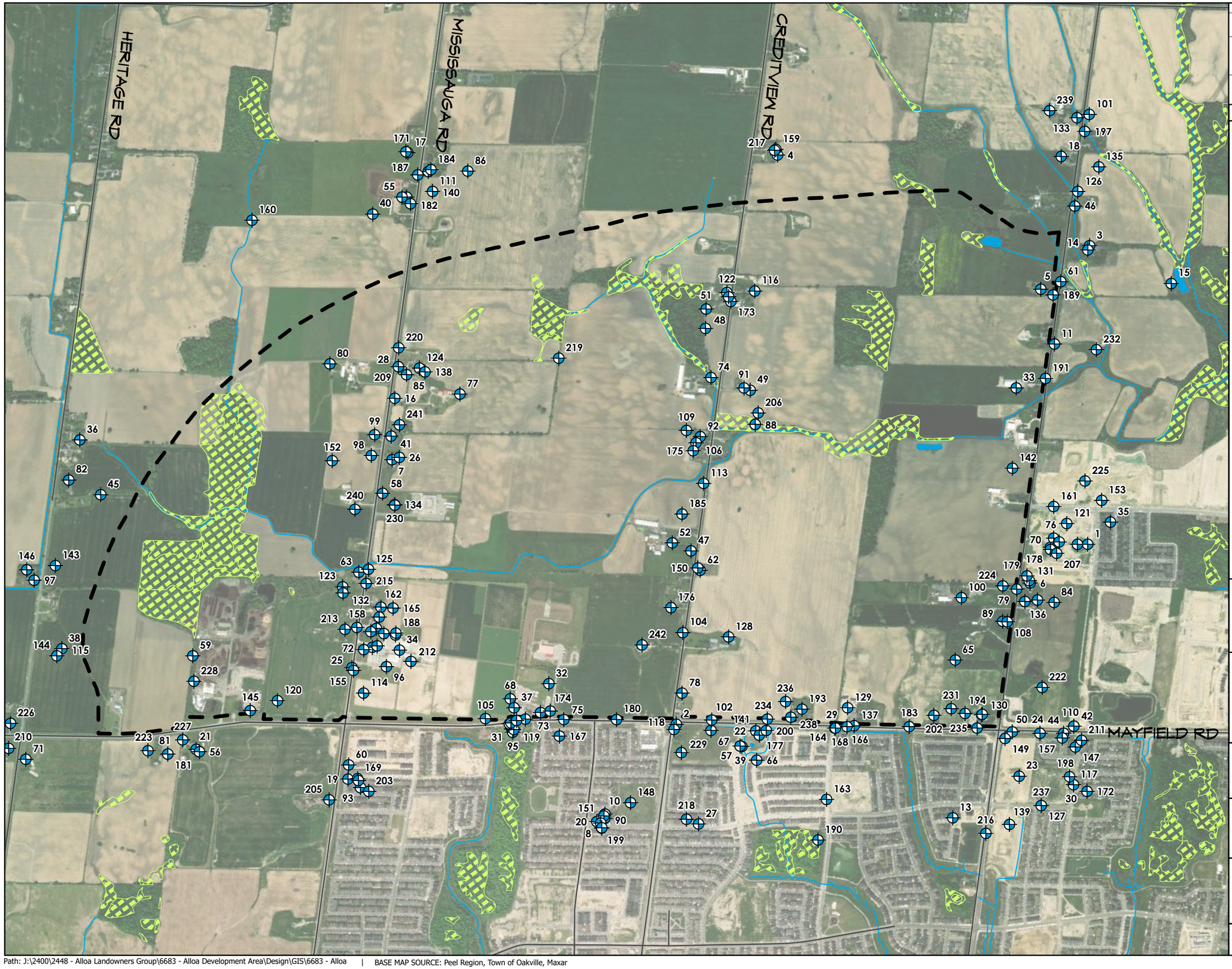
- The majority of the well records indicate a thin layer of topsoil, ranging from 0.3 m to 1.5 m in thickness, followed by a layer of clay with varying amounts of silt, sand, and gravel. Most of the well records indicate a layer of sand or gravel beneath the layer of sand. From this, it can be interpreted that the primary aquifer utilized for domestic water supply for the wells screened in the overburden is a confined to semi confined sand/gravel unit, constrained by clay above.

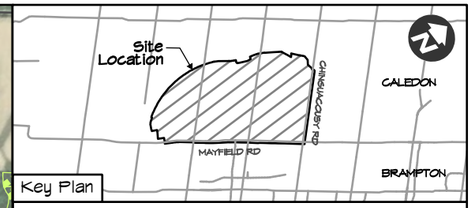
- The majority of the wells are screened within the overburden, with 27 of the wells constructed within bedrock. The average depth to bedrock in the area is 13.20 mbgl, with the primary bedrock material being red and blue shales. For the water supply wells screened within the bedrock, water is drawn from the bedrock aquifer.

- The deepest well is drilled to a depth of 55.2 mbgl, the shallowest well is drilled to a depth of 3.7 mbgl. The average depth of the wells is 16.9 mbgl.

- Static water levels in the wells range from 0.5 mbgl to 13.7 mbgl, with an average of 4.7 mbgl. The majority of the wells draw water from the confined overburden aquifer.

- Well yield ranged from 1.1 litres per minute (LPM) to 189.3 LPM, with an average of 36.0 LPM.





Key Plan

LEGEND

- PRIMARY STUDY AREA
- MECP WELL - SEE APPENDIX
- ROAD
- WETLAND (LIO)
- WATERBODY
- WATERCOURSE

NOTES:

Please note that the groundwater contours are representative of an interpreted groundwater surface based on the presence of a significant confining layer.

0 270 540 m

1:15,000

Project:

Alloa Subwatershed Study

Alloa Landowners Group

Title:

MECP Well Location Plan

CROZIER

70 Huron St Suite 100, Collingwood, ON (705) 446-3510

Date:	Drawn By:	Approved By:	
2025-08-19	C.M.	E.F.	Figure 13

Path: J:\2400\2448 - Alloa Landowners Group\6683 - Alloa Development Area\Design\GIS\6683 - Alloa | BASE MAP SOURCE: Peel Region, Town of Oakville, Maxar

7.2 Wetland Water Balance

In order to support the natural functioning of wetland features on the site, a baseline assessment of the conditions within each wetland was carried out. Crozier, Beacon, and TRCA staff staked the wetland features together on site in the summer of 2023 as demonstrated in the provided mapping. The staked wetlands are summarized in Table 9 below.

TABLE 9: GENERAL WETLAND INFORMATION

Wetland ID	Wetland Area (ha)[1]	Existing Catchment Area (ha)[2]	Wetland Community (ELC)[3]
1	8.11	227.22	Swamp Maple Mineral Deciduous Swamp (SWDM3-3)
2	1.33	103.73	Swamp Maple Mineral Deciduous Swamp (SWDM3-3)
3	7.26	189.56	Swamp Maple Mineral Deciduous Swamp (SWDM3-3), Reed Canary Grass Mineral Meadow Marsh (MAMM1-2)
4	1.39	9.88	Swamp Maple Mineral Deciduous Swamp (SWDM3-3)
5	0.40	5.34	Swamp Maple Mineral Deciduous Swamp (SWDM3-3)
6	2.43	28.70	Broad-leaved Cattail Mineral Shallow Marsh (MASM1-1), Reed Canary Grass Mineral Meadow Marsh (MAMM1-2)
7	1.23	86.29	Swamp Maple Mineral Deciduous Swamp (SWDM3-3), Reed Canary Grass Mineral Meadow Marsh (MAMM1-2)

1. *As staked by TRCA, Beacon, and Crozier; Wetland #6 and #7 boundaries updated 2024 by CEA*
2. *As reported in the Pre-Development Drainage Plan by Urbantech, June 2024.*
3. *As described by Beacon and Azimuth.*

The following section outlines the ecology, hydrology, and hydrogeology of Wetlands 1 – 7 within the Alloa Study Area. A companion field study was conducted by Azimuth Environmental and Cunningham Environmental Associates to further ecologically classify the wetland systems.

7.2.1. Ecological Systems

The ecological communities of each Wetland are important to note as the ecology of the system defines the sensitivity of the community to hydrologic change. This includes the flora and fauna species and any special considerations within each community (e.g. bat habitats, spawning areas etc.). Table 10 summarizes the ecological communities of each wetland. Note that further details on the site-specific surveys, testing, and specific species is presented in Section 7.8.

TABLE 10: WETLAND ECOLOGICAL CHARACTERIZATION

Wetland Name	ELC Code	Community	Dominant Species	Fauna	Special Considerations
Wetland #1	SWDM3-3	Swamp Maple Mineral Deciduous Swamp	Silver and Freeman Maple, sedge species, Black Ash, Sensitive Fern, White Cedar	Green Frog, Gray Treefrog, American Toad, Brook Stickleback, Fathead Minnow, Northern Redbelly Dace	None
Wetland #2	SWDM3-3	Swamp Maple Mineral Deciduous Swamp	Silver and Freeman Maple, sedge species, Black Ash, Sensitive Fern, White Cedar	Common Yellowthroat	None
Wetland #3	SWDM3-3, MAMM1-2	Swamp Maple Mineral Deciduous Swamp, Reed Canary Grass Mineral Meadow Marsh	Silver and Freeman Maple, sedge species, Black Ash, Sensitive Fern, White Cedar	American Toad, Alder Flycatcher, Common Yellowthroat, Brook Stickleback, Fathead Minnow, Northern Redbelly Dace	None
Wetland #4	SWDM3-3	Swamp Maple Mineral Deciduous Swamp	American Elm, Black, Green and Red Ash, Spotted Touch-me-not, Red-osier Dogwood	Gray Treefrog, Common Yellowthroat	None
Wetland #5	SWDM3-3	Swamp Maple Mineral Deciduous Swamp	American Elm, Black, Green and Red Ash, Spotted Touch-me-not, Red-osier Dogwood	Green Frog, Common Yellowthroat	None

Wetland #6	MASM1-1, MAMM1-2	Broad-leaved Cattail Mineral Shallow Marsh, Reed Canary Grass Mineral Meadow Marsh	Reed Canary Grass, Broad-leaved Cattail	Wood Frog, Spring Peepers, Gray Treefrog, American Bullfrog, Midland Painted Turtle	Significant Wildlife Habitat for Amphibian Breeding Habitat (Wetlands)
Wetland #7	SWDM3-3, MAMM1-2	Swamp Maple Mineral Deciduous Swamp, Reed Canary Grass Mineral Meadow Marsh	American Elm, Black, Green and Red Ash, Spotted Touch-me-not, Red-osier Dogwood	Gray Treefrog, Common Yellowthroat, Brook Stickleback, Fathead Minnow, Northern Redbelly Dace Common Yellowthroat, Alder Flycatcher, Canada Goose, Mallard	None

Both Swamp Maple Mineral Deciduous Swamp (SWDM3-3 = SWD3-3) and Broad-leaved Cattail Mineral Shallow Marsh (MASM1-1 = MAS2-1) are considered to be moderately sensitive communities according to the TRCA Guideline for Wetland Water Balance (TRCA, 2017), and Reed Canary Grass Mineral Meadow Marsh (MAM2-2 = MAMM1-2) is considered to be a low sensitivity community. This guideline assumes that the community is slightly tolerant to hydrologic change. Under the same guideline, the fauna identified at Wetlands #1, and #4 – #7 are considered highly sensitive fauna during the spring and fall periods when breeding and key growth stages for young occur. Fauna identified in Wetland #3 are considered of medium sensitivity (due to presence of American Toad and Northern Redbelly Dace), and fauna identified in Wetland #2 are considered low sensitivity (due to presence of Common Yellowthroat). Note that spotted or orange touch-me-not are considered to be a common groundwater indicator; they thrive in consistently wet conditions in hydric soils.

7.2.2. Hydrologic and Hydrogeologic Systems

To understand the hydrologic system at each of the wetlands, piezometers were installed at each location and equipped with automatic level loggers to measure continuous water level change on an hourly basis. Manual measurements were captured on roughly a monthly basis.

A summary of the preliminary interpreted of the hydrologic systems of each of the wetlands is provided in Table 11 below.

TABLE 11: WETLAND HYDROLOGIC SYSTEM CHARACTERIZATION

Wetland	Groundwater Input	Residence Time	Additional Notes
Wetland #1	Yes	Short	Groundwater indicator fauna observed
Wetland #2	Yes	Short	
Wetland #3	Yes	Long	
Wetland #4	Yes	Short	
Wetland #5	Yes	Short	
Wetland #6	Yes	Long	
Wetland #7	Yes	Long	

Wetland #1 is equipped with 2 piezometers-one in the north end and one in the south end. Measurements thus far suggest a downward gradient in both PZ9 and PZ10 locations. Similarly, PZ8 deployed in Wetland #2 is demonstrating a downward hydraulic gradient. However, monitoring well MW24-7 S/D and MW24-3 S/D demonstrate a weak upward hydraulic gradient for some periods of the year (primarily in the spring).

Standing water at Wetlands #1 and #2 is shallow and has only been observed in March 2024 and therefore, it is interpreted that these wetlands are primarily a collector of precipitation and runoff from adjacent lands as opposed to being fed entirely by groundwater. Residence times in Wetlands #1and #2 are relatively short, meaning water only pools for a short period of time in the spring freshet or following a large storm event. Groundwater inputs are interpreted to only occur during the spring freshet.

Wetland #3 has two piezometers installed within the stream bank—PZ7 and PZ6—and standing water has been observed within the stream consistently since deployment in 2024. Water levels dropped significantly since installation of the piezometers and as such, the piezometers are no longer submerged in water. Therefore, a vertical gradient is difficult to establish at the current locations.

It is interpreted that Wetland #3 is partially supplied by groundwater to a minor extent. Given its elevation relative to the above grade water levels observed at MW23-101 D and MW24-10, the wetland is interpreted to be fed by groundwater for at least a portion of the year. The residence time is estimated to be long given the duration of standing water at Wetland #3.

In Spring 2024, shallow standing water was observed at Wetland #4. Water depths were recorded at approximately 0.15 mags in March 2024 and declined to no standing water in the summer and fall. Water returned to the area in the spring of 2025. It is interpreted that open water conditions only occur seasonally when groundwater is at its highest and the community will remain dry throughout the remainder of the year. This suggests periodic groundwater discharge and upward gradients during a portion of the year. Given the short period of open

water conditions, it is estimated that the residence time is short. It is assumed that direct runoff and precipitation inflow primarily support the Wetland #4 community. Since the residence time is short, the groundwater inputs to the wetland are interpreted to be negligible.

Wetland #5 is located in between Wetland #4 and Wetland #6 and is interpreted to function similarly to Wetland #4. Wetland #5 was observed to have standing water in March 2024 and no standing water was noted at subsequent field visits. However, given the above grade conditions observed at MW23-411 D/S and the upward gradient noted in Wetland #6, seasonal groundwater inputs are estimated.

Two (2) monitors were established in Wetland #6-one (1) in the west and one (1) in the east. From the hydrograph at PZ1, water levels have consistently ranged from 0.02 mbgs to 0.01 mags since deployment. Water levels do not spike following major precipitation events.

Given that the area has consistent standing water, Wetland #6 has a long residence time and open water is interpreted to be observed within the stream throughout the year. A minor upward gradient has been noted at PZ1 and PZ2, suggesting minor groundwater discharge may occur in this area. The monitoring wells in the area show above grade conditions and groundwater inflows to the wetland could be coming from a confined unit within the till.

Alloa Drain

The stream that flows through Wetland #7 is known as the Alloa drain. In the Spring of 2024, water levels exceeded 1 mags from the base of the stream to the bank in the location of PZ4. However, water levels have dropped since to levels of approximately 0.15 mags. This sudden change suggests significant contributions to Wetland 7 is from runoff and precipitation inputs.

It is interpreted that Wetland #7 has a long residence time and open water will remain in the stream all year. This suggests that the Alloa Drain and Wetland #7 has some groundwater input. We also note that Wetland #7 and the Alloa Drain have input from tile drainage, however the flows from the tile drains are unknown.

The current Alloa Drain exists within the Halton Till, with substrate consisting of silty material with gravel and sand intermixed. Due to the potential of perched groundwater within coarser lenses, small amounts of baseflow are provided to the drain by the surrounding till unit. Deeper in the strata, layers of more conducive glacial and modern deposits, however these units are typically discontinuous and isolated by the surrounding till. Therefore, groundwater transmission is limited.

Along the drain, the confining layer extends to at least to 4.6 mbgl or 255.5 masl. As discussed further in the LSS, the Alloa drain is proposed to be re-aligned. However, the proposed re-alignment does not extend below an elevation of 256 masl. Therefore, no adverse effects from the proposed channel realignment are anticipated.

7.2.3. Wetland FBWB with Groundwater Monitoring Inputs

A preliminary wetland feature-based water balance (FBWB) assessment was conducted by Crozier using monitoring data collected during this study, alongside open-source data from external sources. This water balance assessment was used to quantify the interaction of

groundwater with the wetland communities on the site. A complementary feature-based water balance was also completed by Urbantech using a surface water focused approach rather than groundwater. The details of the surface water balance can be found in the *Alloa Secondary Plan Scoped Servicing Study* (Urbantech, 2025).

For further clarification, two feature based water balances were conducted given the differences in scope between the consulting teams. Urbantech's work supports the hydrology and hydraulics of the Secondary Plan area and hence focuses on the surface water components to the features using the continuous hydrologic model. The results of this model were used in the surface water component of the FBWB. The same model was then provided to Crozier, the project hydrogeologist, for hydrogeological input using the monitoring data from 2023-2025. The results of this form of the model focus on the seepage and infiltration components. Therefore, the findings of the Urbantech continuous FBWB should be used for surface water targets (i.e., runoff) while the Crozier FBWB model can be used to inform infiltration and recharge targets.

As noted above, the objective of the Crozier FBWB is to evaluate the impact of the proposed development on the function of the relevant wetlands from a groundwater input perspective. The assessment quantifies and compares the wetland water balance criteria under both pre- and post-development conditions to determine the necessity and extent of required mitigation measures. The continuous hydrologic model constructed by Urbantech was used as a basis for the groundwater analysis.. Note that this Wetland FBWB has been developed with hydrogeologic inputs from the monitoring program in order to establish targets and objectives for groundwater recharge to wetland features, as required. Please refer to the Urbantech continuous hydrologic model for surface water related targets and water balance.

The Alloa Lands contain seven wetlands. Wetland #1 is classified as Locally Significant, Wetlands #2 through #6 are Provincially Significant, and Wetland #7 is not Provincially Significant. The preliminary FBWB with groundwater data has been completed for all wetlands except Wetland #7, due to its lower classification status and proposed relocation. Wetland features are shown on Figure 19.

To understand the hydroperiod and hydrological function of the Locally Significant and Provincially Significant Wetlands, the features were modelled continuously in Visual OTTHYMO (VO) v. 6.2 hydrologic modelling software using both surface and continuous groundwater monitoring data collected as part of the hydrogeological investigation. Ongoing calibration will be completed as data is collected within the Primary Study Area over the course of the Phase 1 and Phase 2 planning process and will be further coordinated with the stormwater management work completed by Urbantech. A digital copy of the hydrologic model has been provided with the submission of this report.

Calibration Data

Water level and flow monitoring data are used in VO's Plot Calibration tool. The tool compares modelled and monitored data to enable users to review statistics and verify the accuracy of the model. In absence of sufficient calibration data, Urbantech has prepared a sensitivity analysis in the continuous hydrologic model, as described in Appendix J. Monitoring data will be integrated into the continuous hydrologic model once a sufficient range of data has been collected for calibration which will be required at the Tertiary or Draft Plan level stages.

Shallow surface water sensors were installed and monitored by Crozier. The data represents the water level in the wetlands. Flow sensors were installed and monitored by GEO Morphix. The data represents the surface water discharge at the outlet of each wetland. The wetland water level and flow monitoring locations are shown in Figure 3.

Monitoring Data

The continuous wetland feature-based water balance model relies on climate inputs such as precipitation, temperature, and evapotranspiration. To capture localized climate variability, a weather station was installed on-site at the Alloa Lands. However, repeated vandalism of the weather station, identified during routine maintenance, compromised the integrity of the data. Following a detailed review, the collected data was deemed unusable, and external sources were used to support the development of the hydrologic model. Moving forward, the on-site weather station will be secured so that localized climate data can be collected. A summary of the external data sources used is provided below.

- Precipitation Data: Precipitation data was sourced from TRCA rain gauge HY033, located approximately 5.5 km southeast of the Alloa Lands at Heart Lake Conservation Park. The dataset includes 5-minute interval rainfall measurements. Precipitation data is presented in Appendix I.

- Temperature Data: Temperature data was obtained from the Environment Canada Historical Data Climate Library's Toronto Pearson International Airport station. This source is located approximately 16 km southeast of the Alloa lands. Daily maximum and minimum temperature data are included in Appendix I.

- Evapotranspiration Data: Daily potential evapotranspiration was calculated using Hargreaves Method, which incorporates the site's geographic coordinates (latitude and longitude) to estimate wind speed and solar radiation. The calculation also considers the daily temperature data described above. The daily potential evapotranspiration data is found in Appendix I.

- Groundwater Elevation Data: Groundwater data is applied to the model to account for the hydroperiod, or seasonal variation of water levels, in the wetlands. Groundwater monitoring wells were selected based on the proximity to each wetland. Hourly groundwater elevation data, including wetland and groundwater well IDs, are found in Appendix I.

Model Parameters

Preliminary pre- and post-development drainage areas were obtained from Drawing 3F and Drawing 3G, Appendix A, of the *Alloa Secondary Plan Scoped Servicing Study* by Urbantech (August 2025) submitted under separate cover. To account for groundwater contributions to each wetland, the TRCA staked and surveyed wetland boundaries were utilized to delineate wetland areas. These wetland areas were modelled separately from the contributing drainage areas using the RouteWetland command in VO.

A summary of the model parameters for all the wetlands and associated drainage areas is provided in Table 12 below.

TABLE 12: WETLAND FEATURE BASED WATER BALANCE MODEL PARAMETERS

Scenario	Name	VO Command	Area (ha)	CNII[1]	IA[2] (mm)	TP[3] (hrs)	K[4] (mm/day)
Pre-Development	W1 DA	NasHyd	219.27	85	7.19	1.88	NA
	W2 DA	NasHyd	102.73	82	6.98	1.79	NA
	W3 DA	NasHyd	182.30	82	7.11	2.37	NA
	W4 DA	NasHyd	8.49	82	8.73	0.66	NA
	W5 DA	NasHyd	4.97	78	8.52	0.61	NA
	W6 DA	NasHyd	26.28	81	7.27	1.09	NA
	Wetland 1	Route Wetland	7.94	79	12	NA	7.08
	Wetland 2	Route Wetland	1.31	79	12	NA	7.08
	Wetland 3	Route Wetland	7.26	79	12	NA	7.08
	Wetland 4	Route Wetland	1.39	79	12	NA	7.08
	Wetland 5	Route Wetland	0.37	79	12	NA	7.08
	Wetland 6	Route Wetland	2.43	79	12	NA	7.08
Post-Development	W1PDA (Crops) 1	NasHyd	69.40	83	7.27	1.61	NA
	W1PDA (Crops) 2	NasHyd	39.00	85	7.12	1.74	NA
	W1PDA (Woodland)	NasHyd	42.06	85	7.75	1.59	NA
	W2PDA (Crops)	NasHyd	84.20	82	6.86	1.45	NA
	W2PDA (Woodland)	NasHyd	4.69	79	8.14	0.66	NA
	W3PDA (Crops)	NasHyd	136.60	82	7.18	2.07	NA
	W3PDA (Woodland)	NasHyd	10.74	84	7.21	0.71	NA
	W4PDA	NasHyd	8.11	82	9.57	0.55	NA
	W5PDA	NasHyd	4.43	78	8.99	0.55	NA
	W6PDA (Crops)	NasHyd	24.85	82	6.93	1.02	NA
	W6PDA (Woodland)	NasHyd	2.89	82	7.13	0.30	NA

Scenario	Name	VO Command	Area (ha)	CNII[1]	IA[2] (mm)	TP[3] (hrs)	K[4] (mm/day)
	W1IDA (SWMF) 1	StandHyd	10.60	50	5	NA	NA
	W1IDA (SWMF) 2	StandHyd	7.30	50	5	NA	NA
	W2IDA (HWY413 Corridor)	StandHyd	11.30	80	5	NA	NA
	W2 I DA (SWMF)	StandHyd	4.00	50	5	NA	NA
	W3 I DA (HWY 413 Corridor)	StandHyd	20.36	80	5	NA	NA
	W3 I DA (SWM Pond)	StandHyd	2.94	50	5	NA	NA
	W3IDA (SWMF)	StandHyd	6.40	50	5	NA	NA
	W4IDA	StandHyd	0.38	80	5	NA	NA
	W5IDA	StandHyd	0.54	80	5	NA	NA
	W6IDA (HWY413 Corridor)	StandHyd	8.31	80	5	NA	NA
	W6 I DA (SWM Pond)	StandHyd	1.32	50	5	NA	NA
	Wetland 1	Route Wetland	7.94	79	12	NA	7.08
	Wetland 2	Route Wetland	1.31	79	12	NA	7.08
	Wetland 3	Route Wetland	7.26	79	12	NA	7.08
	Wetland 4	Route Wetland	1.39	79	12	NA	7.08
	Wetland 5	Route Wetland	0.37	79	12	NA	7.08
	Wetland 6	Route Wetland	1.93	79	12	NA	7.08

1.CNII (Soil Conservation Service Curve Number) is based on average antecedent moisture conditions (AMCII). CNII calculated using VO GIS tools and underlying soils and land use shapefiles. CN values for Stanhyd are for pervious areas only. 2. IA (Initial Abstraction) calculated using VO GIS tools and underlying soils and land use shapefiles. IA values for Stanhyd are for pervious areas only. 3. TP (Time to Peak) calculated using Airport method and QGIS Time to Peak Calculator. A runoff coefficient of 0.3 was used based on the underlying land use and soils. 4. K (Hydraulic Conductivity) is based on the geometric mean value determined by DS Consultants.

In addition to the above parameters, the assessment of wetland areas includes storage as a model consideration. To evaluate the topography of the wetlands, a LiDAR surface was acquired from the Natural Resources Canada (NRC) High Resolution Digital Elevation Model

(July 2025). A QGIS Volume Calculator tool was used to generate depth-area curves for each wetland based on the aforementioned LiDAR data. Furthermore, the LiDAR data facilitated the generation of cross-sectional geometry and slope profiles for the wetland outlet locations. Subsequently, FlowMaster v8i was utilized to develop stage-discharge curves. A Manning's roughness coefficient of 0.05 was applied, reflecting an unmaintained channel with brush. Depth-area and stage-discharge curves, along with the results from the FlowMaster modelling, are presented in Appendix I.
Results of the wetland feature-based water balance and anticipated impacts of the Alloa Lands under proposed conditions are discussed in Section 11.2.5.

7.3 Site Wide Water Balance

A site wide water balance was conducted to assess pre-to-post runoff and infiltration conditions across the entire Alloa Secondary Plan Area to inform potential Low Impact Development (LID) design post-development.

The site water balance assessment was completed using a continuous hydrologic model, as per Town requirements. For the portion of the site within the Etobicoke Creek subwatershed, the TRCA's approved Visual OTTHYMO hydrologic model was used as a basis for the site water balance continuous model.

The continuous model was simulated for the period of 1986 to 2007 using data from the Buttonville Airport weather station, as recommended by TRCA. This data set from Buttonville Airport was used for the sensitivity analysis until such time that sufficient monitoring data is available for model calibration. The selected data set captures a suitable range of wet and dry years, as well as extreme events, for the given period of 1986 to 2007.

The results from the site water balance continuous model for the portion of the site within the Etobicoke Creek subwatershed are summarized in Table 13. Additional information and the continuous site water balance hydrology model is provided in Appendix C of the Urbantech *Alloa Secondary Plan Scoped Servicing Study* (Urbantech, August 2025) submitted under separate cover.

The average annual GWI (groundwater infiltration) under post-development conditions was compared to the pre-development average annual GWI for each of the three sensitivity analysis scenarios in order to assess the impacts of the subject development on infiltration and groundwater recharge Please refer to the Sensitivity Analysis Memo (Urbantech, 2025) submitted and accepted by the TRCA under separate cover, see Appendix J). The "low runoff" scenario has the most conservative infiltration target with respect to the site-wide water balance (i.e., low runoff means more infiltration and vice versa). As further described in Section 18.1.4 herein, the proposed LID mitigation for the Alloa Secondary Plan area provides approximately 11.0 mm of retention across the Site, which exceeds the calculated water balance infiltration target.

The results of the water balance assessment are provided in Table 13.

TABLE 13: SUMMARY OF CONTINUOUS MODELING RESULTS (ETOBICOKE CREEK)

Annual Infiltration	Baseline Scenario	High Runoff Scenario	Low Runoff Scenario
Pre-Development GWI (mm/year)	199	109	319

Post-Development GWI (mm/year)	121	71	188
GWI Deficit (mm/year)	78	37	131
Precipitation (mm/yr)	826		
Deficit / Precipitation (%)	9%	5%	16%
Target Retention (mm)	1.5	1.0	2.0
Mitigation Provided (mm)	11.0		

For the portion of the site within the Huttonville Creek and Fletcher's Creek subwatersheds, the unitary infiltration targets from the HFSWS were applied to the subject area, which are based on the modelling that was done for the water balance analysis for Huttonville Creek and Fletcher's creek. These target infiltration volumes for the portion of the subject lands within Fletcher's Creek are summarized in Table 14.

TABLE 14: SUMMARY OF INFILTRATION TARGETS (FLETCHER'S CREEK)

Land Use Type	LID Infiltration Target (m3/ha)	Total Area (ha)	Total Volume (m3)
Low Density Residential	10.4	102	1,058
Medium Density Residential	9.6	0	0
Commercial	17.3	66	1,144
School	6.4	0	0
NHS / Open Space / Park / SWM Pond	0	0	0
Total	-	168	2,203

As per Table 14, the target retention volume to achieve the infiltration target for the portion of the subject lands within Fletcher's Creek is 2,203 m3. The location and preliminary design of the proposed LIDs for the portion of the site within the Huttonville Creek and Fletcher's Creek Subwatersheds are to be determined at the Tertiary Plan / FSR stage, and are subject to groundwater conditions.

7.4 Hydrology and Hydraulics

The Alloa Secondary Plan Area falls within the Upper Etobicoke Creek subwatershed, Fletcher's Creek subwatershed, and Huttonville Creek subwatershed. This hydrology and hydraulics section provides an overview of the existing drainage conditions, and includes information based on various studies, including the Etobicoke Creek Hydrology Update (WSP, 2013), Subwatershed Study for the Huttonville and Fletcher's Creeks (June 2011), the Heritage Heights Subwatershed Study Phase 2 Report (March 2022), the Mayfield West Phase 2 development studies (EIS/SWS), and recommendations from the SABE report. It also incorporates analysis using the Visual OTTHYMO and HEC-RAS models provided by the TRCA.

Table 15 below summarizes the total area of the Alloa study area within the Etobicoke Creek watershed, Fletcher's Creek watershed, and East/West Huttonville Creek watershed.

TABLE 15: SUMMARY OF STUDY AREA WITHIN ADJACENT SUBWATERSHEDS

Watershed	Area [ha]	Percent of Total
Etobicoke Creek	541.87	75.70%
Fletcher's Creek	141.15	19.70%
East Huttonville Creek	19.14	2.70%
West Huttonville Creek	13.95	1.90%
Total	**716.11**	**100%**

Table 16 below notes the hydrologic and hydraulic models that were used for the following purposes in this Local Subwatershed Study.

TABLE 16: HYDROLOGIC AND HYDRAULIC MODELS USED FOR ALLOA LSS

Purpose		Model	Report or study
Existing condition hydrology (event based)	Establish existing flows at various nodes of interest (i.e., targets). Used in hydraulics analysis	Visual OTTHYMO	Local Subwatershed Study
Proposed conditions hydrology (event based)	Establish proposed uncontrolled flows. Used in hydraulics analysis.	Visual OTTHYMO	Local Subwatershed Study
SWM facility sizing	Confirm storage requirements for each design storm.	Visual OTTHYMO	FSR
Erosion assessment	Confirm proposed extended detention criteria adequately meet targets east of Chinguacousy Road.	Continuous Visual OTTHYMO	FSR
Feature Based Water Balance	Compare existing and proposed average / extreme monthly runoff volumes to selected features	Continuous Visual OTTHYMO	FSR
Flood hazard mapping (existing)	Establish existing Regional floodplain	HEC-RAS (1D)	Local Subwatershed Study
Flood hazard mapping (proposed)	Establish proposed Regional floodplain	HEC-RAS (1D)	Local Subwatershed Study

Flood storage analysis	Evaluate change from existing conditions to proposed natural heritage system design.	HEC-RAS (1D dynamic) HEC-RAS (2D quasi - steady state)	Local Subwatershed Study

The flow chart on Figure 14 illustrates the relationships between the selected models and the associated inputs and outputs for each key task.

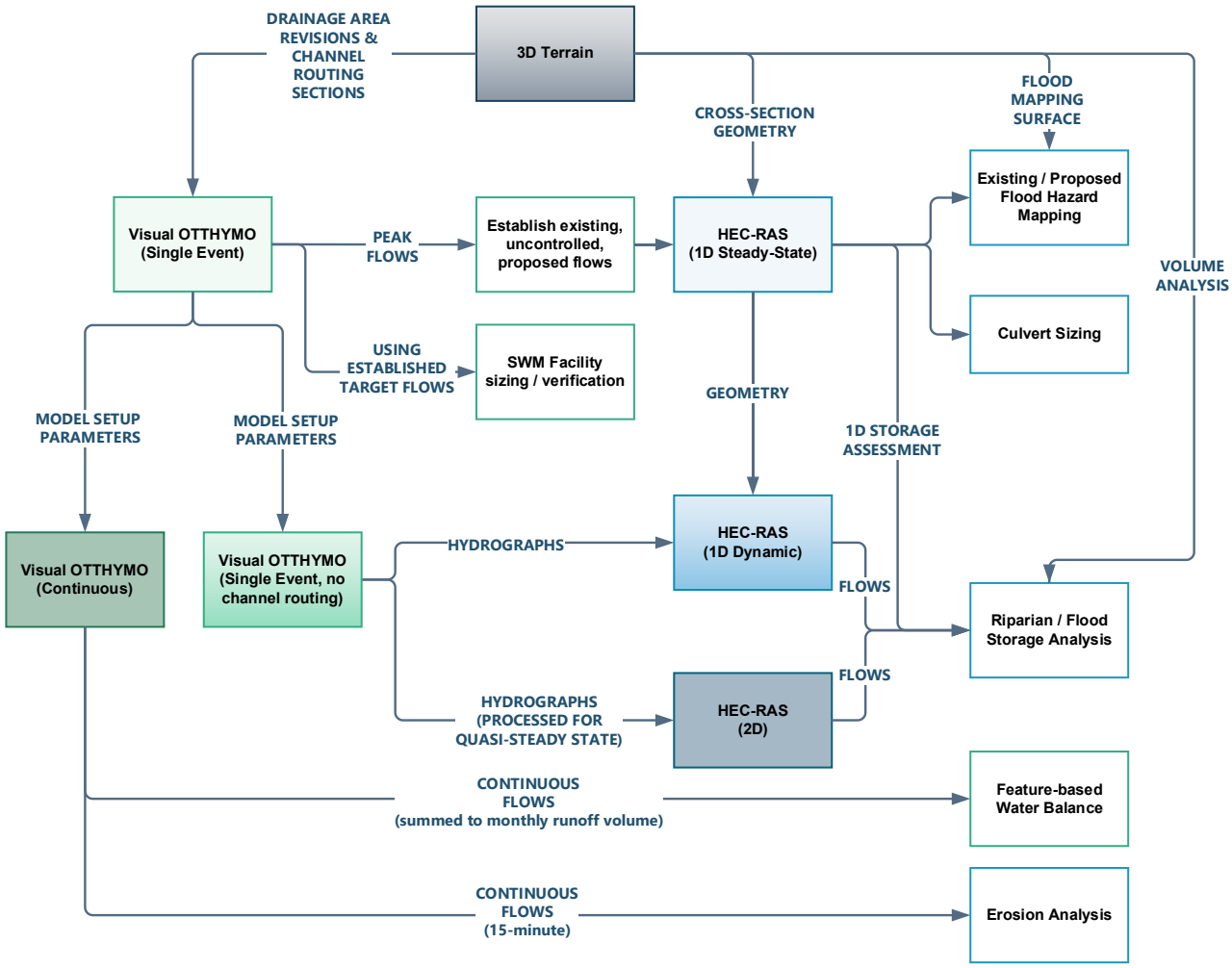


Figure 14: Model Relationships

The results of the analyses indicated above are provided in the subsequent sections (and studies, in the case of more detailed results that will be within the scope of the FSR).

7.4.1. Background Studies

The following background studies provided the foundation for the hydrologic and hydraulic modeling, as well as the evolution of the SWM strategy for the Primary Study Area and surrounding study areas.

Etobicoke Creek Headwaters Subwatershed Study Synthesis Report (Toronto and Region Conservation Authority (TRCA), in partnership with the Region of Peel, Town of Caledon, City of Brampton, and the Etobicoke and Mimico Creek Watersheds Coalition, 2008)

This study evaluated the hydrology and hydraulics components of the Etobicoke Creek subwatershed and included a review of several historical and updated models used for establishing flood risks and water flow. Hydrologic models like HYMO, OTTHYMO-89, and Visual OTTHYMO (VO2) have been used historically to predict the impacts of development. Continuous hydrologic modeling was also completed to inform geomorphological studies and considers long-term meteorological data for more accurate predictions. Hydraulic models (HEC-2 and HEC-RAS), have been historically employed to delineate flood hazard areas. Regular flooding is a significant concern, especially in downstream developed sections of the Etobicoke Creek Headwaters area, where modeling has identified vulnerable areas and recommended flood control measures.

The stream flow regime was found to be significantly influenced by precipitation, as it was determined that the area's soils and geology favor surface runoff over infiltration.

Mayfield West Phase 2 (West) Part A: Subwatershed Characterization (AMEC, December 2014)

This study built upon the hydrologic study conducted in 2008 and provided additional data on rainfall and streamflow to understand current conditions within the Etobicoke Creek Watershed. Continuous flow measurements and rainfall data were collected, indicating variations in flow rates and responses to wet and dry weather conditions. This study focused primarily on the lands east of Chinguacousy Road, but by necessity included hydrologic and hydraulic modelling west of Chinguacousy Road.

Update to the hydrologic and hydraulic modelling include consideration for the local soil types (primarily Chinguacousy clay loam and Jeddo Clay Loam), which influence the infiltration rates. The majority of the area has low permeability, affecting groundwater recharge and surface runoff.

Existing drainage systems include natural watercourses and constructed hydraulic structures (e.g., culverts and bridges), were surveyed and mapped to understand their geometry and functionality.

Models and catchment delineation were updated using LiDAR mapping and topographic data to more accurately reflect the drainage conditions for the study area. Continuous simulations and frequency analyses were conducted using a 40-year meteorological dataset to predict flow rates, provide input to geomorphological analyses, and to assess the impact of storm events, such as Hurricane Hazel.

The study recommended conventional end-of-pipe stormwater management facilities to control post-development flows to pre-development levels and found that certain development scenarios would increase peak flows within the Etobicoke Creek watershed, necessitating over-control of storm runoff beyond conventional post-to-pre development standards to mitigate flooding risks for downstream properties.

A key outcome of the AMEC work was the development of erosion threshold analyses and corresponding extended detention flow and volume targets east of Chinguacousy Road, which apply to the Alloa Secondary Plan study area.

Etobicoke Creek Subwatershed Study Update (MMM Group, 2013)

The Etobicoke Creek Hydrology Update study built on the previous work completed in the study area and focused on consolidating / updating the hydrologic models for the entire Etobicoke Creek watershed and developing stormwater management quantity control criteria. The following points summarize the findings and recommendations as they relate to Caledon and Alloa:

The Etobicoke Creek watershed was characterized as a long and narrow watershed with a mix of urbanized areas and undeveloped rural areas, primarily located in the headwaters. The report updated the hydrologic models to reflect current drainage characteristics, as previous models were based on outdated data from 1996 and 2007. This update included recalibrating the models using more recent precipitation events and refining subcatchment and stream delineation boundaries.

Calibration was performed using data from multiple gauges, including one in Caledon (Laidlaw Bus Depot). This ensures that the model accurately represents the hydrology of the region.

The calibration process involved adjusting parameters such as Curve Number (CN), imperviousness, initial abstraction, and runoff travel length to closely match observed runoff volumes and peak flows.

The report considered different future development scenarios, including "Ultimate Development Conditions," which assumes development beyond current official plan boundaries but excluding Greenbelt and Environmental Protection Areas (EPAs) within the headwaters. Another scenario, "Full Development Conditions," hypothetically included all areas within the headwaters for development, which significantly impacted peak flow rates and flood risks downstream.

A stormwater management quantity control strategy was developed to handle existing and future flooding risks. This strategy includes controlling peak flows for various storm events to mitigate the impacts of future development on Etobicoke Creek.

The downstream Mayfield West Phase 2 development studies used the aforementioned Etobicoke Creek Hydrology Update Study and included detailed hydrologic and hydraulic analyses, addressing the impacts of urbanization on local watercourses.

The stormwater management criteria established in this study apply directly to the Alloa local subwatershed study area.

Settlement Area Boundary Expansion (SABE) Scoped Subwatershed Study (Region of Peel / Wood, November 2022)

The SABE report provided high-level guidance and recommendations for the growth areas in the SABE study area, including the Alloa Secondary Plan lands.

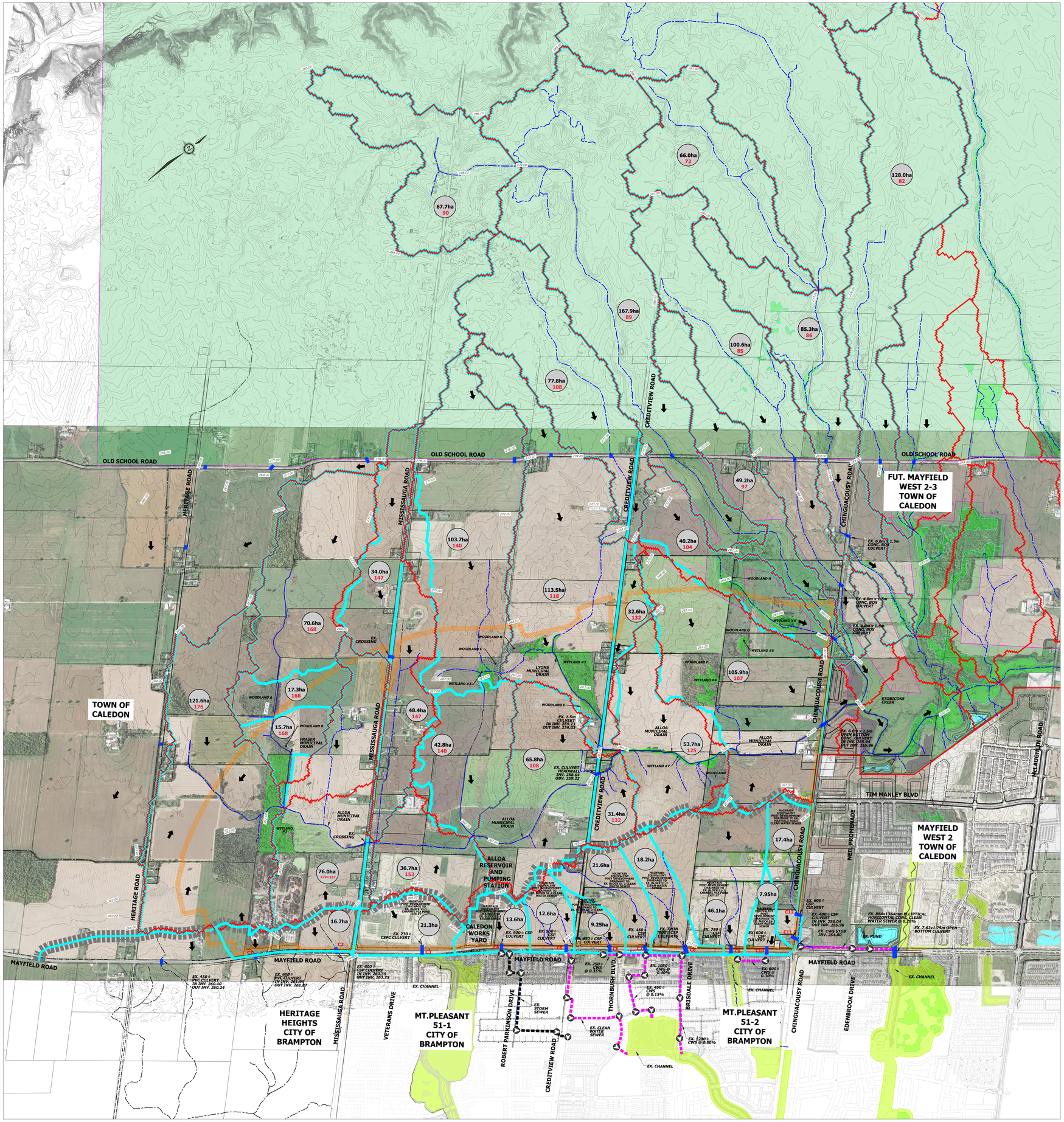
With respect to hydrology and hydraulics, the SABE study emphasized, in general, the importance of maintaining both surface and groundwater quality and quantity through integrated stormwater management strategies. These strategies involve identifying areas suitable for stormwater management facilities to handle runoff and mitigate flooding. However, the Alloa area, part of the Upper Etobicoke Creek and Huttonville / Fletcher's creek subwatersheds, requires tailored planning and management approaches due to its specific soil types and drainage patterns. To enhance climate resilience, the SABE study recommended incorporation of climate change adaptation measures and green infrastructure solutions into planning and development, aiming to manage stormwater, reduce runoff, and improve urban resilience against extreme weather events.

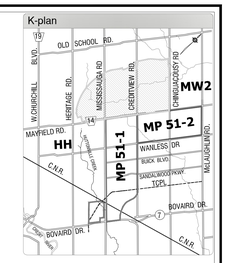
It was recommended that an assessment and potential upgrade to municipal drains to accommodate increased runoff from future developments, along with designing road crossings to minimize impacts on stream morphology be considered through future studies of the Alloa Lands.

7.4.2. Hydrologic Model Updates

TRCA updated the 2013 Etobicoke Creek Hydrology model in 2022 and provided the calibrated Visual OTTHYMO model for the study area to the Alloa study team (Urbantech Consulting) in 2024. This model forms the basis of the Secondary Plan and Local Subwatershed Study hydrologic analysis, including flow estimation, continuous modelling, and water balance assessments. This model uses the 2-year to 100-year 12-hour AES storm distribution (AMC II conditions), as well as the final 12 hours of Hurricane Hazel for the Regional event (AMC III conditions). Minimal modifications were made to the original TRCA hydrology model for Etobicoke Creek, as part of the Secondary Plan and Local Subwatershed Study hydrologic analysis. The TRCA model was discretized appropriately for a Local Subwatershed Study scale and therefore, no significant changes were made beyond minor drainage area and time to peak adjustments.

The model was updated by Urbantech to reflect current conditions based on additional topographic mapping information and updated drainage area delineation as shown on Drawing 3A (see Figure 15).





LEGEND:

- ALLOA BOUNDARY
- GREENBELT
- EXISTING WATERCOURSE
- 258.00 EXISTING CONTOUR AND ELEVATION
- C1 EXISTING ROAD CROSSING & ID #
- PRE-DEVELOPMENT DRAINAGE BOUNDARY (BY TRCA)
- PRE-DEVELOPMENT DRAINAGE BOUNDARY (BY URBANTECH)
- EXISTING FLETCHERS / ETOBICOKE CREEK WATERSHED DRAINAGE BOUNDARY
- 46.1ha 108 PRE-DEVELOPMENT DRAINAGE AREA IN HECTARES; CATCHMENT ID, WHERE APPLICABLE
- PRE-DEVELOPMENT OVERLAND FLOW DIRECTION
- EXISTING CLEAN WATER SEWER AND FLOW DIRECTION
- EXISTING STORM SEWER AND FLOW DIRECTION

NOTES:

* ALLOA SECONDARY PLAN IS PART OF THE PRE-DEVELOPMENT DRAINAGE CATCHMENTS FOR FLETCHERS CREEK AND ETOBICOKE CREEK.
* PRE-DEVELOPMENT CATCHMENT BOUNDARY TO BE GENERALLY MAINTAINED IN THE POST-DEVELOPMENT CONDITION. REFER TO DRAWING 3D FOR PRELIMINARY SWM SERVICING DETAILS.
* EXISTING CULVERTS ACROSS MAYFIELD ROAD AND THE SOUTH LIMIT OF CHINGUACOUSY ROAD CONVEY ALLOA SURFACE DRAINAGE TO FLETCHERS CREEK.
* EXISTING CULVERTS ACROSS CHINGUACOUSY ROAD, BETWEEN ALLOA DRAIN CROSSING AND THE GREENBELT, CONVEY ALLOA SURFACE DRAINAGE TO ETOBICOKE CREEK.
* ULTIMATE STORM OUTLETS ACROSS BOUNDARY ROADS TO BE COORDINATED WITH THE MAYFIELD ROAD AND CHINGUACOUSY ROAD IMPROVEMENTS BY REGION OF PEEL AND TOWN OF CALEDON RESPECTIVELY. REFER TO DRAWING 3B FOR THE ULTIMATE BOUNDARY ROAD CROSSING SIZES AND LOCATIONS, AND COMPARISON OF THE PRE TO POST DRAINAGE AREA CONTRIBUTION.
* MODIFICATION TO THE EXISTING ALLOA MUNICIPAL DRAIN REQUIRED TO PROVIDE ULTIMATE STORM OUTLETS AND MANAGE THE POST-DEVELOPMENT FLOODPLAIN. REFER TO 4 SERIES DRAWINGS FOR PROPOSED CREEK REALIGNMENT AND CHANNEL DETAILS.

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ALLOA SECONDARY PLAN
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
SERVICING STUDY

PRE-DEVELOPMENT DRAINAGE PLAN

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Note that the Secondary Plan / Local Subwatershed Study continuous modelling has not been calibrated, but it was agreed by the agencies that the water resources recommendations for the LSS (erosion control, wetland water balance, site water balance) could move forwards on the basis of a sensitivity analysis in lieu of calibration. The sensitivity analysis tested various scenarios including a baseline, "high" runoff, and "low" runoff, each based on agreed-upon adjustments to key modelling parameters affecting runoff (SCS Curve Number, Initial Abstractions, and soil type/land use). Refer to Appendix J for the sensitivity analysis memo. The single event model used for establishing return period event flows and Regional flows for the purposes of hydraulic modelling and pond sizing does not require calibration, as it has been calibrated though the 2013 ECHUS and is accepted by TRCA.

7.4.3. Existing Hydraulic Model

The existing flood hazard mapping for the Alloa Secondary Plan area informs the extent of the existing NHS, as well as future management strategies related to the development of the Alloa Lands.

Etobicoke Creek has undergone various flood mapping studies, including the Etobicoke Creek Synthesis Study (CH2MHILL & TRCA, December 2014), which was used as the basis for the Mayfield West Stage 1 and Stage 2 Functional Servicing Reports, and accompanying CEISMP and EIR studies completed by Crozier in support of development in the Mayfield West Phase 2 area.

The Visual OTTHYMO (2022 model by TRCA) model introduced revisions to flow data, cross-section locations, naming conventions, and geometry based on presumably improved topographic mapping. This model was updated by Urbantech based on minor revisions to drainage areas. The updated "future" scenario was used for the existing conditions HEC-RAS analysis. Urbantech has further updated the TRCA flood mapping as described in the following sections.

West of Mississauga Road – The 2022 TRCA model did not extend west of Mississauga Road. As described in the May 11, 2023 report by Urbantech Consulting prepared for Area 10 / 12300 Mississauga Road, the existing regional floodplain in this area is best described as an extensive backwater system with a large, flat depression area. This type of system is difficult to analyze using standard / accepted modelling approaches. Through frequent consultation with TRCA and Town of Caledon staff and senior management in late 2022 to early 2023, the challenges with the hydraulic modelling and ultimate development of this area have been explored, and area-specific solutions have been developed and agreed to with the agencies to define a suitable approach to modelling the subject lands under existing and proposed conditions (specific to Area 10), including:

- the use of a 2D hydraulic model (with specific assumptions and parameters as prescribed by TRCA and noted herein); and,
- acknowledgment that post-development flood storage does not have to match pre-development flood storage as agreed to with TRCA staff (although best efforts to do so should be explored).

The general approach to the proposed channel corridor sizing and model evaluation was also established in the May 11, 2023 report, and the supporting studies / model results are included therein. TRCA recommended the use of a quasi-steady state approach, in which hydrographs from the Visual OTTHYMO model were extended at the peak flow time until the end of the simulation. The ROUTE CHANNEL elements were removed from the Visual OTTHYMO model to avoid double-counting flow routing (i.e. in VO and in the 2D model). This approach was carried forward into the LSS study and minor updates were made to the models in terms of Manning's roughness, flows, and ultimate channel design geometry.

Mississauga Road to Chinguacousy Road – The floodplain in this location is based on the September 2022 TRCA model, surface (2015 LiDAR) and flows, with minor refinements to incorporate the recent ground surveys for the surrounding lands (RPE, April 2024 / JD Barnes, April 2024) and which includes the low-flow channel survey of the Alloa Drain. The peak flows from the updated Visual OTTHYMO model were incorporated into the model. The Urbantech Regional floodplain is generally consistent with the TRCA Regional floodplain, with any difference attributed to refinements to the surface topography. This portion of the model was updated through the LSS study and this study, based on refined topography and flows, and the ultimate channel geometry.

Chinguacousy Road to downstream - The Urbantech HEC-RAS model completed through the Mayfield West Phase II FSR process was updated to incorporate the revised flow data and geometry west of Chinguacousy Road and downstream of the FP Mayfield lands to the nearest confluence downstream of the proposed channel works in Etobicoke Creek. The future configuration of the channel/floodplain near the FP Mayfield lands was assumed to be in place east of Chinguacousy Road, as the permitting process is currently underway. The proposed works and accompanying hydraulic modelling were described in a memo dated March 13, 2024 which was addressed to Dilnesaw Chekol at the TRCA. Therefore, the ultimate conditions for the FP Mayfield lands have been integrated into the existing (updated) TRCA model.

The consolidated floodplain shown on Drawing 3B (see Figure 16) and Drawing 3C (see Figure 17) is therefore based on:

Existing May 11, 2023 2D Model west of Mississauga Road

+

Updated September 2022 TRCA model between Mississauga Road to Chinguacousy Road

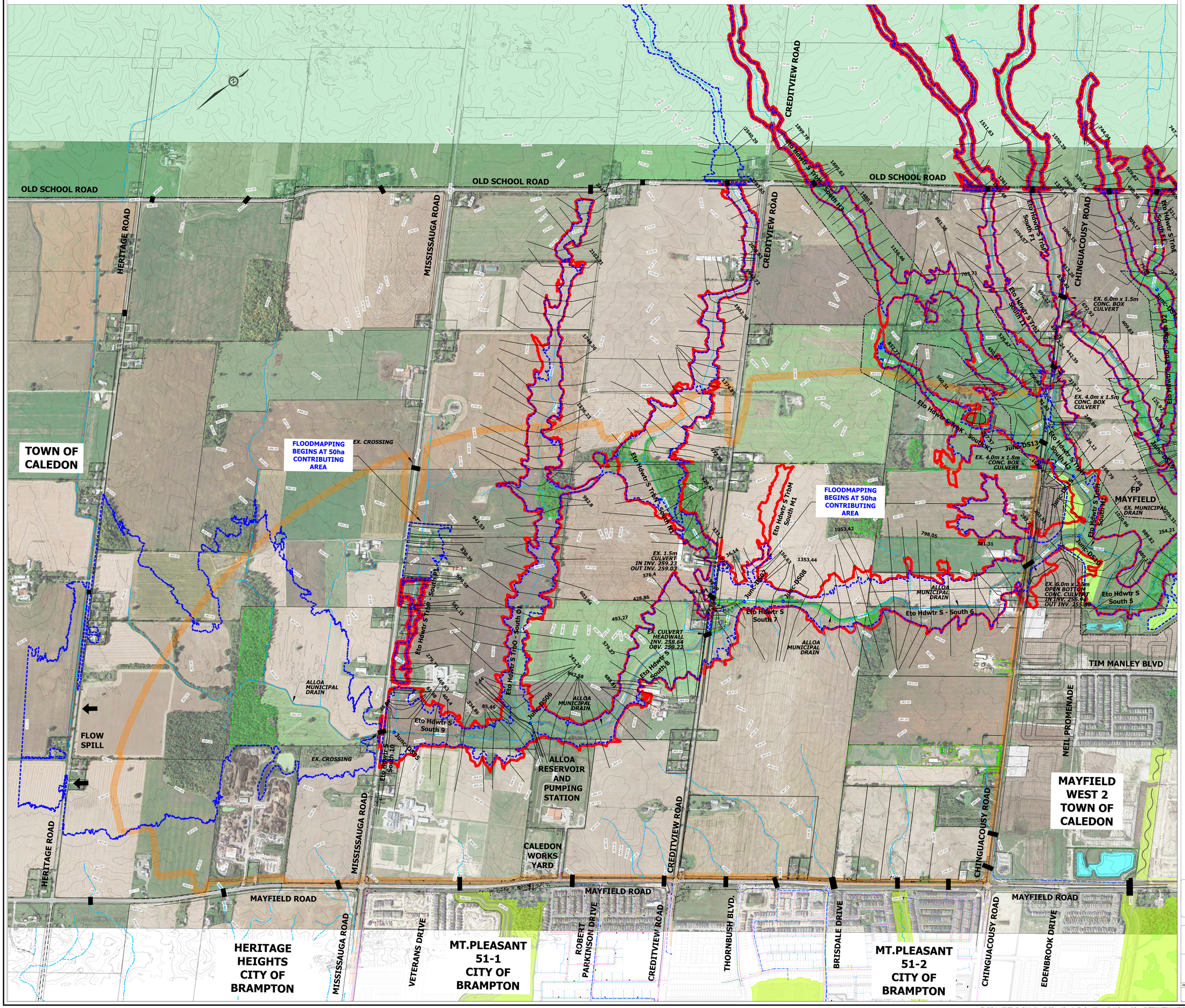
+

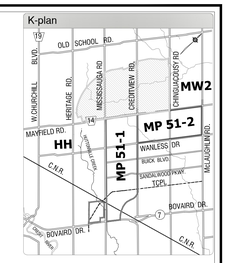
Ultimate March 13 2024 FP Mayfield Model east of Chinguacousy Road

+

Existing September 2022 TRCA east of FP Mayfield.

The 2022 TRCA existing conditions flood mapping results are shown on Drawing 3B (red line type) (see Figure 17). The consolidated / updated flood mapping by Urbantech is shown in the blue dashed line. Note that not all model cross-sections have been shown to improve the clarity of





LEGEND:

- ALLOA BOUNDARY
- GREENBELT
- Eto Hdwtr S South 7 — EXISTING WATERCOURSE REACH
- EXISTING ROAD CROSSING
- 258.00 — EXISTING CONTOUR AND ELEVATION
- FLOW SPILL DIRECTION
- 9826 — HEC-RAS STATION BY TRCA
- EXISTING REGIONAL FLOOD HAZARD (TRCA, SEPTEMBER 2022)
- EXISTING REGIONAL FLOOD HAZARD (URBANTECH, JULY 2025)

NOTES:

* EXISTING ALLOA REGIONAL FLOODMAPPING BASED ON THE MOST RECENT VERSION OF THE ETOBICOKE CREEK HYDRAULIC MODEL (TRCA, SEPTEMBER 2022).
* EXISTING REGIONAL FLOODPLAIN LIMIT WEST OF MISSISSAUGA ROAD ESTABLISHED USING A 2D HYDRAULIC MODEL AS PER AGREEMENT WITH TRCA (URBANTECH, MAY 11, 2023 MEMO FOR 12300 MISSISSAUGA ROAD).
* REGIONAL FLOODLINES EAST OF CHINGUACOUSY ROAD REFLECT THE PROPOSED DEVELOPMENT CONDITION WITHIN MW2. REFER TO HYDRAULIC MODEL FOR FP MAYFIELD DEVELOPMENT APPLICATION (URBANTECH, MARCH 13, 2024 FOR FP MAYFIELD).
* REFER TO DRAWING 3C FOR HEC-RAS MODELING TABLES (CROSS SECTIONS AND EXISTING REGIONAL WATER LEVELS).

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ALLOA SECONDARY PLAN
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
SERVICING STUDY

PRE-DEVELOPMENT FLOODMAPPING

PROJECT No.	DATE	SCALE	DWG No.
20-665	JULY 2025	1:5,000	3B

File: P:\Projects\20-665 - Alloa Caledon (Argo - Peel)\Reports\Secondary Plan Scoped Servicing Study_Drawings & Figures\3_STORMWATER MANAGEMENT STRATEGY\DWG 3B_Pre-development Floodmapping.dwg - Revised by <DZEC> - Fri, Jun 27 2025 - 7:37am

Sections	Eto Hdwtr STrbP-South P1	
	TRCA	Urbantech
941.53	265.65	265.65
926.11	265.65	265.65
893.27	265.65	265.65
882.29	265.65	265.65
Farm Road		
861.48	265.64	265.63
852.98	265.62	265.62
Farm Road		
838.39	265.62	265.61
805.07	265.62	265.61
763.87	265.61	265.61
716.7	265.61	265.61
706.63	265.61	265.61
Farm Road		
689.55	265.28	265.25
672.11	265.26	265.24
627.23	265.23	265.21
584	265.11	265.11
579	265.02	265.02
573	264.88	264.88
561.15	264.69	264.69
531.15	264.57	264.57
449.78	264.08	264.08
350.14	263.49	263.49
279.71	263.29	263.22
242.08	263.24	263.07
230	263.22	263.03
Alloa Public School Rd		
190.99	263.13	262.87
176.94	263.12	262.85
141.09	263.11	262.83
124.82	263.11	262.83
103.99	263.11	262.83
61.98	263.11	262.82

Sections	Eto Hdwtr STrbO-South O1	
	TRCA	Urbantech
2447.2	274.28	274.19
2384.78	273.83	273.75
2329.03	273.45	273.4
2248.66	272.99	272.92
2178.75	272.64	272.58
2102.71	271.94	271.88
2019.6	271.41	271.3
1952.53	270.66	270.66
1883.39	270.36	270.3
1821.91	269.99	269.93
1749.36	269.25	269.17
1676.49	268.61	268.53
1567.49	267.96	267.9
1487.49	267.38	267.34
1413.44	266.83	266.73
1336.23	266.45	266.38
1277.86	266.12	266.04
1224.81	265.99	265.93
1175.98	265.85	265.82
1111.25	265.32	265.26
1058.36	265.17	265.13
982.8	265.05	264.98
914.41	264.87	264.76
843.05	264.7	264.59
770.03	264.4	264.27
695.28	264.28	264.14
603.94	264.19	264.06
511.3	264.07	263.94
427.12	263.79	263.66
352.14	263.35	263.23
243.29	263.02	262.82
193.64	262.96	262.71
149.08	262.93	262.68
92.61	262.92	262.66

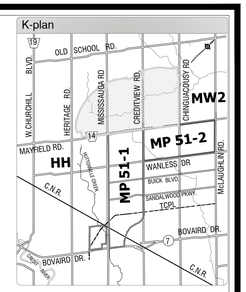
Sections	Eto Hdwtr STrbN-South N1	
	TRCA	Urbantech
3728.34	280.19	280.19
3609.64	279.72	279.71
3445.67	279.29	279.3
3302.11	278.89	278.84
3226.38	278.69	278.6
3119.28	278.15	278.03
2997.41	276.94	276.84
2900.84	275.74	275.64
2811.8	274.59	274.51
2768.95	274.09	274.03
2704.77	273.34	273.24
2649.79	273	272.93
2591.9	272.49	272.4
2540.29	272.34	272.32
2497.83	272.32	272.31
2444.57	272.31	272.31
2431.98	272.31	272.31
Old School Rd		
2400.66	271.48	271.38
2383.65	271.42	271.32
2325.46	271.15	271.03
2267.06	270.75	270.66
2190.18	270.34	270.24
2129.55	270.16	270.08
2075.6	270	269.98
2058.83	269.96	269.95
Farm Road		
2040.05	269.91	269.89
2029.31	269.89	269.87
1989.1	269.84	269.84
1981.56	269.84	269.84
Farm Road		
1956.49	269.27	269.27
1942.72	268.98	268.92
1849.95	268.14	268.04
1813.45	267.7	267.59
1749.43	267.32	267.21
1700.93	267.06	266.97
1662.38	266.87	266.76
1611.44	266.66	266.53
1533.75	266.19	266.09
1461.19	265.73	265.65
1412.53	265.59	265.51
1374.85	265.38	265.29
1278	264.89	264.81
1196.09	264.58	264.5
1136.23	264.21	264.13
1071.01	263.85	263.81
973.88	263.65	263.48
911.36	263.6	263.47
844.82	263.59	263.46
768.37	263.58	263.45
707.21	263.56	263.42
629.42	263.43	263.19
584.02	263.14	262.91
505.61	262.8	262.73
452.51	262.6	262.6
389.9	262.31	262.24
333.7	262.25	262.25
327.2	262.23	262.23
Farm Road		
302.29	262.08	261.98
291.61	262.04	261.96
199.09	261.96	261.96
157.95	261.95	261.95
154.65	261.94	261.95
Creditview Road		
122.79	261.19	260.72
109.19	261.19	260.85
36.14	261.19	260.84

Sections	Eto Hdwtr STrbM-South M1	
	TRCA	Urbantech
704.15	263.59	263.51
614.68	262.92	262.84
502.85	262.51	262.41
428.79	262.13	262.06
369.01	261.96	261.82
337.1	261.9	261.76
304.12	261.53	261.55
246.8	261.26	261.16
211.67	261.24	260.92
156.63	261.23	260.88
125.24	261.17	260.81
53.23	261.07	260.71

Sections	Eto Hdwtr STrbK-South K1	
	TRCA	Urbantech
832.77	264.31	264.28
764.88	263.89	263.83
714.31	263.46	263.29
682.28	263.3	263.17
634.18	263.02	263.04
560.31	262.54	262.36
479.58	262.4	262.29
418.21	262.37	262.27
326.67	262.28	262.15
308.35	261.7	261.77
227.57	261.03	261.07
131.29	260.74	260.65
62.41	260.66	260.63

Sections	Eto Hdwtr STrbK-South 6 to 10	
	TRCA	Urbantech
26.04	263.11	262.82
15.81	263.11	262.82
573.62	263.1	262.81
469.63	263.08	262.79
404.4	263.06	262.77
334.86	263.01	262.72
247.19	262.94	262.66
204.14	262.92	262.63
132.32	262.89	262.6
85.46	262.88	262.59
32.93	262.86	262.57
19.21	262.86	262.57
4.52	262.85	262.56
2.44	262.85	262.56
1208.81	262.81	262.5
1137.3	262.74	262.45
1075.82	262.66	262.35
989.73	262.53	262.25
936.39	262.46	262.18
842.58	262.27	262
777.24	262.07	261.85
720.56	261.86	261.69
701.24	261.8	261.67
688.81	261.76	261.65
Farm Road		
666.51	261.75	261.62
652.85	261.7	261.6
579.37	261.63	261.57
493.27	261.59	261.55
428.86	261.57	261.55
376.4	261.57	261.54
264.39	261.55	261.54
248.01	261.55	261.54
Creditview Road		
221.78	261.33	261.07
206.26	261.33	261.05
164.75	261.29	260.99
92.98	261.22	260.88
32.55	261.2	260.86
117.2	261.14	260.78
45.61	261.04	260.69
1499.07	260.88	260.51
1437.05	260.65	260.28
1353.44	260.41	260.1
1248.74	260.22	259.91
1183.99	260.07	259.79
1121.64	259.95	259.69
1053.42	259.86	259.61
985.29	259.75	259.54
890.44	259.69	259.48
843.98	259.66	259.43
798.05	259.62	259.39
713.2	259.55	259.34
599.67	259.42	259.26
546.27	259.39	259.25
460.91	259.26	259.16
381.31	259.18	259.12
293.77	259.1	259.08
280.55	259.1	259.07
Chinguacousy Rd		
248.06	259.08	258.94
203.53	259.06	258.91
127.12	258.98	258.84
128.12	-	258.75
Pedestrian Bridge		
127.12	-	258.65
78.4	-	258.55
77.4	258.91	258.57
17.65	258.84	258.58

K-plan



NOTE:

* REFER TO DRAWING 3B FOR HEC-RAS CROSS SECTION LOCATIONS AND EXISTING FLOODPLAIN.

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ALLOA SECONDARY PLAN
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
SERVICING STUDY

HEC-RAS STATIONS AND PRE-DEVELOPMENT FLOOD ELEVATIONS

PROJECT No.	DATE	SCALE	DWG No.
20-665	JULY 2025	N.T.S.	3C

File: P:\Projects\20-665 - Alloa Caledon (Argo - Pred)\Reports\Secondary Plan Scoped Servicing Study_Drawings & Figures\3_STORMWATER MANAGEMENT STRATEGY.DWG 3C_HEC-RAS Stations and Existing Flood Elevation Tables.dwg - Revised by <DZEC> - Fri, Jun 27 2025 - 1:10pm

the drawing. Furthermore, elevation results (while typically included beside each cross-section) have been provided in Drawing 3B (see Figure 16) for clarity.

In keeping with industry practice, portions of the floodplain have been removed in 2 locations where the contributing drainage area is less than 50 ha (based on the drainage areas in Drawing 3A) (see Figure 15).

In general, the floodplain through the Alloa study area is large and is governed by backwater conditions downstream of Chinguacousy Road. The channel slopes throughout the study area are relatively flat and the backwater impacts are significant, to the extent that the floodplain west of Mississauga Road spills west, over Heritage Road. This was demonstrated in the 2D model for existing conditions.

7.4.4. Existing Hydraulic Structure Inventory

The HEC-RAS model was used to assess the existing culvert infrastructure within the study area as noted in Table 17 below. Smaller farm road crossings were not considered.

TABLE 17: HEC-RAS MODEL ASSESSMENT OF EXISTING CULVERT INFRASTRUCTURE

Crossing Location & HEC-RAS Section	Crossing Type	Size of Opening [span x rise] or [diameter]	Upstream Invert	Downstream Invert	Road Centerline Elevation	Approximate Level of Service prior to overtopping	Flow & Upstream WL at Level of Service
		[mm]	[m]	[m]	[m]		[m³/s]
Private DW Eto Hdwtr S Trb P South P1 XS 872.64	CSP Circ.	0.4 assumed	264.70	264.68	265.32	< 2-year	0.26 265.46
Private DW Eto Hdwtr S Trb P South P1 XS 848.31	CSP Circ.	0.4 assumed	264.54	264.54	265.32	< 2-year	0.32 265.46
Private DW Eto Hdwtr S Trb P South P1 XS 697.28	CSP Circ.	0.4 assumed	264.56	264.49	265.43	< 2-year	0.32 265.46
12287 Mississauga Road DW	3x Conc. Box	1.72 x 0.88 3.59 x 0.88	262.24	262.18	263.73	Regional	6.60 263.22

Eto Hdtwr S Trb P South P1 XS 212		1.78 x 0.88					
Driveway Eto Hdwtr S Trb N South N1 XS 318	CSP Circ.	1.52	259.83	259.66	261.74	25-year	3.28 261.41
Creditview Road Eto Hdwtr S Trb N South N1 XS 143	CSP Circ.	1.7	259.23	259.03	261.54	100-year	4.72 261.42
Farm Road Eto Hdwtr S South 8 XS 676	CSP Circ.	0.4 assumed	259.10	259.09	260.77	< 2-year	2.47 260.96
Creditview Road Eto Hdwtr S South 8 XS 237	3x CSP Circ.	1.35 / 1.40 / 1.40	258.87	258.84	261.09	50-year	9.74 260.97
Chinguacousy Road Eto Hdwtr S South 6 XS 267	Conc. Box	6.05 x 1.67	256.56	256.56	258.58	100-year	17.01 258.29
Chinguacousy Road Eto Hdwtr S Trb H South H2 XS 180	Conc. Box	4.37 x 1.07	258.74	258.74	260.18	100-year	7.33 260.02
Chinguacousy Road Eto Hdwtr S Trb I South I1 XS 479	Conc. Box	3.00 x 0.86	261.27	261.27	262.22	100-year	2.22 262.06

Chinguacousy Road Eto Hdwtr S Trb F South F1 XS 824.71	Conc. Box	6.3 x 1.06	262.61	262.60	263.86	100-year	6.61 263.55

7.4.5. Existing Riparian / Flood Storage

The riparian storage represents the relationship between the volume of water in the floodplain and the discharge (flow rate) of the watercourse. This relationship is typically assessed without any human-made structures, such as culverts, to understand the natural behavior of the watercourse and its capacity to convey and store water during various flow conditions. However, culverts can influence the extent and depth of flooding in the surrounding floodplain area and can affect the volume of water that the floodplain can store during flood events, impacting the flood hazard downstream.

To evaluate the existing riparian storage and flood storage (with culverts in place), the study area was divided into two specific areas: west of Mississauga Road, which features a large depression or ponding area serving as a significant storage region during flood events and which has been characterized with a 2D HEC-RAS model, and the area between Mississauga Road and Chinguacousy Road, which is more characteristic of conveyance systems rather than a storage area. The 1D HEC-RAS model was employed for the hydraulic modeling east of Mississauga Road. As agreed with TRCA staff, an unsteady-state modelling approach was permitted to properly characterize the existing and proposed storage between Mississauga Road and Chinguacousy Road, and to evaluate the potential impacts of changes in riparian storage.

The results of the HEC-RAS model runs are presented in the following tables, which show the existing floodplain storage with existing flows, assuming all crossings have been removed both west of Mississauga Road (2D model) and east of Mississauga Road to Chinguacousy Road (1D unsteady state model). Note that the 2D model results indicate a spill to the west, across Heritage Road. The flow lost to this spill was ignored, and the full flow generated by the catchments west of Mississauga Road were used in the hydraulic modelling east of Mississauga Road as a conservative measure for establishing the riparian storage targets and flood hazards).

TABLE 18: EXISTING RIPARIAN STORAGE – 2D MODEL, NO CULVERTS, WEST OF MISSISSAUGA RD

Event	Volume (m^3)
	West of Mississauga Road
Regional	482.452
100-year	254.74
50-year	213.804

25-year	171.327
10-year	113.876
5-year	73.08
2-year	25.47

TABLE 19: EXISTING FLOOD STORAGE – 1D UNSTEADY – STATE MODEL, NO CULVERTS, EAST OF MISSISSAUGA RD

Event	Volume (1000m³)
	Eto Hdwtr S - South 6 to 10 (Main Channel)
Regional	369.01
100-year	102.69
50-year	88.28
25-year	73.87
10-year	54.10
5-year	38.50
2-year	20.76
Event	**Existing Riparian Volume (1000m³)**
	Eto Hdwtr S - South K1
Regional	51.61
100-year	20.66
50-year	17.54
25-year	16.73
10-year	14.87
5-year	10.05
2-year	6.77
Event	**Existing Volume (1000m³)**
	Eto Hdwtr S - South N1
Regional	61.47
100-year	12.83
50-year	10.85
25-year	9.00

10-year	6.72
5-year	5.25
2-year	3.43
Event	**Existing Volume (1000m³)**
	Eto Hdwtr S - South O1
Regional	51.35
100-year	18.21
50-year	16.01
25-year	13.85
10-year	10.95
5-year	8.75
2-year	5.69
Event	**Existing Volume (1000m³)**
	Eto Hdwtr S - South P1
Regional	36.62
100-year	12.53
50-year	11.04
25-year	9.52
10-year	6.23
5-year	4.84
2-year	3.00
Event	**Existing Volume (1000m³)**
	TOTAL
Regional	570.06
100-year	166.92
50-year	143.72
25-year	122.97
10-year	92.87
5-year	67.39
2-year	39.65

The storage volumes computed for these area are significant. As agreed with TRCA staff through meetings regarding the 12300 Mississauga Road lands, matching the storage volumes west of Mississauga Road is impractical (although best efforts should be investigated). Furthermore, the large floodplain west of Mississauga Road will be partially filled by the future Highway 413 extension, reducing the existing floodplain storage by at least 35%.

7.5 Headwater Drainage Feature and Fluvial Geomorphology Characterization

Headwater drainage features (HDF) can be defined as, "non-permanently flowing drainage features that may not have defined bed or banks; they are first-order or zero-order intermittent and ephemeral channels, swales and connected headwater wetlands, but do not include rills or furrows" (TRCA and CVC, 2014). HDFs are important sources of food, sediment, water, nutrients, and organic matter for reaches downstream (TRCA and CVC, 2014). HDFs are most prevalent in the upper catchments of a given watershed/subwatershed and have drainage areas that are typically less than 50 ha in size.

Section 1 of Ontario Regulation 41/24 defines a watercourse as, "a defined channel, having a bed and banks or sides, in which a flow of water regularly or continuously occurs". As HDFs may or may not have defined banks, one of the main distinguishing factors between an HDF and a watercourse is flow permanency. HDFs typically have ephemeral or intermittent flow regimes, are generally morphologically poorly defined and often do not exhibit sediment sorting.

These definitions were considered in the desktop and field-based assessments. In a limited number of instances, HDFs had defined banks due to channelization as part of agricultural land use and municipal drain systems or to facilitate the installation of other infrastructure (i.e., roads, crossing structures). In these cases, flow permanency, evidence of instream erosion, and other characteristics such as substrates were considered in the evaluation.

7.5.1. Reach Delineation

Both HDFs and watercourses can be delineated into reaches or units of study based on segments of channel/drainage feature that have similar characteristics. Reaches are studied semi-independently as each is expected to function in a manner that is at least slightly different from adjoining reaches. This method allows for a meaningful characterization of an HDF or watercourse as the aggregate of reaches, or an understanding of a reach, for example, as it relates to a proposed activity. Reaches are typically delineated based on changes in the following:

- Drainage feature/channel planform
- Drainage feature/channel gradient
- Physiography
- Land cover (land use or vegetation)
- Flow, due to tributary inputs
- Soil type and surficial geology

- Historical modifications

This follows scientifically defensible methodology proposed by Montgomery and Buffington (1997), Richards et al. (1997), and the Toronto and Region Conservation Authority (2004). Reaches are typically first delineated as a desktop exercise using available data and information such as aerial photography, topographic mapping (including LiDAR), and geology and physiography maps. The results are then field-verified.

HDF and watercourse reaches were delineated by Wood (2022) as part of the Region of Peel SABE study. Due to the identification of multiple new reaches (largely HDFs) based on site-specific detailed field work, the reach naming convention and reach breaks have been revised as part of the current study. Several sources of data, including previously completed mapping and topographic data, were reviewed to initially identify potential HDFs. Specifically, this included data available from the TRCA, Peel Region, MNRF and the Scoped SWS (Wood, 2022). Preliminary desktop reach delineation was completed, followed by detailed field verification (where access permitted), to confirm the existing drainage network and associated characteristics.

Several reaches were delineated along the Alloa Drain, which flows centrally in a west to east orientation, as well as the lower portions of the Fraser and Lyons Drains in the western and central portions of the Primary Study Area, respectively. All municipal drain/watercourse reaches are located within the Etobicoke Creek watershed. Drainage features identified in the southern portion of the Primary Study Area near Mayfield Road are located within the Fletchers Creek and Huttonville Creek subwatersheds and are characterized as HDFs. The HDF and watercourse reach delineation are graphically presented in Figure 2 within Appendix L or within the detailed Fluvial Geomorphology Assessment in Appendix M.

The following sections outline the methodology and results of HDF assessments following CVC and TRCA (2014) guidelines, and rapid and detailed geomorphological assessments. These field investigations were completed to characterize existing drainage patterns and municipal drain/watercourse conditions, inform opportunities and constraints to development, and support the preparation of conceptual natural corridor design plans.

7.5.2. Headwater Drainage Feature Assessment Methodology

HDFAs were completed within the Primary Study Area generally following the TRCA and CVC (2014) guidelines. This approach includes three (3) separate site visits to assess the aquatic, hydrologic, terrestrial, and geomorphic attributes of each headwater reach. In 2024, the first HDF site visit was completed over multiple days, including March 15, March 26 – 28, April 1, and April 4, 2024, during spring freshet conditions. The second site visit was completed on May 16, 2024, following a period of 48 consecutive hours without rainfall. The third site visit was completed on July 29, 2024, following a period of 72 consecutive hours without rainfall. If a feature that was mapped as part of the desktop assessment was dry during a round of observations, it was not revisited during subsequent field assessments.

In 2025, field work was completed on two additional properties not previously accessed, with the first assessment conducted on March 20 and April 10, 2025 to capture spring freshet conditions. The second round of evaluations was completed on May 12, 2025, following a period of 48

consecutive hours without rainfall. As features assessed in 2025 were dry during the second site visit, a third visit was not conducted.

7.5.3. Headwater Drainage Feature Conditions Summary

A brief summary of HDF characteristics is provided in Table 20, below. Conditions along each HDF reach and representative photographs are contained in Appendix K of the LSS.

TABLE 20: SUMMARY OF HDF REACH CHARACTERISTICS AND FIELD OBSERVATIONS

HDF Reach	Notes/Observations
AD1-1B	Vegetated swale feature with multiple flow paths; limited flowing water during Round 1 site visit; standing water during Round 2 site visit; dry during Round 3 site visit; riparian area dominated by meadow and land use as pastures; limited habitat and channel definition due to multiple flow paths; bankfull channel indicators difficult to discern. The feature will likely be impacted by the future Highway 413 alignment.
AD1-2A	Vegetated swale feature with multiple flow paths; downstream portion flowed through wetland vegetation; limited flowing water during Round 1 site visit; standing water during Round 2 site visit; dry during Round 3 site visit; riparian area dominated by meadow and land use was pasture; limited feature definition and canopy cover due to multiple flow paths; bankfull indicators difficult to discern. Approximately 50% of the upstream feature is anticipated to be impacted by the future Highway 413 alignment.
AD1-2D	Tile drain outlet connecting the adjacent pond to watercourse **Reach AD1-2**; water flowing over the ground surface in Rounds 2 and 3 site visits; riparian area consisted of wetland and forested buffers; limited feature definition; artificial feature associated with the adjacent dug pond. The feature was not identified during the Round 1 field assessment but was assessed during Round 2 and Round 3 field assessments.
AD1-3	Wetland feature with multiple flow paths; upstream portion through woodlot; standing water during all site visits; riparian area dominated by wetland vegetation with meadow vegetation further from the banks; limited feature definition due to multiple flow paths; bankfull indicators difficult to discern. Approximately 50% of the feature upstream will likely be impacted by the future Highway 413 alignment.

AD1-4	Poorly defined feature through a forested wetland; standing water during Round 1 site visit; dry during Round 2 site visit; riparian area dominated by wetland and forest; woody debris frequently observed; feature was poorly defined. The feature will likely be impacted by the future Highway 413 alignment.
AD2-1	Vegetated swale with ditching occurring downstream; standing water during Round 1; dry during Round 2 site visit; riparian area dominated by meadow vegetation consisting largely of grasses; limited feature definition with minor definition in the ditched portion.
AD2-1B	Feature situated in an agricultural field; standing water at upstream extent during Round 1 site visit; dry during Round 2 site visit; riparian area dominated by agricultural fields on both sides; limited habitat and feature definition
AD3-1	Feature situated in an agricultural field; flowing water during Round 1 site visit; dry during Round 2 site visit; riparian area dominated by agricultural fields on both sides; limited habitat with a lack of feature definition in Round 2 site visit.
AD3-1B	Tiled feature with surface flows through a swale during Round 1; dry during the Round 2 site visit; riparian area dominated by meadow vegetation with grasses; limited habitat and feature definition.
AD3-1C	Vegetated hedgerow between two agricultural fields; standing water during Round 1 and 2; dry during Round 3 site visit; immediate riparian buffer dominated by meadow vegetation with a few trees; the dominant riparian zone consisted of agricultural fields; limited feature definition throughout, and no visible evidence of a connection to downstream.
AD4-1	Defined feature with wetland vegetation; standing water present during all site visits; riparian buffer dominated by wetland vegetation along its immediate banks; the further riparian buffer along the right bank is agricultural fields; further riparian buffers along the left banks are a lawn and driveway. The feature is defined but lacks morphological features. Some habitat provided by the immediate riparian buffer, but the features lacks canopy cover. Feature was heavily modified due to land use activities.
AD4-2	Feature situated in agricultural field; flowing water during Round 1 site visit; dry with a reduction in channel definition observed during Round 2 site visit; limited habitat and channel definition; riparian area dominated by agricultural fields on both sides.

AD4-3	Tiled feature with surface flows through approximately one third of the feature during Round 1; the feature was dry during Round 2 and was tilled and planted; the riparian area is dominated by agricultural fields; no apparent habitat or channel definition.
AD5-1 **AD5-3**	Straightened channel with multiple flow path; flowing through wetland vegetation; minimally flowing water was present during the Round 1 and Round 2 site visits; dry during the Round 3 site visit; riparian area dominated by wetland vegetation with agricultural fields further from the banks; limited channel definition.
AD5-5	Feature situated in an agricultural field; flowing water during Round 1 site visit; generally dry during Round 2 site visit; minimal pooling at the furthest downstream portion; limited habitat and channel definition; riparian area dominated by agricultural fields on both sides.
AD6-2A	Ditched feature along a residential property; flowing water during Round 1 site visit; generally dry during Round 2 site visit; minimal pool with algae mid-reach; limited habitat; riparian area dominated by manicured lawn with an agricultural field to the south.
AD7-1	Defined feature flowing through a woodlot and wetland; flowing water in Round 1 site visit; standing water during Round 2 site visit; dry during Round 3 site visit; riparian area dominated by forested vegetation; critical terrestrial habitat and riparian vegetation.
AD8-1	Straightened, defined feature flowing between two agricultural fields; flowing water in Round 1 site visit; dry during Round 2 site visit; riparian area dominated by agricultural fields with meadow vegetation on the immediate banks; limited habitat. This feature is a headwater to the Alloa drain and directly connects to the uppermost reach of the Alloa Drain. The feature may be impacted by the future Highway 413 alignment.
LD4-2	Defined surface feature through an agricultural field; flowing water during Round 1 site visit; standing water during Round 2 and Round 3 site visits; limited habitat and channel definition; riparian area dominated by agricultural fields on both banks.
LD4-3	Defined feature flowing through a woodlot and wetland; flowing water during Round 1 site visit; standing water during Round 2 and Round 3 site visits; riparian area dominated by forests and wetlands; important terrestrial habitat and riparian vegetation.

LD4-3A	Defined feature flowing through a woodlot and wetland; flowing water during Round 1 site visit; standing water during Round 2 site visit; isolated pools of standing water during Round 3 site visit; poorly defined banks; riparian area dominated by forests and wetlands; important terrestrial habitat and riparian vegetation.
LD4-3B	Features situated in an agricultural field; flowing water during Round 1 site visit; dry during Round 2 site visit; limited habitat and channel definition; riparian area dominated by agricultural fields on both sides. At the furthest upstream portion, pooling was observed as a result of a depression in the agricultural field. This pooling is likely only connected to the feature during large rain events and freshet conditions, and may not occur consistently each year, as there was evidence of cultivation. Ecological field work conducted in 2024 confirmed that this feature does not warrant a wetland classification.
LD4-3C	Feature flowing through a woodlot and wetland; standing water during Round 1 and Round 2 site visits; dry during Round 3 site visit; poorly defined banks; riparian area dominated by forests and wetlands; important terrestrial habitat and riparian vegetation.
LD5	Tiled feature without any surface feature present; tile is present underneath active agricultural fields; riparian area dominated by agricultural fields. The feature directly inputs into the upstream extent of a watercourse reach that forms part of the Lyons Drain (**LD4**). The feature may also be impacted by the future Highway 413 alignment.
LD6	Tiled feature with evidence of surface flows; defined feature on the surface through agricultural fields; surface feature dry during Round 1 and 2 site visits; riparian area dominated by agricultural fields; feature ultimately inputs into the upstream extent of the Lyons Drain. The feature may also be impacted by the future Highway 413.
FD1-1	Defined feature; flowing water during Round 1; dry during Round 2 site visit; limited feature form and habitat; riparian area dominated by meadow vegetation with a forest further south of the feature.
FD2-1	Ditched feature alongside a woodlot; flowing water during Round 1 site visit; standing water during Round 2 site visit; dry during Round 3 site visit; limited habitat in the immediate riparian area; immediate riparian area dominated by meadow with lawn near the right bank and forest near the left bank.

	The feature may also be impacted by the future Highway 413 alignment.
FD3	Tiled feature with evidence of surface flows; defined feature on the surface through agricultural fields; surface feature dry during Round 1 and 2 site visits; riparian area dominated by agricultural fields; feature ultimately inputs to the upstream extent of the Fraser Drain. The feature may also be impacted by the future Highway 413 alignment.
FC-1B	Swale feature transecting an agricultural field; standing water during Round 1 and 2 site visits; dry during Round 3 site visit; immediate riparian area dominated by meadow vegetation along both banks; upstream reach (**FC-1C**) contains trees; however, site access was not permitted.
FC-1D	Defined feature flowing beneath a driveway into the feature downstream; limited flow during Round 1 site visit; standing water during Round 2 site visit; dry during Round 3 site visit; canopy cover and habitat present; immediate riparian area is dominated by meadow vegetation with a manicured lawn further from the banks Downstream feature (**Reach FC-1C**) contains trees and a dug pond; however, site access was not permitted. Dug pond contained water at the time of the site meeting attended with CVC (April 29, 2025); however, **Reach FC-1D** was dry and **Reach FC-1B** contained a small pool of standing water at the culvert thereby demonstrating a limited hydrologic connection CVC confirmed via email correspondence dated May 2, 2025 (Trisha Hughes, RPP, Planner) that this tributary is not considered a watercourse. Tributary is permanently piped downstream of Mayfield Road for approximately 600 m.
FC-1E **FC-1F**	Features are located in a pasture area used by horses; standing water during Round 1; dry during Round 2 site visit; very limited definition and natural riparian vegetation absent; agricultural lands upstream
FC-2A	Feature situated in agricultural field; flowing water during Round 1; dry during Round 2 and Round 3 site visits with some standing water at the Mayfield Road culvert downstream; riparian area dominated by agricultural fields; limited channel definition and habitat. Fish were observed in one isolated pool during the Round 3 site visit near the upstream reach break (Refer to location in Figure 2 in Appendix L). The feature flows under Mayfield Road and into a natural channel design.
FC-2B	Feature situated in agricultural field; flowing water during Round 1 site visit; standing water during Round 2 site visit with small, intermittent pools observed; feature was

	ploughed and dry during Round 3 site visit; riparian area dominated by agricultural fields; limited feature form and habitat. Minnows were observed in one pool of standing water within a furrow that was isolated from the drainage feature during Round 2 site visit (refer to location in Figure 2 in Appendix L). The feature also inputs under the road into a natural channel design downstream south of Mayfield Road.
FC-2C	Feature situated in a pasture area used by horses, riparian area dominated by short grasses with limited definition and habitat; standing water during Round 1 site visit and dry during Round 2 site visit.
AD3-2 to AD3-8 AD5-5A AD6-1 AD6-2 LD4-3D LD4-4 FC-2D FC-2D-1 FC-3A FC-3B FC-3C FC-4A FC-4B FC-4C	Features situated in agricultural fields; flowing water during Round 1 site visit; dry during Round 2 site visit; limited habitat and channel definition; riparian area dominated by agricultural fields on both sides.

7.5.4. Headwater Drainage Feature Assessment Management Classification

Management classifications have been assigned to each HDF reach based on the approach outlined by TRCA and CVC (2014), which evaluates and classifies various HDF attributes and functions. The management classification is selected based on a combined evaluation of all attributes, specifically with regard to hydrological regime, riparian conditions, as well as aquatic and terrestrial habitat (TRCA and CVC, 2014).

Each of the classifications come with specific management requirements, which are:

- **Protection** – Important functions: protect and/or enhance the existing feature and its riparian zone and groundwater discharge or wetland in-situ
- **Conservation** – Valued functions: maintain, relocate, and/or enhance drainage feature and its riparian zone corridor

- **Mitigation** – Contributing functions: replicate or enhance functions through enhanced lot level conveyance measures for downstream connection

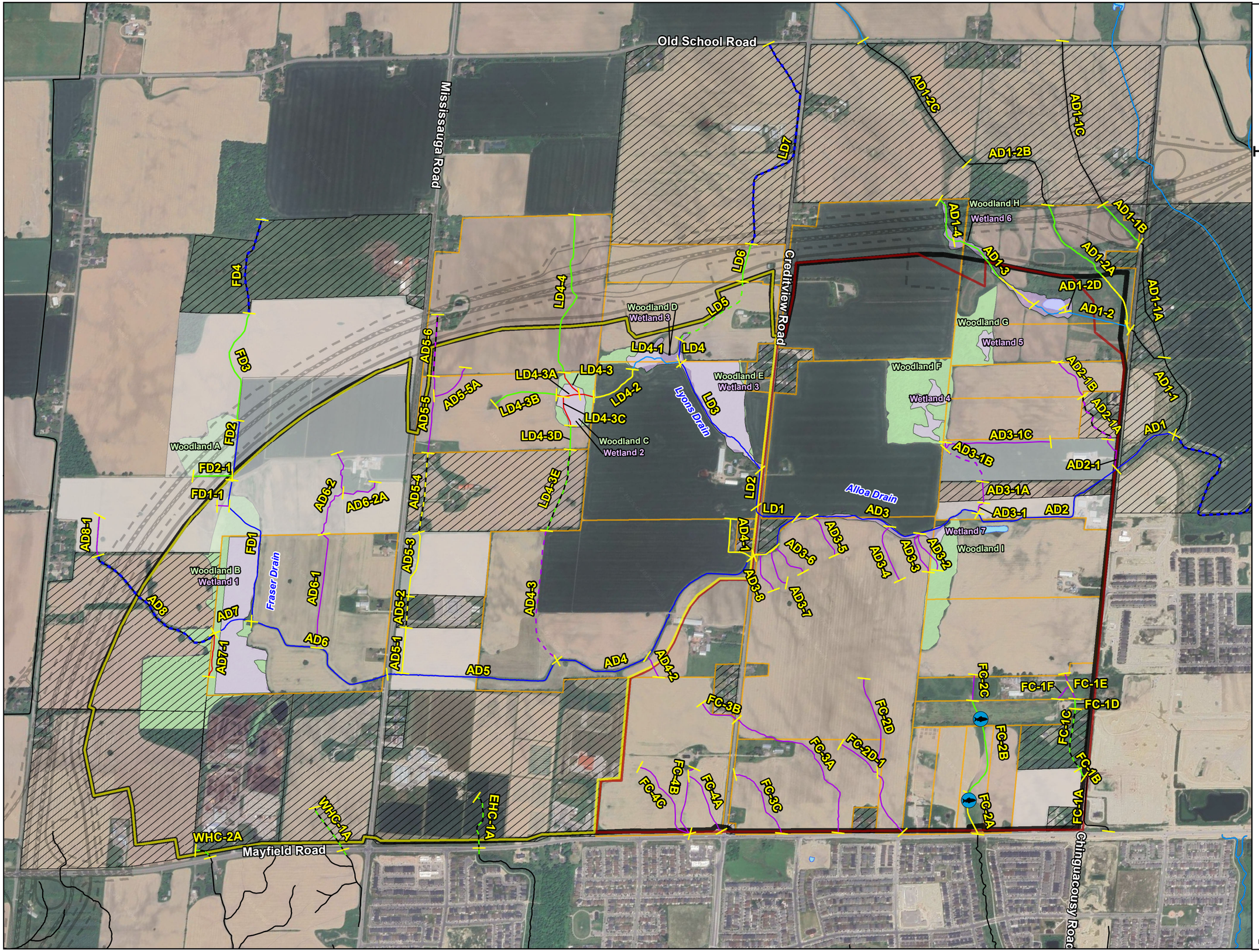
- **No Management Required** – Limited functions: no feature and/or functions associated with the feature are present on the ground and/or there is no downstream connection

A management classification for each HDF reach is illustrated on Figure based on an evaluation of all attributes on a reach basis. For multiple reaches, modifiers are noted where they influence the final management outcome (e.g., historical modification, anticipated drainage modifications/impacts such as the future Highway 413 alignment). A brief overview of management recommendations is provided below. For a detailed breakdown of HDF function according to attributes, refer to the Headwater Drainage Feature Assessment in Appendix K.

The HDF management classification assigned to Reaches AD1-1B, AD1-2A (upstream), AD1-3 (upstream), and AD1-4 is "Mitigation", and the management classification assigned to Reaches AD1-2D, AD1-2A (downstream), and AD1-3 (downstream) is "Conservation". These reaches are anticipated to be directly or indirectly impacted by the future Highway 413 alignment. Reaches AD1-4, AD1-3, AD1-2A, and AD1-2D are also situated in either wetland or woodlots. As such, the recommendations for any of segments of these reaches within the future Highway 413 alignment have been revised to "Mitigation" as they are likely to be heavily impacted. Areas downstream of the Highway 413 alignment that are within wetlands or woodlots have been assigned "Conservation" status due to the potential lack of upstream inputs once the future Highway 413 is constructed.

The management of the FC1 HDF tributary is unique due to the previous planning decisions east and downstream of Chinguacousy Road. The portion of drainage feature downstream of Chinguacousy Road was first identified in the Mayfield West Phase 2 CEISMP (AMEC Environment and Infrastructure et al., 2014) as a low constraint reach (denoted as Reach MFC-R27), whereby the reach could be eliminated. This constraint ranking was carried forward to the Mayfield West Phase 2 Stage 2 CEISMP (Hensel Design Group Inc., 2019). Formal HDF assessments were completed south of Mayfield Road as part of the Mount Pleasant EIR/FSR (Urbantech Consulting, 2016). The portion of tributary immediately south of Mayfield Road was identified as simple contributing habitat (Mitigation) based on TRCA and CVC (2011) guidelines. Following these previously approved constraint rankings, the Mayfield West Phase 2 Stage 2 FSR (Urbantech Consulting, 2022) noted that the external drainage area west of Chinguacousy Road was to be directed to a constructed natural heritage corridor in Block 51-2 south of Mayfield Road via a clean water pipe along Mayfield Road. The alignment of the clean water pipe is shown in Drawing 501 of the Mayfield Phase 2 Stage 2 FSR (Urbantech Consulting, 2022). It is understood that the pipe is approximately 600 m long and has since been constructed.

The initial HDF management classification assigned to Reaches FC-1B to FC-1D for the current study was "Conservation". This was mainly due to a small section of well-defined feature and riparian vegetation along the corridor; however, due to the permanently piped condition downstream of Mayfield Road, the final management classification has been revised to



GEO MORPHIX™

HDF Management Classifications
Alloa Secondary Plan Area
Caledon, Ontario

Legend

- Reach Break and ID
- Fish Observations

HDF Management Classifications

- Mitigation
- Mitigation (Tile Drain)
- Mitigation - Not Field Verified
- Conservation
- Conservation - Not Field Verified
- Protection
- No Management
- No Management - Not Field Verified
- No Management (Tile Drain)
- Watercourse
- Municipal Drain
- Municipal Drain Not Field
- Not Field
- Wetlands
- Woodlands
- OHN Waterbody
- Participating Properties
- Non-Participating Properties,
- Non-Participating Property, No
- Highway 413 Footprint
- Phase 1 Lands
- Phase 2 Lands
- Alloa Secondary Plan Area and Primary Study Area

N

0 300 600

Metres

Imagery: Google Earth, 2022. Waterbody, Watercourse: MNRF, 2023. Alloa Phase 1 & 2 Lands, Alloa Secondary Plan Area:Crozier, 2024. HDFs, Watercourse, HDF Recommendations: GEO Morphix Ltd., 2024. 0.5 m Contour: MNRF, 2014-2016. 413 Highway Footprint: MTO, 2023. Participating Properties, Wetlands, Dripline, Woodland: Crozier, 2024. Fish Observation: GEO Morphix Ltd., 2025.
Print Date: July 2025. PN24009. Drawn By: R.A., M.O., S.S.O., K.W., G.U.

"Mitigation". Reaches FC-1E and FC-1F were assigned management classifications of "No Management" due to their limited hydrology and form.

The HDF management classification assigned to Reaches FC-2A is "Conservation" while the classification assigned to FC-2B is "Mitigation". Both features were identified within agricultural fields and had limited feature form. FC-2B had small intermittent pools of standing water still present in the Round 2 site visit, while FC-2A had one small, isolated pool in the Round 3 site visit. Fish were observed in the FC-2B in the Round 2 site visit in a furrow near a hedgerow that was isolated from the drainage feature (see Figure 2 in Appendix L). A "Mitigation" management classification was assigned as the feature has been heavily impacted by active agricultural practices, and did not have a hydrological connection to downstream reaches during Round 2 of the HDFAs. Several fish were also observed in FC-2A in one small, isolated pool near the upstream reach break during the Round 3 site visit (see Figure 2 in Appendix L). "Conservation" status was assigned as it provides important hydrological inputs to the downstream natural channel design. It lacks natural riparian vegetation and has been heavily impacted by agricultural practices similar to FC-2B. However, the "Conservation" status provides the opportunity for the enhancement of this feature whilst maintaining the downstream connection. This feature is also to be replicated as per the wetland restoration agreement with CVC for the property located at 1850 Mayfield Road.

The HDF management classification assigned to Reaches LD4-3B, LD4-3D, and LD4-4 is "Mitigation", and the management classification assigned to Reaches LD4-3, LD4-3A, and LD4-3C is "Protection". It should be noted that Reaches LD4-3, LD4-3A, and LD4-3C are situated within a woodlot and wetland feature that are to be maintained post-development. As such, Reaches LD4-3, LD4-3A, and LD4-3C will remain protected by virtue of their location within the existing woodlot and wetland. Reaches LD4-3B, LD4-3D, and LD4-4 were assigned "Mitigation" status as they directly feed the HDFs flowing through the wetland and woodlot. A shallow depression containing pooling water in the upstream extent of Reach LD4-3B was discussed with the Town of Caledon during the site meeting on June 4, 2024. The pool was relatively small and lacked established natural wetland vegetation and was influenced by agricultural activities. Satellite imagery from Google Earth Pro for the last approximately 20 years indicates that the farmer has planted this area in some years and left it fallow in others, likely due to seasonally wet and dry conditions and the timing of image capture. Wet conditions are not persistent enough to consistently preclude cultivation from occurring. This area was also cross-referenced with ELC mapping prepared by others, and a wetland has not been delineated in this location. It is also understood that this location was previously reviewed by C.F. Crozier and Associates Inc. in consultation with the MNR and it was subsequently removed from provincial wetland mapping.

Reach LD4-2 was assigned the management classification of "Conservation". Typically, the upstream classification of "Protection" would also apply to this reach. However, due to the feature having a limited form and flowing through an active agricultural field, the classification was reduced to "Conservation". The HDFs in this area ultimately flow into the Lyons Drain, and as such, hydrological inputs to the downstream receiving channel should be maintained. The Lyons Drain is a constructed open drain with limited geomorphological features and / or riparian buffers.

Reaches LD5, LD6, and FD3 were assigned the management classification of "Mitigation". These features are tiled and contribute flow to the downstream watercourse (Reach LD4 and Reach FD2). This function is required to be maintained to the downstream watercourses/municipal drain systems and as such the features were classified as "Mitigation".

Due to observed riparian conditions, Reaches AD4-1, AD5-1, and AD5-3 have been classified as "Conservation", which indicates that these features can be maintained, replicated, or restored in the future condition. Reaches AD5-2, and AD5-4 are classified as "Conservation – to be field verified". It is recommended these reaches are field verified should site access become available. Downstream of these reaches is the Alloa Drain, to which they directly discharge. The Alloa Drain watercourse is a municipal drain that collects flows from the Fraser Drain, Lyons Drain, and multiple headwater drainage features with limited geomorphological features and / or riparian buffers.

The HDF management classification assigned to Reach AD7-1 is "Protection". It should be noted that this feature is situated within a woodlot and wetland feature and connects to the Alloa Drain downstream. As the woodlot and wetland will be maintained in the future condition, the reach will remain protected by virtue of its location.

Reaches AD8-1 and FD1-2 were assigned the management classification of "Mitigation". These straightened features are defined and are directly connected to downstream watercourse reaches (Reach AD8 and Reach FD1). The contributing hydrology function is required to be maintained to the downstream watercourse, and as such, the reaches are classified as "Mitigation". These features are anticipated to also be impacted by the future Highway 413 alignment

Note that several HDFs have been included in the mapping for completeness but were not field verified due to site access restrictions. Features were documented based on a desktop mapping exercise and are labelled as "Not Field Verified" on all mapping. Where the feature was observed to be connecting two field-verified features, a management classification was recommended. However, field verification is required should property access become available.

The remainder of the reaches were assigned an HDF management classification of "No Management" as they had limited or no channel form and were located in active agricultural fields or along tile drains with no surface feature apparent. These features were also observed to be dry during the Round 2 site visit.

7.5.5. Rapid Field Assessments for Municipal Drain and Watercourse Reaches

Rapid assessments along municipal drain and watercourse reaches were completed on May 2, 2024, and included the following observations on a reach basis:

- Descriptions of riparian conditions
- Estimates of bankfull channel dimensions
- Determination of bed and bank material composition and structure
- Confirmation of valley form (i.e., unconfined, partially confined, confined)
- Observations of erosion, scour, or deposition
- Collection of photographs to document watercourses, riparian areas, adjacent land use, and channel disturbances such as crossing structures

These observations and measurements are summarized in Table 21. Refer to Appendix K for detailed reach descriptions, a photographic record, and copies of field assessment sheets. Additional figures can be reviewed in Appendix L of this report.

TABLE 21: GENERAL REACH CHARACTERISTICS

Reach Name	Avg. Bankfull Width (m)	Avg. Bankfull Depth (m)	Bed Substrate	Bank Materials	Dominant Riparian Conditions	Notes
Alloa Drain						
***AD1-2**	2.99	0.21	**Clay, silt and sand		Narrow buffer of established grasses at the downstream extent Wide forested buffer of trees and grasses at the upstream extent	Channel flowed through a wetland and was straightened Wetland vegetation present in the downstream portion of the reach
***AD-2**	4.05	0.42	*Clay, silt and sand		Narrow riparian buffer consisting of grasses with isolated trees	Run-dominant straightened channel between agricultural fields

AD3	3.64	0.82	Sand, gravel, and cobbles	Clay, silt, sand	Narrow riparian buffer consisting of shrubs and grasses	Straightened channel with poor longitudinal substrate sorting. Run-dominant system with few riffles
***AD4**	5.37	0.52	**Clay, silt, and sand		Narrow riparian buffer consisting of grasses	Straightened channel through agricultural fields Multiple crossings
***AD5**	3.97	0.42	**Clay, silt, and sand		Narrow riparian buffer of grasses with a few trees	Channel moderately entrenched with moderate encroachment of grasses in the channel
AD6	3.96	1.01	**Clay, silt, and sand		Narrow riparian buffer consisting of grasses	Channel had a low sinuosity with irregular meanders Attached algae and rooted emergent vegetation present
AD7	3.67	0.63	**Clay, silt, and sand		Wide mature forested buffer dominated by trees and shrubs	Water in the channel was turbid and had an organic smell
Lyons Drain						
LD1	3.93	0.77	**Clay, silt to gravel		Narrow fragmented buffer consisting of mature trees and shrubs	Straightened channel with sand/silt substrate. One artificial riffle was present following the culvert at the road
LD2	1.95	0.69	Clay, silt, gravel, cobbles	Clay, silt, gravel	Narrow riparian buffer consisting of established grasses	Ditch along Creditview Road that contained predominantly runs with some artificial riffles .Undercutting common along the reach
LD3	4.96	0.78	**Clay, silt, and sand		Moderate mature riparian buffer of trees	Run-dominant with a few riffles and pools mid-reach

					and shrubs along the left bank upstream Narrow riparian buffer of mature trees and shrubs on both banks in downstream section	Generally straight, entrenched channel with minimal erosion
LD4	3.80	0.61	**Clay, silt, and sand		Narrow fragmented riparian buffer consisting of established trees and grasses	Short reach with moderate entrenchment and minimal erosion Watercress was present and grasses were encroaching the channel
LD4-1	2.80	0.63	**Clay, silt to gravel and minimal cobbles		Moderate riparian buffer of mature trees and grasses	Erosion, undercutting, and steep banks were observed in the upstream portion of the reach in the forest
Fraser Drain						
FD1	2.71	0.51	**Clay, silt and sand		Wide mature riparian buffer of trees in the upstream section and downstream along the right bank Narrow riparian buffer of grasses on the left bank	Straightened channel between a forested buffer and an agricultural field Film present on water surface at various locations where woody debris was present The bed was also heavily silted
FD2	3.42	0.67	Gravel and cobbles	Clay, silt and sand	Wide mature riparian buffer of trees along the right bank	Channel was dominated by runs with riffles for approximately 25% of the reach Runs were dominated by clay, silt, and sand

					Narrow riparian buffer of established grasses on the left bank	

** Bankfull dimensions based on detailed geomorphological assessment*
*** Uniform channel bed, substrate observations reflective of full channel condition*

Rapid assessments were completed within the Primary Study Area to identify dominant geomorphic processes, document stream health, and to identify any areas of concern regarding erosion or instability. Channel instability was objectively quantified through the application of the Ontario Ministry of the Environment's (2003) Rapid Geomorphic Assessment (RGA). Observations were quantified using an index that identifies channel sensitivity based on evidence of aggradation, degradation, channel widening, and planimetric adjustment. The index produces values that indicate whether a channel is stable/in regime (score <0.20), stressed/transitional (score 0.21-0.40), or adjusting (score >0.41).

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

Although the RGA and RSAT tools are intended to be generally applied to natural systems, which are largely not present in the Primary Study Area due to the presence of municipal drains, results are reported below as they still provide an assessment of channel stability and overall stream health. A summary of the reach classifications and rapid assessment scores is provided in Table 22.

TABLE 22: SUMMARY OF RAPID ASSESSMENT RESULTS

Reach	RGA (MOE, 2003)		RSAT (Galli, 1996)		
	Score	Condition	Score	Condition	Limiting Feature(s)
Alloa Drain					
AD1-2	0.098	In Regime	24	Fair	Physical Instream Habitat
AD-2	0.174	In Regime	23	Fair	Riparian Habitat Conditions
AD3	0.170	In Regime	23	Fair	Riparian Habitat Conditions
AD4	0.176	In Regime	24	Fair	Riparian Habitat Conditions
AD5	0.145	In Regime	24	Fair	Riparian Habitat Conditions
AD6	0.103	In Regime	23	Fair	Riparian Habitat Conditions
AD7	0.165	In Regime	23	Fair	Water Quality
Lyons Drain					

LD1	0.067	In Regime	25	Good	Riparian Habitat Conditions
LD2	0.180	In Regime	22	Fair	Riparian Habitat Conditions
LD3	0.143	In Regime	25	Good	Physical Instream Habitat and Riparian Habitat Conditions
LD4	0.103	In Regime	23	Fair	Physical Instream Habitat and Riparian Habitat Conditions
LD4-1	0.130	In Regime	20	Fair	Physical Instream Habitat
Fraser Drain					
FD1	0.197	In Regime	20	Fair	Physical Instream Habitat
FD2	0.165	In Regime	20	Fair	Physical Instream Habitat and Riparian Habitat Conditions

The Alloa Drain is an artificial feature that has been straightened and entrenched along its entire length within the Primary Study Area. The channel has a low gradient and generally flows between agricultural fields. The riparian vegetation buffer is narrow but continuous, consisting of isolated trees and grasses that moderately encroach the channel. Limited erosion was present along the drain. Bed substrates consisted of primarily clay, silt, and sand and evidence of channel aggradation was observed due to accumulations of fine-grained sediments along the drain bed. The banks were steep, ranging from 60 – 90 degrees. Watercress was often present in the channel in most reaches. An absence of bar forms was observed in all reaches, indicating they are either poorly formed or otherwise removed from the channel. All reaches were classified to be "In Regime" based on the RGA and in "Fair" condition based on the RSAT. For detailed descriptions of each reach, refer to Appendix K.

7.5.6. Detailed Geomorphological Assessments

Obtaining detailed geomorphological measurements and observations allows for a more complete characterization of channel geometry, flow, and sediment characteristics. The data obtained is used to inform the natural corridor designs. In the interest of maintaining or improving channel conditions with regard to stability and fluvial function, the most natural and sensitive reaches within a study area are typically assessed; however, given the extent of historical channel modification within and downstream of the Secondary Plan Area, historically modified reaches were surveyed and then evaluated in the context of hydrology modelling provided by Urbantech (2024), our previous experience designing naturalized corridors in the watershed, our understanding of natural heritage system targets and agency expectations.

Reaches AD1, AD1-2, AD2, AD4, AD5, AD5-1, and LD2 were selected for detailed assessments in support of the proposed realignment and restoration of the Alloa Drain and associated tributaries. The selected reaches serve as reference locations for the existing drain that may be used to inform future design approaches and criteria.

The surveys were completed between May 24, 2024, to June 3, 2024 and included the following:

- Longitudinal survey of the channel centre line

- Detailed surveys of up to eight to ten detailed cross-sections
- Instream measurements of bankfull channel geometry, riparian conditions, bank material, bank height/angle, and bank root density at each surveyed cross-section
- Bed material sampling at each cross-section following a modified Wolman (1954) pebble count or substrate sample, as appropriate

The results of the detailed assessments are presented below in Table 23. A full summary of each detailed assessment is provided in Appendix M.

TABLE 23: DETAILED ASSESSMENT SUMMARY

Channel parameter	Reach AD1	Reach AD1-2	Reach AD2	Reach AD4	Reach AD5	Reach AD5-1	Reach LD2
Average bankfull width (m)	4.90	2.99	4.05	5.37	3.97	2.87	6.47
Average bankfull depth (m)	0.25	0.21	0.42	0.52	0.42	0.10	0.38
Channel gradient (%)	0.25	0.88	0.01	0.15	0.10	0.49	0.38
D_{50} (mm)	0.145	0.284	0.219	0.099	0.2	0.169	0.084
D_{84} (mm)	1.334	0.718	0.766	0.456	0.6	0.659	0.534
Manning's n roughness coefficient	0.035	0.035	0.035	0.035	0.035	0.035	0.035
Calculated Bankfull discharge (m^3/s)*	0.73	0.60	1.66	2.05	0.89	0.11	2.66
Calculated Bankfull velocity (m/s)*	0.60	0.98	0.98	0.73	0.53	0.39	1.08

**Based on Manning's equation*

7.5.7. Meander Belt Width Assessment – Existing Conditions

Most watercourses in southern Ontario have a natural tendency to develop and maintain a meandering planform provided there are no topographical or spatial constraints. When defining the limits of an erosion hazard for a watercourse, unconfined and confined systems are assessed differently (TRCA, 2004 and MNR, 2002). Unconfined systems are those with streams in open areas (i.e., valley not apparent) or with valley walls that are positioned at a sufficient distance where the channel cannot reasonably be expected to contact because of migration under existing or future hydrologic scenarios. In this type of setting, the extent of the erosion hazard is delineated by the meander belt width, which is defined as the lateral extent that a channel has historically occupied and will likely occupy in the future.

Following MNR (2002), the meander belt width can be applied, at minimum, based on 20 times the bankfull channel width. Alternatively, the meander belt width can be determined through a detailed geomorphological study that examines the largest channel meanders observed

through historical and recent aerial photograph interpretation. The meander belt width can then be graphically defined using orthorectified aerial imagery by determining the channel centerline and the channel's central tendency (i.e., meander belt axis). In cases where the channel is not discernible in aerial photographs or the channel has been substantially modified, empirical models can be used to estimate the meander belt width.

Confined systems, in contrast, are those where a watercourse is contained within a defined valley where meander bend migration may be constrained by valley walls. Partially confined systems are those where meander bends are adjacent to only one valley wall and the watercourse is therefore restricted in migration and floodplain occupation on one side of the valley system. In these settings, where the channel is positioned within 15 m of a valley slope, the erosion hazard is generally defined by the toe erosion allowance, stable slope allowance, and erosion access allowance. In some instances, a meander belt width may also apply in partially confined systems (i.e., where the channel is greater than 15 m from the valley slope toe).

All watercourse reaches within the Secondary Plan Area/Primary Study Area were characterized as unconfined. Because all watercourse reaches have been historically straightened to accommodate agricultural land uses and/or are managed as municipal drains, natural meanders are not present on the landscape. Aerial imagery was reviewed to locate potential reference reaches to use as surrogates. No suitable reference reaches are available for the Alloa, Lyons and Fraser Drains or associated tributaries with natural watercourse reaches (i.e., AD1-2 and LD4-1). Natural meanders are present along Etobicoke Creek approximately 2.7 km downstream of the Primary Study Area; however, several tributary inputs are present that would influence meander amplitude. A suite of empirical equations was therefore used to delineate meander belt widths.

The bankfull channel dimensions observed during field reconnaissance were used to inform both the Williams (1986) and Ward (2002) models outlined below.

The empirical relations from Williams (1986) were modified to include channel width, and applied using the bankfull channel dimensions such that:

$$B_w = 18A^{0.65} + W_b$$

$$B_w = 4.3{W_b}^{1.12} + W_b$$

where Bw is meander belt width (m), A is bankfull cross-sectional area (m2), and Wb is bankfull channel width (m). An additional 20% buffer, or factor of safety, was applied to the computed belt width values. This addresses issues of under prediction.

The Ward et al. (2002) bankfull width model was also used to determine a meander belt width (ft), Bw:

$$B_w = 6{W_b}^{1.12}$$

The resulting value was then converted to the metric system (m). A 20% factor of safety was not applied to this value due to the approach used in the modelling (i.e., hazard envelope rather than a linear relationship).

Lastly, meander belt widths were also calculated based on TRCA's (2004) empirical model:

$$B_w = -14.827 + 8.319\ln(\rho g Q S * DA)$$

where ρ is water density (1000 kg/m^3), g is acceleration due to gravity (9.8 m/s^2), Q is discharge (m^3/s), S is channel slope (m/m), and DA is drainage area (km^2). Reach gradients were determined using topographic data derived from LiDAR. Drainage areas were obtained from the Ontario Watershed Information Tool (OWIT), while the 2-year discharge for each reach was provided by Urbantech (2024). Table 24 provides a summary of parameters used in the TRCA (2004) model.

TABLE 24: PARAMETERS USED IN TRCA (2004) EMPIRICAL MODEL

Reach	Discharge (m^3/s)	Slope (m/m)	Drainage Area (km^2)
Alloa Drain			
AD1-2	0.23	0.0050	3.30
AD-2	3.74	0.0015	9.83
AD3	3.42	0.0015	9.48
AD4	2.50	0.0015	6.31
AD5	2.08	0.0007	5.57
AD6	1.53	0.0008	2.85
AD7	0.66	0.0029	1.15
Lyons Drain			
LD1	0.96	0.0084	2.03
LD2	0.96	0.0035	2.02
LD3	0.96	0.0028	1.98
LD4	0.96	0.0059	1.85
LD4-1	0.96	0.0092	0.11
Fraser Drain			
FD1	0.53	0.0008	2.24
FD2	0.53	0.0004	0.77

Empirical modelling results are summarized in Table 25, below. The extents of all meander belt widths based on existing conditions are illustrated in Appendix M With regard to the Alloa Drain, calculated meander belt widths range from 19 m to 58 m. With the exception of Reach AD1-2 in the eastern extent of the Primary Study Area, values determined using the TRCA (2004) model are recommended as the final meander belt widths. These values include one (1) standard error

(8.63) as a factor of safety. A meander belt width of 19 m based on the modified Williams (1986) width equation and a 20% factor of safety is recommended for Reach AD1-2 under existing conditions. This reach is proposed for realignment as part of future development and the designed channel and associated meander belt width are to be accommodated in the constructed corridor.

Calculated meander belt widths along Lyons Drain range from 13 m to 49 m. Values calculated using the modified Williams (1986) width equation are generally selected as appropriate. Typically, meander belt widths decrease in the upstream direction due to reduced drainage areas, relatively lower discharges and in turn, smaller bankfull channel geometries. The modified Williams (1986) width equation resulted in a narrow meander belt width for Reach LD2 relative to adjoining reaches. Therefore, the 29 m meander belt width calculated upstream and downstream was adopted for this reach. In addition, the TRCA (2004) model resulted in a 29 m meander belt width for Reach LD2. Reaches LD1 and LD2 are proposed for realignment as part of future development and therefore the designed channel and associated meander belt widths are to be accommodated within their constructed corridors.

Meander belt widths calculated for Fraser Drain ranged from 12 m to 41 m. A negative value resulted from the TRCA (2004) model for Reach FD2 and was therefore disregarded. A meander belt width of 25 m is recommended for both watercourse reaches using the modified Williams (1986) equation and a 20% factor of safety. This value represents the approximate median of the range of modelled belt widths and adequately addresses the potential erosion hazard.

TABLE 25: SUMMARY OF MODELLED MEANDER BELT WIDTHS FOR WATERCOURSE REACHES FOR EXISTING CONDITIONS

Reach	Modified Williams (1986) Area*	Modified Williams (1986) Width*	Ward Width (2002)	TRCA (2004)**	Recommended Meander Belt Width (m)
Alloa Drain					
AD1-2	27	19	21	24	19
AD-2	55	31	34	46	46
AD3	48	26	29	45	45
AD4	51	32	36	39	39
AD5	54	29	33	30	30
AD6	58	29	32	23	23
AD7	42	27	30	19	19
Lyons Drain					
LD1	49	29	32	36	29
LD2	42	21	23	29	29

LD3	47	29	33	27	29
LD4	42	28	31	32	28
LD4-1	35	20	22	13	20
Fraser Drain					
FD1	30	19	21	12	25
FD2	41	25	27	-2	25

** Includes 20% factor of safety*
*** Includes one standard error (8.63 m) for factor of safety*

7.6 Surface Water Quality Monitoring

7.6.1. Sampling Methodology and Parameters

Five (5) surface water quality sampling locations, ASW1, ASW2, ASW3, ASW4, and ASW5, were established during spring 2024 at road crossings in the Primary Study Area to characterize baseline water quality. At the onset of the 2025 monitoring season, an additional three (3) surface water quality sampling locations, ASW6, ASW7, and ASW8, were established. A map of all monitoring locations is provided in Appendix N.

The sampling program is event-based, capturing at least one (1) wet (10 mm of rain in 24 hours) and one (1) dry event (48 hours with no precipitation) seasonally (spring, summer, fall). During wet weather sampling, two (2) samples are collected. The first is collected during the ascending limb, and the second is collected during the receding limb of the hydrograph. To ensure appropriate conditions are captured in sampling, the ascending limb of the hydrograph is captured using automatic composite samplers equipped with water level triggers to initiate sampling. The grab sampling method is utilized to collect the receding limb sample. Water quality sampling activities at all locations included the following:

Discrete baseline water quality sampling during three (3) wet events and three (3) dry events included in situ measurement of the following parameters during each event:

- Temperature
- Turbidity
- Dissolved Oxygen
- Conductivity

Sampling also included laboratory-analyzed measurement of the following parameters during each event:

- Ammonia
- Anions (Nitrate, Nitrite, Phosphate, Chloride)
- BOD5 (Biochemical Oxygen Demand)

- Metals (Al, Sb, As, Ba, Be, B, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Mo, Ni, P, K, Se, Si, Ag, Na, Sr, Tl, Sn, Ti, W, U, V, Zn, Zr)
- PAH (Polycyclic Aromatic Hydrocarbons)
- pH / Alkalinity
- Total Kjeldahl Nitrogen (TKN)
- Total Phosphorus
- Total Suspended Solids (TSS)
- Monumented photographs of all sampling activities to verify location and timing.

Daily precipitation data for 2024 was acquired from a Brampton Weather Underground Station (Climate ID: IBRAMP10) located approximately 2.5 km southeast of the subject site. During the 2024 water quality sampling period (April 1 – November 30), precipitation was recorded on 128 of 244 monitoring days and there were 12 occurrences of daily rainfall ≥10 mm. At the onset of the 2025 monitoring season, a GEO Morphix Weather Station was installed approximately 1.6 km east of the subject site measuring from the center of the subject site (located <350 m from ASW4). During the ongoing 2025 monitoring period (March 13 to May 30), precipitation was recorded on 37 of 79 monitoring days, and there have been 6 occurrences of daily rainfall ≥10 mm. Monitoring will continue to the end of November 2025.

7.6.2. Results

Discrete water measurements of several water quality parameters (listed above) were collected at each monitoring location. All sampled parameters were compared to Provincial Water Quality Objective (PWQO) guidelines, where applicable. Generally during rain events, parameters exceeding the PWQO guidelines were greater during the ascending limb compared to the receding limb. During both 2024 and 2025 sampling, aluminum, copper, iron, and lead were measured to be in exceedance of the PWQO at all monitoring sites during multiple sampling events. All the parameters measured in exceedance of the PWQO during 2024 and 2025 sampling efforts are primarily heavy metals, apart from arsenic, a metalloid. For specific results based on location, refer to Appendix N of the LSS. Note that Appendix N documents the monitoring program undertaken in 2024 as well as April and May of 2025. Monitoring will continue to the end of November 2025, after which time, an updated surface water monitoring report can be provided.

The principal surrounding land use is composed of agricultural fields, the exceeding metals and metalloids are likely sourced from agricultural applications (manure/fertilizers, pesticides etc.). Additionally, given the high traffic in the area a likely source of heavy metals could also be airborne urban road dust. Urban road dust consists of small particles most commonly created from wear on vehicle parts (Hwand et al., 2016), including farm equipment. Lastly, exceedances may also be a baseline characteristic of the system as some parameters are naturally occurring in soil and rocks. Overall, the results presented are representative of baseline conditions. Water quality sampling will continue for the balance of the 2025 monitoring period.

Total Suspended Solids and Turbidity

Total suspended solids and turbidity measure the concentration of organic and inorganic matter in suspension and relate to the lack of clarity or transparency of water. Suspended matter consists of silt, clay, fine particles of organic and inorganic matter, soluble organic compounds, plankton, and other microscopic organisms. The higher the concentration of these substances in water, the more turbid the water becomes. Environmental samples vary within the normal range of 1 to 1000 NTUs (CCME, 2002).

TSS and turbidity will vary depending on watershed characteristics such as precipitation, contributing drainage area, flow conditions, and time of year. General trends in TSS and turbidity were consistent between 2024 and 2025. TSS and turbidity results were typically greater during the ascending limb than the receding limb during rain events. This is a typical pattern of watercourses, as during the ascending and peak flows, the watercourse will have additional capacity to transport sediment, thus increasing TSS/turbidity. During the receding limb, as flow rates decline, suspended sediment falls out of suspension and is deposited back onto the bed.

The maximum TSS concentration recorded in 2024 was 1740.0 mg/L at **ASW4** during the spring event ascending limb. In 2025, the maximum TSS concentration of 1130.0 mg/L was also measured during the ascending limb of the spring event at site **ASW3**. Minimum TSS concentration was recorded during each year's first dry event, where concentrations were 3.0 mg/L at **ASW3** and 2.0 mg/L at **ASW1**, respectively. All turbidity measurements collected during wet and dry events in 2024 and 2025 were within the normal range of 1 to 1000 NTUs. Sampling locations and a summary of accredited laboratory results up to the end of May 2025 are included in Appendix N for reference.

Water Temperature

Temperature plays a significant role in influencing aquatic life and chemical interactions within aquatic environments. An aquatic organism's temperature tolerance differs based on various factors, including species, age, acclimation range, exposure to toxic substances, and season. Changes in temperature also influence the solubility and reaction equilibria of many chemicals, including dissolved oxygen.

Discrete temperature collection was completed between April and October of 2024. Continuous temperature monitoring was first initiated in late October 2024. Average discrete temperatures in 2024 ranged from 13.3 to 15.5°C. Maximum discrete water temperatures for each monitoring location were recorded on July 10, 2024, with values ranging from 18.2 to 21.4°C .

During the 2025 monitoring season to the end of May, continuous water temperature was recorded, capturing diurnal fluctuations and seasonal trends. Average water temperatures from the initiation of monitoring to May 30, 2025, ranged from 7.3 to 9.3°C across all monitoring locations. A maximum water temperature of 26.1°C was measured at **ASW4**.

Water temperatures generally follow diurnal fluctuations in air temperature, with more gradual variations observed in locations with deep channels and canopy coverage. **ASW8** typically has high water levels and is located adjacent to a woodlot that provides shade to the sensor and incoming flows from upstream. **ASW7** is situated in a woodlot that provides full canopy cover and shade. The remaining monitoring locations generally have minimal canopy cover as sites are adjacent to a road crossing. Monitoring will continue for 2025, where periods of thermal

stress during warm summer months can be further analyzed to establish a full stream thermal classification for each location and gather additional baseline data. Complete continuous temperature data and discrete measurements collected up to the end of May 2025 are provided in Appendix N.

Dissolved Oxygen

Dissolved oxygen is a fundamental parameter for aquatic organism life. Oxygen solubility is governed by atmospheric and hydrostatic pressure, turbulence, temperature, salinity, and biological processes. The lowest acceptable dissolved oxygen concentration for aquatic life is between 5.5 mg/L and 6.0 mg/L for warm water streams, and between 6.5 mg/L and 9.5 mg/L for cold water streams, depending on the aquatic organism's life stage and the stream's thermal classification (CCME, 1999).

Throughout the monitoring program, dissolved oxygen concentrations across all monitoring locations ranged from 0.19 to 11.00 mg/L, and 2.08 to 11.46 mg/L in 2024 and 2025, respectively. During the 2024 monitoring season, average dissolved oxygen concentrations during rainfall events ranged from 3.66 to 6.77 mg/L at sites ASW1 to ASW5, while during the 2025 season, average DO concentrations ranged from 6.05 to 9.52 mg/L at sites ASW1 to ASW8. Maximum dissolved oxygen values were generally recorded during rain events during both years.

As expected, during 2024 dry events that were sampled during low flow conditions, lower dissolved oxygen concentrations are expected. During 2024 dry events, average DO concentrations ranged from 1.32 to 6.85 mg/L. Notably, minimum dissolved oxygen concentrations in 2024 were observed during dry events in late summer, when flow continuity was limited or water was stagnant. As dissolved oxygen and temperature have an inverse relationship, where the capacity for water to dissolve oxygen is lower when water temperatures increase, lower DO concentrations are expected during these periods. Refer to Appendix N for a summary of results up to the end of May 2025 based on sampling location.

Conductivity

Conductivity is useful as a general measure of stream water quality. Conductivity measures the ability for electrical current to pass through water and provides an estimate of water salinity. Each stream tends to have a relatively constant range of conductivity that, once established, can be used as a baseline for comparison with regular conductivity measurements. Mid-range conductivity (200 to 1000 µS) is the normal background for most major rivers. Conductivity outside this range could indicate that the water is not suitable for particular species of aquatic organisms (ENR, 2017). High levels of conductivity (1000 to 10,000 µS) may be due to increased discharge (i.e., rain event) or some other source of pollution entering the system (ENR, 2017). In southern Ontario, that application of road salt during the winter creates a significant source of salt that can drain into watercourses and increase conductivity during spring flows.

The average conductivity measured across all monitoring sites during rain events was within the mid-range and is generally suitable for supporting aquatic organisms. During 2024 rain events, average conductivity ranged from 443.1 µs to 936.0 µs across monitoring sites. During 2024 dry events, average conductivity ranged from 417.0 µs to 1212.7 µs across monitoring sites. Average conductivity results were generally greater during dry events compared to rain events.

In 2025, average conductivity during rain events ranged from 274.9 µs to 538.2 µs. Conductivity appears generally consistent during an event's ascending and receding limbs. During the spring 2025 dry event, conductivity ranged from 674.0 µs to 1258.0 µs.

Conductivity will continue to be monitored in 2025 to characterize baseline water quality during various seasonal conditions. A complete record of discrete water quality measurements up to the end of May 2025 is provided in Appendix N.

7.7 Instream Water Quantity Monitoring

7.7.1. Methodology

Water level and discharge measurements were collected to characterize baseline conditions and better understand stream response to various precipitation events throughout the year. Baseflow is the component of streamflow derived from natural storage sources and does not include direct runoff from precipitation. There must not be any evidence in the stage discharge hydrograph of any recent storm events when considering baseflow. Water level responses depend on the magnitude of the rainfall and antecedent conditions.

Discrete water level and discharge measurements were collected in 2024, with continuous water level and discharge monitoring initiated in October 2024. In 2025, continuous water level and discharge monitoring recommenced on March 13, 2025, and is ongoing. Monumented photographs of all sampling activities were collected in 2024 and 2025 to verify their location and timing.

Once continuous monitoring was initiated, the following activities were completed at each location:

- Continuous water level and temperature monitoring at 15-minute intervals using a Solinst Levelogger5 transducer installed at the stream bed, with an additional atmospheric sensor installed nearby to measure air temperature and barometric pressure.
- Continuous velocity and discharge monitoring was completed using Pulsar MantaRay Portable Level-Velocity Loggers collecting data at 15-minute intervals. The MantaRay logs water level and velocity in open channels and is ideal for reasonably shallow flows. Monitoring equipment was installed periodically at each site to develop a stage-discharge relationship. Discrete ADV readings were completed along established cross-sections to confirm MantaRay readings.

7.7.2. Results

Annual minimum and maximum water level and discharge measurements for 2024 and March to May 2025 are summarized below in Tables 26 and 27, respectively. Water quantity monitoring remains ongoing in 2025 and additional data collected for the balance of the monitoring period will be provided in subsequent reporting.

TABLE 26: 2024 MINIMUM AND MAXIMUM WATER DEPTHS AND DISCRETE DISCHARGE

Location	2024

	Water Level (m)		Discrete Estimated Discharge (m^3/s)	
	Minimum	Maximum	Minimum	Maximum
ASW1	0.32	0.61	0.000	0.343
ASW2	0.19	0.50	0.000	0.039
ASW3	0.00	0.55	0.000	0.010
ASW4	0.01	0.19	0.000	N/A
ASW5	0.11	0.24	0.000	0.013
ASW6	0.32	0.58	N/A	
ASW7	0.00	0.13		
ASW8	N/A			

TABLE 27: 2025 Minimum and Maximum Water Depths and Calibrated Discharge

Location	2025			
	Water Level (m)		Calibrated Discharge (m3/s)	
	Minimum	Maximum	Minimum	Maximum
ASW1	0.40	1.62	0.000	0.571
ASW2	0.27	1.46	0.002	0.327
ASW3	0.46	1.27	0.000	1.289
ASW4	0.11	0.87	0.176	6.025
ASW5	0.03	0.95	0.000	0.849
ASW6	0.38	0.95	0.000	0.385
ASW7	0.03	0.56	0.000	0.628
ASW8	0.24	1.28	0.042	0.338

During the condensed 2024 monitoring period, maximum continuous water levels across all sites were observed on November 20, following a 16.2 mm precipitation event. Up the end of May 2025, maximum water levels were observed during the spring rain event on April 3 and 4, following 68.6 mm of precipitation over 48 hours. Continuous discharge measurements in 2025 followed similar trends, with maximum discharge ranging from 0.327 to 6.025 m3/s across all sites measured on April 3.

ASW8, **ASW1**, **ASW2**, and **ASW4** are located upstream to downstream along the Alloa Drain. During 2025 monitoring, water levels along the Alloa Drain ranged from 0.11 to 1.62 m. Sites **ASW1, ASW2**, and **ASW8** demonstrated similar baseline characteristics in 2024 and 2025, characterized by deep channels, generally low flow conditions, and wetted widths extending

across the full channel span. Water level and discharge at **ASW4** varied between 2024 and 2025 due to backwatering conditions downstream of Chinguacousy Road. Water level measured on September 25, 2024, was 1.04 m, with stagnant or slow-moving flow conditions, similar to other sites along the Alloa Drain. Between September 25 and October 23, 2024, water levels decreased drastically, revealing a low-flow channel within the bankfull corridor at **ASW4**. Site visits have confirmed that water levels remain shallow during baseflow conditions. Measurements within the low flow channel have also recorded increased flow rates, with a maximum discharge of 6.025 m3/s recorded on 2025-04-03 following 68.6 mm of precipitation in 48 hours.

ASW5 is located along a northern tributary to the Alloa Drain. Upstream of the monitoring location is a pond receiving flows from headwater drainage features. Water levels at **ASW5** ranged from 0.11 to 0.24 m in 2024 and from 0.03 to 0.95 m in 2025. Discharge in 2025 ranged from 0.000 to 0.849 m^3/s.

ASW6 is located at the southeastern extent of the Primary Study Area along a tributary of Fletcher's Creek, receiving flows from headwater drainage features northwest of Mayfield Road. Water levels in 2024 and 2025 ranged from 0.32 to 0.58 m and 0.38 to 0.95 m, respectively. Discharge in 2025 ranged from 0.000 to 0.285 m^3/s.

Site **ASW7** is located in a forested woodlot, along a headwater drainage feature upstream of Lyons Drain. Flows upstream of **ASW7** are headwater drainage features originating in agricultural fields. Water levels at **ASW7** ranged from 0.00 to 0.13 m in 2024 and from 0.03 to 0.56 m in 2025. Discharge measurements commenced in 2025, ranging from 0.000 to 0.628 m^3/s. **ASW3** is located downstream of **ASW7** along the Lyons Drain, which ultimately flows into the Alloa Drain. At **ASW3**, water levels in 2024 and 2025 ranged from 0.00 to 0.55 m and 0.56 to 1.27 m, respectively and discharge in 2025 ranged from 0.000 to 1.289 m^3/s.

Complete continuous water level data and discrete measurements are provided in Appendix N.

7.8 Aquatic Ecosystems

7.8.1. Field Program: Documentation of Existing Conditions

Azimuth undertook the following fish habitat assessment field activities for this study. The field program was limited to the Primary Study Area:

- Conducted one spring fisheries survey to document presence of direct/indirect fish habitat features and fish habitat sensitivities .

7.8.2. Data Analysis and Reporting

- Reviewed potential fish habitat resources in accordance with background information and observed site conditions.

7.8.3. Fish and Fish Habitat

Watercourses and drainage features were evaluated on May 15 and May 16, 2024. Evaluations were aimed at understanding the location of watercourses and drainage features located within the Primary Study Area to determine the presence and extent of direct and indirect fish

habitat features. Field documentation included characterizing fish habitat features such as wetted width, water depths, flow, bank slopes, aquatic vegetation, substrate and general morphology. Fish sampling was not completed because fish community data and thermal regime information were available through online resources (MNR, 2024a/2024b) and from previously completed fieldwork (Beacon, 2023a, b). Headwater drainage feature assessments were completed by GEOMorphix.

7.8.4. Benthic Invertebrates

Beacon selected five water quality sampling stations across the Primary and Secondary Study Areas in 2023 (Beacon, 2023a, b). In the Primary Study Area, two stations were located at watercourse crossings on Chinguacousy Road (Alloa Drain - Water Quality Station #5; Tributary #3 - Water Quality Station #4). Two stations were along Creditview Road (Alloa Drain - Water Quality Station #3; Lyons Drain - Water Quality Station #2) and one sampling location located along Mississauga Road (Alloa Drain - Water Quality Station #1).

Beacon noted that sampling was completed in accordance with the Rapid Bioassessment techniques set by MNR, which adhere closely to the Ontario Biomonitoring Benthic Association of Environmental Canada. Sampling was to occur bi-annually to establish baseline data on benthic community health, however at this time it is proposed the baseline benthic sampling completed by Beacon in 2023 is sufficient to characterize aquatic ecosystem quality/function in combination with other aquatic investigations *(e.g*. fish habitat review, Headwater Drainage Feature assessments). The first sampling occurred by Beacon on September 20, 2023; benthic invertebrates were not sampled at Water Quality Station #5 in fall 2023 due to high water levels. At each station sampled, water chemistry, water temperature, substrate type, type of aquatic vegetation and presence of woody debris metadata were recorded as habitat correlates. Benthic invertebrates were collected using a 30x30cm 500-micron mesh size Surber Sampler.

The following bethic indices were utilized to understand the ecosystem health of the samples systems.

<u>Ephemeroptera, Plecoptera, and Trichoptera (EPT) Index</u>

This EPT index estimates water quality by the relative abundance of three major orders of stream insects that have a low tolerance to water pollution (*i.e.,* Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). These three orders of invertebrates are sensitive to pollutants that may be present in aquatic environments. The EPT Index can be expressed as a percentage of the sensitive orders to the total taxa found. A large percentage of EPT taxa indicates high water quality and a low percentage of EPT taxa indicates low water quality.

<u>Diversity</u>

Diversity indices provide important information about the rarity and commonness of species in a community. The ability to quantify diversity in this way is an important tool for biologists trying to

understand community structure. For analysis of diversity the Simpson's Diversity Index was applied. The Simpson's Diversity Index is a measure of diversity which considers the number of species present, as well as the relative abundance of each species. As species richness and evenness increase, the diversity increases. The value of this index ranges between zero and one, with one representing infinite diversity and zero representing no diversity.

The Hilsenhoff Biotic Index (HBI)

HBI estimates the overall tolerance of the community to organic pollutants in a sampled area, weighted by the relative abundance of each taxonomic group (*e.g.,* family, genus). Organisms are assigned a tolerance number from zero to ten pertaining to that group's known sensitivity to organic pollutants with zero being the most sensitive and ten being the most tolerant. Therefore, a community with a higher number of pollutant tolerant species will have a higher HBI number, which therefore indicates water quality is likely poorer and/or polluted.

7.8.5. Fisheries Existing Conditions

Primary and Secondary Study Area

The Primary and Secondary Study Areas are located in three different subwatersheds (see Appendix O). The majority of the study area and watercourses/drainage features are in the Etobicoke Creek Subwatershed which is within TRCA jurisdiction. Specifically, the Alloa Drain and all associated tributaries are within the Etobicoke Creek Subwatershed. At the landscape level, a majority of the Alloa Drain features within the Primary and Secondary Study Areas are considered headwater features that convey intermittent flows to the Alloa Drain. In particular, the drainage features and watercourses to the northwest of the Primary Study Area within the Secondary Study Area all appear to be small headwater drainage features within an agriculturally dominated landscape. Based on aerial imagery interpretation, these features have been heavily manipulated and altered for agricultural purposes similar to those within the Primary Study Area. Furthermore, based on the general characterization of fish habitat features along the Alloa Drain as described below (i.e., severely impaired systems with marginal direct/indirect fish habitat functions), the features to the northwest within the Secondary Study Area are also anticipated to provide marginal or poor direct/indirect fish habitat features for a warmwater fish community.

The southern and eastern portion of the study area is within the CVC jurisdiction, which drains towards the Huttonville Creek and Fletcher's Creek Subwatersheds. The Fletcher's Creek Subwatershed within the Secondary Study Area is largely contained within an urban setting that consists of dense residential housing. Therefore, the drainage features and watercourses within this subwatershed have been significantly altered and manipulated. The Huttonville Creek subwatershed to the south is similar to the Etobicoke Creek Subwatershed in that it is dominated by agricultural lands within the Secondary Study Area. The drainage features within the Huttonville Creek subwatershed would be considered headwater features that are poorly defined and often flow through actively cropped farm fields.

Within the Primary Study Area, three watercourse features were identified on background mapping and during field investigations, which are labelled as drains on background mapping (Alloa Drain, Lyons Drain, and Fraser Drain). In addition to these three drains, eleven tributaries

(Tributaries #1-11) and two ponds were identified on background mapping and were investigated in the field. A description of these fish habitat features within the Primary Study Area is provided below:

Alloa Drain

The main watercourse feature through the Primary Study Area is the Alloa Drain (see Appendix O). The Alloa Drain is a Municipal Drain, that under the Drainage Act, flows in a northeast direction and originates approximately 1.4km west of Mississauga Road. Most of the drain is relatively straight and consists of a run/glide morphology. The straightened nature of the channel limits the occurrence of riffles and pools, and riparian vegetation/canopy cover is largely absent from large segments of the feature. At the upstream limits of the Primary Study Area near Creditview Road, the channel has a wetted width of approximately 1.5m, which increases to approximately 3m downstream of the Lyons Drain confluence. Water depths also range from 0.3m at the upstream limits to over 0.5m downstream of this confluence. Minimal flow was observed through the upstream and middle segments of the Primary Study Area, with water clarity observed to be poor/turbid. Substrate consisted of silty material with gravel/sand intermixed.

Watercress was noted in sections of the channel, indicating potential groundwater inputs. At the downstream limits of the study area near Chinguacousy Road, the channel widens to approximately 6m with no visible flow, indicating a low gradient segment. Filamentous algae were present in this area, indicating stagnant water and warmwater conditions.

Riparian lands are dominated by agricultural activities (row crops), and tile drain outlets into the feature are common throughout the study area. Channel banks are steep and the channel is well incised, which may indicate historical dredging to improve drainage for farming practices. Small shrubs and riparian grasses are common along the steep channel banks, which appear unstable in some sections due to the steep nature of the channel. Numerous road and farm crossings are present along the Alloa Drain, but no permanent fish barriers were noted.

The MNR online mapping characterizes the Alloa Drain as a warmwater feature (MNRF, 2024b). Previous fish sampling completed by Beacon (2023a, b) captured the following species: Blacknose Dace; Bluntnose Minnow; Brook Stickleback; Common Shiner; Creek Chub; Fathead Minnow; Largemouth Bass; Northern Pearl Dace and White Sucker. This fish community is representative of a warmwater system. Therefore, the Alloa Drain is characterized as a permanent feature that hosts a warmwater fish community and would be protected under the *Fisheries Act*. Overall, fish habitat is considered poor and degraded due to the straightened and incised nature of the channel and minimal riparian shading.

Fraser Drain

This drain originates to the north of the Alloa Drain between Heritage Road and Mississauga Road (see Appendix O). The total drain length is approximately 830m with an average wetted width of 1.5-2m and water depth that ranged from 5-20cm. The drain flows south and riparian lands consist of farm fields to the east and forested lands to the west. The Fraser Drain outlets into the Alloa Drain at the corner of a farm field within the Primary Study Area as shown on the attached figures. The drain has a straight morphology with no pools or natural meanders and is

incised with steep banks and a bankfull depth of 0.8m+. Substrate was dominated by soft silty material with sparse segments of gravel/sand. Small-bodied fish were observed within the drain during the field investigation. Therefore, Lyons Drain would be characterized as a permanent feature that supports direct fish habitat and would be protected under the *Fisheries Act*.

Given the connection to Alloa Drain and similar channel characteristics, the same fish community is expected to be present within Fraser Drain (warmwater fish species). MNR online mapping also indicates that Fraser Drain has a warmwater thermal regime (MNR, 2024b). Overall, fish habitat in the Fraser Drain would be considered poor due to the straight morphology, shallow water conditions, and adjacent farm fields that limits riparian vegetation/shading.

Lyons Drain

This drain originates on the west side of Creditview Road and collects drainage from agricultural lands to the west and north (see Appendix O). Lyons Drain flows in an easterly direction and outlets into the Alloa Drain approximately 150m east of Creditview Road. The total surface length of Lyons Drain is approximately 1.4km, but the feature also collects tile drainage from surrounding agricultural fields. The drain meanders slightly in forested lands at the upstream limits of the feature, but straightens as it reaches the roadside ditch before bending 90° to flow underneath Creditview Road. From the road, the drain flows straight and outlets into the Alloa Drain. Patches of watercress were present along the feature with gravel and sand substrate intermixed with silt. The wetted width of the feature in the Primary Study Area was 1-1.5m, with a water depth of 15-20cm. Small-bodied fish were observed both within the study area east of Creditview Road, and at the upstream limits of the feature on lands to the west of the Primary Study Area. Therefore, Lyons Drain would be characterized as a permanent feature that supports direct fish habitat and would be protected under the *Fisheries Act*. Given the connection to Alloa Drain and similar channel characteristics, the same fish community is expected to be present in the Lyons Drain (*i.e.* warmwater fish species). Online MNR mapping also indicates that Lyons Drain has a warmwater thermal regime (MNRF, 2024b).

Tributaries #1-3

Tributaries #1-3 are similar in nature and flow through the north corner of the Primary Study Area in an easterly direction (see Appendix O). All three features flow into the Alloa Drain approximately 500m downstream. The features are poorly defined with dense riparian grasses both adjacent and within sections of the features. Trickle flow was observed in all three features during the field visit, and substrate consisted of silty material. The wetted width ranged from 1-2m, with water depths ranging from 5-20cm. These features have a straight run morphology with no riffles or pools. Based on the site characteristics (*i.e.* poorly defined banks, terrestrial vegetation within channel bottom, minimal substrate sorting), these features are characterized as intermittent and may become dry during the summer months. All three features are characterized as warmwater features on background mapping (MNRF, 2024b). Brook Stickleback have been captured in Tributary #2 based on MNRF online information (MNRF, 2024a). A pond is also present in proximity to Tributary #3, which drains directly into the channel at the southeast corner of the pond. Drainage flows around the pond along the southern edge in a poorly defined drainage feature. No direct inlet was observed into the pond from Tributary #3, but the wetland feature to the west appears to seasonally flood into the pond. During the

spring survey, flow was observed draining from the pond into Tributary #3. Therefore, the pond is considered to be an online feature. Fish were observed in the pond, including Goldfish and Pumpkinseed. At the upstream limits of Tributary #3, the channel was observed to be dry within a lowland swale area with no defined flow path. This upstream segment was characterized as ephemeral and indirect fish habitat.

Based on the fish capture data for Tributary #2 and the online pond along Tributary #3, all three tributaries have been characterized as providing direct fish habitat and would be protected under the *Fisheries Act*. However, fish habitat is poor and likely only seasonal during the spring months when water levels are elevated.

Tributary #4

Tributary #4 is a poorly-defined agricultural swale that originates approximately 450m north of Mayfield Road (see Appendix O). The feature flows through an actively tilled agricultural field with no defined banks or substrate sorting. During the spring survey, this feature was predominantly dry with minimal standing water in segments of the feature. Tributary #4 drains into a channel on the south side of Mayfield Road that was densely covered with invasive *Phragmites*. Online MNR mapping indicates this feature on the south side of Mayfield Road has a coolwater thermal regime (MNRF, 2024b). The nearest fish community data are from approximately 500m downstream of Mayfield Road where the following species have been captured in the past: Brook Stickleback; Creek Chub; Fathead Minnow and Pumpkinseed. These species are common in both warm and coolwater systems. Therefore, due to the connection to direct fish habitat downstream, Tributary #4 is characterized as indirect fish habitat and would be protected under the *Fisheries Act*.

Tributary #5

Tributary #5 is a poorly-defined swale that drains from a treed area to the northwest of the Chinguacousy Road crossing (see Appendix O). The feature was dry during the spring field investigation with no standing water or moist soils on the west side of Chinguacousy Road. In addition, no banks, substrate sorting or defined flow path were observed during spring field investigations, and dense terrestrial vegetation was present throughout the feature. Therefore, the feature is characterized as ephemeral and not fish habitat. Downstream (east) of Chinguacousy Road, the feature drains into a roadside ditch network where standing water was present. However, due to the dry nature of the feature in the study area during the spring investigation and lack of a direct connection to a fish-bearing watercourse downstream, Tributary #5 is not expected to have functions protected under the *Fisheries Act*. A summary of existing fish habitat conditions is provided below in Table 28.

Tributary #6

This feature is a short (100m) channel that outlets into Lyons Drain from the north. Tributary 6 originates from a culvert that appears to collect tile drainage from farm lands to the north (see Appendix O). Tributary 6 is directly connected to Lyons Drain with no fish barriers observed during the field investigation. The channel had an average wetted width of 1.5m and depth of 20cm. Watercress was also observed within the feature. Given the direct connection to Lyons Drain and similar channel characteristics, Tributary 6 would be characterized as a permanent

feature that supports direct fish habitat and would be protected under the *Fisheries Act*. The same fish community is expected to be present in Tributary 6 as Lyons Drain (warmwater fish species). MNRF online mapping also indicates that Tributary 6 has a warmwater thermal regime (MNR, 2024b).

Tributary #7

This feature flows south on the east side of Mississauga Road for approximately 900m and outlets into the Alloa Drain (see Appendix O). The feature is contained within a poorly defined vegetated swale and is relatively straight with no defined banks or substrate sorting. Dense terrestrial grasses are present along the feature, and standing water was observed during the spring field investigation. At the outlet into the Alloa Drain, water drains down a steep incised bank to the Alloa Drain, which would be a barrier for fish entering Tributary 7. At the upstream limits of the feature, Tributary 7 was dry with no observable swale feature in actively cropped farm lands. An offline pond is located in proximity to Tributary 7 as shown on the figures, but access was limited to confirm the connection of the pond to Tributary 7. However, the pond appears to be offline given its location 30m east of the Tributary 7 flow path. Based on these field observations, Tributary 7 is characterized as an intermittent feature that functions as indirect fish habitat and would be protected under the *Fisheries Act*.

Tributary #8

This feature flows east into the Fraser Drain and is approximately 150m in length (see Appendix O). The channel appears to be historically straightened for drainage purposes along the edge of a farm field. The feature has no defined banks or substrate sorting and had standing water during the spring field investigation. This feature would provide marginal indirect inputs to the Fraser Drain (*i.e.,* seasonal/storm flow) and would therefore be considered indirect fish habitat and be protected under the *Fisheries Act*.

Tributary #9

Tributary 9 is a poorly defined swale/lowland area that drains from a forested area south of the Alloa Drain (see Appendix O). Large segments of the feature were dry during the spring field investigation with only standing water or moist soils present throughout the forested lands. No banks, substrate sorting, or defined flow path were observed during the spring field investigation. Therefore, the feature is characterized as ephemeral and not fish habitat and would therefore not be protected under the *Fisheries Act*.

Tributaries #10 and #11

These tributaries are located along the southern edge of the Primary Study Area (see Appendix O). Both are headwater features that originate immediately north of Mayfield Road. Tributary 10 originates from a farm field to the west and likely collects tile drainage. Tributary 11 drains a stormwater pond to the north on private lands. Tributary 10 had moist soils during the spring investigation and Tributary 11 was dry. Both features drain south into a farm field where they converge and continue to flow south throughout actively farmed crop fields. These features are expected to provide marginal indirect fish habitat functions (*i.e.,* seasonal/storm flow) and are expected to be dry for a majority of the year. However, they would be protected under the *Fisheries Act* due to their indirect fish habitat functions.

TABLE 28: SUMMARY OF EXISTING FISH HABITAT CONDITIONS IN THE ALLOA PRIMARY STUDY AREA

Feature ID	Fish Habitat*	Feature Permanency**	Thermal Regime[1]	Fish Community
Alloa Drain	Direct	Permanent	Warm	Blacknose Dace, Bluntnose Minnow, Brook Stickleback, Common Shiner, Creek Chub, Fathead Minnow, Largemouth Bass, Northern Pearl Dace, and White Sucker (Beacon, 2023a, b)
Fraser Drain	Direct	Permanent	Warm	Same as Alloa Drain based on connection and proximity
Lyons Drain	Direct/Indirect	Permanent/ intermittent	Warm	Same as Alloa Drain based on connection and proximity
Tributary #1	Direct	Intermittent	Warm	Brook Stickleback based on connectivity with Tributary #2
Tributary #2	Direct	Intermittent	Warm	Brook Stickleback (MNR, 2024a)
Tributary #3	Direct/Indirect	Ephemeral/ intermittent	Warm	Brook Stickleback based on connectivity with Tributary #2. Goldfish and Pumpkinseed in online pond (Azimuth field observations).
Tributary #4	Indirect	Ephemeral	Cool	N/A
Tributary #5	Not fish habitat	Ephemeral	N/A	N/A
Tributary #6	Direct	Permanent	Warm	N/A
Tributary #7	Indirect	Intermittent	Warm	N/A
Tributary #8	Indirect	Intermittent	Warm	N/A
Tributary #9	Not fish habitat	Ephemeral	N/A	N/A
Tributary #10	Indirect	Intermittent	Warm	N/A
Tributary #11	Indirect	Intermittent	Warm	N/A

**Fish Habitat: direct, indirect or not fish habitat.*
***Feature Permanency: permanent, intermittent or ephemeral.*
[1]Based on MNRF online database (MNRF, 2024b).

Benthic Invertebrates

The findings of the September 20, 2023 benthic invertebrate sampling work and analysis is presented in Table 29. Overall, the number of benthic invertebrate individuals collected ranged

from 194-841 for Water Quality Stations #1-4. The data were used to characterize the benthic invertebrate communities and to assess water quality and degree of habitat disturbance at each station. Overall, all four locations are considered to be degraded with respect to their benthic invertebrate communities. The %EPT of the benthic invertebrate communities at each location was low or non-existent, indicating that species sensitive to pollution are generally not present within these watercourses. In addition, the Simpsons Diversity Index was also low at all four locations (less than 1 on a scale of 1-10), indicating minimal community diversity. The HBI was also high, indicating that pollution tolerant species are abundant within the benthic community, which is generally indicative of poor water quality. A summary of the four water quality stations is provided below.

Station WQ1

A low number of specimen (194) were collected from Station WQ1, along with a moderate number of taxa (20), and a low number of sub-families (12). This indicates that habitat degradation and poor water quality are likely in WQ1. Unimpaired creeks (with gravel bottoms) in southern Ontario are expected to have between 15 and 30 taxa per sample (Griffith 1999). Species diversity was poor on the Simpson's Diversity Index which indicates a large amount of habitat degradation. Only 7.22% of specimen were EPT species, which shows poor water quality and high amount of water pollution. A relatively high HBI index (7.36) indicates that species found in WQ1 have high tolerance to organic pollutants, suggesting a higher amount of sediment and pollution tolerant species in WQ1.

Station WQ2

The benthic invertebrate community at this station included a higher number of specimens (841), a moderate number of taxa (22) and a moderate number of families or sub-families (16), indicating habitat degradation and poor water quality. Species diversity was low, indicating a significant amount of habitat degradation. No EPT species were found at this station which reflects the high level of channel sedimentation and slow-moving flows, leading to very poor water quality.

Station WQ3

A relatively low number of specimen (247), an extremely low number of taxa (6) and families/subfamilies (5), indicating very poor water quality and high amounts of habitat degradation. No EPT species were found throughout WQ3, signaling very poor water quality with high amounts of organic pollution. The Simpson's Diversity Index (0.56) indicates very poor diversity of species throughout this section, along with a high HBI index of 8.04, illustrating that the species in WQ3 have a high tolerance for poor water quality and pollutants.

TABLE 29: BENTHIC INVERTEBRATE COMMUNITY BIOTIC INDICES IN THE ALLOA PRIMARY STUDY AREA

	WQ1				WQ2				WQ3				WQ4			
Substation	1	2	3	Total	1	2	3	Total	1	2	3	Total	1	2	3	Total
Total Specimens	25	110	59	194	280	252	309	841	117	34	96	247	97	102	112	311
Total Taxa	7	15	8	20	13	16	10	22	5	3	5	6	9	12	13	19
Family/Sub - Family Richness	5	11	8	12	12	12	9	16	4	3	5	5	9	9	12	15
% EPT	0	3.64	16.95	7.22	0	0	0	0	0	0	0	0	1.03	0	0	0.32
Simpsons Diversity Index	0.46	0.46	0.62	0.51	0.81	0.46	0.52	0.60	0.45	0.61	0.62	0.56	0.51	0.66	0.69	0.62
HBI	7.36	7.39	7.31	7.36	6.4	7.63	7.48	7.17	8.8	7.06	8.25	8.04	7.47	7.22	7.4	7.36

Station WQ4
A high number of specimen (749) and a moderate number of taxa (19) and families/subfamilies (15) were found. EPT presence was low at WQ4 (~1%), signaling very poor water quality with high amounts of organic pollution. The Simpson's Diversity Index (0.62) indicates very poor diversity of species throughout this section, and the HBI index was again high at 7.36, illustrating that the species in WQ4 have a high tolerance for poor water quality and pollutants.

7.9 Terrestrial and Wetland

7.9.1. Field Program: Documentation of Existing Conditions

In addition to field inventories completed by Beacon in 2022 and 2023, Azimuth and CEA undertook the following 2024 field activities for this study. The field inventory program was limited to the Primary Study Area however reconnaissance level roadside surveys were conducted and second source information was used to characterize the Secondary Study Area.

The following field surveys were conducted in 2024 to document existing natural heritage features, functions and species within the Primary Study Area:

- Characterized, photographed, inventoried, and documented dominant and associated species of trees, shrubs, vines, and groundcover in each natural and cultural vegetation community feature, including wetlands, woodlands, shrub thicket, hedgerows, meadows and agricultural lands. The vascular plant inventory had regard for SAR plants, such as Butternut (*Juglans cinerea*) and Black Ash (*Fraxinus nigra*), and included collection of Global Positioning System (GPS) coordinates for each observed SAR plant;

- Refined/verified/mapped boundaries of woodland and wetland features that were identified previously by Beacon (2023a, b);

- Refined/verified/updated the Ecological Land Classification (ELC) codes used previously by Beacon (2023a, b) to characterize ELC vegetation communities in accordance with Lee (2008);

- Completed an assessment in early spring during snow-off and leaf-off conditions to screen for amphibian egg masses in open water wetlands/ponds and conduct detailed mapping of candidate bat snag trees to identify key areas of habitat for bats (plot method) in woodland units;

- Completed three evening calling amphibian surveys (early, mid and late spring) at four additional survey station locations to supplement data collected by Beacon (2023a, b);

- Completed three dawn breeding bird surveys at a total of 41 point count stations with regard for SAR grassland birds;

- Conducted three nocturnal breeding bird surveys at four point count stations with specific regard for possible Eastern Whip-poor-will;

- Common Nighthawk were considered to not be present in the study area, and therefore, the survey effort targeted primarily Eastern Whip-poor-will, although Common Nighthawk was given consideration to the extent possible at the three nocturnal breeding bird survey stations used.

- Completed five basking turtle surveys at one survey station location for possible presence of SAR turtles ;

- Conducted 10 consecutive nights of acoustic monitoring in eight woodland units to document areas of possible habitat use by SAR bats; and,

- Recorded all incidental wildlife observations during field visits, including collecting Global Positioning System (GPS) coordinates for observed locations of terrestrial crayfish chimneys.

Additional field investigations were undertaken or are scheduled for spring/summer 2025 to further characterize environmental features within the Primary Study Area:

- Supplementary review of structures for potential to provide roosting/nesting habitat for Chimney Swift (completed May 25, 2025);

- Conduct bat exit surveys within candidate structures identified as having potential to support bat roosting, including review of 11 structures (Bat1-Bat13; Figure 2B) across two (2) evenings in June-early July 2025; and,

- Inventory and assessment of Black Ash (Endangered) trees in accordance with provincial guidelines, where presence was identified during the 2024 vegetation inventory (summer 2025).

7.9.2. Data Analysis and Reporting

Azimuth and CEA undertook the following data analysis and reporting activities for this study. Unless otherwise indicated, the effort listed below was completed for areas within the Primary Study Area limit:

- Characterized wetlands in accordance with background information and ELC methodology, supported by the Ontario Wetland Evaluation System: Southern Manual 4th Edition (OWES; MNRF, 2022);

- Completed a formal wetland assessment under the OWES Manual for Wetland #7 (Alloa Drain) and submitted wetland boundary adjustments to MNR for Wetland #6 and Wetland #7 based on 2024 field studies;

- Initiated an interim Significant Woodland assessment in regards to woodland units in accordance with Town and Region Official Plans (OPs), and Technical Definitions under the Greenbelt Plan (Ministry of Municipal Affairs, 2017) within the Greenbelt Natural Heritage System (NHS) where applicable;

- Completed an assessment of potential Significant Valleylands in accordance with Town and Region OPs, and Technical Definitions under the Greenbelt Plan (OMNR, 2012) within the Greenbelt Natural Heritage System;
- Initiated an assessment of Significant Wildlife Habitat (SWH) functions based on background information and field data collected to date, in accordance with provincial criteria (MNRF, 2015a);
- Reviewed municipal and provincial mapping resources for presence/absence of Areas of Natural and Scientific Interest (ANSIs);
- Initiated an assessment of SAR (Endangered, Threatened, and Special Concern) listed under Ontario's *Endangered Species Act, 2007* confirmed and/or presumed to occur;
- Conducted a high-level identification and review of wetlands, woodlands, potential for Significant Valleylands, SWH, ANSIs and SAR/SAR habitat in the Secondary Study Area; and,
- Compiled/synthesized existing conditions field and background data for the Primary and Secondary Study Areas (with emphasis on Phase 1 Lands (lands east of Creditview Road) within the Primary Study Area) and prepared an initial assessment of preliminary constraints of the proposed development on the Key Natural Heritage Features (KNHFs) identified.

7.9.3. Vegetation Community Mapping and Surveys

Vegetation communities and plant species (floristics) within the Primary Study Area were identified through direct observation, as well those listed in Beacon (2022, 2023). Vegetation communities included wetlands, woodland, thickets, hedge-rows, and meadows, with crop identification noted and documented in the various agricultural blocks. An overall detailed photographic record was compiled for all properties visited from May to September (see Appendix P).

Field reconnaissance and vegetation community and plant species inventories were conducted starting on May 1, 2024 (beginning of leaf-out) and continued into June. Additional botanical field work was continued into July, August and mid-September 2024, with an emphasis on wetlands, woodlands, meadows and thickets and/or areas where Species at Risk (SAR) flora (e.g., black ash) and any NHIC SRank (S1, S2 and S3) vegetation communities and/or species have been observed.

Section 3.12.7, b) of Future Caledon indicates that:

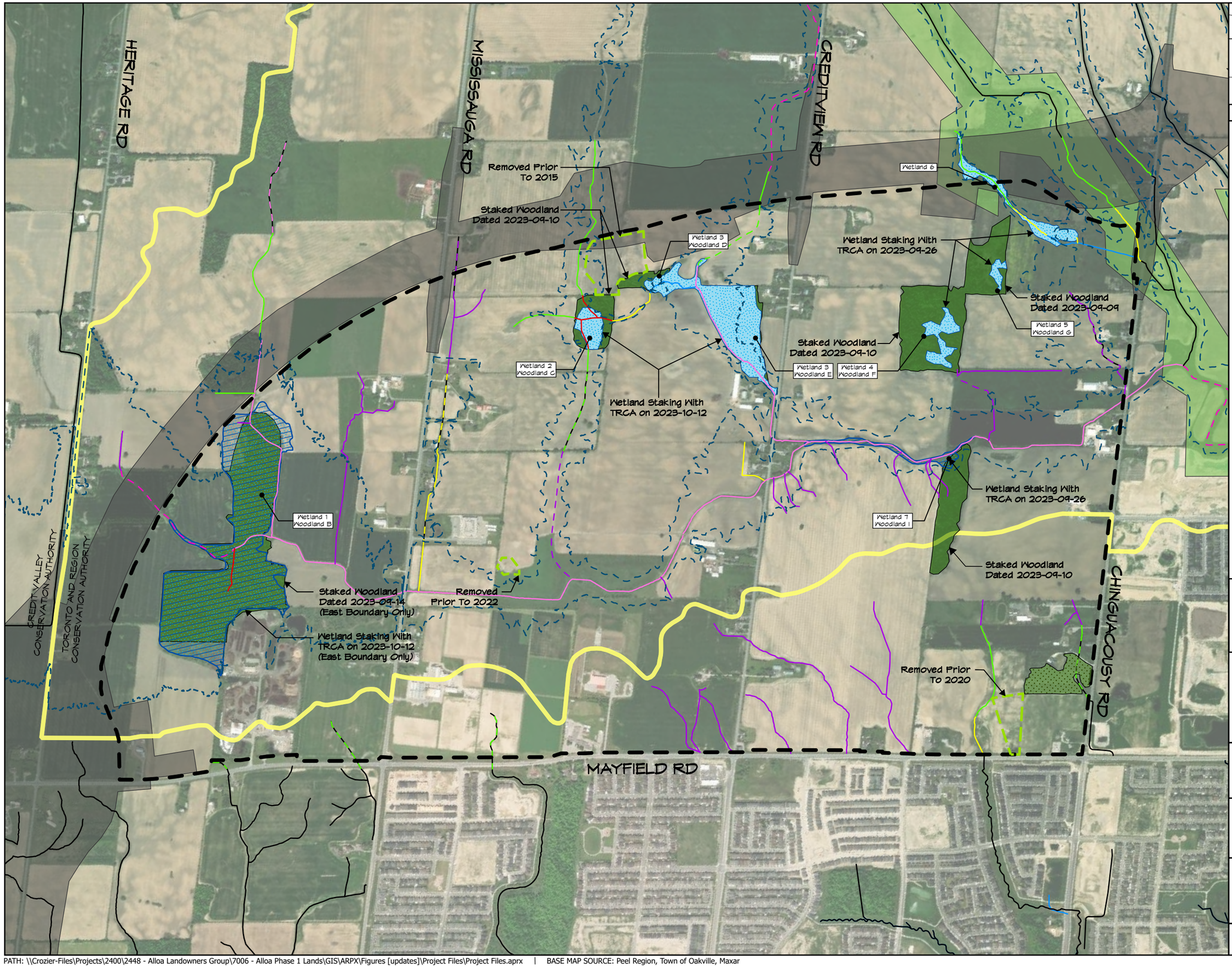
> "*b) Where a Natural Feature and Area, key natural heritage feature, key hydrologic feature, or Supporting Feature and Area has been removed without authorization in advance of making, or prior to approval of, an application for development or site alteration, Town staff will use all available information to determine the limit and classification of the feature that existed, and restoration of the feature will be required through the approval of the application for development or site alteration.*"

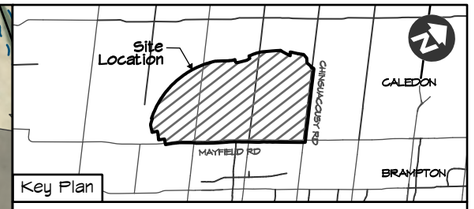
To address this OP consideration, the Consultant Team referred to historical aerial photography to determine woodland areas of the plan that had been removed. A review of the Subwatershed area led to identification of three (3) apparent historical woodland areas that have either been reduced in area or had been removed altogether (see Figure 19). Landowners were consulted to provide information about the woodland area reductions and the woodland patches were all found to have been removed to advance agricultural production. We further investigated the authorization process which permitted the woodland removal and learned that the issue of agriculturally related woodland removal was adjudicated in Provincial Court and the Court ruling supported woodland removal for agricultural purposes (personal communication, Mr. Tom Dolson, June 2024).

As a result of the Town permitting woodland removals for agriculture use (see Appendix Q), none of the three (3) historically removed woodland areas have been considered for restoration. It is worth noting that the enhanced natural heritage system provides the opportunity for a greater than 150% increase in natural cover within the whole of the Alloa Secondary Plan Area.

Other small woodland areas within the Alloa Secondary Plan area were also evaluated using the Future Caledon Official Plan Woodlands definition (Chapter 31, Glossary). One area of approximately 4.0ha of conifer dominated plantation woodland area was identified (see Figure 20) and evaluated using reconnaissance level (over the fence viewing) and aerial photography. Per the approved Alloa Secondary Plan, this woodland should be subject to a detailed assessment however the subject woodland is located on lands owned by a non-participating landowner, so site access is not permitted at this time. The opinion of biologists and arborists who completed the reconnaissance level evaluation of the woodland feature note that the conifer plantation is young and does not demonstrate diverse species composition nor does it provide significant habitat benefits for other plant and animal species. It is considered a low-quality woodland feature. It is proposed that this feature be ultimately removed and that a compensation plan be developed for this particular feature that replicates and further enhances the feature diversity, habitat value, and natural cover increase so that net gain to the natural heritage system is realized. The implementation of a diverse woodland/shrub compensation planting will provide an improvement/net benefit over that which was provided by the removed conifer plantation. The details of the compensation (specifications, diversity, area) shall be confirmed as a part of the EIR for these lands and shall be prepared to the satisfaction of the Town of Caledon (per Section 13.99 of the Future Caledon Official Plan).

The classification of the on-site and abutting vegetation communities and plant species was characterized based on species composition and physiognomic characteristics.





LEGEND

- PRIMARY STUDY AREA
- STAKED & SURVEYED LOCALLY SIGNIFICANT WETLAND (MNRF, 2016) (NON-PARTICIPATING LANDOWNERS, ACCESS ONLY TO EAST EDGE OF FEATURE)
- STAKED & SURVEYED PROVINCIALLY SIGNIFICANT WETLAND (TRCA, OCT./NOV. 2023)
- STAKED & SURVEYED WOODLAND EDGE (TOWN OF CALEDON, NOV. 2023)
- CONSERVATION AUTHORITY JURISDICTION BOUNDARY
- HIGHWAY 413 PRELIMINARY RIGHT-OF-WAY
- GREENBELT OUTER BOUNDARY (LIO, 2024)
- HISTORICALLY REMOVED WOODED AREAS
- CONIFER PLANTATION
- EXISTING FLOODLINE

HEADWATER DRAINAGE FEATURE CLASS

- EXISTING WATERCOURSE
- CONSERVATION
- CONSERVATION - NOT FIELD VERIFIED
- DRAIN
- DRAIN - NOT ASSESSED
- DRAIN - NOT FIELD ASSESSED
- MITIGATION
- MITIGATION (TILE DRAIN)
- MITIGATION - NOT FIELD VERIFIED
- NO MANAGEMENT
- NO MANAGEMENT (TILE DRAIN)
- NO MANAGEMENT - NOT FIELD VERIFIED
- NOT FIELD ASSESSED
- PROTECTION

NOTES:
HIGHWAY 413 RIGHT-OF-WAY LIMIT AS PER 50% PRELIMINARY DESIGN.

0 250 500 m
1:14,000

Project:
Alloa Subwatershed Study
Alloa Landowners Group

Title:
Existing Natural Features/Conditions

CROZIER
70 Huron St Suite 100, Collingwood, ON (705) 446-3510

Date:	Drawn By:	Approved By:	
2025-08-19	M.M.	M.H.	**Figure 19**

PATH: \\Crozier-Files\Projects\2400\2448 - Alloa Landowners Group\7006 - Alloa Phase 1 Lands\GIS\ARPX\Figures [updates]\Project Files\Project Files.aprx | BASE MAP SOURCE: Peel Region, Town of Oakville, Maxar

The nomenclature for the flora observed is consistent with and relied on the following authorities:

- Lycopodiaceae to Aspleniaceae. Cody, W. J., and D. F. Britton. 1989. Fern and Fern Allies of Canada. Publication 1829/E, Agriculture Canada, Research Branch, Ottawa.
- Taxaceae to Orchidaceae – Voss, E. G. 1972. Michigan Flora. Part 1: Gymnosperms and Monocots. Cranbrook Institute of Science and University of Michigan Herbarium. Bulletin 55.
- Saururaceae to Cornaceae – Voss, E. G. 1985. Michigan Flora. Part 2: Dicots. Cranbrook Institute of Science and University of Michigan Herbarium. Bulletin 59.
- Pyrolaceae to Compositae – Voss, E. G. 1996. Michigan Flora. Part 3: Dicots. Cranbrook Institute of Science and University of Michigan Herbarium. Bulletin 61.
- Newmaster, S. G., A. Lehela, P. W. C. Uhlig, S. McMurray, M. J. Oldham, and Ontario Forest Research Institute. 1998. Ontario Plant List. FRI Paper No. 123.
- Bradley, D. J. 2013. Southern Ontario Vascular Plant Species List. 3rd Edition. Science & Information Branch Southern Science and Information Section. Ontario Ministry of Natural Resources, Peterborough, Ontario. SIB SSI SR-03, 78 p.

7.9.4. Wildlife Surveys

Wildlife species within the Primary Study Area were identified from direct observation, auditory signs and/or through interpretation of other signs (tracks, scats, vocalizations, *etc.*) as a matter of course while conducting field surveys.

7.9.5. Dawn Breeding Birds

Three dawn breeding bird surveys were conducted at 40 point count stations on May 24, June 3 and June 14, 2024 guided by point count methodology presented in Appendix D of the OBBA Guide for Participants (2001). One additional point count station (Station #41) was added in the southwest corner of the Primary Study Area in Woodland B for the June 3 and June 14, 2024, surveys, for a total of 41 point count stations. All surveys were conducted no earlier than one half hour before sunrise and were completed prior to 10:00am. Surveys were completed under suitable weather conditions [*i.e.* no precipitation and light winds (Beaufort wind scale ≤3), see Tables 4a-e in Appendix S], with an observation period of 10min carried out at the 40 point count stations shown on Figure 2B in Appendix R. The point count stations conferred representative coverage of vegetation communities in the Primary Study Area. Data from the dawn breeding bird surveys have been included in Appendix S of this report. As part of the initial SAR habitat screening conducted on April 9, 2024, Azimuth completed a preliminary review of anthropogenic structures in the Primary Study Area for evidence of potential suitability for use by Chimney Swift. Structures were assessed visually in regard to their possible use by Chimney Swift based on structural cues (*e.g.* chimney openings of suitable size, chimneys not capped). A supplementary field study completed on May 25, 2025, determined that all initially identified candidate chimneys were capped, and no other suitable structures with potential to support Chimney Swift habitat were located within the Primary Study Area. No Chimney Swift were observed during the breeding bird survey program, or incidentally throughout the remainder of the field program.

7.9.6. Nocturnal Breeding Birds

In consideration of the potential presence of Eastern Whip-poor-will to be associated with open woodland/forest opening areas in the Primary Study Area, two nocturnal breeding bird surveys were conducted during the "early-season" window (May 18-May 23, 2024) and one (1) during the "mid-season" window (June 15-June 21, 2024) at four survey station locations (Figure 2B in Appendix R). The first two early-season nocturnal breeding bird surveys were completed on consecutive evenings, on May 20 and May 21, 2024. In accordance with provincial survey protocols (MNRF, 2014), survey dates were chosen within the optimal survey windows during the week leading up to the full moon (May 23 and June 21, 2024), thereby providing the ideal conditions for the species to be active and detected (if present). Breeding evidence was assessed using MNRF (2014) criteria (males calling on two or more surveys from the same general location conferred "probable breeding"). Given the size of the Primary Study Area, the dispersed nature of potentially suitable habitat for the species and relatively short survey window duration (between 30min after sunset and 90min after sunset), the four survey station locations were selected based on proximity to potentially suitable nesting habitat locations for Eastern Whip-poor-will. Preferred habitat features for Common Nighthawk were considered to not be present in the study area, and therefore, the survey effort targeted primarily Eastern Whip-poor-will, although Common Nighthawk was given consideration to the extent possible at the three nocturnal breeding bird survey stations used.

7.9.7. Amphibian Breeding

In addition to the evening calling amphibian surveys completed by Beacon at 16 survey station locations on June 14 and June 15, 2022, and April 11, April 12, May 29 and May 30, 2023 (Beacon, 2023a, b), Azimuth conducted three evening calling amphibian surveys on April 22, May 21 and June 18, 2024, at four additional survey station locations (Figure 2B in Appendix R) to supplement field data collected by Beacon. The rationale for the additional survey station locations completed by Azimuth in spring 2024 was to provide a more fulsome assessment of evening calling amphibian breeding activity within the Primary Study Area.

Surveys were completed in accordance with the Great Lakes Marsh Monitoring Program (Bird Studies Canada, 2008) during the period between 30min after sunset and midnight, on an evening with winds Beaufort <4. Azimuth's surveys occurred during the early-spring (April 15-30), mid-spring (May 15-31) and late-spring (June 15-30) survey windows on evenings with minimum ambient temperatures of 5°C, 10°C and 17°C, respectively, and no precipitation (see Appendix T. Data from the calling amphibian breeding survey program area included in Appendix T of this report.

7.9.8. Basking Turtles and Other Reptiles

To screen for the possible presence of SAR turtles, five visual encounter (basking) turtle surveys were completed in 2024 on May 3, May 6, May 24, June 3 and June 11 in accordance with the open water wetlands provincial protocol for Blanding's Turtle (MNRF, 2015b). As per the protocol, surveys were completed during the period between spring ice-off and June 15 between 08:00am and 5:00pm during sunny weather with air temperatures at least 10°C, or on partly overcast days with air temperatures above 15°C. Each survey was 20-30min in duration, with surveys spread out over at least three weeks (OMNR, 2015). Potentially suitable basking habitat

for turtles was limited to one open aquatic pond in the northeastern corner of the Primary Study Area (Figure 2B in Appendix R and Table 6 in Appendix U). Data from the turtle basking survey program are presented in Appendix U of this report.

Any observations for other reptiles (*e.g.* snakes) were undertaken as a matter of course during fieldwork.

7.9.9. Bats and Bat Habitat

Bat Exit Survey Screening

During the April 9, 2024 initial screening of possible habitat for SAR, Azimuth screened visually anthropogenic structures (*e.g.* houses, barns, outbuildings) for features that may render the structures potentially suitable for use by SAR bats. Structural features such as exterior gaps that bats could use to access attics, obtain shelter behind siding or access old wooden barns or outbuildings as habitat for maternity or day roosting, were noted during the initial screening effort. Field studies are ongoing to determine whether potentially suitable structures for bats are occupied by bat species for roosting purposes, occurring in June-early July 2025 in accordance with provincial protocols.

Bat Snag Surveys

Several bat species (including Endangered bats Little Brown Myotis, Northern Myotis and Tri-colored Bat) may use large trees [*e.g.* ≥25 centimetres (cm) diameter at breast height (DBH)], although trees smaller than 25cm DBH in early stages of decay may also be used by maternity and/or day roosting bats (MECP, 2022a; MECP, 2022b). Consequently, trees of any DBH size were considered in the assessment of potential bat snags. Trees used for roosting by bats are described as "snag" trees – those having features such as cracks, splits, cavities/holes, hollows, *etc.* that could feasibly provide access for bats.

Azimuth ecologists conducted a bat snag mapping exercise on April 9, April 10, April 15, May 3 and May 6, 2024 during the "leaf-off" period under suitable weather conditions using the plot-based snag density method in accordance with provincial protocols (MECP, 2022b). Based on the provincial protocol (MECP, 2022b) and estimated size of the eight woodland polygons that were surveyed within the Primary Study Area, a total of 35, 12.6m fixed radius (0.05ha) plots were established at random in the woodland communities. The 35 fixed radius plots conferred a representative sampling of the woodland communities surveyed (plot centroids shown on Figure 2B in Appendix R). Bat snag surveys were not completed in Woodland G because the woodland unit had been logged partially. To help offset the absence of bat snag data for Woodland G, the unit was treated as "high density" for candidate bat snags (see below definition) and extra bat acoustic monitoring devices were deployed in this woodland for additional consideration of detection of possible SAR bats using Woodland G.

Suitable snag trees with potential for use by bats to establish maternity and/or day roosts during the active bat season were identified using binoculars (MECP, 2022b). All snag trees in each of the 35 plots were identified, the DBH was measured and snag features were recorded. Consideration of snag features included an evaluation of decay class category, which ranged from Decay Class #1 (least amount of decay, live tree with full canopy) to Decay Class #6 [highest extent of decay (*i.e.* advanced decay of main trunk of tree with no live branches, tree

mostly dead)]. A "high quality" bat snag tree was defined based on its overall characteristics (*e.g.* decay class #1 or #2, combination of snag features typically 3-10m or higher in the tree) and was considered to have the greatest potential for use by bats.

For each plot, snag data were used to calculate the total number of bat snags (*i.e.* high and low quality snags) and the total density of snag trees (# snags/ha). For data presentation purposes, total snag density values were categorized [0-9 snags/ha (low density), ≥10 snags/ha (high density)] to portray the distribution of bat snag habitat in the woodlands surveyed with potential for use by roosting bats (if present). Snag density categories were based on MECP guidance indicating that suitable treed ELC vegetation communities with snag density of ≥10 snags/ha should be considered "high quality potential maternity roost habitat" (MECP, 2022b). The surveys were completed during suitable leaf-off conditions, with good tree feature visibility in the communities. Bat snag mapping was generally completed under dry conditions. Light rain started near the end of the May 3, 2024 bat snag survey; however, the rain did not obscure visual observations of candidate bat snag tree features such that the results of the assessment would be compromised. Global Positioning System coordinates were obtained for each plot centroid (Figure 2B in Appendix R).

Acoustic Monitoring

Acoustic monitoring provides reliable presence/absence data and relative occurrence of bat species for a monitored area. As per the provincial protocol (MECP, 2022b), acoustic monitoring is recommended for suitable ELC polygons that have snag densities that are ≥10 snags/ha, although woodlands not meeting this snag density threshold can also provide suitable habitat for SAR bats. Fourteen acoustic monitors were deployed on May 31, 2024 to commence recording that evening. Figure 2B in Appendix R present the distribution of the monitors in each woodland community. Monitors were deployed in accordance with provincial protocols (MECP, 2022b). The monitors were positioned proximal to areas where candidate bat snag trees were present and/or where the habitat was considered visually to be most suitable to detect echolocating bats, while also considering to the extent possible that bats generally prefer foraging near woodland edges, in woodland gaps and/or proximal to water (*i.e.* the pond). The function of the acoustic monitor deployed proximal to the pond was to detect possible bats using the pond as a foraging area (if present).

Monitors were checked and data downloaded mid-way through the acoustic survey period (June 6, 2024), and at the end of the survey period. The acoustic monitors were left in situ for >10 consecutive nights to ensure data capture during suitable survey conditions (*e.g.* minimum air temperature ≥10°C, no rain). Agency guidelines require that acoustic monitoring for bats be conducted for a minimum of 10 consecutive nights, with at least 10 nights in June (MECP, 2022b; MECP email correspondence). Monitors were programmed to record bat echolocation calls from 30min before sunset to 30min after sunrise.

Acoustic data were collected using Wildlife Acoustics SM3BAT bioacoustic monitors; each monitor was connected to an SMM-U1 ultrasonic microphone. Acoustic data are pending analysis using Kaleidoscope V5.1.9g software designed by Wildlife Acoustics. Identification of SAR bat species will be based on a combination of auto-classification by the software, and subsequent manual analysis of call characteristics for species confirmation. Relative activity levels by species or group will be estimated using Kaleidoscope's auto-classification algorithm,

and based on the number of bat "passes" (*i.e.* a bat flying by a recording monitor while echolocating). Azimuth uses auto-classification threshold criteria set at ≥16 pulses and ≥60% match ratio to identify the best quality calls for analysis and species confirmations. Certain species (*e.g.* Big Brown Bat versus Silver-haired Bat, different *Myotis* sp.) are difficult to differentiate acoustically with respect to bat passes. As a result, these species will be grouped in the analysis of relative activity levels.

7.9.10. Alloa Natural Heritage Features Existing Conditions

Land Use, Topography and Soils

The overall ~2,178ha Primary and Secondary Study Areas are located in the community of Alloa, Ontario north of Brampton, and span approximately 6km x 8km. The Primary Study Area portion is bound by Mayfield Road to the south, Chinguacousy Road to the east, Old School Road to the north and Heritage Road to the west (Figures 1-01 to 1-03 in Appendix R). This area is comprised of mostly agricultural fields [e.g. corn (*Zea mays*), soybean (*Glycine max*)] with interspersed wetlands, remnant woodlands and a watercourse that traverses through the central region of the Primary Study Area (Figure 2B in Appendix R).

Based on background aerial imagery, the pond in the northeastern region of the Primary Study Area has existed since at least 1972 (Beacon, 2023a). Topography is generally flat at ~265m above sea level (mASL), with relief sloping gradually toward 260-255mASL to the east, south and west (VuMap 2.0, Appendix B).

At the landscape scale, lands comprising the Secondary Study Area beyond the Primary Study Area have similar natural heritage features to those within the Primary Study Area - a mosaic of agricultural lands and scattered wetlands and woodlands. Aerial imagery from NHIC in Appendix B shows the general landscape features in the Secondary Study Area. An established residential neighbourhood with commercial land uses occurs south of Mayfield Road, with a new residential subdivision under construction east of Chinguacousy Road. A number of rural residential properties occur throughout the Secondary Study Area. The future provincial Highway 413 is planned along the north and west perimeters of the study area, connecting Highway 400 (south of King Road) with Highway 407 in Mississauga.

Using physiography data from the CVC and Region (CVC, 2022a, b; Region, 2022b, c), soils throughout the Secondary Study Area are generally fine-grained moraine till and knolls. See Section 7.1.4 herein.

Terrestrial Resources

Vegetation

As per Section 7.8.1, all wetlands, woodlands, thickets, hedge-rows, meadows and agricultural blocks were surveyed and Ecological Land Classification (ELC) units were characterized based on the dominant tree, shrub, vine, and groundcover species assemblage, as warranted. Table 30 lists the ELC Code, vegetation type, as well as a summary description of the dominant and typical plant species within each ELC unit delineated within the Primary Study Area.

TABLE 30: LIST OF VEGETATION COMMUNITIES (ELC) DELINEATED AND CHARACTERIZED IN THE PRIMARY STUDY AREA

ELC Code	Vegetation Type	Summary Description
Wetland Communities		
MAMM1-3	Reed-canary Grass Graminoid Mineral Meadow Marsh Type	• dominated by reed canary grass, along with various grasses, sedges, ferns and aquatic forbs • other typical groundcover species include marsh marigold, ostrich fern, eastern tall goldenrod, Canada goldenrod, spotted jewelweed, field horsetail, coltsfoot, Canda thistle, common thimbleweed, narrow-leaved cattail, broad-leaved cattail, path rush, common thimbleweed, purple loosestrife, purple-stemmed aster, Devil's beggarticks, hairy willowherb, Joe-pye weed, common reed, curled dock, fowl manna grass, fringed loosestrife, watercress, common duckweed, and Kentucky blue grass • scattered shrubs include silky dogwood, pussy willow, red-osier dogwood, common elderberry, and heart-leaved willow
MASM1-1	Cattail Mineral Shallow Marsh Type	• dominated by narrow-leaved cattail • other groundcover species include marsh marigold, eastern tall goldenrod, spotted jewelweed, reed canary grass, awl-fruited sedge, retrorse sedge, creeping bentgrass, Canada bluejoint, soft rush, fringed willow-herb, celery-leaved buttercup, and northern blue flag • scattered shrubs include red-osier dogwood, guelder-rose, choke cherry, tartarian honeysuckle, and green ash
SWDM3-3	Swamp Maple Mineral Deciduous Swamp Type	• dominated by green ash and swamp maple, along with some Freeman maple and silver maple • other woody associates include basswood, choke cherry, bitternut hickory, white elm, red-osier dogwood, silky dogwood, blue beech, pussy willow, Bebb's willow, poison ivy, shagbark hickory, common buckthorn, common elderberry, swamp white oak, black ash (whips), two black ash (8 cm DBH), bur oak, shagbark hickory, and common buckthorn • typical groundcover includes bladder sedge, awl-fruited sedge, graceful sedge, troublesome sedge, brome-like sedge, retrorse sedge, common hop sedge, soft rush, reed canary grass, field horsetail, Virginia creeper, riverbank grape, fringed loosestrife, zig-zag goldenrod, barren strawberry, spotted jewelweed, fowl manna grass, enchanter's nightshade, water plantain, blue flag iris, Devil's beggarticks, celery-leaved buttercup, creeping buttercup, deadly nightshade, marsh marigold, Michigan lily, American water-horehound, white trillium, garlic mustard, woodland strawberry, yellow trout-lily, Jack-in-the-pulpit, herb-robert, sensitive fern, ostrich fern, fragile fern, lady-fern, tall goldenrod, coltsfoot, swamp milkweed, Canada goldenrod, necklace sedge, tall meadowrue, Canadian wood nettle, hairy sedge, water parsnip, green bulrush, and running strawberry bush
SWDM4-2	White Elm Mineral Deciduous Swamp Type	• one stand of this treed swamp was found along the north tributary to the Alloa Drain and is dominated by white elm. Other tree and shrub species include dead and dying green ash, along with common buckthorn, red-osier dogwood, silky dogwood, swamp maple, pussy willow, and Freeman maple • typical groundflora includes species also found in SWDM3-3, such as spotted jewelweed, tall goldenrod, fringed loosestrife, fowl manna grass, reed canary grass, awl-fruited sedge, graceful sedge, field horsetail, troublesome sedge, enchanter's nightshade, Jack-in-the-pulpit, Virginia creeper, riverbank grape, hog peanut, poison ivy, panicled aster, ostrich fern, sensitive fern and lady fern

ELC Code	Vegetation Type	Summary Description
Aquatic Communities		
OAO	Open Aquatic	• this feature is an open water pond of deep water with a cladophora (algae) cover, with a littoral band dominated by narrow-leaved cattail and broad-leaved cattail • other open water and littoral species contains minimal aquatic vegetation, namely pondweeds, common duckweed, spotted jewelweed, purple loosestrife and yellow rocket
Woodland Communities		
FODM5	Dry – Fresh Sugar Maple Deciduous Forest Ecosite	• part of a larger intact woodland which was partially clear-cut in April 2021 (SVMM3-3), and is dominated by sugar maple, bur oak and basswood, along with associates such as American beech, ironwood, green ash, red oak, blue beech, white birch, red maple, white ash saplings and white elm • the shrub and vine stratum includes common buckthorn, poison ivy, beaked hazel, wild red raspberry, tartarian honeysuckle, choke cherry, maple-leaved viburnum, pussy willow, riverbank grape, Virginia creeper, and hog-peanut • groundflora includes may-apple, white trillium, downy yellow violet, large-leaved aster, running strawberry bush, barren strawberry, woodland strawberry, garlic mustard, Jack-in-the-pulpit, fringed loosestrife, yellow trout-lily, common blue violet, Virginia spring beauty, common dandelion, and zig-zag goldenrod
FODM5-1	Dry – Fresh Sugar Maple Deciduous Forest	• sugar maple and white ash (saplings) a long with dead/dying white ash dominate this intact woodland feature, along with small scattered conifer components of Norway spruce, white pine, and eastern hemlock • other woody associates include black cherry, red oak, common buckthorn, white elm, choke cherry, pasture gooseberry, red-osier dogwood, poison ivy, common elderberry, Manitoba maple, black cherry, and silky dogwood • typical groundflora includes barren strawberry, common burdock, hairy agrimony, enchanter's nightshade, common strawberry, wild lily-of-the-valley, Virginia waterleaf, red baneberry, Jack-in-the-pulpit, common wood sorrel, garlic mustard, and smaller forget-me-not
FODM5-2	Dry – Fresh Sugar Maple – Beech Deciduous Forest Type	• this tableland woodland is dominated by sugar maple and American beech in the overstorey, with white pine and red pine in the super canopy • other trees in the understorey include white ash (saplings), dead/dying white ash, trembling aspen, white birch, red maple, basswood, black cherry, eastern white cedar, white spruce, white elm, and sour cherry • the shrub and vine stratum includes wild red raspberry, choke cherry, pasture gooseberry, common buckthorn, silky dogwood, red-osier dogwood, Virginia creeper, riverbank grape, and black raspberry • typical woodland wildflowers, ferns, grasses, sedges and forbs include yellow trout-lily, woodland strawberry, graceful sedge, necklace sedge, false melic grass, running strawberry bush, barren strawberry, herb-robert, white trillium, Jack-in-the-pulpit, spring beauty, mayapple, creeping buttercup, deadly nightshade, common blue violet, downy yellow violet, garlic mustard, Virginia waterleaf, enchanter's nightshade, field horsetail, along with tall goldenrod, Canada goldenrod, common burdock, dame's rocket, garlic mustard at the outer edges

ELC Code	Vegetation Type	Summary Description
FODM5-3	Dry – Fresh Sugar Maple – Oak Deciduous Forest Type	• this relatively mature deciduous woodland is dominate by sugar maple, bur oak, and American beech, along with somewhat minor representation by shagbark hickory and basswood in the overstorey • other trees and shrub, and vines include white elm, white ash (saplings), dead/dying white ash, common buckthorn, choke cherry, red-osier dogwood, long-thorned hawthorn, pasture gooseberry, wild red raspberry, silky dogwood, scattered eastern hemlock, eastern white cedar (saplings), Virginia creeper, riverbank grape, green ash, and white birch • the groundflora is similar to FODM5-2 and consists of typical woodland wildflowers, grasses, sedges and ferns such as enchanter's nightshade, woodland strawberry, fringed loosestrife, herb-robert, tall goldenrod, hairy agrimony, Jack-in-the-pulpit, barren strawberry, creeping buttercup, fragrant bedstraw, necklace sedge, long-stalked sedge, running strawberry bush, mayapple, common blue violet, woodland strawberry, white trillium, false Solomon's-seal, coltsfoot, field horsetail, wild lily-of-the-valley, ostrich fern, zig-zag goldenrod, and common wood sorrel
FODM6-1	Fresh – Moist Sugar Maple – Low Ash Deciduous	• this woodland feature is dominated by sugar maple, along with dead/dying white ash, white ash (saplings), and has an inclusion of treed swamp component (SWDM3-3) • other trees include bur oak, scattered green ash, American beech, red maple, ironwood, black cherry, white birch, basswood, dead white pine, and white elm • the shrub and vine stratums contain poison ivy, Virginia creeper, hog-peanut, riverbank grape, choke cherry, common buckthorn, pasture gooseberry, wild red raspberry, and running strawberry bush • typical groundflora includes spotted jewelweed, garlic mustard, wild strawberry, hairy agrimony, Philadelphia fleabane, zig-zag goldenrod, tall goldenrod, common burdock, herb-robert, white trillium, yellow trout-lily, helleborine, spinulose woodfern, Canada thistle, and Virginia waterleaf
FODM7-2	Fresh – Moist Green Ash – Hardwood Lowland Deciduous Forest Type	• north of the north tributary to the Alloa Drain is a small stand of lowland deciduous woodland dominated by dead/dying green ash, dead/dying white ash, along with white elm, common buckthorn, red-osier dogwood, choke cherry, silky dogwood, Virginia creeper, riverbank grape, wild red raspberry, and pussy willow • there are barren shallow troughs with wet to saturate mucky soils devoid of groundcover, with rises vegetated with common strawberry, hairy agrimony, tall goldenrod, Canada goldenrod, creeping buttercup, common blue violet, field horsetail, graceful sedge, common dandelion, mayapple, Jack-in-the-pulpit, common burdock, running strawberry bush, Sprengel's sedge, fragrant bedstraw, and elecampane
FODM7-3	Fresh – Moist Willow Lowland Deciduous Forest Type	• this woodland feature partially surrounds the eastern and southern portions of OAO (on-line pond) • Willows dominate this lowland deciduous woodland, which contains crack willow, white willow, pussy willow, green ash, scattered black walnut, dead/dying white ash, and white ash saplings • Shrubs and vines include choke cherry, common buckthorn, tartarian honeysuckle, guelder-rose, Virginia creeper, riverbank grape and hog-peanut
FODM8-1	Fresh – Moist Poplar Deciduous Forest Type	• a small pocket of this fresh-moist poplar woodland is associated with a partially cut and clear-cut woodland located south of the northern tributary of the Alloa Drain • trembling aspen is dominant, with associates of bur oak, Freeman maple, balsam poplar, basswood and white elm • the groundflora is similar but less diverse than SWDM3-3

ELC Code	Vegetation Type	Summary Description
FODM9	Fresh – Moist Oak – Maple – Hickory Deciduous Forest	• this feature lies within part of the proposed Highway 413 corridor • typical woody vegetation includes bur oak, red maple, sugar maple, shagbark hickory, red maple, bitternut hickory, common buckthorn, choke cherry and white elm • groundflora includes white trillium, common blue violet, Jack-in-the-pulpit, sensitive fern, spotted jewelweed, graceful sedge, troublesome sedge, bladder sedge, fowl manna grass, lady fern and spinulose woodfern
FODM9-3	Fresh – Moist Bur Oak Deciduous Forest Type	• bur oak, white elm, green ash, white ash and basswood are dominant, with most of the mature green ash and white ash dead/dying • other trees, shrubs and vines include red-osier dogwood, silky dogwood, guelder-rose, choke cherry, common buckthorn, tartarian honeysuckle, Morrow's honeysuckle, black walnut, ironwood, sugar maple, red oak, hawthorn, poison ivy, Virginia creeper, riverbank grape, wild red raspberry, with scattered white pine, eastern hemlock and eastern white cedar • groundflora species include mayapple, garlic mustard, tall goldenrod, yellow trout-lily, running strawberry bush, hairy agrimony, white trillium, common blue violet, downy yellow violet, toothwort, herb-robert, barren strawberry, large-leaved aster, eastern woodland sedge, graceful sedge, spinulose woodfern, coltsfoot, zig-zag goldenrod, enchanter's nightshade, deadly nightshade, and troublesome sedge
Cultural Communities		
MEMM3	Dry – Fresh Mixed Meadow Ecosite	• this cultural feature is dominated by grasses, weeds and herbaceous forbs, are in various stages of succession (tree and shrub cover <25%), and are situated along the northern tributary to the Alloa Drain and a few other locations • characteristic groundflora includes reed canary grass, Kentucky blue grass, wild carrot, bull thistle, common mullein, wild mustard, common dandelion, spiny-leaved sow-thistle, Canada goldenrod, hairy agrimony, rough-fruited cinquefoil, sow-thistle, field horsetail, tall goldenrod, wild strawberry, heal-all, yellow rocket, common blue violet, teasel, red clover, white clover, New England aster, creeping buttercup, common buttercup, wormseed mustard, Canada thistle, field pennycress, field peppergrass, and common milkweed • trees and shrubs encroaching from the woodland edges and naturally regenerating in the meadow include red-osiers dogwood, choke cherry, wild red raspberry, common lilac, common buckthorn, cockspur hawthorn, white ash, pussy willow, and trembling aspen
TAGM1	Coniferous Plantation	• a triangular conifer plantation situated adjacent to the northern tributary of the Alloa Drain, and dominated by planted Norway spruce, with subcomponents of white spruce and white pine • other regenerating trees and shrubs include white birch, trembling aspen, white ash, scattered black cherry, choke cherry and dogwood • the groundcover is barren due to the dense spruce plantings, with only sporadic weeds and grasses

ELC Code	Vegetation Type	Summary Description
SVDM3-3	Dry – Fresh Bur Oak Deciduous Savannah Type	• early successional to mid-aged trees dominate (25-50% coverage) this cultural woodland due to cutting in April 2021 • dominant trees include bur oak and American beech, along with sugar maple and ironwood • other woody associates include saplings and sucker of trembling aspen, balsam poplar, green ash, white ash, basswood, Freeman maple, silver maple, choke cherry, red oak, beaked hazel, blue beech, wild red raspberry, black raspberry, and red maple • groundcover includes a mix of woodland wildflowers, weeds and aquatics such as white trillium, zig-zag goldenrod, yellow trout-lily, common blue violet, large-leaved aster, fringed loosestrife, running strawberry bush, common mullein, barren strawberry, common strawberry, coltsfoot, teasel, common burdock, Philadelphia fleabane, and common dandelion
THDM2-6	Buckthorn Deciduous Shrub Thicket	• most of the buckthorn thickets are located at the interface of blocks of agricultural cropland and woodland edges, as well as between woodland • dominant species include common buckthorn, with associates such as choke cherry, red-osier dogwood, dead/dying white ash, hawthorn, pussy willow and tartarian honeysuckle • the groundcover is comprised of species similar to MEMM3
MEMM3/SVDM3-3	Dry – Fresh Mixed Meadow Ecosite/ Dry – Fresh Bur Oak Deciduous Savannah Type	• most of these ELCs are located on Cooperating, Non-Participating Owner properties in the western portion of the SP area, and are comprised of a sparse tree canopy of dead/dying white ash, silver maple, white elm and basswood • the groundcover is comprised of weeds, grasses and herbaceous forbs similar to MEMM3
Other Communities		
FOCM5	Naturalized Coniferous Hedge-row Ecosite	• these hedge-rows are found along the driveways of single-family detached homes, (rural properties) as well as farmstead comprised of single-family detached homes in combination with agricultural buildings (farmsteads) • these hedge-rows are dominated by natural and planted conifers such as planted white spruce, Norway spruce and Colorado blue spruce, with some minor interspersion of black walnut, common privet, tartarian honeysuckle, European birch, white ash, choke cherry, eastern white cedar, and Manitoba maple • groundcover generally consists of manicured grassed lawn, as well as MEMM3
FODM13	Naturalized Mixed Hedge-row Ecosite	• this type of hedgerow is typically found along the property perimeters of agricultural blocks and consist of deciduous trees in combination with deciduous shrubs, and varies from disjunct to contiguous • tree species include bur oak, basswood, white elm, common apple, bitternut hickory, shagbark hickory, and scattered eastern white cedar • typical shrubs include tartarian honeysuckle, common privet, common buckthorn, hawthorn, red-osier dogwood, silky dogwood, and choke cherry, with a groundcover similar to MEMM3

ELC Code	Vegetation Type	Summary Description
FODM11	Naturalized Deciduous Hedge-row Ecosite	• dominant tree species in this type of hedge-row include bur oak, red oak, dead-dying white ash, shagbark hickory, bitternut hickory, basswood, white elm and scattered eastern white cedar • the underlying shrub stratum contains common buckthorn, tartarian honeysuckle, nannyberry, guelder-rose, red-osier dogwood and silky dogwood • the groundcover consists of MEMM3 species
OAGM2	Perennial Cover Crop	• this agricultural use is comprised of blocks of hay field on various parcels in the Alloa SP area • grass species in this feature includes Kentucky bluegrass, awnless brome grass, timothy, reed canary grass, wheat and annual blue grass • weed and herbaceous forbs include ox-eye daisy, Philadelphia fleabane, curled dock, field horsetail, field peppergrass, red clover, white clover, field pennycress, spiny-leaved sow-thistle, common burdock, common mullein, common dandelion, common sow-thistle, Rugel's plantain, common plantain, English plantain, lamb's-quarters, common ragweed, common milkweed, oak-leaved goosefoot, black medic, alfalfa, cow vetch, Canada thistle, bull thistle, common buttercup, yellow cress, dame's rocket, motherwort, catnip, giant ragweed, and wormseed mustard
OAGM1a	AG (wheat)	• there are blocks of agricultural cropland planted with wheat (cf. *Triticum aestivum*)
OAG1Mb	AG (soybean)	• in addition to corn, soybean (cf. *Glycine max*) is one of the two most common agricultural crops planted in the Alloa SP area
OAGM1c	AG (corn)	• in addition to soybean, corn (cf. *Zea mays*) is one of the two most common agricultural crops planted in the Alloa SP area
OAGM1d	AG (fallow)	• some of the blocks of agricultural cropland are fallow, as of June and into mid-September
OAGM4	Open Pasture	• blocks of pastureland comprised of grassland and hay field for horses and cattle
CVR_4	Rural Property	• the lot contains a detached single-family dwelling (bungalow, 2-storey, accessory structures, etc.), without agricultural buildings
IAGM1	Agricultural Buildings	• contains farm buildings, farming equipment, etc., with or without a detached single-family dwelling (bungalow, 2-storey, accessory structures, etc.)

Figure 2B in Appendix R provides an illustrative view of the ELC units within each Participating Owner Parcels (#7, #14, #15, #28, #29, #35, #36, #37, #39, #44, #45, #50, #53, #55, #58, #59, #69, #70, #73, #75, #76, #77, #78) and within the Cooperating, Non-Participating Owner Parcels (#3, #4, #21, #64, #66, #67, #68, #71, and #80).

The seven (7) wetland units (Wetland #1 to Wetland #7) identified on the landscape were staked and surveyed (OLS) in-situ with Beacon, TRCA and Crozier in September and October 2023 (Figure 2B in Appendix R) as shown on Figure 19.

The Vascular Plant Species List in Appendix V provides a list of plant found to-date in each ELC code, within the Primary Study Area, with additional species in the LSS Area garnered from digital sources, where warranted.

Rare and Uncommon Plants

Two NHIC elements of occurrence (EO_ID) exist in the Secondary Study Area for Provincially Endangered or Threatened plant species: Butternut and Black Ash - both Endangered. One record for a provincially rare (S1-S3) plant species occurs in the Secondary Study Area: Hart's Tongue Fern (*Asplenium scolopendrium*; S3) - according to the NHIC database (MNRF, 2024a).

Endangered Black Ash was identified during property investigations in Woodlands E-F. Black Ash is listed as Endangered under Ontario's *Endangered Species Act*, 2007 (ESA). As of January 26, 2024 under O. Reg. 6/24 (MECP, 2024a) and 7/24 (MECP, 2024b), species and habitat protections respectively for "healthy" Black Ash are in effect. For **species protections**, as per O. Reg. 6/24, a healthy Black Ash tree is one that appears to have survived exposure to Emerald Ash Borer, is in a healthy condition, is 1.37m tall or taller and has a trunk diameter at breast height (DBH; at 1.37m height) of 8 centimeter (cm) or greater. Only Black Ash determined to be healthy based on a health assessment by a qualified professional are afforded species protections. In terms of **habitat protections**, O. Reg. 7/24 applies a radial distance of 30m around each individual healthy Black Ash tree as protected habitat for the individual of the species (see below for recommendations of additional work pertaining to Black Ash). On June 5, 2025, the province of Ontario adopted Bill *5, Protect Ontario by Unleashing our Economy Act*, 2025 ("Bill 5") which included revision to the ESA definition of "habitat" to include (in regards to flora), only the critical root zone surrounding the stem. As such, habitat protections for Black Ash include only the critical root zone around each stem and not the 30m radial distance specified in O. Reg. 7/24.

Beacon (2022, 2023) lists on Table 5.8.2 Regional Rare or Uncommon Plant Species known to occur or have been identified in the Primary Study Area. Two (2) provincially rare (S2-S3) plant species as ranked by NHIC were observed by CEA during the May to June field program, reflexed sedge (*Carex retroflexa* S2 Rank) and black ash (Fraxinus nigra, S3 Rank). As above, black ash as of January 25, 2024 is now listed as Endangered (END). Two specimens (8cm or greater) were found in Wetland #3/Woodland E and were GPSd. In addition, numerous black ash "whips" were flagged in Wetland #4/Woodland F.

Wildlife

Mammals

Evidence of 11 mammalian species (direct observation and/or tracks/scat/den) [White-tailed Deer, Eastern Grey Squirrel, Coyote, Groundhog, Raccoon, Porcupine, Striped Skunk, Virginia Opossum, Red Squirrel, Eastern Chipmunk, Eastern Cottontail] was observed during Azimuth's field program. Beacon (2023a, b) also reported observing evidence of Red Fox. Given the greater landscape, it is expected that the following other mammals could conceivably be encountered in the overall study area: small mammal species (various mice, voles, and shrews); Northern Flying Squirrel; Muskrat; American Mink; Beaver and weasel species.

Dawn Breeding Birds

A total of 71 bird species were recorded during the breeding bird survey program and incidentally throughout the remainder of the field program (Appendix S).

Threatened Eastern Meadowlark and Bobolink were detected during the dawn breeding bird surveys primarily within the northeastern region of the Primary Study Area (Tables 4a-e in Appendix S, Figure 2B in Appendix R). In regard to Special Concern species, nine Eastern Wood-pewee were heard during dawn breeding bird surveys (Woodlands A-C, E-F, H-I), plus one individual on adjacent lands north of the study area. One Wood Thrush was detected vocalizing in Woodland E (Appendix S, Figure 2B in Appendix R). No other SAR birds were detected in the area surveyed. Barn Swallows were present throughout the area (Figure 2B in Appendix R)

Background NHIC and OBBA records exist in the study area for Eastern Meadowlark, Bobolink and Bank Swallow (Threatened), as well as for Eastern Wood-pewee and Wood Thrush (Special Concern), consistent with field data. Background OBBA data also indicate records for Special Concern Barn Swallow and Grasshopper Sparrow; Grasshopper Sparrow was not detected in the field. Beacon (2023a, b) also detected Great Horned Owl and American Woodcock in the Primary Study Area.

Nocturnal Breeding Birds

No Eastern Whip-poor-will or Common Nighthawk were detected during nocturnal breeding bird surveys conducted in May-June 2024.

Amphibians and Reptiles (Herpetofauna)

Regarding the evening calling amphibian data collected in 2022 and 2023, a total of four calling amphibian species were detected from the 16 survey stations monitored by Beacon, as summarized in Table 5 in Appendix T.

In terms of the amphibian data collected by Azimuth in 2024, amphibian egg masses (suspected to be Wood Frog based on Wood Frog calling in the area and time of spring observations) were observed in Woodland B on April 15, 2024. During evening calling amphibian survey stations monitored by Azimuth in 2024, five calling amphibian species were identified during the early-. mid-, and late-spring survey periods (Appendix T), plus American Bullfrog which was identified incidentally within the pond at Wetland #7 during summer 2024 wildlife studies.

Incidental observations of calling amphibian activity are also shown in Appendix T, identifying an additional species. Based on background review of ORAA data, the most recent evening calling amphibian records in the four 10km x 10km grid squares 17TNJ83, 17TNJ84, 17TNJ93 and 17TNJ94 that are part of the study area were from 2018-2019.

Records for Jefferson Salamander (as recent as 2011), unisexual Ambystoma Jefferson Salamander (as recent as 2016) and unisexual Ambystoma Small-mouthed/Blue-spotted Salamander (2002) exist in the ORAA, iNaturalist (for Jefferson Salamander) and NHIC in the Primary and Secondary Study Areas (Appendix B). No salamanders (including Jefferson Salamander or Small-mouthed/Blue-spotted Salamander) or newts were observed over the course of the field program. Observed amphibian egg clusters are understood to be Wood Frog (i.e. not Jefferson Salamander/Ambystoma).

Evidence of seeps was observed in the spring in Woodlands E-F and I on April 10, 2024 and May 6, 2024, and one Wood Frog was heard calling from these woodlands as incidental observations but the species was not heard calling from these woodlands (i.e. from evening calling amphibian survey Station #2) during the early-, mid-, and late-spring surveys (Appendix T).

Regarding the results of the basking turtle surveys, the data indicated a total of four observations of Midland Painted Turtles at the pond (Figure 2B, Appendix R and Appendix U). No other turtle species were observed, including no SAR turtles. Data from ORAA indicate records for two other turtle species [Snapping Turtle (2019), Northern Map Turtle (2018)] (Appendix U); however, these SAR turtles were not observed in the field.

One Eastern Gartersnake was observed on May 6, 2024 in Woodland C.

Bats and Bat Habitat

The total amount of woodland habitat surveyed for candidate bat snags was ~44.4ha, with a mean woodland size of 4.9ha/woodland. Bat snag mapping in early-spring during suitable leaf-off conditions identified a total of 167 high and low quality bat snag trees in the 35 plots surveyed throughout the Primary Study Area (Table 31). These snags were identified as having characteristics suitable for potential use by bats (Figure 2B in Appendix R). Overall snag density ranged from 40 snags/ha to 140 snags/ha. High quality bat sags ranged from 0 snags/ha to 40 snags/ha. Bat snag trees identified varied in decay class and the quality of the snag features observed. Of the167 bat snags, 13/167 (7.8%) are considered high quality snag trees with the greatest potential for use by bats as shown in Table 31. These 13 deciduous trees had snag characteristics rendering the trees most suitable for use by maternity and/or day roosting bats due to the size, number and height of snag characteristics observed.

The detailed results of bat acoustic monitoring carried out within woodlands within the Primary Study Area in June 2024 is included in Table 32, and a summary of bat presence documented within each woodland is included in Table 33.

TABLE 31: RESULTS OF PLOT-BASED BAT SNAG MAPPING FOR THE PRIMARY STUDY AREA

Woodland ID (Est. Size in ha)	ELC Polygon	No. of Plots	Bat Snag Plot ID	High and Low Quality Snags		High Quality Snags	
				Overall Total No. of Snags	Overall Snag Density (#/ha)¥	No. of Snags	Density (#/ha)
A[1] (4.3ha)	FOD	-	-	-	-	-	-
B (12ha)	SWDM3-3	11	14-24	69*	125.5	3	5.5
C (3.1ha)	FODM9-3	3	33-35	6	40	0	0
D (1.6ha)	FOMM2-2/SWDM 3-3	2	31-32	4	40	0	0
E (5.2ha)	SWDM3-3	6	25-30	28*	93.3	2	6.7
F (8ha)	FODM5-3/SWDM 3-3	7	1-7	29*	82.9	3	8.6
G[2] (2.6ha)	FODM5/SWDM3-3	-	-	-	-	-	-
H (2.7ha)	FODM5-2	2	12-13	14*	140	4	40
I (4.9ha)	FODM9-3	4	8-11	17*	85	1	5.0

See Figure 2B, Appendix R for overall snag density range distribution in Primary Study Area.

[1]*Woodland adjacent to Primary Study Area not surveyed.*

[2]*Woodland partially logged - not surveyed; extra acoustic monitoring completed.*

**One or more high quality snags in plots sampled.*

TABLE 32: BAT ACOUSTIC MONITORING DETAILED RESULTS

Monitor No.	Woodland	SAR Bat Species	Est. No. of Bat Passes
1	B	Little Brown Myotis Northern Myotis* Eastern Small-footed Myotis*	≥55 (Genus-level)
	B	Big Brown Bat***	≥1105
	B	Silver-haired Bat***	≥11
	B	Hoary Bat	≥1
2	B	Myotis sp.** Little Brown Myotis*	≥10
	B	Eastern Red Bat	≥5
	B	Big Brown Bat***	≥839
	B	Silver-haired Bat***	≥195
	B	Hoary Bat	≥27
3	C	Myotis sp.** Little Brown Myotis*	≥459 (Genus-level)
	C	Big Brown Bat***	≥787
	C	Silver-haired Bat***	≥7
	C	Hoary Bat	≥25
4	D	Little Brown Myotis Northern Myotis*	≥150 (Genus-level)
	D	Eastern Red Bat	≥8
	D	Tri-colored Bat	≥5
	D	Big Brown Bat***	≥1181
	D	Silver-haired Bat***	≥195
	D	Hoary Bat	≥175
5	E	Little Brown Myotis Northern Myotis* Eastern Small-footed Myotis*	≥150 (Genus-level)
	E	Eastern Red Bat	≥23
	E	Big Brown Bat	≥859
	E	Silver-haired Bat	≥106
	E	Hoary Bat	≥120
6	F	Little Brown Myotis Northern Myotis*	≥21 (Genus-level)
	F	Big Brown Bat***	≥360
	F	Eastern Red Bat	≥2

	F	Hoary Bat	≥63
	F	Silver-haired Bat***	≥72
7	G	Eastern Small-footed Myotis* Little Brown Myotis Northern Myotis*	≥48 (Genus-level)
	G	Big Brown Bat***	≥642
	G	Eastern Red Bat	≥7
	G	Hoary Bat	≥59
	G	Silver-haired Bat***	≥91
8	F	Myotis sp.**	≥13 (Genus-level)
	F	Big Brown Bat***	≥160
	F	Hoary Bat	≥7
	F	Silver-haired Bat***	≥13
9	I	Little Brown Myotis	≥4 (Genus-level)
	I	Big Brown Bat***	≥875
	I	Eastern Red Bat	≥13
	I	Hoary Bat	≥93
	I	Silver-haired Bat***	≥176
10	G	Little Brown Myotis	≥15 (Genus-level)
	G	Big Brown Bat***	≥966
	G	Eastern Red Bat	≥3
	G	Hoary Bat	≥1
	G	Silver-haired Bat***	≥60
11	H	Eastern Small-footed Myotis* Northern Myotis*	≥2 (Genus-level)
	H	Big Brown Bat***	≥162
	H	Eastern Red Bat	≥1
	H	Silver-haired Bat***	≥1
12	H	Eastern Small-footed Myotis* Northern Myotis* Little Brown Myotis	≥160 (Genus-level)
	H	Big Brown Bat***	≥2,543
	H	Eastern Red Bat	≥28
	H	Hoary Bat	≥195
	H	Silver-haired Bat***	≥316
13	B	Myotis sp.** Northern Myotis*	≥35 (Genus-level)

	B	Big Brown Bat***	≥275
	B	Silver-haired Bat***	≥2
14	South side of OAO pond	Eastern Small-footed Myotis* Northern Myotis* Little Brown Myotis	≥419 (Genus-level)
	South side of OAO pond	Big Brown Bat***	≥2,065
	South side of OAO pond	Eastern Red Bat	≥44
	South side of OAO pond	Hoary Bat	≥259
	South side of OAO pond	Silver-haired Bat***	≥161
	South side of OAO pond	Tri-colored Bat	≥1

See Figure 2B, Appendix R for acoustic monitor locations.
Each bat "pass" recorded is not necessarily a different individual.
*Detailed manual analysis of calls revealed calls with parameters suitable for the species, and species presence reasonable based on habitat features within Primary Study Area.
**Unable to attain species-level identification due to call structures recorded; majority of calls likely Little Brown Myotis.
*** Detailed manual analysis of calls revealed calls with parameters suitable for the species, although there is considerable overlap in call structure

TABLE 33: EXISTING BAT ACOUSTIC MONITORING SPECIES SUMMARY

Woodland ID (Est. Size in ha)	Little Brown Myotis*	Northern Myotis	Tri-colored Bat	Eastern Small-footed Myotis	Eastern Red Bat	Big Brown Bat	Silver-haired Bat	Hoary Bat
A[1] (4.3ha)**	--	--	--	--	--	--	--	--
B (12ha)	X	X		X	X	X	X	X
C (3.1ha)	X					X	X	X
D (1.6ha)	X	X	X			X	X	X
E (5.2ha)	X	X		X	X	X	X	X
F (8ha)	X	X			X	X	X	X
G[2] (2.6ha)	X	X		X	X	X	X	X
H (2.7ha)	X	X		X	X	X	X	X
I (4.9ha)	X				X	X	X	X
South Side OAO Pond	X	X	X	X	X	X	X	X

* "X" indicates presence of species (≥1 pass) during bat acoustic monitoring program
**Woodland A located almost entirely outside of Primary Study Area and not sampled

An estimated 12 properties within the Primary Study Area were observed during the initial spring 2024 SAR habitat screening to have potential structures that may provide habitat function for roosting by SAR bats (Figure 2B, Appendix R). In spring 2025 it was observed that two (2) of the residences had been demolished at 12540 Chinguacousy Road (initial ID = Bat10) and 12100 Creditview Road (initial ID = Bat12). At the client's request, one (1) additional structure at 12205 Creditview Road (ID = Bat13) was added to the field program, resulting in a total of 11 structures within the Primary Study Area subject ot the bat exit survey program. Field studies are ongoing to determine whether potentially suitable structures for bats are occupied by bat species for roosting purposes,occurring in June-early July 2025 in accordance with provincial protocols.

Wetlands

Primary Study Area

Consistent with NHIC background mapping, seven wetland areas were identified in the field within the Primary Study Area (Wetlands #1-#7; Figure 2B, Appendix R). Each wetland is associated with woodland units (Woodlands B-I). The wetland habitat associated with Woodland I extends westward beyond Woodland I toward Creditview Road as part of a riparian corridor comprising the Alloa Drain. One wetland is proximal to the pond located in the northeast corner of the study area (Figure 2B in Appendix R). This wetland polygon is fringed with scattered mature trees.

According to Beacon (2023a, b), all wetlands within the Primary Study Area were evaluated by the MNRF and determined to be PSWs in April 2014, including components of the Etobicoke Creek Headwater Wetland Complex. However, Wetland #1 has been described by CEA as a NON-PSW (Figure 2B, Appendix R). This wetland is part of the Etobicoke Creek Headwater II Wetland Complex (MNRF2016), and is described as a Locally Significant Wetland, now referred to as a NON-PSW. Following revisions to the Ontario Wetland Evaluation System Southern Manual in 2022 (particularly as it relates to removal of wetland complexing).

The 2024 site investigations undertaken by CEA determined the eastern boundary of the Wetland #6 feature consisted of upland woodland (FODM7-3; Figure 2B in Appendix R) resulting in this portion of the mapped wetland feature (*i.e.* east of the pond) being removed from the Wetland #6 unit. As Wetland #6 is considered PSW by the province, the adjusted wetland boundary was provided to the MNR on November 22, 2024. It should be noted that the OWES Southern Manual enables adjustments to wetland boundaries without formal re-evaluation of the feature for significance.

Wetland #7, located in the central region of the Phase I Lands between Chinguacousy Road and Creditview Road (*i.e.* Alloa Drain), was preliminarily reviewed as potentially scoring non-significant under a formal OWES Evaluation. Upon completion of the OWES Evaluation, Wetland #7 was found to no longer be considered a PSW unit (Azimuth, 2024). A formal OWES Evaluation, associated scorecard and supplementary materials for Wetland #7 is available in Appendix W. A minor adjustment to the wetland boundary has also been applied, where a mapped segment of wetland near the north edge of Woodland I was found to be upland forest (FODM9-3; Figure 2B in Appendix R). As per the OWES 2022 manual, an outer boundary of the wetland and confirmation of status as non-significant was submitted to the MNR on November 22, 2024.

With regard for Wetland #6, the OWES 2022 manual clarifies that wetland evaluations are point in time assessments. The boundary of a wetland can be updated if new information becomes available or if land changes occur. It is understood that northern portions of Wetland #6 beyond the boundary of Primary Study Area may be removed to accommodate the provincial Highway 413, and as such, re-evaluation of Wetland #6 may be prudent at a later date following completion of the full build-out of earthworks associated with construction of Highway 413.

Secondary Study Area

At a high-level and in regard to lands outside the Primary Study Area but within the Secondary Study Area, an estimated 10 additional wetlands/complexes (Wetlands #8-17) are shown in background resources (Figure 2A, Appendix R and Appendix B). The wetland communities vary in size, with some appearing to be <1ha. One of the wetland communities (Wetland #8 - east side of Heritage Road ~1.5km north of Mayfield Road) has been evaluated as a non-PSW (portion of the Etobicoke Creek Headwaters II Wetland Complex). Wetland #9, located west of Mississauga Road and south of Old School Road, is mapped provincially as "Unevaluated". Additionally, two minor wetland nodes (Wetlands/Complexes #16-17) south of Mayfield Road and west of Mississauga Road are mapped as non-PSW, referred to as "202403014 Aurora Midhurst Owen Sound District - Chinguacousy Twp - #1 Wetland and #2 Wetland" on provincial mapping resources.

Remaining wetlands across the landscape within the Secondary Study Area have been evaluated by the MNRF as PSWs based on the Ontario Wetland Evaluation System at the time of the evaluations. Mapped PSW Complexes in the Secondary Study Area are summarized as follows:

- Huttonville Creek and Area Wetland Complex (south of Mayfield Road and west of Mississauga Road);
- Upper Fletchers Creek Wetland Complex (south of Mayfield Road between Creditview Road and Chinguacousy Road; among a residential subdivision); and,
- Etobicoke Creek Headwater Wetland Complex (north of Old School Road, comprising numerous units between Mississauga Road and Chinguacousy Road).

Background mapping shows one unevaluated wetland within the Secondary Study Area (see Appendix B), located adjacent to the northwest boundary of the Secondary Study Area south of Old School Road and east of Heritage Road.

Background mapping from LIO shows up to approximately eight ponds in the Secondary Study Area.

Woodlands

Primary Study Area

Within the Primary Study Area, a total of nine (9) woodlands (Woodland A to Woodland I) were delineated, staked in-situ and surveyed (OLS)with Beacon, TRCA and Crozier in September and October 2023. The locations of each are illustrated on Figure 2B. An additional woodland, a

conifer plantation was also identified within the Primary Study Area on non-participating lands (see Figure 20).

Secondary Study Area

An estimated 10 additional woodland communities (Woodlands J-S) are shown on aerial imagery and background provincial mapping (Figure 2A, Appendix R ; see also NHIC imagery in Appendix B). Most of the woodland communities are relatively small in size; however, one woodland unit in the northern end of the Secondary Study Area (Woodland L - north of Old School Road and east of Mississauga Road) may be at least 10ha in size.

Candidate Significant Valleyland

Primary Study Area

No portion of the Primary Study Area is identified as Significant Valleyland nor assigned a similar designation on municipal or provincial mapping resources. There are no valleyland features located in the study area according to municipal or provincial guidelines outlined in the Town OP, Region OP, NHRM and/or Technical Paper of the Greenbelt Plan. No portion of the Primary Study Area fulfills the well-defined valley morphology and landform prominence required to be considered Candidate Significant Valleyland.

Secondary Study Area

Based on background mapping (*i.e.* VuMap 2.0), portions of the Secondary Study Area may be considered consistent with valleyland morphology. For example, contour mapping in the northern region of the Secondary Study Area [south of Highway 9/King Street and east (and west) of Mississauga Road] may be valleylands. The feature east of Mississauga Road varies in elevation from ~270-285mASL. An area west of Mississauga Road ranges from ~260-285mASL. Both areas are associated with a watercourse.

Candidate Significant Wildlife Habitat

Primary Study Area

An assessment of the potential for SWH in the Primary Study Area was completed using criteria outlined in the Significant Wildlife Habitat Technical Guide (OMNR, 2000) and the accompanying Ecoregion 6E Criteria Schedules (MNRF, 2015a), as documented in Table 8 presented in Appendix X.

Based on the results of the field program, the following Candidate SWH types have been documented and are afforded further consideration for lands within the Primary Study Area:

- Bat Maternity Colonies (Woodlands B, C, D, E, F, H and I)
- Seeps and Springs (Woodlands E-F and I);
- Amphibian Breeding Habitat (Wetlands) and Amphibian Movement Corridors (Wetland #6);
- Terrestrial Crayfish (east of Woodlands B, south of Wetland #6);
- Habitat for Special Concern and Rare Wildlife Species;

- Eastern Wood-pewee (Woodlands A-C, E-F, H-I, and south side of OAO pond); and,
    - Wood Thrush (Woodland E).

Figure 2B in Appendix R illustrates approximate locations for these SWH type observations.

Secondary Study Area

Background data/mapping in Table 1 in Appendix B indicates **potential** for the following possible Candidate SWH types to occur in the Secondary Study Area:

- Bat Maternity Colonies;
- Turtle Wintering Areas;
- Colonially-Nesting Bird Breeding Habitat (Trees/Shrubs);
- Deer Winter Congregation Areas;
- Waterfowl Nesting Area;
- Bald Eagle and Osprey Nesting, Foraging and Perching Habitat;
- Turtle Nesting Areas;
- Seeps and Springs;
- Amphibian Breeding Habitat (Woodland);
- Amphibian Breeding Habitat (Wetlands);
- Marsh Breeding Bird Habitat;
- Terrestrial Crayfish;
- Special Concern and Rare Wildlife Species;
    - Barn Swallow;
    - Eastern Wood-pewee;
    - Golden-winged Warbler;
    - Northern Map Turtle;
    - Snapping Turtle;
    - Wood Thrush; and,
- Amphibian Movement Corridors.

This list of **potential** SWH types is intended as preliminary information. Fieldwork within the Secondary Study Area would be required to investigate further, however there is presently no permitted access to these lands.

Areas of Natural and Scientific Interest

There are no Areas of Natural and Scientific Interest mapped in either the Primary or Secondary Study Areas according to provincial resources (see Appendix B).

7.9.11. Resource Significance

Primary Study Area

At this time and based on field observations, the initial results of Azimuth's field studies indicate the potential for the following preliminary candidate KNHFs in the Primary Study Area:

- Habitat for Threatened or Endangered Species:
  - Black Ash;
  - Eastern Meadowlark;
  - Bobolink;
- SAR Bats (Little Brown Myotis, Northern Myotis, Tri-colored Bat, Eastern Small-footed Bat, Eastern Red Bat, Silver-haired Bat, Hoary Bat);
  - Redside Dace (Tributary #4 - potential contributing habitat);
- Locally Significant Wetlands (non-PSW) (Wetland #1);
- PSWs (Wetlands #2-6);
- Evaluated (Non-Significant) Wetland (Wetland #7)
- Candidate Significant Woodlands (Woodlands A-I) plus a conifer plantation woodland;
- Candidate Significant Wildlife Habitat:
- Bat Maternity Colonies (Woodlands B, C, D, E, F, H, and I)
- Seeps and Springs (Woodlands E-F and I)
- Amphibian Breeding Habitat (Wetlands) and Amphibian Movement Corridors (Wetland #6)
- Terrestrial Crayfish (east of Woodland B, south of Wetland #6)
- Habitat for Special Concern and Rare Wildlife Species
- Eastern Wood-pewee (Woodlands A-C, E-F, H-I, and south side of OAO pond);
- Wood Thrush (Woodland E)
- Fish Habitat:
  - Direct/indirect fish habitat within Alloa Drain, Lyons Drain and Tributaries #1-4; and,
  - Redside Dace potential contributing habitat associated with Tributary #4 (to be confirmed with MECP).

Secondary Study Area

Preliminary consideration based on background information only (Table 1, Appendix B) suggests the **potential** for the following Candidate KNHFs to be possible in the Secondary Study Area:

- Habitat for Threatened or Endangered Species:
  - Bank Swallow;

  - Black Ash;
  - Blue-spotted Salamander/unisexual *Ambystoma*;
  - Butternut;
  - Bobolink;
  - Eastern Meadowlark;
  - Jefferson Salamander/unisexual *Ambystoma*;
  - Endangered bats;
- Unevaluated Wetlands (Wetland #9);
- Locally Significant Wetlands (non-PSW) (Wetlands #8, 16-17);
- PSWs (Wetlands #10-15);
- Candidate Significant Woodlands (Woodlands J-S);
- Candidate Significant Wildlife Habitat:
  - Bat Maternity Colonies;
  - Turtle Wintering Areas;
  - Colonially-Nesting Bird Breeding Habitat (Trees/Shrubs);
  - Deer Winter Congregation Areas;
  - Waterfowl Nesting Area;
  - Bald Eagle and Osprey Nesting, Foraging and Perching Habitat;
  - Turtle Nesting Areas;
  - Seeps and Springs;
  - Amphibian Breeding Habitat (Woodland);
  - Amphibian Breeding Habitat (Wetlands);
  - Marsh Breeding Bird Habitat;
  - Terrestrial Crayfish;
  - Special Concern and Rare Wildlife Species;
    - Barn Swallow;
    - Eastern Wood-pewee;
    - Golden-winged Warbler;
    - Northern Map Turtle;
    - Snapping Turtle;
    - Wood Thrush;
  - Amphibian Movement Corridors; and,

- Fish Habitat

7.9.12. Species At Risk (SAR)

Study Approach

The SAR screening being undertaken for the Primary and Secondary Study Areas includes an ongoing assessment of SAR with potential to occur at the regional scale. The regional list is being modified based on habitat features in the area and species' ranges. Where potentially suitable habitat is present, the assessment also considers SAR occurrence records from OBBA ("highest breeding evidence" for 10x10km grid squares 17TNJ93 and 17TNJ94) (Cadman *et al.*, 2007), ORAA (10x10km grid squares 17TNJ83, 17TNJ84, 17TNJ93 and 17TNJ94) (Ontario Nature, 2024), iNaturalist ("Verifiable" and "Threatened" filters) (iNaturalist, 2024) and NHIC databases. The background records are presented in Appendix B.

With regards to NHIC data, since there is considerable repetition of individual SAR records among each NHIC 1km x 1km gid square encompassing the overall area, the complete list of NHIC SAR records has not been included in Appendix B. Instead, only the NHIC aerial imagery is appended to show the study area scale and general landscape features, such as areas of woodlands, wetlands and agricultural lands. A consolidated summary list of all SAR records from NHIC, separated by Primary and Secondary Study Area, can be found in Table 1 in Appendix B. The assessment of potential SAR/SAR habitat will also include any unique SAR records from the CVC, Region and TRCA natural areas inventory databases once all of those data files have been received and analyzed.

An assessment of SAR habitat requirements, presence and appropriate designations (Endangered, Threatened or Special Concern) is provided in Table 7 within Appendix X, the results of which are summarized in Section 7.8.11 above. The SAR assessment follows the MECP guidance document - Client's Guide to Preliminary Screening for SAR (MECP, 2019) that emphasizes SAR screenings are to be undertaken as a proponent-driven exercise.

Aquatic Species at Risk

Primary Study Area

No aquatic SAR occur in the Primary Study Area based on available online mapping and databases. DFO aquatic SAR mapping does indicate the presence of Redside Dace (Endangered) downstream of the study area, approximately 2.2km south of the Tributary #4 crossing at Mayfield Road (DFO, 2024). Tributary #4 was characterized as indirect fish habitat, which means it may be considered contributing habitat for Redside Dace and protected under the ESA. Further consultation with MECP should be completed to confirm if Tributary #4 would be considered contributing habitat, and if there would be any permitting requirements should alterations to this feature be proposed as part of the development.

Secondary Study Area

Data from NHIC indicate records for one provincially rare fish species in the Secondary Study Area: American Brook Lamprey (S3) (Appendix B). The records pertain generally to:

- South of Highway 9/King Street and east of Mississauga Road (Turquoise System on Figure 4, Appendix O);
- South of Highway 9/King Street and west of Creditview Road (Turquoise System on Figure 4, Appendix O); and,
- South of Highway 9/King Street and east of Heritage Road (Turquoise System on Figure 4, Appendix O).

Information regarding watercourses/drainage features within the Secondary Study Area has been compiled in Table 1 in Appendix B (see also Figure 4, Appendix O) as part of a detailed background review and synthesis. The data collected includes ARA identifiers for the feature segments, the overall thermal regime for each watercourse/drainage feature "system" (colour-coded on Appendix O) and MNRF fish community information (MNRF, 2024b). Background review revealed three distinct systems/networks of watercourses/drainage features that generally flow in a southerly direction (Appendix O).

As it pertains to SAR fish, Redside Dace has been recorded in at least two different watercourse/drainage feature segments in the Secondary Study Area. Fish sampling data gathered by the MNRF indicated that portions of Segment #10 (coldwater thermal regime; pink system on Figure 4, Appendix O) are associated with Redside Dace, within approximately 1.4km (to the south) of the southern Primary Study Area limit (MNRF, 2024b). As noted above, mapping from DFO also showed presence of Redside Dace approximately 2.2km south of where Tributary #4 crosses Mayfield Road (DFO, 2024), also in the southern end of the Secondary Study Area.

Terrestrial Species at Risk

Primary Study Area

The following SAR/SAR habitat have been observed in the field/confirmed in the Primary Study Area:

- **Threatened or Endangered:** Black Ash (Woodlands E-F); Eastern Meadowlark; Bobolink; SAR bats (woodlands, and consideration for possible SAR bats using houses, barns or outbuildings for roosting pending 2025 studies); Redside Dace (Tributary #4 - potential contributing habitat).
- **Special Concern:** Eastern Wood-pewee (Woodlands A-C, E, H-I), Wood Thrush (Woodland E), Barn Swallow (foraging and nesting).

The approximate locations of the observed SAR are presented in Figure 2B, Appendix R. Woodland A, although it is technically located within the Secondary Study Area, has been included above because it is within 120m of the Primary Study Area (*i.e.* adjacent lands). Restricted Species records that occur in the NHIC database within the Secondary Study Area will be investigated as part of a LSS update. Only species designated Threatened or Endangered receive individual and habitat protections under Section 9 and Section 10 of the ESA. Special Concern species are considered in the context of SWH (Habitat for Special Concern and Rare Wildlife Species).

Secondary Study Area

The detailed background review of data records for the Secondary Study Area outside of the Primary Study Area indicated records for wildlife SAR in addition to SAR detected during the field program:

- **Threatened or Endangered:** Bank Swallow; Blue-spotted Salamander/Blue-spotted Salamander unisexual *Ambystoma*; Butternut; Jefferson Salamander/ Jefferson Salamander unisexual *Ambystoma*.
- **Special Concern:** Golden-winged Warbler; Northern Map Turtle and Snapping Turtle.

8.0 Phase 1 Summary and Next Steps (Completion of Protocols)

The Phase 1 characterization assessment summarizes the value, function, and sensitivity of the area resources associated with the respective Subwatersheds by study discipline (i.e. hydrology/ hydraulics, hydrogeology, water quality, stream morphology, aquatic and terrestrial ecology). Background and supplemental field data were assessed to establish the form, function, and potential linkages of the environmental resources. From this work, existing natural features and conditions were confirmed, and objectives were developed relevant to the respective Subwatersheds under study. The characterization assessment in Phase 1 will inform the water regime, Natural Heritage System, linkages and identify development potential for the Alloa Secondary Plan Area. While data collection and evaluation started in 2023 and was completed in 2024 for terrestrial and wetland resources, data collection/monitoring is ongoing related to surface water quantity and quality as well as groundwater measurement. These data will be used to inform subsequent studies through the Tertiary Plan and Draft Plan processes. The 2022- 2024 field inventory data reinforces the conclusions made in this report.

"The characterization assessment in Phase 1 will inform the water regime, Natural Heritage System, linkages, and identify development potential"

Phase 2: Subwatershed Impact Assessment

9.0 Overview of Phase 2: Subwatershed Impact Assessment

While Phase 1 of the LSS provided a characterization of the natural heritage features and resources within both the Primary and Secondary Plan Areas, Phase 2 will assess the potential impacts of the proposed land use change on the area's resources. These impacts will be assessed against a series of criteria that have been established based upon conventional practices, governing legislation, policies, and guidelines. The purpose of Phase 2 is to conduct an analysis of the potential environmental impacts associated with the proposed changes in land use within the Alloa Secondary Plan Area. Phase 2 of the LSS will also provide an evaluation of the proposed land use scenario, that can be fitted to an enhanced Natural Heritage System (NHS) and will also provide proposed impacts mitigation and restoration opportunities all with consideration of climate change related challenges.

10.0 Land Use Planning Process

10.1 Proposed Alloa Secondary Plan

The development of the proposed Alloa Secondary Plan has involved collaboration and consultation among the various supporting technical disciplines for the overall Secondary Planning Process. The proposed Alloa Secondary Plan as shown on Figure 20, defines the proposed land use for all lands within the Primary Study Area which is bounded by Chinguacousy Road to the east, Mayfield Road to the South and is framed along its westerly and northern limits by the proposed Highway 413 alignment (see Figure 20). The lands comprise an area of approximately 725 ha (1,800 acres), including a net developable area of 555 ha (1371 acres) after the limits of the enhanced Natural Heritage System were confirmed through the field studies completed in Phase 1. This significant developable area can accommodate a full range of land uses to sustain a complete community, including a mix of housing and employment opportunities, as well as lands for education, recreation, parks and open space, and cultural and community facilities. The Secondary Plan presented herein represents efforts over the past several years to confirm locations and extent of potential land uses. The recent evolution of the plan has seen a significant increase in the area designated for an enhanced Natural Heritage System (NHS) as data collected from second sources and the site informed area requirements and opportunities for multipurpose greenway corridors. The Alloa Secondary Plan was approved on July 8, 2025 by the Town of Caledon.

The Proposed Alloa Secondary Plan is envisioned as a complete, compact, pedestrian-friendly multi-modal mixed-use community and employment area, with an emphasis on street-oriented built form in key locations. The Secondary Plan is designed to provide an inter-connected transportation network that includes road, pedestrian, cycling, and transit infrastructure. It is planned to accommodate a population of approximately 33,600 people within 11,200 residential dwelling units, 1,500 population-related jobs, and 2,740 employment related jobs.

In summary, the Secondary Plan generally consists of an enhanced Natural Heritage System, community area and employment area, in conformity with and meeting the intent of the Community Area and Employment Area designations in the higher-tier Region of Peel and Town

TOWN OF CALEDON

OFFICIAL PLAN

Schedule H36

Alloa
Community Structure & Land Use

HERITAGE RD
MISSISSAUGA RD
CREDITVIEW RD
CHINGUACOUSY RD
MAYFIELD RD
SP1
SP2

Legend

- Secondary Plan Boundary
- Phase 1 Boundary
- Phase 2 Boundary
- Neighbourhood Park
- Community Park
- Community Centre
- Elementary School
- Secondary School
- Alloa Water Pumping Station
- Stormwater Pond
- Heritage Resource
- Site Specific Exemption
- Natural Features and Areas
- Neighbourhood Area
- Major Commerial / Mixed-Use Area
- Prestige Employment Area
- General Employment Area
- Neighbourhood Centre Area
- Urban Corridor Area
- Conceptual Collector Road
- Active Transportation - Trail System
- Brampton Airport Outer Surface Limit
- Special Policy Areas

Highway 413 Map Elements

- Planned Highway 413 and NWGTA Transmission Corridor Protection Area
- Highway 413 Focused Analysis Area
- Highway 413 Road Right-of Way

0 500 1,000 1,500 2,000 m

June 2025

Date of print: 6/26/2025
Sources: Town of Caledon, Regional Municipality of Peel
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This map forms part of the Future Caledon Official Plan of the Town of Caledon and must be read in conjunction with the text, other schedules and secondary plans. The boundaries/alignments of designations on this schedule are approximate and are not intended to be scaled.

of Caledon Official Plans. The community area of the Secondary Plan will generally consist of "Neighbourhood Area" and "Major Commercial/Mixed Use Area" land use designations. The employment area will generally consist of "General Employment Area" and "Prestige Employment Area" land use designations. The Secondary Plan otherwise identifies a "Natural Environment System Area" designation and additional community infrastructure or amenities. The community area has an estimated density of 78 residents and jobs per hectare. The employment area will have a minimum estimated density of 26 jobs per hectare.

The Neighbourhood Area designation constitutes a significant area of the Secondary Plan and is intended for a wide range of community land uses. This designation is generally proposed to permit residential uses, long term care homes, public service facilities, and neighbourhood scale retail. The proposed residential uses will permit a wide variety of housing options, including single detached, semi-detached, townhouse, stacked townhouse, apartment, and mixed-use built forms. Please refer to the Planning Justification Report prepared for the Alloa Secondary Plan by Glen Schnarr & Associates Inc. (August 2025), for further detail about all proposed land uses.

The Urban Corridor designation is located along the Mayfield Road corridor, the extension of Tim Manley Avenue, and the north extension of Chinguacousy Road (north of Tim Manley Avenue). This designation is intended to facilitate mixed-use, mid-rise development that supports quality urban living environments connected to transit services and cycling infrastructure. The Urban Corridor is characterized by primarily high density forms of development, including residential, community facilities, retail and commercial uses. Ground-related development may also be permitted at the rear of the Urban Corridor designation.

Two Neighbourhood Centre designations are identified on the Secondary Plan, including the northeast adjacent to the Chinguacousy/Highway 413 interchage (Alloa North) and the west intersection of Mississauga Road/Tim Manley Avenue. The Neighbourhood Centre designation is planned to facilitate mixed use and high density development, and high connectivity to transit. Special Policy 1 area of the Secondary Plan is located within the Alloa North Neighbourhood Centre designation.

The Major Commercial/Mixed Use Area designation is generally located along the Mayfield Road corridor and will serve as the preferred location for major commercial and mixed-use sites. A portion of this designation is also proposed at the intersection of Mississauga Road and the future Tim Manley Avenue extension. This designation is generally proposed to permit retail, service, office, cultural, institutional, hospitality, entertainment, recreational, and medium to high density residential uses. This designation has potential for the Secondary Plan's highest densities.

The General Employment Area designation is proposed in the location of the existing Region of Peel Alloa Reservoir and Pumping Station and the Alloa Holding School. We anticipate the Alloa Holding School to be acquired by the Town of Caledon and converted into an operations centre and public works yard. This designation is primarily intended to recognize these existing and planned uses.

The Prestige Employment Area designation is proposed for the remaining employment area lands and will generally permit manufacturing, offices, hotels, convention centres, trade schools, and ancillary uses.

"The enhanced Natural Heritage System has been designed to accommodate regional storm conditions while also providing and celebrating the extensive greenway corridors that are to be central to the proposed Land Use Plan"

The Natural Environment System Area designation is intended to identify the functional and connected natural heritage system, as discussed within this document, and generally prohibits development beyond essential infrastructure, fish and wildlife conservation, passive recreation, and stormwater infrastructure. The Secondary Plan is planned to protect, restore, and enhance natural features and areas, including water resource systems. Regarding stormwater, ten conceptual locations for stormwater management ponds are identified in the Secondary Plan.

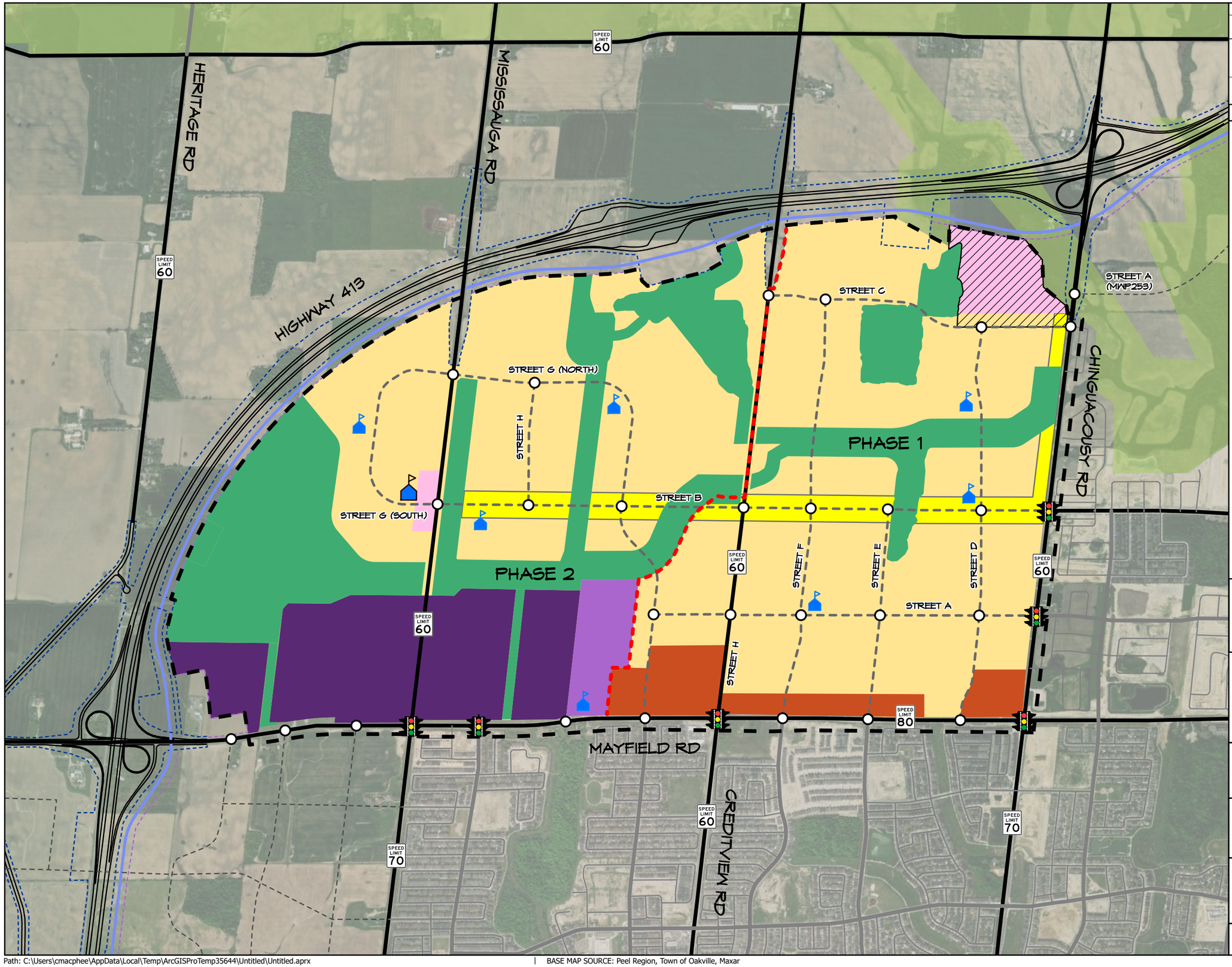
Additional community amenities within the Secondary Plan/Primary Study Area include schools and parks, which are shown symbolically on the Land Use Plan. A total of eight schools are proposed, including the existing Alloa Public School east of Mississauga Road and the Alloa Holding School on Mayfield Road. A total of six neighbourhood parks, two community parks, and one community recreation centre are proposed. The parks are intended to connect to and enhance the Natural Environment System Area designation wherever possible without impact, including potential community trail access.

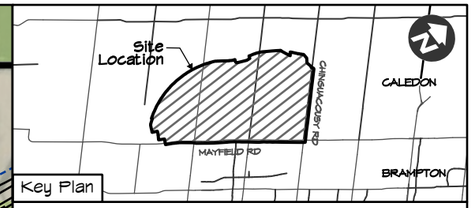
The Secondary Plan is proposed to be implemented in two Phases. Phase 1 of the Secondary Plan is generally west of Chinguacousy Road and is positioned to develop earlier in the planning approvals process, given the availability of adjacent infrastructure from built up areas (see Section 10.3 below). Phase 2 of the Secondary Plan is proposed to proceed once sufficient infrastructure is available.

10.2 Transportation Network

The transportation network proposed to support the Alloa Secondary Plan is a hybrid system that recognizes the role of the automobile, while supporting a foundation for the establishment of transit service with strong active transportation connections within and beyond the community. As the Primary Study Area abuts multijurisdictional infrastructure including the future Highway 413 (MTO), Regional roads of Mayfield Road and Mississauga Road and Town roads of Chinguacousy Road and Creditview Road, the proposed network takes advantage of planned capital improvements to help maximize the use of existing/planned infrastructure.

The internal collector road network supports a grid structure that facilitates connectivity to the neighbouring communities of Mayfield West, east of the Primary Study Area; Mount Pleasant to the south, and the future Heritage Heights Secondary Plan Area to the southwest. Recognizing constraints of the Natural Heritage System, two east-west and two-north south collector road crossings are proposed within the Phase 1 lands, while one north-south and three east-west crossings are proposed within the Phase 2 lands (see Figure 21). The network was designed to minimize the occurrence of crossings throughout the Plan Area while also respecting transportation guidelines and requirements as well as public safety. When crossings were required, they were conceptually located in areas that minimized impacts while considering the





LEGEND

- ALLOA SECONDARY PLAN BOUNDARY
- PHASE BOUNDARY
- ONTARIO GREENBELT

STUDY INTERSECTION

- PROPOSED INTERSECTION
- SIGNALIZED INTERSECTION

TRANSPORTATION NETWORK

- ARTERIAL
- COLLECTOR
- LOCAL
- PROPOSED ROAD
- PLANNED ROAD
- PRELIMINARY HIGHWAY (RIGHT-OF-WAY)
- PRELIMINARY HIGHWAY (EDGE OF PAVEMENT)
- PRELIMINARY TRANSITWAY
- PRELIMINARY TRANSITWAY (RIGHT-OF-WAY)

SECONDARY PLAN LANDUSE

- SECONDARY PLAN DEVELOPMENT AREA
- COMMERCIAL
- PRESTIGE EMPLOYMENT
- GENERAL EMPLOYMENT
- URBAN CORRIDOR AREA
- NATURAL ENVIRONMENT SYSTEM AREA
- NEIGHBOURHOOD CENTRE
- SPECIAL POLICY AREA

NOTES:

1. Road Classification per Town of Caledon Multi-modal Transportation Master Plan and the City of Brampton OP Schedule B City Road Hierarchy
2. Transit Network as per Future Caledon Official Plan 2024
3. Highway 413 area and alignment as per 50% Preliminary Highway Design (Highway 413 Interactive Map, 2024)
4. Intersection controls are only shown within study scope

0 290 580m

1:16,000

Project:

Alloa Subwatershed Study

Alloa Landowners Group

Title:

Proposed Transportation Network

CROZIER

70 Huron St Suite 100, Collingwood, ON (705) 446-3510

Date:	Drawn By:	Approved By:	Figure 22
2025-08-19	D.M.	M.H.	

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mobility and connectivity requirements. The proposed network also supports a connected active transportation system comprised of on-road multi-use paths and off trail routes that connect residents to key land uses such as parks, schools, and commercial uses in addition to the boundary road network.

The grid system proposed will also support the establishment of a future transit network that will leverage existing and planned Brampton Transit service, and a proposed bus stop network where over 95% of all residents are located within 400m from future transit stops. These transit routes will also allow direct connections to the Mayfield West transit hub, Mount Pleasant GO Station, and or the Highway 413/Mayfield Road Transit Station without the need to drive, contributing to increased sustainable modal share.

10.3 Development of External Lands

The lands to the east of the Alloa Secondary Plan Area are identified as the Mayfield West Phase 2 Secondary Plan Area. The Mayfield West Phase 2 lands are proposed as a planned complete community with mixed-use residential, commercial, and institutional uses. At present, the lands north and west of the proposed Highway 413 have not been identified as lands for future growth, either in the Town of Caledon's current Official Plan or for inclusion in the New Urban Area 2051 in Future Caledon. Lands south of Mayfield Road fall within the Northwest Brampton Mount Pleasant Community, a mixed-use community with similar land uses as the proposed Alloa Secondary Plan Area. To integrate the natural heritage resources within the Alloa Secondary Plan Area to those on external lands, it is proposed that terrestrial linkages be created to be contiguous to existing terrestrial corridors on external lands where feasible.

10.4 Terrestrial/Natural Heritage System

10.4.1. Existing Natural Heritage System

Existing conditions were comprehensively inventoried using all available second sources, then field investigated by a team of qualified biologists, scientists, engineers, and hydrogeologists. Field investigations included inventories of all woodlands, wetlands, other vegetation, wildlife, and water regimes. All findings, 2022-present were recorded and presented in Section 7 herein. The monitoring protocol for groundwater will continue and additional data will be included in an updated version of this report or future Environmental Impact Report (EIR). The additional data is anticipated to only reinforce the conclusions of this report.

Section 3.12.7, b) of Future Caledon indicates that:

"*b) Where a Natural Feature and Area, key natural heritage feature, key hydrologic feature, or Supporting Feature and Area has been removed without authorization in advance of making, or prior to approval of, an application for development or site alteration, Town staff will use all available information to determine the limit and classification of the feature that existed, and restoration of the feature will be required through the approval of the application for development or site alteration*."

To address this OP consideration, the Consultant Team referred to historical aerial photography to determine woodland areas of the plan that had been removed. A review of the

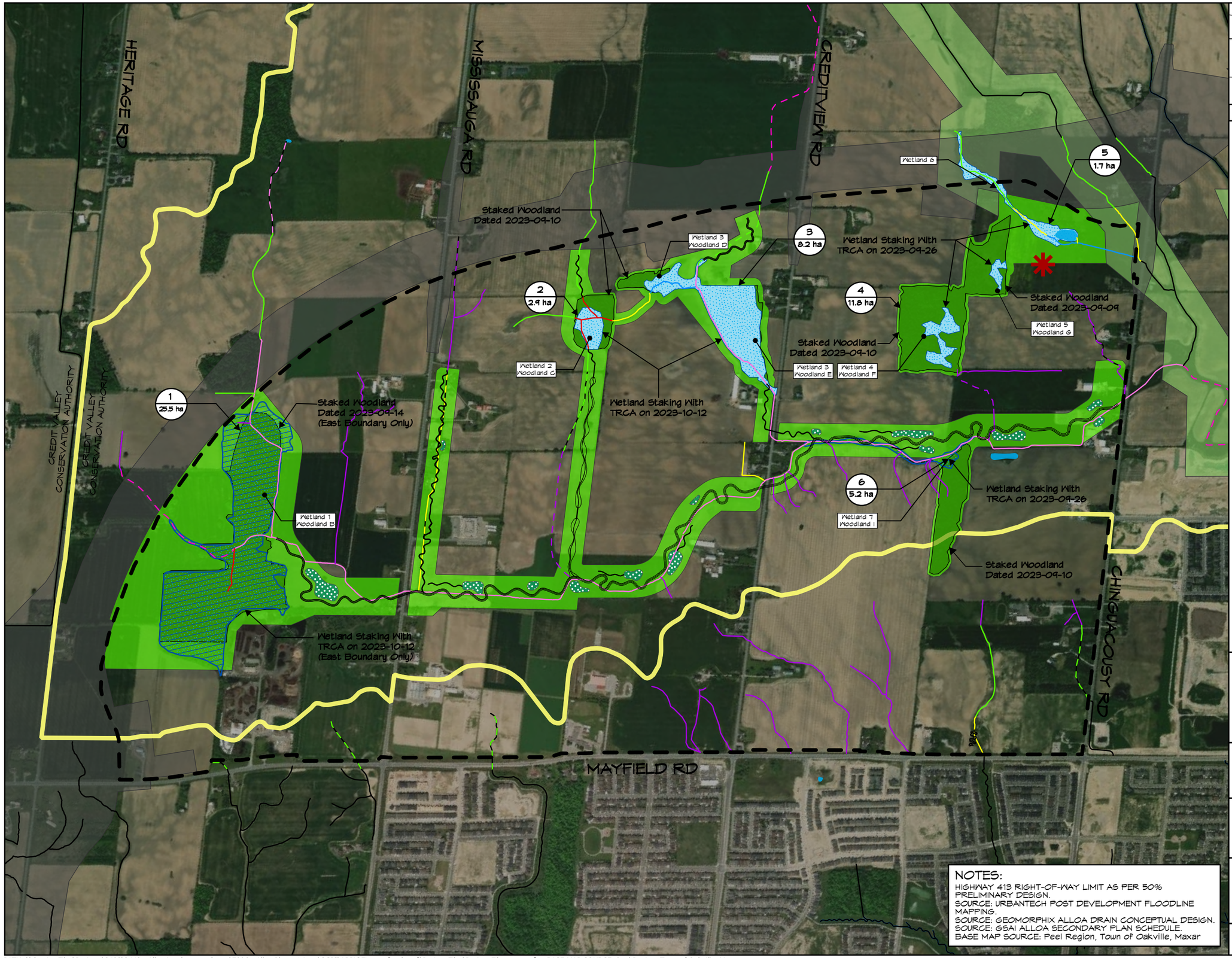
Subwatershed area led to identification of three (3) apparent woodland areas that have either been reduced in area or removed altogether. Landowners were consulted to provide information about the woodland area reductions or removals and the woodland patches were all found to have been removed to advance agricultural production. The Consultant Team further investigated the authorization process which permitted the woodland removal and learned that the issue of agriculturally related woodland removals was adjudicated in Provincial Court and the Court ruling supported woodland removal for agricultural purposes (personal communication, Mr. Tom Dolson, June 2024 and Appendix Q).

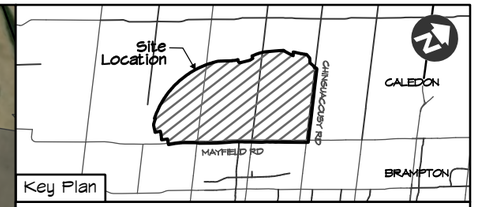
As a result of the Town permitting woodland removals for agriculture use (see Appendix Q), none of the three (3) historically removed woodland areas have been considered for restoration. The enhanced Natural Heritage System provides the opportunity for a greater than 150% increase in natural cover within the whole of the Alloa Secondary Plan Area/Primary Study Area.

Other small woodland areas within the Alloa Secondary Plan area were also evaluated using the Future Caledon Official Plan Woodlands definition (Chapter 31, Glossary). One area of approximately 4.0ha of conifer dominated plantation woodland area was identified (see Figure 19) and evaluated using reconnaissance level (over the fence viewing) and aerial photography. Per the approved Alloa Secondary Plan, this woodland should be subject to a detailed assessment however the subject woodland is located on lands owned by a non-participating landowner, so site access is not permitted at this time. The opinion of biologists and arborists who completed the reconnaissance level evaluation of the woodland feature note that the conifer plantation is young and does not demonstrate diverse species composition nor does it provide significant habitat benefits for other plant and animal species. It is considered a low-quality woodland feature. It is proposed that this feature be ultimately removed and that a compensation plan be developed for this particular feature that replicates and further enhances the feature diversity, habitat value, and natural cover increase so that net gain to the natural heritage system is realized. The implementation of a diverse woodland/shrub compensation planting will provide an improvement/net benefit over that which was provided by the removed conifer plantation. The details of the compensation (specifications, diversity, area) shall be confirmed as a part of the EIR for these lands and shall be prepared to the satisfaction of the Town of Caledon (per Section 13.99 of the Future Caledon Official Plan).

10.4.2. Enhanced Natural Heritage System

The Alloa Secondary Plan was prepared after careful consideration of the existing natural heritage features (see Figure 19) and reconfiguration of existing floodplain to create greenway corridors that provide both confined flood storage and opportunities for increased natural cover including wetland areas, creation of new watercourse channels using natural channel principles, routes for active transportation, and LID infrastructure (see Figure 22). The enhanced Natural Heritage System has been designed to accommodate regional storm conditions while also providing and celebrating the extensive greenway corridors that are central to the proposed Land Use Plan.





LEGEND

- PRIMARY STUDY AREA
- CHANNEL CENTRELINE/SWALE (GEOMORPHIX)
- CONSTRUCTED WETLAND (GEOMORHIX) (3.5 HA)
- EXISTING POND
- STAKED & SURVEYED LOCALLY SIGNIFICANT WETLAND (MNRF, 2016) (NON-PARTICIPATING LANDOWNERS, ACCESS ONLY TO EAST EDGE OF FEATURE)
- STAKED & SURVEYED PROVINCIALY SIGNIFICANT WETLAND (TRCA, OCT./NOV. 2023)
- STAKED & SURVEYED WOODLAND EDGE (TOWN OF CALEDON, NOV. 2023)
- CONSERVATION AUTHORITY JURISDICTION BOUNDARY
- HIGHWAY 413 PRELIMINARY RIGHT-OF-WAY
- GREENBELT OUTER BOUNDARY (LIO, 2024)
- ADDITIONAL POST-DEVELOPMENT NATURAL HERITAGE SYSTEM (117 HA)

HEADWATER DRAINAGE FEATURE CLASS

- EXISTING WATERCOURSE
- CONSERVATION
- CONSERVATION - NOT FIELD VERIFIED
- DRAIN
- DRAIN - NOT ASSESSED
- DRAIN - NOT FIELD ASSESSED
- MITIGATION
- MITIGATION (TILE DRAIN)
- MITIGATION - NOT FIELD VERIFIED
- NO MANAGEMENT
- NO MANAGEMENT (TILE DRAIN)
- NO MANAGEMENT - NOT FIELD VERIFIED
- NOT FIELD ASSESSED
- PROTECTION
- SPECIAL STUDY AREA
- 1 / 11.1 ha — WETLAND/WOODLAND AREA ID / AREA IN HECTARES

SUMMARY OF BUFFERS INCLUDED IN NHS:

- 10m TO ALL WOODLANDS
- 30m TO ALL PSWs
- 10m TO ALL WATERCOURSES (MEANDER BELT)

0 250 500 m

1:14,000

NOTES:

HIGHWAY 413 RIGHT-OF-WAY LIMIT AS PER 50% PRELIMINARY DESIGN.
SOURCE: URBANTECH POST DEVELOPMENT FLOODLINE MAPPING.
SOURCE: GEOMORPHIX ALLOA DRAIN CONCEPTUAL DESIGN.
SOURCE: GSAI ALLOA SECONDARY PLAN SCHEDULE.
BASE MAP SOURCE: Peel Region, Town of Oakville, Maxar

Project:
Alloa Subwatershed Study
Alloa Landowners Group

Title:
Enhanced Natural Heritage System

CROZIER
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Date:	Drawn By:	Approved By:	
2025-08-19	M.M.	M.H.	Figure 22

PATH: \\Crozier-Files\Projects\2400\2448 - Alloa Landowners Group\7006 - Alloa Phase 1 Lands\GIS\ARPX\Figures [updates]\Project Files\Project Files.aprx | BASE MAP SOURCE: Peel Region, Town of Oakville, Maxar

Buffers

Ecological buffers are considered a part of the enhanced natural heritage system within the Alloa Secondary Plan Area. Buffer means an area of land located adjacent to natural heritage features and areas, woodlands, wetlands, and watercourses usually bordering lands that are subject to development or site alteration. The purpose of a buffer is to protect the features and their ecological functions by mitigating impacts from the proposed development or site alterations.

Within the Alloa Secondary Plan area, preliminary minimum buffers have been applied to all identified and field verified natural heritage features using 10m outside of dripline along woodland edges and 30m outside of all mapped wetland boundaries, and 10m outside of the flood hazard area. It should be noted that 10m, 30m, and 10m buffers were considered reasonable starting points given that no buffers presently exist for most natural heritage features because agricultural tilling and cropping is presently conducted right up to the feature boundary. Most buffers will have to be created and naturalized. Final buffer widths will be determined through further detailed scientific analysis and completion of an Environmental Impact Report (EIR) that may identify the need for increase or decrease to buffers specific to varied site specifications and settings.

In the Alloa Secondary Plan, all buffers and planned greenway corridors require naturalization typically considering the TRCA – Post Construction Restoration Guidelines. Site specific final buffer scenarios will need to be developed to the satisfaction of the Town of Caledon for unique situations where community trails and/or LID infrastructure is proposed within minimum buffer zones per the Future Caledon Official Plan 13.9.6. As part of preparing the required EIR in support of future draft plans of subdivision submissions robust rationale shall be provided to explain recommended buffer widths and restoration treatments.

Restoration Initiatives

Restoration Initiatives in the context of the Alloa Secondary Plan include all efforts within the Primary Study Area to restore/increase natural cover, offset and compensate for features that are being removed, impacted, or relocated and to provide enhancements to existing features that add diversity or resiliency in the face of climate change extremes.

The Specifications for ecological restoration need to be area specific within the Primary Study Area/Alloa Secondary Plan and shall generally follow the TRCA Post-Construction Restoration Guidelines (July 2004). Pre-consultation with the Town of Caledon and Conservation Authority (within Regulated Areas) shall be required to confirm the objective for each area to be naturalized. The goal of the comprehensive subwatershed level restoration effort is to provide a vibrant, diverse, and sustainable enhanced natural heritage system that responds well to the range of anticipated climate extremes, provides wildlife habitat and interpretive and active transportation environments for the future Alloa Community residents.

It should be noted that the significant restoration initiatives of the Alloa Secondary Plan will include the creation of approximately 6,800m of new natural channel, a 200% increase in natural cover, and 3.5ha of constructed wetland to address offsets for removed wetland and to provide net increase in overall wetland area.

Road Crossings (Through NHS)

The Alloa Secondary Plan identified 9 at grade collector road crossings of the NHS, additional at-grade and sub-surface corridors will also be required to provide sub-surface road crossings to address fluvial considerations including watercourse form and functions with the aquatic corridors and accommodate conveyance and storage of regional storm flows, where appropriate, and wildlife passage as appropriate. Road crossing designs will not need to provide for the sub-surface passage of large mammals. Design considerations for movement of large mammals across roads at grade will be road signage, road speed, warning lights, rumble strips and fencing, each as appropriate.

Terrestrial / aquatic wildlife passage beneath the terrestrial corridor crossings is not anticipated nor required. The crossings will be at-grade however in order to mitigate impacts to wildlife is required and noted below.

The aquatic corridor channel crossings are considered typical watercourse crossings, and the crossings will need to be designed according to the following design principles:

- Road crossings will have flood-free access during the Regional Storm.
- Although the road crossings will not experience substantial flows due to the relatively small contributing drainage areas (as the crossings are located within the headwaters of the respective watersheds), the road crossings will be designed with fluvial considerations, including watercourse form and function. A stable low flow channel will be provided to allow drainage as well as stability under critical flow conditions; the specific design components of these crossings will need to be provided.
- Closed-bottom box culverts will be utilized for the crossings of the aquatic corridor channels. The culverts will be countersunk to allow for a natural substrate through the culverts. Open-span crossings should also be considered.
- Terrestrial corridor crossings will all be made at-grade. In order to mitigate impacts to wildlife a range of design options should be considered including enhanced plantings at crossing points, roadway signage to cue drivers to wildlife potential, road markings, rumble strips within the asphalt, directional fencing, etc. Detailed design of impact mitigation methods for wildlife shall be provided as part of future Draft Plan submissions.
- Proposed wildlife crossings of Mayfield Road have been identified through the Mayfield Road EA process. It is understood that these subsurface crossings (culverts) have been approved by MNRF and will be detailed as part of detailed design for this section of Mayfield Road located along the Alloa Primary Study Area frontage.

Special Study Area

Due to the uncertainty of overall influences resulting from design of the proposed Highway 413, additional study of this area of the plan is required before appropriate land use limits can be confirmed. Additionally, the Town of Caledon is in the process of developing a new Transportation Master Plan that may affect collector road location through this area of the Secondary Plan. The LSS is therefore not able to evaluate potential impacts nor proposed land uses for this area of the Alloa Secondary Plan at this time.

10.5 Conceptual Natural Channel Design Summary

10.5.1. Design Objectives

The majority of the Alloa Drain (i.e., Reaches AD2 to AD6) within the Primary Study Area is proposed for realignment. This drain is currently managed as infrastructure to service the surrounding agricultural lands according to requirements under the *Drainage Act, 1990* and has a linear planform, contains predominantly fine-grained sediments and lacks riffle-pool morphology. The Alloa Drain is proposed to be restored with a nested channel system to provide a self-maintaining low-flow channel while enhancing connection to the floodplain. The proposed design will continue supporting low-flow conditions and storm events with channel form and function enhancements. An amended Municipal Drain Agreement between the affected landowners and the Town of Caledon will need to be prepared to address proposed modifications to the existing Alloa Drain.

Reaches LD1 and LD2 of the Lyons Drain are also proposed for realignment. These two reaches consist of a straightenend channel with a narrow riparian buffer consisting of a mix of tree, shrubs and grasses. Natural riffle and pool morphology was absent. A limited number of artificial riffles were present in association with the culvert crossing at Creditview Road and along Reach LD2, which effectively functions as a roadside ditch.

In addition, HDF Reach LD5, HDF Reach LD4-4, HDF Reach LD4-3D and HDF Reaches AD5-1 to AD5-4 are proposed for realignment. These drainage features have been significantly impacted by historical agricultural land uses and generally lack natural riparian vegetation and have limited form.

The proposed realignments provide an opportunity to replace the morphologically-limited, impacted channels and HDFs with naturalized watercourses and enhanced corridors. The proposed designs will have cross-sectional dimensions closer to a naturalized watercourse conveying similar flows and will significantly improve morphologic form and function per unit length. The realignment and naturalization designs provide opportunities for improved riparian conditions and well-developed bankfull channels with morphological variability. Improvement in morphology and function will benefit sediment balance, floodplain storage, vegetation communities, aquatic and terrestrial habitat, water balance, fish passage and water quality. Preliminary conceptual design renderings are provided in Figures 23 to 26 to illustrate functionality of the corridors. The full set of conceptual design drawings are contained in Appendix M of the LSS and are subject to refinement as the LSS proceeds.

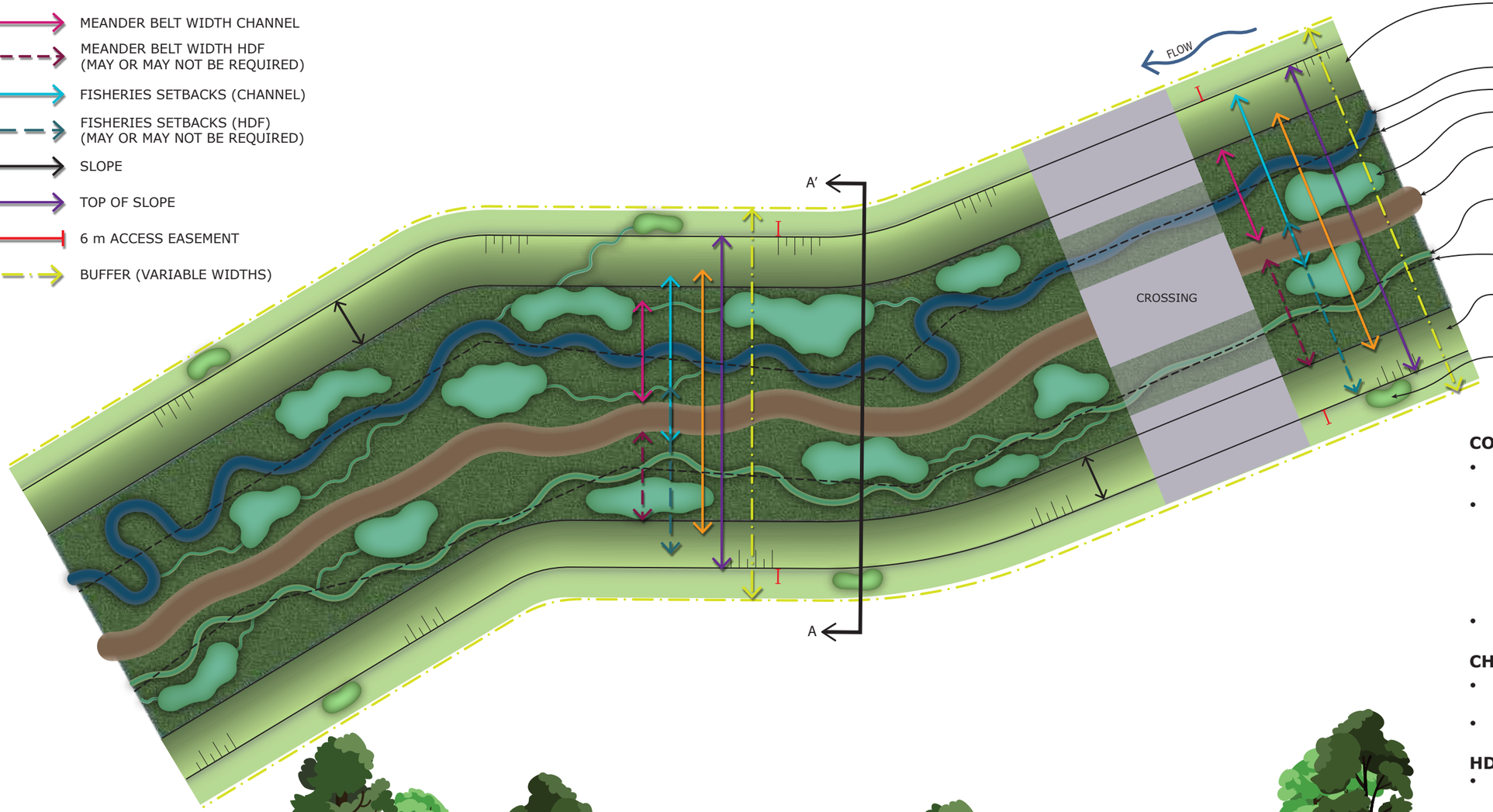
The primary objectives of the designs are to:

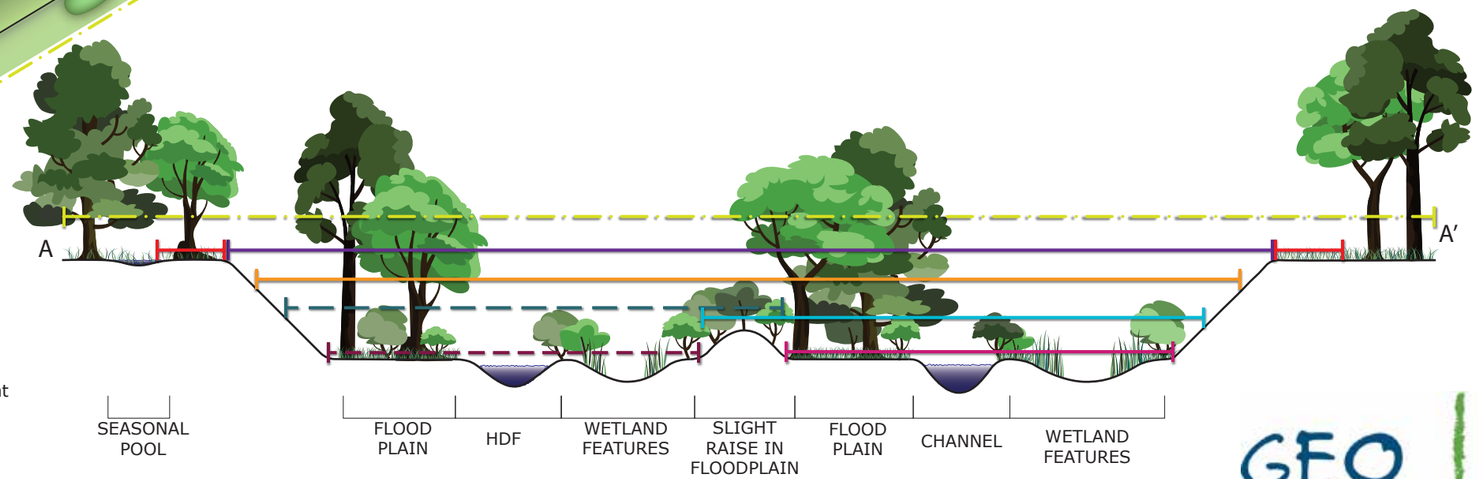
- Reinstate a more natural physical form, including planform and instream characteristics
- Improve the function of the channels by increasing flow interactions with the floodplain

CONCEPTUAL COMPOUND CORRIDOR WITH HDF REQUIREMENTS

LEGEND

- FLOODPLAIN
- MEANDER BELT WIDTH CHANNEL
- MEANDER BELT WIDTH HDF (MAY OR MAY NOT BE REQUIRED)
- FISHERIES SETBACKS (CHANNEL)
- FISHERIES SETBACKS (HDF) (MAY OR MAY NOT BE REQUIRED)
- SLOPE
- TOP OF SLOPE
- 6 m ACCESS EASEMENT
- BUFFER (VARIABLE WIDTHS)





COMMON NOTES:

- Compound corridor can replicate, wetlands, channel length, headwater drainage length
- Slopes are generally graded at a 3:1 to 4:1. Slopes that are greater than to 2 m to 2.5 m would require geotechnically stable top of slope, 6 m access easement sits at top of slope within the buffer which is applied to the greatest of the constraints. No slope constraints required on slopes less than 2.0 m in height.
- There may be additional area requirements for wetland replication.

CHANNEL NOTES

- Buffers are applied from to the greatest constraints on the outside extent of the corridor
- Buffers are not shown on diagram but need to be considered in the width of the corridor

HDF NOTES:

- Buffers if required, are applied from the greatest constraints on the outside extent of the corridor
- In absence of constraints, no buffer likely required
- May not require fisheries setbacks, or erosions hazard set backs
- May not require floodplain - only conveyance
- Buffers are not shown on diagram but may need to be considered in the width of the corridor, if other constraints are present

CROSSING RECOMMENDATIONS:

- Crossings should be designed to minimize the probability of the channel contacting with crossing infrastructure and should span at least three (3) times the bankfull channel width
- Crossings designs should where appropriate consider potential channel erosion and/or migration and any upstream or local meanders
- Crossings should traverse the drainage feature at a reasonably straight and stable section of channel and be at a perpendicular angle to the drainage feature

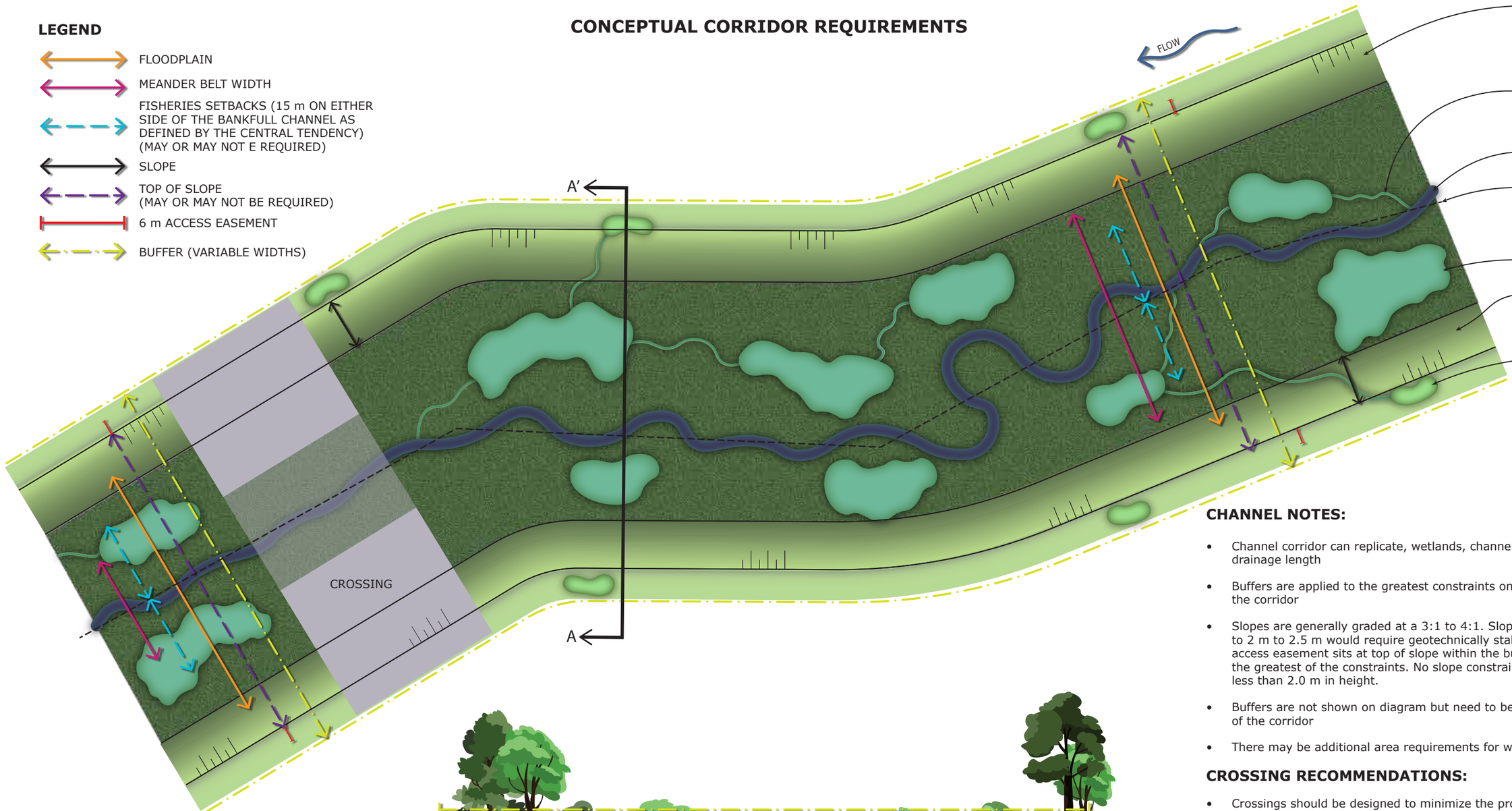
GEO MORPHIX™

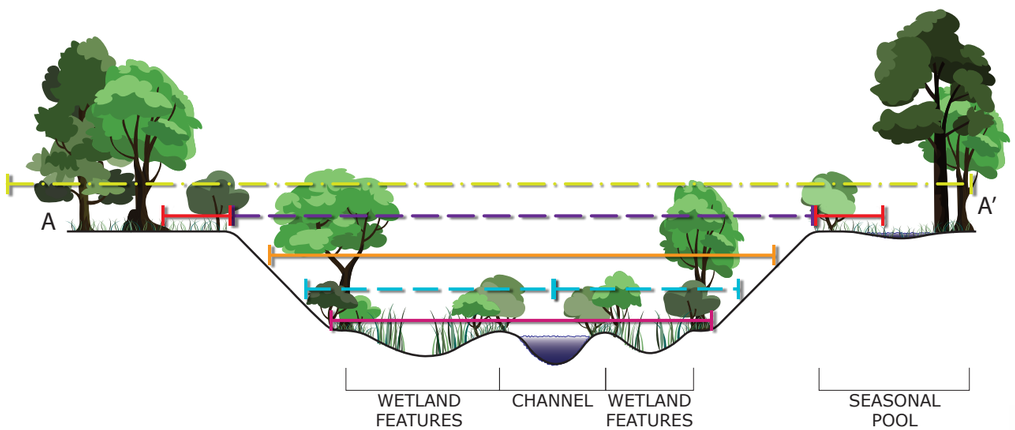
Figure 23

CONCEPTUAL CORRIDOR REQUIREMENTS

LEGEND

- FLOODPLAIN
- MEANDER BELT WIDTH
- FISHERIES SETBACKS (15 m ON EITHER SIDE OF THE BANKFULL CHANNEL AS DEFINED BY THE CENTRAL TENDENCY) (MAY OR MAY NOT E REQUIRED)
- SLOPE
- TOP OF SLOPE (MAY OR MAY NOT BE REQUIRED)
- 6 m ACCESS EASEMENT
- BUFFER (VARIABLE WIDTHS)





CHANNEL NOTES:

- Channel corridor can replicate, wetlands, channel length, headwater drainage length
- Buffers are applied to the greatest constraints on the outside extent of the corridor
- Slopes are generally graded at a 3:1 to 4:1. Slopes that are greater than to 2 m to 2.5 m would require geotechnically stable top of slope, 6 m access easement sits at top of slope within the buffer which is applied to the greatest of the constraints. No slope constraints required on slopes less than 2.0 m in height.
- Buffers are not shown on diagram but need to be considered in the width of the corridor
- There may be additional area requirements for wetland replication.

CROSSING RECOMMENDATIONS:

- Crossings should be designed to minimize the probability of the channel contacting with crossing infrastructure and should span at least three (3) times the bankfull channel width
- Crossings designs should where appropriate consider potential channel erosion and/or mitigation and any upstream or local meanders
- Crossings should traverse the drainage feature at a reasonably straight and stable section of channel and be at a perpendicular angle to the drainage feature

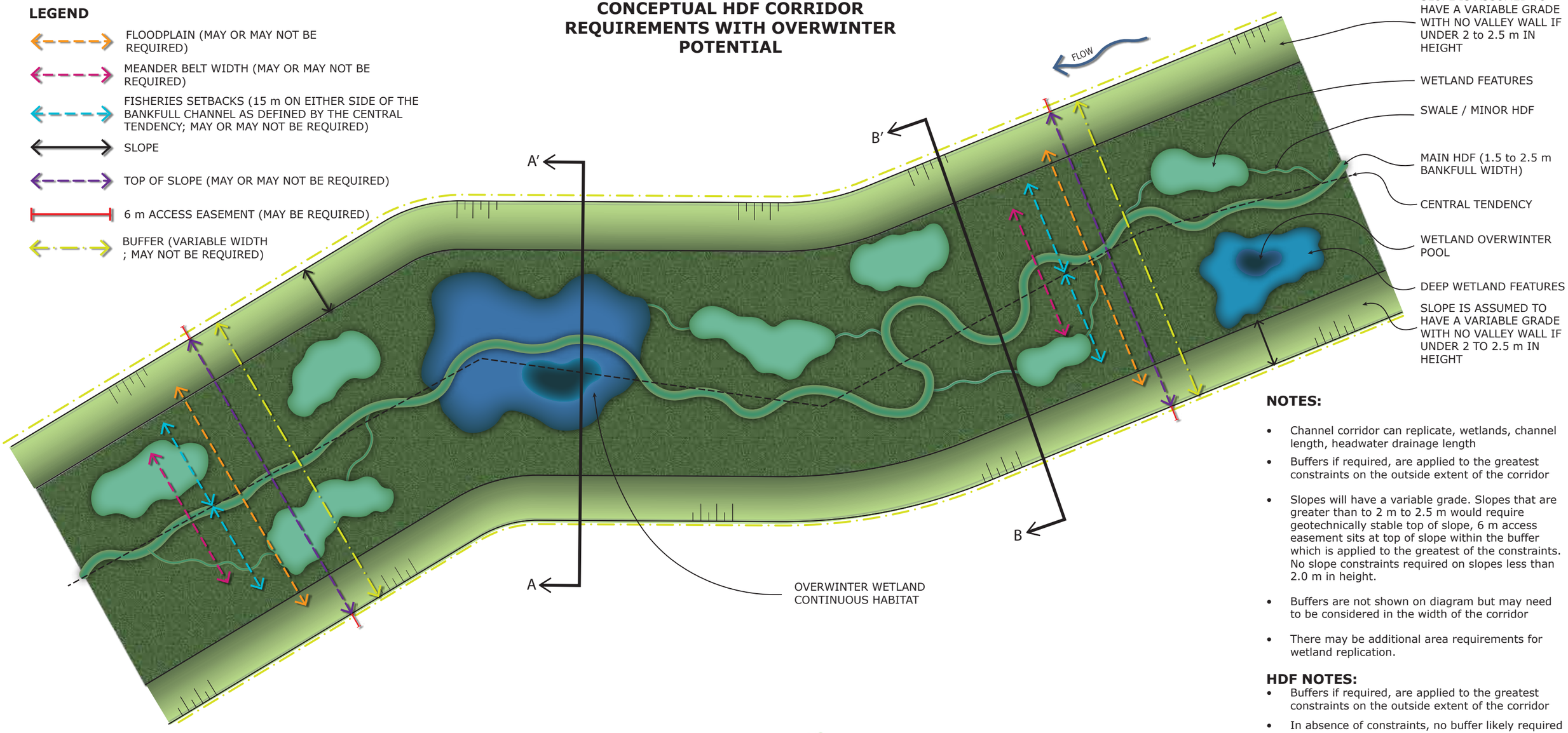
GEO MORPHIX™

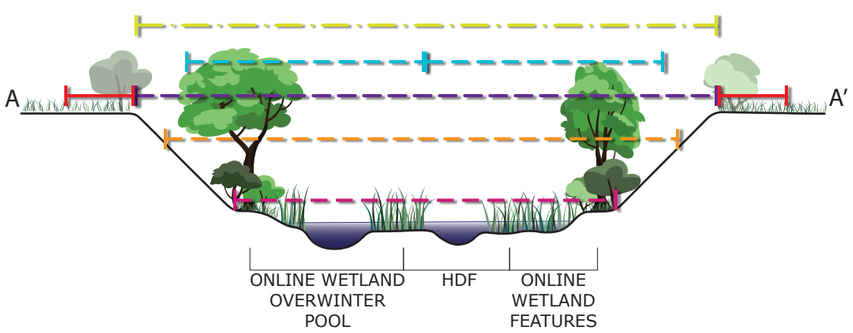
Figure 24

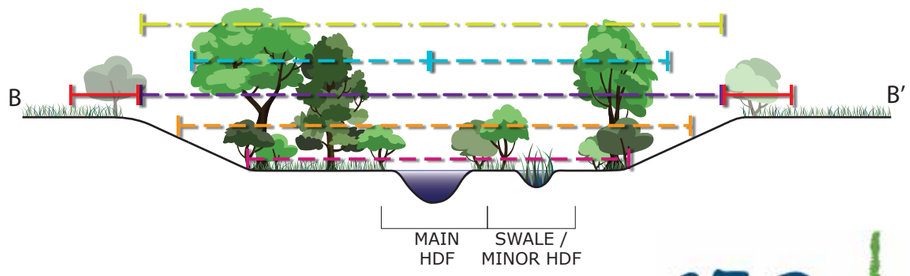
CONCEPTUAL HDF CORRIDOR REQUIREMENTS WITH OVERWINTER POTENTIAL

LEGEND

- FLOODPLAIN (MAY OR MAY NOT BE REQUIRED)
- MEANDER BELT WIDTH (MAY OR MAY NOT BE REQUIRED)
- FISHERIES SETBACKS (15 m ON EITHER SIDE OF THE BANKFULL CHANNEL AS DEFINED BY THE CENTRAL TENDENCY; MAY OR MAY NOT BE REQUIRED)
- SLOPE
- TOP OF SLOPE (MAY OR MAY NOT BE REQUIRED)
- 6 m ACCESS EASEMENT (MAY BE REQUIRED)
- BUFFER (VARIABLE WIDTH ; MAY NOT BE REQUIRED)







NOTES:

- Channel corridor can replicate, wetlands, channel length, headwater drainage length
- Buffers if required, are applied to the greatest constraints on the outside extent of the corridor
- Slopes will have a variable grade. Slopes that are greater than to 2 m to 2.5 m would require geotechnically stable top of slope, 6 m access easement sits at top of slope within the buffer which is applied to the greatest of the constraints. No slope constraints required on slopes less than 2.0 m in height.
- Buffers are not shown on diagram but may need to be considered in the width of the corridor
- There may be additional area requirements for wetland replication.

HDF NOTES:

- Buffers if required, are applied to the greatest constraints on the outside extent of the corridor
- In absence of constraints, no buffer likely required
- May not require fisheries setbacks, or erosions hazard set backs
- May not require regulatory floodplain - only conveyance
- Buffers are not shown on diagram but may need to be considered in the width of the corridor, if other constraints are present

GEO MORPHIX™

Figure 25

GEO MORPHIX™

CONCEPTUAL JOINED CORRIDOR REQUIREMENTS

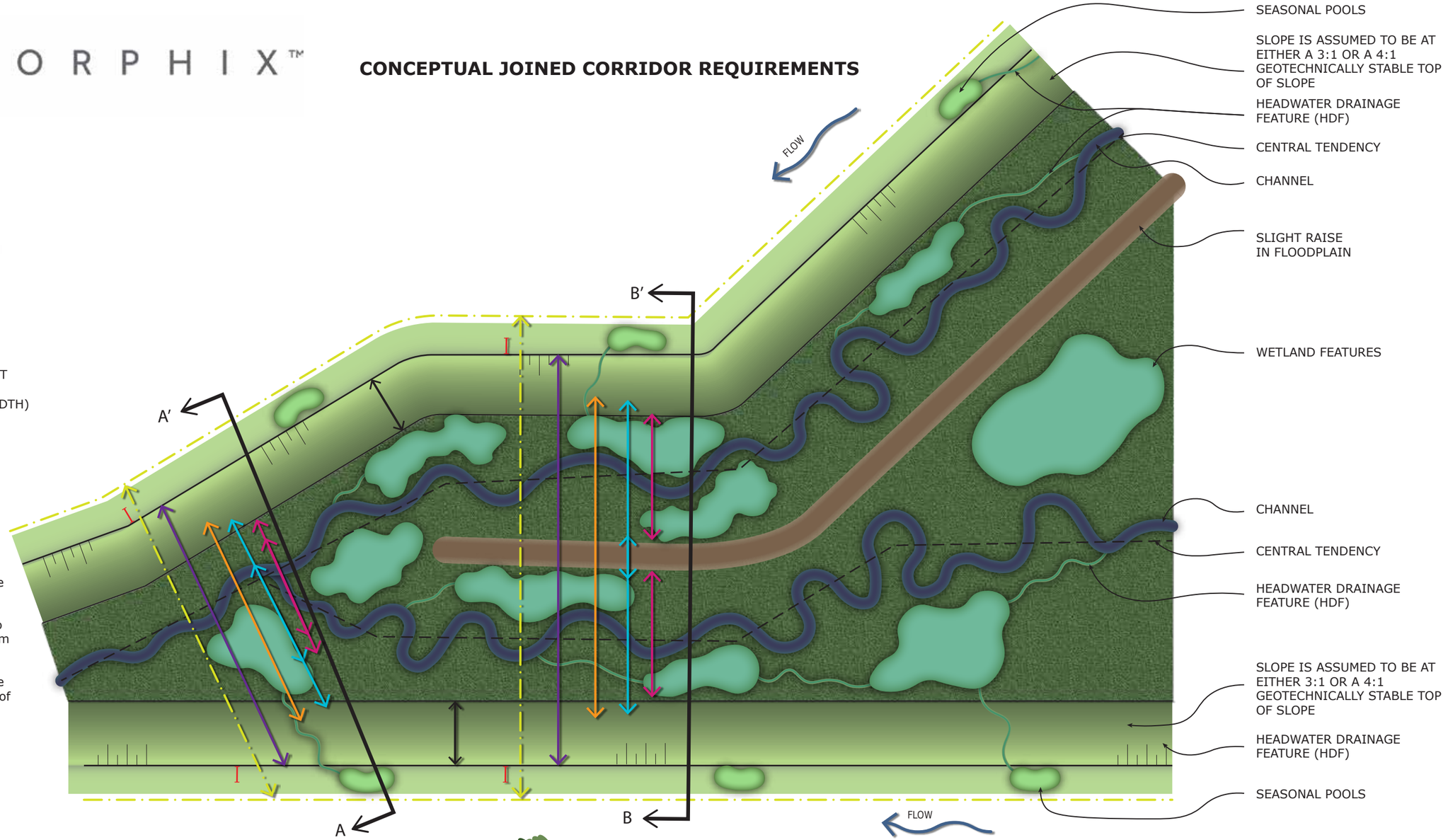
Figure 26

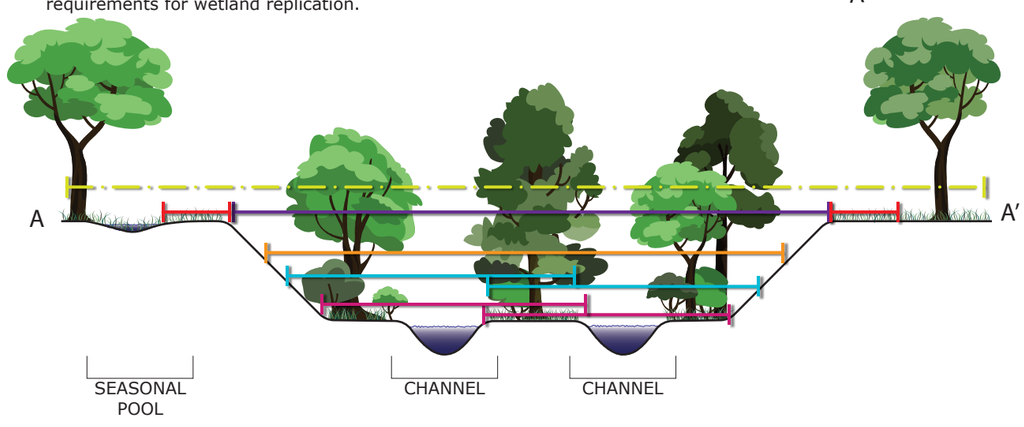
LEGEND

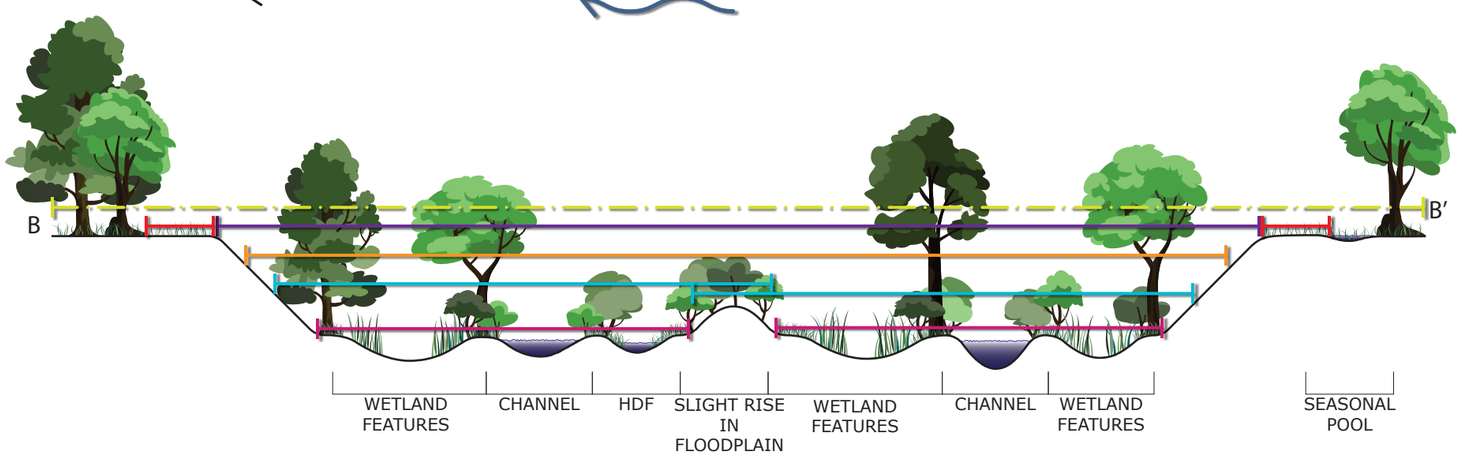
- FLOODPLAIN
- MEANDER BELT WIDTH
- FISHERIES SETBACKS
- SLOPE
- TOP OF SLOPE
- 6 m ACCESS EASEMENT
- BUFFER (VARIABLE WIDTH)

NOTES:

- Channel corridor can replicate, wetlands, channel length, headwater drainage length
- Buffers are applied to the greatest constraints on the outside extent of the corridor
- Slopes are generally graded at a 3:1 to 4:1. Slopes that are greater than to 2 m to 2.5 m would require geotechnically stable top of slope, 6 m access easement sits at top of slope within the buffer which is applied to the greatest of the constraints. No slope constraints required on slopes less than 2.0 m in height.
- Buffers are not shown on diagram but need to be considered in the width of the corridor
- There may be additional area requirements for wetland replication.







- Provide a mix of coarse and fine sediment sources throughout the low-flow channel and floodplain
- Enhance aquatic habitat through the provision of a morphologically diverse channel with spatially varied flows
- Improve riparian habitat by installing woody plantings and dynamic floodplain features
- Mitigate potential hazards to the development as well as lands surrounding the development
- Preserve flood storage to the greatest extent possible
- Replicate existing Wetland 7 within the realigned corridors

The recommended restoration design for watercourse reaches focuses on a riffle-pool system, which provides significant improvements to not only the channel as it essentially replicates a natural system but also to the aquatic habitat. When it is assessed to be an appropriate channel type, a riffle-pool system offers numerous benefits, namely:

- Channel bed relief for flow variability
- Water aeration in riffle sections
- Relatively quiescent flows in pool sections to provide refuge for fish during high flows
- In-channel energy dissipation

The realigned features will enhance terrestrial habitat by increasing diversity and providing a more natural floodplain form. Further functional benefits, such as water retention, infiltration, evapotranspiration, and sediment banking, are also provided in the proposed design.

The following sections summarize key elements of the proposed designs such as bankfull channel dimensions, channel lengths, headwater drainage feature and wetland replication, and details related to the dry swale/terrestrial corridor in the western portion of the Secondary Plan Area/Primary Study Area. Additional details related to proposed floodplain enhancements and conceptual design drawings are contained in Appendix M of this report.

10.5.2. Bankfull Channel Dimensions and Channel Lengths

Channel design dimensions are determined by bankfull discharge, as this represents what is generally referred to as the "channel-forming discharge" or the "dominant discharge". Several methods can be applied to select an appropriate bankfull discharge. Back calculation of discharge from a reference reach and support from hydrological modelling is usually the most appropriate. Given the significant historical channel modifications due to agricultural activities and anticipated hydrology changes likely to occur due to the proposed development, discharges based on hydrologic modelling were determined for all reaches proposed for realignment. These discharges were then used to define channel bankfull geometries. The

bankfull discharge used to size the channel was assumed to be equivalent to the modelled 2-year flow return period post-development flow.

A simple Manning's approach was used to iteratively back-calculate bankfull dimensions for the proposed designs. Since pool sections are designed to contain ineffective space, this model over-predicts the amount of discharge they convey. The modelled values for the riffle sections better predict the channel's capacity.

The final channel planform design was established through an iterative process. First, a cross-section with defined bankfull geometry was developed to calculate parameters for the planform (i.e., radius of curvature, riffle-pool spacing). The cross-section was then further refined, based on the final channel gradient. Once the cross-section dimensions were refined, hydraulic sizing for the channel substrate was completed. For additional technical details regarding the proposed design, refer to Appendix M of this document.

Channel riffle and pool geometries and anticipated bankfull conditions for the proposed channels are provided for each design reach in Tables 34 to 43, below. As natural channel design is an iterative process, it is anticipated that the proposed channel geometries and design elements and will be updated as the project proceeds. For additional details related to corridor width requirements and proposed habitat features, refer to Appendix M.

In developing a natural channel design, the length of the watercourse proposed to be realigned is typically replicated or exceeded to provide an overall gain in habitat. The existing total length of the Alloa Drain Reaches AD2, AD3, AD4, AD5, and AD6 proposed for rehabilitation is approximately 4,024 m, with the realigned corridor providing a total linear length of approximately 4,529m.

The existing total length of the Lyons Drain Reaches LD1, LD2, LD4-4, LD4-3D and LD5 proposed for rehabilitation is approximately 896 m, with the realigned corridors providing a total linear length of approximately 1,090 m.

The existing total length of Reaches AD5-1, AD5-2, AD5-3, and AD5-4 proposed for rehabilitation is approximately 911 m, with the realigned corridors providing a total linear length of approximately 1,142 m. The realigned sinuous channels will produce systems more similar to what would occur in nature, resulting in an increased total channel length of 990 m for all reaches. Therefore, the proposed channels will significantly increase the restored and enhanced habitat area.

TABLE 34: BANKFULL PARAMETERS FOR AD REACH 1 OF THE PROPOSED CHANNEL

Channel parameter	Low-flow Channel		Bankfull Channel	
	Riffle††	Pool†	Riffle††	Pool†
Bankfull width (m)	3.20	3.95	5.75	7.20
Average bankfull depth (m)	0.31	0.39	0.49	0.64
Maximum bankfull depth (m)	0.45	0.65	0.80	1.15
Bankfull width-to-depth ratio	10.30	10.16	11.71	11.33
Channel gradient (%)	0.45	0.10	0.46	0.10
Bankfull gradient (%)	0.10		0.10	
Radius of curvature (m) ‡	16			
Riffle-pool spacing (m) ‡‡	46			
Manning's roughness coefficient, *n*	0.07	0.05	0.07	0.05
Mean bankfull velocity (m/s) *	0.39	0.30	0.54	0.42
Bankfull discharge (m^3/s) *	0.39	0.46	1.53	1.92
Discharge to accommodate (m^3/s)	--		1.53	
Tractive force at bankfull (N/m^2)	20	6	36	11
Stream power (W/m)	17	5	69	19
Unit stream power (W/m^2)	5	1	22	5
Froude Number (unitless)	0.22	0.15	0.25	0.17
Maximum grain size entrained (m) **	0.02	0.01	0.04	0.01
Mean grain size entrained**	0.01	0.00	0.02	0.01

† Based on bankfull gradient
†† Based on riffle gradient
‡ Based on Williams (1986)
‡‡ Based on Hey and Thorne (1986)
** Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative*
*** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)*

TABLE 35: BANKFULL PARAMETERS FOR AD REACH 2 OF THE PROPOSED CHANNEL

Channel parameter	Low-flow Channel		Bankfull Channel	
	Riffle††	Pool†	Riffle††	Pool†
Bankfull width (m)	4.05	4.10	6.30	7.80
Average bankfull depth (m)	0.39	0.43	0.56	0.72
Maximum bankfull depth (m)	0.55	0.75	0.90	1.35
Bankfull width-to-depth ratio	10.29	9.57	11.19	10.81
Channel gradient (%)	0.46	0.10	0.45	0.10
Bankfull gradient (%)	0.10		0.10	
Radius of curvature (m) ‡	17			
Riffle-pool spacing (m) ‡‡	49			
Manning's roughness coefficient, *n*	0.07	0.05	0.07	0.05
Mean bankfull velocity (m/s)*	0.46	0.32	0.59	0.45
Bankfull discharge (m^3/s) *	0.74	0.56	2.08	2.56
Discharge to accommodate (m^3/s)	--		2.08	
Tractive force at bankfull (N/m^2)	25	7	40	13
Stream power (W/m)	33	5	92	25
Unit stream power (W/m^2)	8	1	25	6
Froude Number (unitless)	0.24	0.16	0.25	0.17
Maximum grain size entrained (m)**	0.03	0.01	0.04	0.01
Mean grain size entrained**	0.02	0.00	0.03	0.01

† Based on bankfull gradient
†† Based on riffle gradient
‡ Based on Williams (1986)
‡‡ Based on Hey and Thorne (1986)
** Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative*
*** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)*

TABLE 36: BANKFULL PARAMETERS FOR AD REACH 3 OF THE PROPOSED CHANNEL

Channel parameter	Low-flow Channel		Bankfull Channel	
	Riffle††	Pool†	Riffle††	Pool†
Bankfull width (m)	4.10	4.90	6.80	8.60
Average bankfull depth (m)	0.39	0.47	0.60	0.77
Maximum bankfull depth (m)	0.55	0.75	0.95	1.35
Bankfull width-to-depth ratio	10.42	10.47	11.30	11.13
Channel gradient (%)	0.45	0.10	0.45	0.10
Bankfull gradient (%)	0.10		0.10	
Radius of curvature (m) ‡	19			
Riffle-pool spacing (m) ‡‡	53			
Manning's roughness coefficient, *n*	0.07	0.05	0.07	0.05
Mean bankfull velocity (m/s)*	0.46	0.34	0.61	0.48
Bankfull discharge (m^3/s) *	0.73	0.78	2.50	3.17
Discharge to accommodate (m^3/s)	--		2.50	
Tractive force at bankfull (N/m^2)	24	7	41	13
Stream power (W/m)	32	8	109	31
Unit stream power (W/m^2)	8	2	27	6
Froude Number (unitless)	0.23	0.16	0.25	0.17
Maximum grain size entrained (m) **	0.02	0.01	0.04	0.01
Mean grain size entrained**	0.02	0.00	0.03	0.01

† Based on bankfull gradient
†† Based on riffle gradient
‡ Based on Williams (1986)
‡‡ Based on Hey and Thorne (1986)
** Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative*
*** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)*

TABLE 37: BANKFULL PARAMETERS FOR AD REACH 4 OF THE PROPOSED CHANNEL

Channel parameter	Low-flow Channel		Bankfull Channel	
	Riffle††	Pool†	Riffle††	Pool†
Bankfull width (m)	4.50	5.15	7.35	9.10
Average bankfull depth (m)	0.44	0.51	0.68	0.84
Maximum bankfull depth (m)	0.60	0.85	1.05	1.50
Bankfull width-to-depth ratio	10.34	10.01	10.89	10.85
Channel gradient (%)	0.45	0.10	0.45	0.10
Bankfull gradient (%)	0.10		0.10	
Radius of curvature (m)‡	20			
Riffle-pool spacing (m) ‡‡	57			
Manning's roughness coefficient, *n*	0.07	0.05	0.07	0.05
Mean bankfull velocity (m/s)*	0.49	0.36	0.66	0.50
Bankfull discharge (m^3/s) *	0.95	0.95	3.26	3.83
Discharge to accommodate (m^3/s)	--		3.26	
Tractive force at bankfull (N/m^2)	26	8	46	15
Stream power (W/m)	42	9	143	38
Unit stream power (W/m^2)	9	2	32	7
Froude Number (unitless)	0.24	0.16	0.26	0.18
Maximum grain size entrained (m) **	0.03	0.01	0.05	0.02
Mean grain size entrained**	0.02	0.01	0.03	0.01

† Based on bankfull gradient
†† Based on riffle gradient
‡ Based on Williams (1986)
‡‡ Based on Hey and Thorne (1986)
** Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative*
*** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)*

TABLE 38: BANKFULL PARAMETERS FOR AD REACH 5 OF THE PROPOSED CHANNEL

Channel parameter	Low-flow Channel		Bankfull Channel	
	Riffle††	Pool†	Riffle††	Pool†
Bankfull width (m)	4.35	5.25	7.25	9.40
Average bankfull depth (m)	0.43	0.50	0.70	0.86
Maximum bankfull depth (m)	0.60	0.80	1.10	1.50
Bankfull width-to-depth ratio	10.07	10.45	10.36	10.89
Channel gradient (%)	0.45	0.10	0.45	0.10
Bankfull gradient (%)	0.10		0.10	
Radius of curvature (m) ‡	20			
Riffle-pool spacing (m) ‡‡	57			
Manning's roughness coefficient, *n*	0.07	0.05	0.07	0.05
Mean bankfull velocity (m/s)*	0.49	0.36	0.67	0.51
Bankfull discharge (m^3/s)*	0.91	0.94	3.42	4.15
Discharge to accommodate (m^3/s)	--		3.42	
Tractive force at bankfull (N/m^2)	26	8	49	15
Stream power (W/m)	40	9	152	41
Unit stream power (W/m^2)	9	2	36	8
Froude Number (unitless)	0.24	0.16	0.26	0.18
**Maximum grain size entrained (m) ** **	0.03	0.01	0.05	0.02
Mean grain size entrained**	0.02	0.01	0.03	0.01

† Based on bankfull gradient
†† Based on riffle gradient
‡ Based on Williams (1986)
‡‡ Based on Hey and Thorne (1986)
** Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative*
*** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)*

TABLE 39: BANKFULL PARAMETERS FOR AD REACH 6 OF THE PROPOSED CHANNEL

Channel parameter	Low-flow Channel		Bankfull Channel	
	Riffle††	Pool†	Riffle††	Pool†
Bankfull width (m)	4.30	5.65	7.65	9.80
Average bankfull depth (m)	0.43	0.52	0.72	0.89
Maximum bankfull depth (m)	0.60	0.80	1.10	1.50
Bankfull width-to-depth ratio	9.99	10.91	10.67	11.06
Channel gradient (%)	0.45	0.10	0.45	0.10
Bankfull gradient (%)	0.10		0.10	
Radius of curvature (m) ‡	21			
Riffle-pool spacing (m) ‡‡	60			
Manning's roughness coefficient, *n*	0.07	0.05	0.07	0.05
Mean bankfull velocity (m/s) *	0.48	0.36	0.68	0.52
Bankfull discharge (m^3/s) *	0.90	1.06	3.74	4.53
Discharge to accommodate (m^3/s)	--		3.74	
Tractive force at bankfull (N/m^2)	26	8	48	15
Stream power (W/m)	40	10	163	44
Unit stream power (W/m^2)	9	2	35	8
Froude Number (unitless)	0.24	0.16	0.26	0.18
Maximum grain size entrained (m) **	0.03	0.01	0.05	0.02
Mean grain size entrained**	0.02	0.01	0.03	0.01

† Based on bankfull gradient
†† Based on riffle gradient
‡ Based on Williams (1986)
‡‡ Based on Hey and Thorne (1986)
** Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative*
*** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)*

TABLE 40: BANKFULL PARAMETERS FOR DESIGNED LD REACH1 AND REACH LD REACH 2

Channel parameter	LD Reacg 1		LD Reach 2	
	Riffle††	Pool†	Riffle††	Pool†
Bankfull width (m)	2.65	3.25	2.60	3.20
Average bankfull depth (m)	0.27	0.33	0.26	0.33
Maximum bankfull depth (m)	0.35	0.55	0.35	0.55
Bankfull width-to-depth ratio	9.98	9.72	9.87	9.64
Channel gradient (%)	2.21	0.55	2.40	0.60
Bankfull gradient (%)	0.55		0.60	
Radius of curvature (m) ‡	7		7	
Riffle-pool spacing (m)‡‡	22		21	
Manning's roughness coefficient, *n*	0.04	0.03	0.04	0.03
Mean bankfull velocity (m/s) *	1.36	1.05	1.41	1.09
Bankfull discharge (m^3/s) *	0.96	1.14	0.96	1.16
Discharge to accommodate (m^3/s)	0.96	0.96	0.96	0.96
Tractive force at bankfull (N/m^2)	76	30	82	32
Stream power (W/m)	207	62	227	68
Unit stream power (W/m^2)	78	29	105	33
Froude Number (unitless)	0.84	0.58	0.88	0.61
Maximum grain size entrained (m) **	0.08	0.03	0.08	0.03
Mean grain size entrained**	0.06	0.02	0.06	0.02

† Based on bankfull gradient
†† Based on riffle gradient
‡ Based on Williams (1986)
‡‡ Based on Hey and Thorne (1986)
** Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative*
*** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)*

TABLE 41: BANKFULL PARAMETERS FOR DESIGNED REACH LD4 REACH 1 AND REACH LD4 REACH 2

Channel parameter	Reach LD4 Reach 1		Reach LD4 Reach 1	
	Riffle††	Pool†	Riffle††	Pool†
Bankfull width (m)	2.25	2.85	2.75	3.45
Average bankfull depth (m)	0.26	0.31	0.0.33	0.38
Maximum bankfull depth (m)	0.35	0.55	0.45	0.65
Bankfull width-to-depth ratio	8.82	9.62	8.4	9.4
Channel gradient (%)	1.00	0.25	0.40	0.10
Bankfull gradient (%)	0.25		0.10	
Radius of curvature (m) ‡	6		8	
Riffle-pool spacing (m) ‡‡	19		23	
Manning's roughness coefficient, *n*	0.04	0.03	0.04	0.03
Mean bankfull velocity (m/s)*	0.88	0.67	0.65	0.48
Bankfull discharge (m^3/s)*	0.50	0.59	0.59	0.65
Discharge to accommodate (m^3/s)	0.50		0.59	
Tractive force at bankfull (N/m^2)	34	13	18	6
Stream power (W/m)	49	14	23	6
Unit stream power (W/m^2)	27	8	11	3
Froude Number (unitless)	0.56	0.38	0.36	0.25
**Maximum grain size entrained (m) ** **	0.04	0.01	0.02	0.01
Mean grain size entrained**	0.03	0.01	0.01	0.00

† Based on bankfull gradient
†† Based on riffle gradient
‡ Based on Williams (1986)
‡‡ Based on Hey and Thorne (1986)
** Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative*
*** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)*

TABLE 42: BANKFULL PARAMETERS FOR DESIGNED REACH LD5

Channel parameter	Reach LD5	
	Riffle††	Pool†
Bankfull width (m)	2.75	3.45
Average bankfull depth (m)	0.27	0.35
Maximum bankfull depth (m)	0.35	0.55
Bankfull width-to-depth ratio	10.29	9.98
Channel gradient (%)	2.00	0.45
Bankfull gradient (%)	0.45	
Radius of curvature (m)‡	8	
Riffle-pool spacing (m)‡‡	23	
Manning's roughness coefficient, *n*	0.04	0.03
Mean bankfull velocity (m/s) *	1.30	0.98
Bankfull discharge (m^3/s) *	0.96	1.16
Discharge to accommodate (m^3/s)	0.96	
Tractive force at bankfull (N/m^2)	69	24
Stream power (W/m)	188	51
Unit stream power (W/m^2)	82	22
Froude Number (unitless)	0.81	0.53
Maximum grain size entrained (m) **	0.07	0.03
Mean grain size entrained **	0.05	0.02

† Based on bankfull gradient
†† Based on riffle gradient
‡ Based on Williams (1986)
‡‡ Based on Hey and Thorne (1986)
** Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative*
*** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)*

TABLE 43: BANKFULL PARAMETERS FOR DESIGNED AD5 REACH 1

Channel parameter	AD5 Reach 1	
	Riffle††	Pool†
Bankfull width (m)	2.45	3.10
Average bankfull depth (m)	0.29	0.33
Maximum bankfull depth (m)	0.40	0.60
Bankfull width-to-depth ratio	8.47	9.33
Channel gradient (%)	1.00	0.25
Bankfull gradient (%)	0.25	
Radius of curvature (m) ‡	7	
Riffle-pool spacing (m) ‡‡	21	
Manning's roughness coefficient, *n*	0.07	0.05
Mean bankfull velocity (m/s)*	0.54	0.42
Bankfull discharge (m^3/s)*	0.38	0.43
Discharge to accommodate (m^3/s)	0.38	
Tractive force at bankfull (N/m^2)	39	15
Stream power (W/m)	38	11
Unit stream power (W/m^2)	20	5
Froude Number (unitless)	0.32	0.23
Maximum grain size entrained (m)**	0.04	0.02
Mean grain size entrained**	0.03	0.01

† Based on bankfull gradient
†† Based on riffle gradient
‡ Based on Williams (1986)
‡‡ Based on Hey and Thorne (1986)
** Based on Manning's equation; as pools contain ineffective space, the velocity and discharge conveyed in them are not representative*
*** Based on Shields equation (Miller et al., 1977), assuming Shields parameter equals 0.06 (gravel)*

10.5.3. Headwater Drainage Feature FC-2A Restoration Design

As part of the first LSS submission, Reaches FC-2A and FC-2B were initially assigned a management classification of "Mitigation". The management classification of Reach FC-2A has since been revised to "Conservation". Refer to the Headwater Drainage Feature Assessment Report prepared under separate cover (GEO Morphix Ltd., 2025). In addition, a wetland that was formerly present along Reach FC-2A on the property located at 1850 Mayfield Road is to be restored, as agreed to in consultation with Credit Valley Conservation (CVC).

A conceptual swale and wetland design is proposed to replicate and enhance Reach FC-2A and restore the previously removed wetland. The design proposes a meandering swale with areas of deeper pools within a wetland feature. Approximately 168 m of headwater drainage feature designated for conservation (i.e., Reach FC-2A) will be removed and replaced with 194 m of a design features that will provide an overall net benefit to the system. The corridor also provides 2,083 m^2 of wetland compensation area, which is slightly larger than the 2,070 m^3 agreed to in consultation with CVC. The proposed design will provide feature form, length and function while incorporating wetland features to promote infiltration, evapotranspiration and produce organic carbon for the downstream system.

The wetland features will enhance terrestrial habitat by increasing diversity and providing a more natural floodplain form while also providing functional benefits such as short-term water retention and sediment banking. The wetlands will be irregularly shaped to maximize the perimeter for a given area, which increases the potential for edge effects. These wetlands' short-term water retention function helps polish the water and moderate discharge. These features, combined with the integrated swale feature, will increase system diversity and function, provide habitat features, and enhance overall productivity for the downstream natural heritage system.

10.5.4. Wetland Replication

In addition to the corridor realignments, one existing wetland (i.e., Wetland 7) is proposed for replication. This wetland was evaluated in 2024 by Azimuth Environmental Consulting Inc. (Azimuth), following the Ontario Wetland Evaluation System (OWES) methodology outlined in the OWES Southern Manual 4th Edition (MNRF, 2022). Based on this assessment, Wetland 7 was determined to be not significant, following provincial criteria. Wetland 7 has a total area of 1.23 ha and will be replicated within the Alloa Drain corridor. A total of 3.4 ha of offline wetlands and stone-cored wetlands are proposed within the Alloa Drain corridor. Additional wetlands proposed in other realigned corridors result in a total constructed wetland area of 3.5 ha.

The offline wetland features proposed within the corridor in addition to the low-flow channel will enhance terrestrial habitat by increasing diversity and providing a more natural floodplain form. They also provide functional benefits such as short-term water retention, infiltration, evapotranspiration, and sediment banking. They are irregularly shaped to maximize the perimeter for a given area, which increases the potential for edge effects and increases habitat diversity. Submerged and dry mounds are proposed within the offline wetlands to increase habitat heterogeneity by providing a topographically complex bottom. A granular mix is proposed within these features and can provide future sediment sources to the channel if it migrates laterally. The granular mix will have substrate sizes similar to those proposed within the riffle features.

Stone-cored wetlands will also be installed at the proposed stormwater management ponds and on-site control outfalls throughout the corridor. The stone core refers to hydraulically sized rounded stone, the subsurface material used to ensure wetland stability. The stone should be hydraulically sized during detailed design. Like the offline wetlands, the stone core wetlands will have submerged and dry mounds to provide a topographically complex bottom that will increase habitat heterogeneity. The short-term water retention function of these wetland types helps to polish the water, increase potential infiltration, and moderate the discharge of water into the channel (in addition to the functions provided by the SWM pond).

The channel corridor will be restored using native plant species, including appropriate species for the various seed mixes and woody vegetation. The plantings are intended to enhance the terrestrial habitat by providing species and habitat diversity, increasing floodplain soil stability, and increasing floodplain roughness and sedimentation. Landscape restoration planting plans will be prepared by others as part of detailed design.

A water availability assessment was completed for designed wetlands to ensure that appropriate hydroperiods can be maintained in the post-development condition. Results of the water availability assessment were subsequently used to calculate annual infiltration volumes from all constructed wetlands and volumetric storage from topsoil augmentation. This information was used in conjunction with the findings of the hydrologic model to determine infiltration targets for the Secondary Plan area. Refer to Appendix M of this Report for additional information.

10.5.5. Dry Bioswale

Reaches LD4-3D and AD4-3 are proposed as a realigned green corridor with a dry bioswale feature. The feature is expected to be fully vegetated, providing a corridor for wildlife connecting the woodlot to the North and the realigned Alloa Drain in the south. The bioswale will have intermittent flows and a meandering planform with variable widths and irregular shapes to maximize the feature's perimeter, increasing the potential for edge effects. Although it is anticipated to be dry most of the time, the feature will provide additional functional benefits such as short-term water retention and sediment banking. Additionally, this feature will enhance local recharge by allowing for infiltration. Mounds will be included within the wide meander areas to add morphological variation. Given the limited energy, limited flow conditions, and vegetation control, the feature has no erosion hazard.

11.0 Impact Assessment

11.1 Evaluation Factors

The factors that are considered in the evaluation of environmental impacts from proposed land uses and the development of management strategies are measured against a series of integrated parameters. These parameters are used to determine if a proposed development scenario or associated management strategy would be anticipated to adequately protect and enhance the area's environmental systems in accordance with governing legislation and practices. While these are conventionally organized into specific disciplines, it is recognized that the evaluation of one objective for a particular discipline is contingent upon an objective

established in another discipline; hence, the practice of establishing the evaluation factors necessarily requires an integrated approach among the various disciplines involved.

The following principles have been used for the development, interpretation, and application of the evaluation factors applied for the Impact Assessment of the respective land uses considered within the Alloa Secondary Plan Area:

i. Evaluation factors must be founded upon scientific principles which are recognized and accepted among the practitioners in the respective field and must be consistent with the respective standards of practice.

ii. Evaluation factors must be consistent with the current laws, regulations, and current policies from regulatory agencies.

iii. With respect to their relationship to developing management strategies, evaluation factors must recognize current environmental management practices, technologies, and the limitations of same.

iv. Evaluation factors must recognize the influence of current human intervention in the area, specifically with respect to the influence of existing agricultural practices.

v. The evaluation factors applied for the impact assessment and the development of the environmental management system must ultimately be useful for yielding management strategies which are feasible (implementable) and enforceable.

For the purpose of this study, the evaluation factors must be consistent with the Planning Objectives for the Alloa Secondary Plan. The Planning Objectives include:

a) Support climate change mitigation and adaptation;

b) Conserve and incorporate cultural heritage resources into community design;

c) Support and achieve a high standard of urban design;

d) Facilitate a sustainable, environmentally sound, and diverse local economy;

e) Achieve a broad mix and range of housing types, including affordable housing;

f) Provide adequate community service facilities;

g) Provide an inter-connected multi-modal transportation network;

h) Provide adequate municipal services;

i) Design a stormwater management system that protects the natural environment system;

j) Provide financially sustainable services, public facilities, and infrastructure;

k) Protect and enhance the natural environment system;

l) Provide a well-connected, accessible public open space recreation system; and,

m) Provide a well-connected, cohesive and publicly accessible system of parks, open spaces, trails and community facilities that provide a range of multi-seasonal recreational, leisure and social opportunities for people of all ages, abilities and interests.

A list of evaluation factors has been developed, specific to each study discipline for the environmental Impact Assessment, based upon the above principles, to evaluate the impacts of the proposed land use plan. These factors have been established based upon prevailing standards of practice, governing legislation, and recent trends from similar studies in other jurisdictions. The factors, by discipline, are summarized in Table 44. Several have inter-disciplinary importance; this integration will be addressed in Phase 3.

TABLE 44: SUMMARY OF ENVIRONMENTAL FACTORS APPLIED FOR IMPACT ASSESSMENT

Discipline	Factor
Hydrogeology	Groundwater Recharge and Discharge
	Aquifers and Local Groundwater Users
	Pre-to-Post Development Water Budget
Hydrology/Hydraulics	Flooding Potential (downstream off-site)
	Flooding Potential (on-site)
Stream/Fluvial Geomorphology	Maintenance of Channel length
	Erosion Mitigation (downstream off-site)
Surface Water Quality	Instream Water Quality (mass loading)
Fisheries and Aquatic Habitat	Watercourse Protection (sensitivity/ # crossings)
Terrestrial	Riparian Cover
	Wetland Cover
	Natural Cover
	Native Biodiversity Functions
	Natural System Protection

11.2 Hydrogeological

Site development leads to an increase in impervious area, which results in increased runoff and a decrease in infiltration volumes. Groundwater recharge supports local groundwater levels, natural features, and aquifers. Groundwater discharge supports stream baseflow, which can occur both locally and within the greater watershed area. Changes to groundwater recharge and discharge have the potential to negatively impact groundwater resources and groundwater supported natural features such as watercourses, wetlands, and shallow aquifers.

Management of the quantity and quality of groundwater recharge is considered necessary to:

- Maintain groundwater levels to support hydraulic gradients for groundwater discharge to functionally dependent creek reaches and wet terrestrial features; and,
- Maintain groundwater quality and quantity for local water wells.

As such, groundwater impact assessment factors reflect the following:

- Impacts to natural features (i.e. wetland ecological communities, wetland water balance);
- Groundwater quantity (i.e. aquifers and well users);
- Groundwater quality (i.e. source protection considerations); and,
- Groundwater recharge and discharge (i.e. average on a functional scale, site wide water balance).

To properly identify system functions that may be impacted through developmental change, it is important to incorporate the findings of the Primary Study Area's conceptual model to highlight areas that may be at risk.

TABLE 45: SUMMARY OF ENVIRONMENTAL FACTORS APPLIED FOR IMPACT ASSESSMENT

Discipline	Factor
Hydrogeology	Groundwater Recharge and Discharge
	Aquifers and Local Groundwater Users
	Pre-to-Post Development Water Budget
Hydrology/Hydraulics	Flooding Potential (downstream off-site)
	Flooding Potential (on-site)
Stream/Fluvial Geomorphology	Maintenance of Channel length
	Erosion Potential Mitigation (downstream off-site)
	Maintenance of Drainage Density
Surface Water Quality	Instream Water Quality (mass loading)
Fisheries and Aquatic Habitat	Watercourse Protection (sensitivity/ # crossings)
Terrestrial	Riparian Cover
	Wetland Cover
	Natural Cover
	Native Biodiversity Functions
	Natural System Protection

11.2.1. Wetland Water Balance Risk Assessment

A wetland water balance risk assessment was completed to evaluate the sensitivity of the wetlands within the Primary Study Area and determine the scope in monitoring and mitigating each feature. According to the TRCA, the need for a feature-based water balance assessment is dependent on the amount of hydrologic change and the sensitivity of the wetland to hydrologic change; the greater the sensitivity to change, the greater the risk to the wetland community.

Given that a vast majority of the wetland catchments in the Primary Study Area extend north into the Secondary Study Area, land use changes independent of the Alloa Secondary Plan Area will have the ability to greatly impact the mitigative policies that are intended to be employed. As such, future changes should be accounted for in the consideration of wetland mitigation techniques.

Methodology

As described in the TRCA Wetland Water Balance Risk Evaluation (November 2017) guidance document, the following steps were taken as a part of the wetland risk assessment:

1. Determine which wetlands may be impacted by development;
2. Determine the magnitude of potential hydrological change;
3. Determine the sensitivity of the wetland to hydrological change; and
4. Assign a level of risk to each wetland.

Based on the risk level assigned, analysis and monitoring protocol shall be implemented by the proponent as established by the TRCA, shown in Table 46 below.

TABLE 46: TRCA MONITORING PROTOCOL

Risk	Monitoring	Water Balance Model	Resolution of Model
Low	Not required	Non-Continuous	Monthly or higher
Medium	Required	Continuous	Daily to weekly
High	Required	Continuous	Daily to weekly

To determine the magnitude of hydrologic change, the impact of surface water changes and groundwater changes were investigated. Urbantech was retained by the Alloa Landowners Group to delineate the catchments feeding each of the existing wetlands pre- and post-development. The total development area and total area owned by the proponent was outlined using GIS terrain analysis. The catchments for each wetland were delineated by Urbantech for pre- and post- development. The impervious cover scores were then calculated

for each wetland using Equation 1 from the Wetland Water Balance Risk Evaluation guide (TRCA, November 2017).

$$S = \frac{IC(C_{dev})}{C}$$

Where: S = Impervious Cover Score

IC = Proportion of Impervious Cover with the Proponent's Holdings (%)

C_{dev} = Total Development Area of the Catchment (ha)

C = Size of the Wetland's Catchment (ha)

The proposed increase or decrease to post-development catchment sizes were assessed to demonstrate the potential impact of the development to the wetland catchment. It should be noted that many of the wetland catchments originate and drain through non-participating lands outside of the Primary Study Area. Only about 15-25% of the total wetland catchments are within the participating lands where development is proposed to occur.

To determine the sensitivity of each wetland to water taking, construction dewatering volumes were estimated for the proposed development within 500 m of each wetland. Please note that the volumes estimated are entirely preliminary and could range dependent on the final floor elevations, excavation sizes and depths. The assumptions are summarized below and in Appendix Y.

Construction dewatering rates were estimated using the Dupuit equation as described in Construction Dewatering and Groundwater Control: New Methods and Applications by Powers et al. 2007. The Dupuit equation assumed a steady linear flow from all four sides of an excavation and is described by the following equation:

$$Q_w = \frac{\pi K(H^2 - h_w^2)}{ln\frac{R_0}{r_w}}$$

Where: Q_w = discharge rate in m^3/s

K = hydraulic conductivity in m/s

H = static groundwater elevation in masl

h_w = head above base of the excavation at maximum dewatering in masl

R_0 = radius of influence of point source from the centre of excavation in m

rw = equivalent radius of the well in m

Please refer to Appendix Y for the supporting materials.

The sensitivity of the wetland is determined by sensitivity of the communities that the wetland supports. Azimuth Consulting Ltd. and Cunningham Environmental Associates were retained by the Alloa Landowners Group to prepare a detailed natural heritage features assessment to support the Subwatershed study for the Alloa Lands. As a part of this process, faunal and flora surveys were conducted to verify the species within the Primary Study Area and define the wetland communities.

Assumptions

At the time of preparation of this report, only the Alloa Secondary Plan Land Use Plan has been prepared and detailed design is not yet available (i.e. Draft Plans of Subdivision). As such, a number of assumptions were made to complete the risk assessment specifically in relation to the anticipated duration and quantity of dewatering. The assumptions used for the Risk Assessment are summarized in Table 47.

Screening of Wetland Features

Based on the screening criteria for the Wetland Risk Assessment, the wetlands were assigned a risk level as summarized in Table 48. For details at each step of the evaluation, please refer to Appendix Y.

The level of risk assigned to each wetland is determined by the highest level of risk within any category of the wetland evaluation. As seen in Table 48, the sensitivity of all wetlands are considered to be high and therefore the highest level of monitoring and modelling protocol shall be employed to assess wetlands #1 – #6. Wetland #7 will be reconstructed as a part of the Alloa Secondary plan. Further details are included in Section 11.5.

Although all wetlands have been identified has being high risk, it should be noted that development on Site is limited in some of the post-development scenarios for many of the wetlands. As demonstrated by Urbantech (August 2025), the pre-development wetland catchments area for Wetland #1, #2, #3, and #6 drain from external and non-participating lands. In the post-development scenario based on the Alloa Secondary Plan (GSAI, August 2025), less than 25% of the entire catchment area for Wetlands #1-#3 will be developed; within the participating lands the majority of the lands will remain as natural heritage or green space. Therefore, it is anticipated that minimal change will occur in the areas of Wetlands #1 – #3.

Fifty-percent (50%) of the entire catchment area will be developed for Wetland 6. However, within the Primary Study Area, 100% of the development is designated natural heritage. Therefore, minimal change within the participating lands is expected.

TABLE 47: WETLAND RISK ASSESSMENT ASSUMPTIONS

Assumption	Details
Proposed land uses have been assigned imperviousness % based on the runoff coefficients in the Region of Peel documentation.	Industrial – 90% imperviousness Natural Heritage – 10% imperviousness Neighbourhood Area – 70% imperviousness Agricultural Proposed 413 Corridor – 95% imperviousness
Average basement ceiling height of 7 ft or 2.25 m in accordance with the Ontario Building Code.	N/A
Excavation sizes for residential dwellings are estimated based on the Town of Caledon Zoning By-Law.	Single Family Homes – 250 m^2 Townhomes – 120 m^2
Dewatering requirements will be greater in areas of proposed high density residential to accommodate potential underground parking.	N/A
Short-term dewatering will have a greater volume and radius of influence than long-term dewatering	N/A
Construction will occur for an approximate period of 5 years.	N/A

TABLE 48: RISK EVALUATION SUMMARY

Wetland ID	Hydrological Changes				Sensitivity of the Wetland		
	Impervious Cover Score (S)	Percent Increase or Decrease in Catchment Size (%)	Hydrologic Risk Assessment Due to Water Taking	Percent Impact to Recharge Areas (%)	Sensitivity of Vegetation Type (ELC)	Maximum Sensitivity of Present Fauna Species	Maximum Sensitivity of Present Flora Species
	Low <10%	*Low <10%*	*Low 50,000 – 400,000 L/d < 6 mos*	*Low <10%*	*Low Sensitivity*	*Low Sensitivity*	*Low Sensitivity*
	Medium 10-25%	*Medium 10-25%*	*Medium 50,000 –400,000 L/d > 6mos or >400,000 L/d < 6mos*	*Medium 10-25%*	*Medium Sensitivity*	*Medium Sensitivity*	*Medium Sensitivity*
	High >25%	*High >25%*	*High >400,000 L/d > 6mos*	*High >25%*	*High Sensitivity*	*High Sensitivity*	*High Sensitivity*
1	Low	Medium	Medium	Low	Medium	High	High
2	Low	Low	Medium	Low	Medium	Low	High
3	Low	Low	Medium	Low	Medium	Medium	High
4	Low	Low	Medium	Low	Medium	High	High
5	Low	Low	Low	Low	Medium	High	High
6	Low	High	Low	Low	Medium	Medium	High

- *No survey conducted to date – assume high risk.*

As illustrated in the above table, the risk factors associated with the hydrological changes to each feature are generally 'low', as defined by the risk analysis (columns 2-5 above). As noted, minimal to no impervious coverage change is proposed for any catchments draining to the features and as summarized in the Servicing Study (Urbantech, 2025). There is little to no change to catchment areas for Wetlands 2-5, as noted by the 'low' risk factor in column of the table. The 'medium' and 'high' risk associated with Wetlands 1 and 6, respectively, is due to the proposed Highway 413 corridor and not the development of the Alloa Secondary Plan. With that in mind, these 'medium' and 'high' risks are outside of the scope of this Study. The water taking risk in column 4 has been assumed based on available groundwater data and expected excavation depths and extents. Calculations will need to be further refined through detailed designs of the Draft Plans. However, this is only temporary construction dewatering and not long-term so risk is limited temporally. The dewatering plans will require site specific construction management plans and Permits To Take Water (PTTWs) prior to approval to ensure negative impact to the features is minimized. Lastly, there is little to no impact to recharge areas as the Secondary Plan is not proposing any significant change to either surface or groundwater contributing drainage areas.

Based on the findings of the risk assessment and the minimal impact associated with each feature, the hydrological changes associated with Wetlands 1-6 do not trigger any mitigation under post-development of the Alloa Secondary Plan.

11.2.2. Groundwater Quantity

As described above, there are 94 identified well records within 500 m of the Alloa Lands, 50 of which are reportedly used for domestic water supply and 2 for public use. Well users in the area generally draw water from sandy lenses within a clay unit approximately 25 m to 30 mbgl or the fractured shale of the Queenston Formation approximately 35 to 40 mbgl. The shallow groundwater to be potentially impacted by the development through dewatering is located within the first 10 m of ground surface and it is not anticipated that excavations will surpass 10 mbgl even with potential of underground parking (assuming 3 m high parking garage ceilings. The water bearing aquifers for domestic use are confined by approximately 20 m of clayey materials and are interpreted to be hydraulically isolated from the shallow water table above. Therefore, any water taking for dewatering purposes is not anticipated to impact nearby well users.

11.2.3. Groundwater Quality

The Primary Study Area is located within the Toronto Source Protection Area and Credit Valley Source Protection Areas which are governed by the policies outlined within the Approved CTC Source Protection Plan under the Clean Water Act 2006. The CTC Source Protection Plan outlines policy areas related to the protection of source water used for water supply in the greater watershed area.

The CTC Source Protection Plan applies a Vulnerability Score / Threats-Based Approach in which the product of two crucial pieces of information (vulnerability and circumstance) are combined to determine if a specific area and incorporated activity will be considered a Low, Moderate or Significant Drinking Water Threat (LDWT, MDWT, or SDWT).

Related to the Drinking Water Threat classification, The Clean Water Act (2006) employs various levels of policy tools ranging from "Softer" tools such as Education and Outreach to "Part IV Powers" such as Restrictive Land Uses (S. 59), Risk Management Plans (S. 58) and Prohibition (S.57). In general, only SDWTs incur the application of "Part IV Powers".

In general, there are four types of vulnerable areas where activities may incur risks to drinking water sources. These areas are assigned vulnerability index scores ranging from 0 to 10 where the score is derived from numerous factors related to the physical setting. The following list constitutes the four types of vulnerable areas: Wellhead Protection Areas (WHPA), Intake Protection Zones (IPZ), Highly Vulnerable Aquifers (HVA), and Significant Groundwater Recharge Areas (SGRA). Additionally, Event Based Areas (EBA) are delineated to address threats to systems drawing water from larger surface water bodies where the vulnerability scores are generally low.

Activities incurring threats to drinking water sources through impacts to quality and quantity within the region's Source Protection Plan are evaluated based on a hazard rating, also ranging from 0 to 10, and organized into Main and Subcategories.

Main Categories within the Toronto Source Protection Area jurisdiction include:

1. The establishment, operation, or maintenance of a waste disposal site within the meaning of Part V of the Environmental Protection Act.
2. The establishment, operation or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage.
3. The application of agricultural source material to land.
4. The storage of agricultural source material.
5. The management of agricultural source material.
6. The application of non-agricultural source material to land.
7. The handling and storage of non-agricultural source material to land.
8. The application of commercial fertilizer to land.
9. The handling and storage of commercial fertilizer.
10. The application of pesticide to lands.
11. The handling and storage of pesticide.
12. The application of road salt.
13. The handling and storage of road salt.
14. The storage of snow.
15. The handling and storage of fuel.
16. The handling and storage of a dense non-aqueous phase liquids (DNAPLs).
17. The handling and storage of an organic solvent.
18. The management of runoff that contains chemicals used in the de-icing of aircraft.
19. An activity that takes water from an aquifer or a surface water body without returning the water taken to the same aquifer or surface water body.
20. An activity that reduces the recharge of an aquifer.
21. The use of land as livestock grazing or pasturing land, an outdoor confinement area, or a farm-animal yard.

The CTC Source Protection Plan provides a corresponding set of Tables of Drinking Water Threats that show where in a vulnerable area an activity must be located, and under what circumstances, the activity is to be considered a Significant Drinking Water Threat (SDWT). SDWTs typically incur the enactment of policy tools either through mitigation of impacts by applying Restrictive Land Uses and Risk Management Plans or prevention of future impacts through Prohibition.

Currently, the Primary Study Area lands are mapped atop a highly vulnerable aquifer (HVA) in the centre of the lands and a small area of significant groundwater recharge in northwest. The HVA is assigned a vulnerability score of 6 across the Primary Study Area and therefore no significant drinking water threats are identified within this area. However, the following low to moderate drinking water threats are anticipated for the proposed development and should be dealt with using a best management practices approach.

1. The establishment, operation or maintenance of a system that collects, stores, transmits, treats, or disposes of sewage.
    a. Stormwater management facilities and drainage systems: Outfall from a storm water management facility or storm water drainage system.
    b. Stormwater management facilities and drainage systems: Storm water infiltration facility.
12. The application of road salt.
13. The handling and storage of road salt.
14. The storage of snow.
20. An activity that reduces the recharge of an aquifer.

11.2.4. Wetland FBWB with Continuous Groundwater Monitoring Inputs

As noted in Section 7.2.3, a wetland feature-based water balance (FBWB) assessment was conducted by Crozier using groundwater monitoring data collected during this study, alongside open-source data from external sources. The objective of the Crozier FBWB is to evaluate the impact of the proposed development on the function of the relevant wetlands from a groundwater input perspective. The assessment quantifies and compares the wetland water balance criteria under both pre- and post-development conditions to determine the necessity and extent of required mitigation measures for groundwater recharge. The continuous feature-based water balance model prepared by Urbantech was used as the basis with groundwater monitoring data from the hydrogeological investigation to determine infiltration requirements. Please refer to the Urbantech continuous hydrologic model for surface water related targets and water balance, presented in Appendix J.

Groundwater monitoring has been ongoing since September 2023 with the most recent data was collected in June 2025. .

Seasonal wetland water balance graphs were generated in VO and are presented in Appendix I. Seasonal FBWB results under pre- and post-development scenarios are outlined in Table 49 and Table 50, respectively. The seasonal water balance deficits and surplus values are outlined in Table 51.

TABLE 49: PRE-DEVELOPMENT SEASONAL WETLAND FBWB RESULTS

Wetland ID	Season (year)	Precipitation (mm)	Seepage (mm)	Δ Storage (mm)
Wetland 1	Spring (2024)	314	89	-86
	Summer (2024)	322	96	-100
	Fall (2024)	121	25	-13
	Spring (2025)	219	56	-57
Wetland 2	Spring (2024)	314	89	-86
	Summer (2024)	322	97	-101
	Fall (2024)	121	25	-13
	Spring (2025)	219	57	-58
Wetland 3	Spring (2024)	314	90	-86
	Summer (2024)	322	98	-102

Wetland ID	Season (year)	Precipitation (mm)	Seepage (mm)	Δ Storage (mm)
	Fall (2024)	121	25	-13
	Spring (2025)	219	58	-59
Wetland 4	Spring (2024)	314	71	-86
	Summer (2024)	322	95	-101
	Fall (2024)	121	25	-13
	Spring (2025)	219	54	-59
Wetland 5	Spring (2024)	314	51	-84
	Summer (2024)	322	91	-100
	Fall (2024)	121	25	-13
	Spring (2025)	219	48	-57
Wetland 6	Spring (2024)	314	89	-86
	Summer (2024)	322	97	-101
	Fall (2024)	121	25	-13
	Spring (2025)	219	58	-58

TABLE 50: POST-DEVELOPMENT – SEASONAL WETLAND FBWB RESULTS

Wetland ID	Season (year)	Precipitation (mm)	Seepage (mm)	ΔStorage (mm)
Wetland 1	Spring (2024)	314	89	-86
	Summer (2024)	322	96	-101
	Fall (2024)	121	25	-13
	Spring (2025)	219	56	-58
Wetland 2	Spring (2024)	314	89	-86
	Summer (2024)	322	97	-101
	Fall (2024)	121	25	-13
	Spring (2025)	219	57	-58
Wetland 3	Spring (2024)	314	90	-86
	Summer (2024)	322	98	-102
	Fall (2024)	121	25	-13

Wetland ID	Season (year)	Precipitation (mm)	Seepage (mm)	ΔStorage (mm)
	Spring (2025)	219	58	-59
Wetland 4	Spring (2024)	314	71	-86
	Summer (2024)	322	95	-102
	Fall (2024)	121	25	-13
	Spring (2025)	219	54	-59
Wetland 5	Spring (2024)	314	51	-85
	Summer (2024)	322	91	-101
	Fall (2024)	121	25	-13
	Spring (2025)	219	48	-58
Wetland 6	Spring (2024)	314	89	-86
	Summer (2024)	322	97	-101
	Fall (2024)	121	25	-13
	Spring (2025)	219	58	-58

TABLE 51: SEASONAL WETLAND FBWB DEFICIT/SURPLUS

Wetland ID	Season (year)	Precipitation (mm)	Inflow (mm)	ET (mm)	Seepage (mm)	Outflow (mm)	ΔStorage (mm)
Wetland 1	Spring (2024)	0	-46	0	0	-46	0
	Summer (2024)	0	-108	1	1	-108	-1
	Fall (2024)	0	-9	0	0	-9	0
	Spring (2025)	0	-215	0	1	-215	-1
Wetland 2	Spring (2024)	0	2019	0	0	2019	0
	Summer (2024)	0	2038	1	0	2037	0
	Fall (2024)	0	746	1	0	745	0

Wetland ID	Season (year)	Precipitation (mm)	Inflow (mm)	ET (mm)	Seepage (mm)	Outflow (mm)	ΔStorage (mm)
	Spring (2025)	0	1192	0	0	1192	0
Wetland 3	Spring (2024)	0	586	0	0	586	0
	Summer (2024)	0	697	0	0	697	0
	Fall (2024)	0	248	0	0	248	0
	Spring (2025)	0	315	0	0	315	0
Wetland 4	Spring (2024)	0	23	0	0	24	0
	Summer (2024)	0	24	0	0	25	0
	Fall (2024)	0	6	0	0	6	0
	Spring (2025)	0	11	0	0	11	0
Wetland 5	Spring (2024)	0	167	0	0	168	-1
	Summer (2024)	0	167	2	-1	168	-1
	Fall (2024)	0	57	1	0	57	-1
	Spring (2025)	0	100	0	0	101	-1
Wetland 6	Spring (2024)	0	703	0	0	703	0
	Summer (2024)	0	886	0	0	886	0
	Fall (2024)	0	313	0	0	313	0
	Spring (2025)	0	483	0	0	483	0

The preliminary findings from the continuous model indicate that Wetland 1 experiences a deficit in runoff, while the remaining Wetlands #2 through #6 are experiencing a surplus of inflow upon comparing pre- to post-development conditions. The observed changes can be mostly attributed to an increase or decrease in total drainage area and/or impervious area contributing runoff to the wetlands. Specifically, Wetland # 1 experiences a 22 % reduction in total drainage area due to the anticipated construction of Highway 413. Approximately 39.5 ha of impervious drainage area will be directed south, bypassing Wetland 1 under proposed conditions. Wetland #2 experiences a 1% increase in total drainage area. Wetland #3 experiences a 3% reduction in total drainage area, but a significant increase in impervious drainage area Wetland #4 experience a 0% increase in drainage area but receives an increase

in runoff potential due to additional impervious surfaces. Wetland #5 experiences a 1% decrease in total drainage area but receives an increase in runoff potential due to additional impervious surfaces. Wetland #6 experiences a significant surplus in inflow due to both a 39% increase in drainage area and general increase in impervious area.

The inflow deficit at Wetland #1 will require further evaluation to determine whether there is an opportunity to provide mitigation under post-development conditions. It is important to note that the reduction in inflow is entirely attributed to the proposed construction of Highway 413, which is located outside of the Primary Study Area. Mitigation measures will be implemented within the study area to the extent feasible, incorporating best management practices to minimize hydrologic impacts. Potential mitigation at Wetland #1 may include the use of stormwater management controls structures (e.g., weirs, culverts, flow divertors, etc.) to redirect a portion of post-development runoff into the wetland, particularly during critical seasons and low-flow periods.

The inflow surplus at remaining wetlands will be examined. Mitigation at these wetlands may include bypassing excess runoff around the wetlands and/or providing additional infiltration upstream to reduce the surface runoff.

Seepage analysis indicates that the wetlands are spring-fed and receive a portion of their water naturally through groundwater discharge. Notably, the seepage results remain consistent between pre- and post-development conditions, as the mapped wetland areas have not been altered.

Further modelling of infiltration and runoff balance to the wetlands is required to meet the anticipated deficit (Wetland #1) and surplus (Wetland #1 through #6) presented herein. Any surpluses should be reviewed from an ecological standpoint to ensure no damage to the hydroperiod of the existing ecological function of the wetlands. The specific design of these mitigation measures will be incorporated into the overall stormwater management and grading strategies implemented in further detailed studies required to support Draft Plans of Subdivision (FSR, EIR).

Before developing a FBWB mitigation strategy and compensation plan, the following actions must be undertaken:

- Ongoing climate data monitoring at the Alloa weather station, including regular maintenance visits and quality assurance/quality control of collected data.
- Ongoing groundwater monitoring at all locations.
- Ongoing water level monitoring at all wetland piezometers,
- Ongoing flow monitoring at the outlet locations, including the use of velocity panels and the development of rating curves.
- Updates to the continuous hydrologic model with newly collected climate and groundwater data.
- Calibration and validation of the continuous hydrologic model, including graphical comparisons of monitored and modelled data.

- Simulation of long-term climate data inputs from a local weather station to account for variations in antecedent moisture conditions. Long-term data will encompass periods of wet, average, and dry years.

These procedures will confirm the necessity and extent of mitigation required to maintain the pre-development hydroperiod under post-development conditions. If a mitigation strategy is implemented, a continuous post-development scenario with controls will be created in the VO model. The new scenario will aid in designing mitigation measures and provide a comparison of the hydroperiod under pre-development and post-development conditions with controls. The results will ensure that any water balance deficiencies have been successfully resolved during post-development. Post-development monitoring will be conducted as a part of the Comprehensive Adaptive Management Plan (CAMP) to provide the data necessary to confirm the performance of mitigation measures.

11.2.5. Alloa Drain Realignment Groundwater Considerations

The current Alloa Drain exists within the Halton Till, with substrate consisting of silty material with gravel and sand intermixed. Due to the potential of perched groundwater within coarser lenses, small amounts of baseflow are provided to the drain by the surrounding till unit. Deeper in the strata, layers of more conductive glacial and modern deposits, however these units are typically discontinuous and isolated by the surrounding till. Therefore, groundwater transmission is limited.

Along the drain, the confining layer extends to at least to 4.6 mbgl or 255.5 masl. As discussed further in the LSS, the Alloa drain is proposed to be re-aligned. However, the proposed re-alignment does not extend below an elevation of 256 masl. Therefore, no adverse effects from the proposed channel realignment are anticipated.

11.3 Hydrology and Hydraulics

11.3.1. Proposed Hydrologic Model

The model was further updated by Urbantech to reflect proposed conditions based on the proposed Secondary Plan and proposed drainage area delineation. Similar to the updates for existing conditions, model parameters for external catchments under proposed conditions remained consistent with the original version provided by TRCA, except where larger, lumped catchments were split into smaller catchments to refine drainage patterns in areas requiring more resolution. Developed areas were modelled using the STANDHYD command. All model parameters are included in Appendix I. The following scenarios were simulated for post-development conditions:

- 25mm, 2-year to 100-year storms (12-hour AES, AMC II conditions), with SWM facilities in place
- Regional storm – Hurricane Hazel (AMC III conditions), uncontrolled (no SWM facilities), for use in hydraulic modelling
- Regional storm – Hurricane Hazel (AMC III conditions), with SWM facilities in place
- Continuous model, with SWM facilities in place (for use in the feature-based water balance and erosion analysis)

The Regional storm scenario (AMC III conditions) assuming no SWM facilities in place was used for hydraulic modelling. Table 52 compares the proposed model flows to the existing flows at various key nodes:

TABLE 52: PROPOSED VS. EXISTING PEAK FLOWS AT KEY NODES

Location	NHYD	Area (ha)	2-yr	5-yr	10-yr	25-yr	50-yr	100-yr	Regional (with SWM)	Regional (no SWM)
Node 2167 (Mississauga Road)	Existing UT	301.2	1.525	2.732	3.550	4.522	5.317	6.154	24.736	24.736
	Proposed UT	308.28	2.709	3.916	4.789	5.983	6.884	7.807	25.629	31.021
	Difference	7.08	1.184	1.184	1.239	1.461	1.567	1.653	0.893	6.285
	%	2.35%	77.64%	43.34%	34.90%	32.31%	29.47%	26.86%	3.61%	25.41%
Node 1125 (Creditview Road)	Existing UT	856.50	3.387	6.186	8.315	11.138	13.369	15.758	66.885	66.885
	Proposed UT	881.65	5.085	7.954	9.922	12.502	14.779	17.138	63.997	83.224
	Difference	25.15	1.698	1.768	1.607	1.364	1.41	1.38	-2.888	16.339
	%	2.94%	50.13%	28.58%	19.33%	12.25%	10.55%	8.76%	-4.32%	24.43%
Node 1105 (Chinguacousy Road)	Existing UT	1465.32	5.624	10.066	13.506	18.083	21.81	25.814	112.762	112.762
	Proposed UT	1464.16	7.322	11.625	14.6	18.975	22.596	26.414	106.087	127.903
	Difference	-1.16	1.698	1.559	1.094	0.892	0.786	0.6	-6.675	15.141
	%	-0.08%	30.19%	15.49%	8.10%	4.93%	3.60%	2.32%	-5.92%	13.43%

Based on the uncontrolled Regional flow scenario ("no SWM" in preceding table), there is a ~13% to 25% increase in the peak flows approaching Chinguacousy Road. Regional storm control is recommended to mitigate this increase, and the target release rates in the Etobicoke Creek Hydrology Update Study have been demonstrated to reduce the Regional flows below the existing conditions values due to the requirement to control to 60% of existing conditions flows (refer to the Regional – SWM results in the preceding table).

11.3.2. Proposed Hydraulic Model

The proposed conditions hydraulic modelling builds upon the framework and data used in the existing conditions analysis, as well as the preliminary NHS corridor design described in the preceding sections. The primary objective is to compare the existing and proposed conditions to identify changes and potential impacts on the floodplain, storage, and flow conveyance. The following sections provide a detailed overview of the proposed conditions modelling, highlighting significant changes and their implications. The proposed corridor has been sized to handle the post-development, uncontrolled flows resulting from the proposed drainage plan and land use.

11.3.3. Proposed Hydraulic Structure Inventory

Similar to the existing conditions, the HEC-RAS model was utilized to evaluate the proposed culvert infrastructure within the study area (Table 53). The proposed conditions crossings were sized based on hydraulic conveyance requirements (i.e., all new crossings were designed to pass the Regional Storm without overtopping) while meeting the required wildlife crossing and fluvial geomorphological design criteria. Therefore, there is a general improvement proposed compared to the existing structures.

TABLE 53: PROPOSED VS. EXISTING PEAK FLOWS AT KEY NODES

Crossing Location & HEC-RAS Section	Crossing Type	Size of Opening [span x rise] or [diameter] (m)	Upstream Invert (m)	Downstream Invert (m)	Road Centreline Elevation (m)
Chinguacousy Eto Hdwtr S South 6 XS 696	Conc, Box	19.0 x 2.5	256.69	256.64	262.26
Chinguacousy Eto Hdwtr S South 6 XS 1575	Conc. Box	19.0 x 2.5	257.63	257.58	264.04
Creditview Road Eto Hdwtr S South 6 XS 236	Conc. Box	19.0 x 2.5	258.02	257.96	260.20
Creditview Road Eto Hdwtr S Trb N South N1 XS 125	Conc. Box	9 x 1.75	258.95	258.85	262.20
Creditview Road Eto Hdwtr S South 8 XS 580	Conc. Box	19.0 x 2.5	258.66	258.54	253.75
Creditview Road Eto Hdwtr S South 8 XS 906	Conc. Box	19.0 x 2.5	258.68	258.63	264.14
Chinguacousy Eto Hdwtr S Trb O South O1 XS 323	Conc. Box	8 x 1.8	261.02	260.8	265.64

Chinguacousy Eto Hdwtr S Trb O South O1 XS 880	Conc. Box	8 x 1.8	264.4	264	268.54
Chinguacousy Eto Hdwtr S Trb P South P1 XS 314	Conc. Box	8 x 1.5	260.93	260.72	264.78
Mississauga 2D Model	Conc. Box	17 x 2.5	259.97	259.83	264.25

11.3.4. Proposed Riparian/Flood Storage

The riparian storage under proposed conditions was assessed to understand the impact of planned developments and infrastructure modifications on floodplain storage capacity. The analysis considers scenarios both with and without culverts to capture the full range of potential impacts.

The results of the HEC-RAS model runs are presented in the following tables to showcase the differences in floodplain storage and discharge relationships for the 2D model area west of Mississauga Road, and the 1D unsteady state model east of Mississauga Road.

TABLE 54: PROPOSED VS. EXISTING RIPARIAN STORAGE – 2D MODEL, NO CULVERTS, WEST OF MISSISSAUGA ROAD

Event	① Existing Volume (1000m³)	② Proposed Volume (1000m³)	Difference
	West of Mississauga Road		②-①
Regional	482.452	209.246	-273.21
100-year	254.74	78.90	-175.84
50-year	213.804	66.08	-147.72
25-year	171.327	52.34	-118.99
10-year	113.876	38.136	-75.74
5-year	73.08	26.304	-46.78
2-year	25.47	7.395	-18.08

TABLE 55: PROPOSED VS. EXISTING FLOOD STORAGE – 1D UNSTEADY-STATE MODEL, NO CULVERTS, EAST OF MISSISSAUGA ROAD

Event	① Existing Volume (1000m³)	② Proposed Volume (1000m³)	Difference
	Eto Hdwtr S – South 6 to 10 (Main Channel)		②-①
Regional	369.01	426.73	57.72
100-year	102.69	143.28	40.59
50-year	88.28	124.26	35.98
25-year	73.87	104.87	31.00
10-year	54.10	76.73	22.63
5-year	38.50	51.95	13.45
2-year	20.76	21.71	0.95
Event	**① Existing Volume (1000m³)**	**② Proposed Volume (1000m³)**	**Difference**
	Eto Hdwtr S – South K1		**②-①**
Regional	51.61	50.94	-0.67
100-year	20.66	16.38	-4.28
50-year	17.54	14.99	-2.55
25-year	16.73	14.44	-2.29
10-year	14.87	13.12	-1.75
5-year	10.05	9.06	-0.99
2-year	6.77	6.00	-0.77
Event	**① Existing Volume (1000m³)**	**② Proposed Volume (1000m³)**	**Difference**
	Eto Hdwtr S - South N1		**②-①**
Regional	61.47	61.57	0.10
100-year	12.83	15.70	2.87
50-year	10.85	13.13	2.28
25-year	9.00	10.80	1.80
10-year	6.72	7.85	1.13
5-year	5.25	5.85	0.60
2-year	3.43	3.57	0.14
Event	**① Existing Volume (1000m³)**	**② Proposed Volume (1000m³)**	**Difference**

	Eto Hdwtr S - South O1		②-①
Regional	51.35	47.10	-4.25
100-year	18.21	19.87	1.66
50-year	16.01	17.88	1.87
25-year	13.85	15.91	2.06
10-year	10.95	13.10	2.15
5-year	8.75	10.73	1.98
2-year	5.69	6.81	1.12
Event	**① Existing Volume (1000m³)**	**② Proposed Volume (1000m³)**	**Difference**
	Eto Hdwtr S - South P1		**②-①**
Regional	36.62	20.88	-15.74
100-year	12.53	7.32	-5.21
50-year	11.04	6.43	-4.61
25-year	9.52	5.44	-4.08
10-year	6.23	4.09	-2.14
5-year	4.84	2.88	-1.96
2-year	3.00	1.17	-1.83
Event	**① Existing Volume (1000m³)**	**② Proposed Volume (1000m³)**	**Difference**
	TOTAL (1D)		**②-①**
Regional	570.06	607.22	37.16
100-year	166.92	202.55	35.63
50-year	143.72	176.69	32.97
25-year	122.97	151.46	28.49
10-year	92.87	114.89	22.02
5-year	67.39	80.47	13.08
2-year	39.65	39.26	-0.39
Event	**① Existing Volume (1000m³)**	**② Proposed Volume (1000m³)**	**Comparison**
	TOTAL (1D + 2D)		**②-①**
Regional	1052.51	816.47	-236.05

100-year	421.66	281.45	-140.21
50-year	357.52	242.77	-114.75
25-year	294.30	203.80	-90.50
10-year	206.75	153.03	-53.72
5-year	140.47	106.77	-33.70
2-year	65.12	46.66	-18.47
Event	**① Existing Volume (1000m³)**	**② Proposed Volume (1000m³)**	**Comparison**
	TOTAL		**②-①**
Regional	846+654.79 (2D)	625.49+438.177 (2D)	-437.123
100-year	291.52	168.33	-123.19
50-year	243.4	144.35	-99.05
25-year	198.8	120.49	-78.31
10-year	148.43	88.69	-59.74
5-year	114.92	61.74	-53.18
2-year	68.6	32.99	-35.61

The hydraulic modelling for proposed conditions indicates a difference in storage west of Mississauga Road. This difference was anticipated for the lands west of Mississauga Road due to the presence of a large depression or ponding area and loss of storage attributed to the future Highway 413 corridor. For the channel east of Mississauga Road, the riparian storage targets have been generally maintained.

The proposed channel design between Mississauga Road and Chinguacousy Road involves the creation of a more efficient trapezoidal channel, with the design based on fluvial geomorphologic criteria and conveyance of the uncontrolled Regional storm. This type of channel is engineered to improve flow conveyance by having a uniform cross-sectional shape that reduces resistance and promotes faster water movement. While this design enhances the channel's efficiency, it inherently reduces the floodplain's storage capacity compared to a natural, less uniform channel.

The key factors contributing to the reduction in storage capacity include:

- **Reduced Cross-Sectional Area:** The trapezoidal shape minimizes areas where water can accumulate, thus reducing the overall volume of water the floodplain can store during flood events.

- **Increased Flow Velocity:** A more efficient channel design increases the velocity of water, decreasing the likelihood of water spreading out and being stored in the adjacent floodplain.

A portion of the storage lost in the transition from natural conditions to a formal trapezoidal channel is likely attributed to dead storage. Dead storage refers to areas within the floodplain that do not actively contribute to the conveyance of flow. This can include low-lying areas or depressions where water may pool but not significantly influence the overall flow dynamics / flow routing.

To ensure that the loss of riparian storage does not adversely impact downstream flows, further analyses using 1D dynamic and 2D models were conducted. These models provide a more comprehensive view of the flow dynamics and storage interactions over time and across the floodplain.

To evaluate the importance of maintaining the flood plain storage as it relates to flow routing / attenuation along the reach, a 1D dynamic HEC-RAS model and 2D HEC-RAS model was completed for the reaches between Mississauga Road and Chinguacousy Road. This simulation establishes the "actual" volume occupied during the Regional storm, and demonstrates the total "routed" peak flow at Chinguacousy Road. This analysis was conducted for the Regional storm only. The 2D model provides an additional confirmation and utilizes quasi-steady-state flows as preferred by TRCA, whereas the 1D model uses the actual hydrograph from the Visual OTTHYMO model. The total flood storage calculated with the 2D model (based on GIS comparison of the water surface vs. terrain), was similar to the 1D steady statement model (approximately 1.5 million cubic meters). However, the difference in storage was markedly less than the 1D model suggests as shown in Table 56.

TABLE 56: EXISTING RIPARIAN STORAGE – 2D DYNAMIC MODEL, WITH CULVERTS

Location	Scenario	Regional Storage	Sum of peak flows at Chinguacousy Road (VO6 model with no channel routing elements; adjusted for quasi-steady-state flow)	Actual routed Regional Peak flow at Chinguacousy Road	
	[m³] [m³]		[m³/s]	[m³/s]	
Entire study area (Heritage Road to Chinguacousy Road)	Existing	1,478,937	131.66 (TP=11.25 hours)	71.91 + 27.34 spill = 99.25 (19.92 hours)	
	Proposed	1,466,658	139.84 (TP=11.00 hours)	110.50 (20.00 hours)	
	Difference	-12,279	8.18 (-0.25 hours)	11.25 (0.08 hours)	
	%	0.83%	6.2% (-3%)	11.3% (0.91%)	

The key findings from these models include:

Peak Flow Comparisons: The dynamic 1D and 2D models were used to compare peak flows downstream of the proposed channel modifications. The results indicated that despite the reduction in storage capacity, the peak flows at downstream locations such as Chinguacousy Road did not show significant increases even under uncontrolled conditions. The largest difference is attributed to eliminating the spill across Heritage Road through implementation of the Highway 413 corridor. There is no significant difference in peak flow timing in the 2D model or total flow attributed to loss of storage.

Floodplain impacts: The analysis confirmed that the more efficient flow routing through the trapezoidal channel compensated for the loss of storage. The channel's enhanced conveyance capacity ensured that floodwaters were transported more effectively, reducing the risk of backwater effects and localized flooding.

The proposed changes to the channel design between Mississauga Road and Chinguacousy Road, while reducing riparian storage, do not adversely impact downstream flows. The more efficient trapezoidal channel design improves flow conveyance, and the lost storage primarily comprises dead storage that does not significantly contribute to flow dynamics. The validation using 1D dynamic and 2D models confirms that peak flows downstream remain within acceptable limits, ensuring that the proposed conditions maintain effective floodplain management and minimize flood risks.

11.4 Fluvial Geomorphology and Headwater Drainage Features Within the Secondary Plan Area

Realignment and rehabilitation works are proposed for the Alloa Drain and a portion of the Lyons Drain, as well as multiple HDFs, as described in Section 10.5 of this report and Appendix M. Segments of municipal drain proposed for realignment have been historically straightened and undergo periodic maintenance to facilitate agricultural land uses. This has generally resulted in corridors with narrow/absent natural riparian buffers, limited channel form and poor substrate variability. Similarly, the HDFs that are proposed for realignment consist of generally heavily modified features within actively cultivated fields that have limited form and offer limited function under existing conditions. The proposed natural corridor designs will provide sinuous low flow channels with riffle and pool morphology, increased substrate variability and naturalized floodplains that contain numerous wetland features and other terrestrial habitat enhancements. When the length of all municipal drain and HDFs are considered, the proposed naturalized corridors will result in an increase of just under 1 km (990 m) of feature length when compared to existing conditions.

Low order drainage features within the Alloa Secondary Plan Area were evaluated generally following TRCA and CVC (2014) HDF guidelines. The alignment of Highway 413 is anticipated to influence drainage patterns in the northern and western extents of the Primary Study Area and has been considered in the management classifications of HDFs. The majority of HDFs proposed for removal are in agricultural fields, were tiled and/or dry by the second field assessment, lacked natural riparian vegetation and provided limited ecological function. Where HDFs are located within wetlands or woodlands, they are generally to be protected. Where HDFs

contribute flow to downstream wetlands or constructed natural heritage corridors south of Mayfield Road, contributions are to be maintained in the post-development condition.

Based on the above, no significant impacts are anticipated from a fluvial geomorphological perspective as a result of development of the Secondary Plan Area.

11.5 Fluvial Geomorphology Downstream Assessment – Erosion Threshold and Erosion Exceedance Analysis

11.5.1. Erosion Mitigation Approach

Following development, the Alloa Secondary Plan Area/Primary Study Area will have a total footprint of 721.53 ha. The Secondary Plan Area will proceed in two Phases, with Phase 1 located in the northeastern portion of the lands and spanning 329.01 ha, and Phase 2 located within the southeastern portion of the lands and spanning 392.52 ha (see Figure 20). The proposed development will consist primarily of residential lands, with some commercial blocks along the southern portion of the Phase 1 lands and employment areas along the south portion of the Phase 2 lands. A natural channel corridor design is planned for the Alloa Drain to accommodate the proposed development. The implemented design will restore geomorphological and ecological functions and will include offline pocket wetlands within the corridor to enhance infiltration.

The Primary Study Area will be serviced by a total of ten (10) stormwater management (SWM) ponds, with three (3) located within the Phase 2 lands and seven (7) within the Phase 1 lands (Urbantech, 2025). Eight SWM Ponds are proposed to discharge directly to the Alloa Drain, with some of the discharge intercepted by pocket wetlands that are part of the proposed channel corridor enhancement. Runoff from the eight (8) SWM Ponds outletting to the Alloa Drain and its tributary will ultimately discharge to Etobicoke Creek. The total existing drainage area of Etobicoke Creek at its confluence with Alloa Drain is approximately 2,161 ha. Under post-development conditions, Etobicoke Creek will drain approximately 399.9 ha from the subject lands, consisting of 19% of its total drainage area at the confluence with Alloa Drain (Crozier, 2024).

Two SWM Ponds located along the southern boundary of the Phase 1 lands will discharge southeast to tributaries of Fletcher's Creek. Drainage from the two SWM Ponds to Fletcher's Creek will consist of approximately 1.9%, or 87.4 ha of the watercourse's total drainage area of 4,500 ha (Crozier, 2024). Approximately 59.5 ha of additional runoff from the eastern portions of the subject lands will be directed towards the southeastern watercourses via a private SWM Pond and LID facilities, 22.5 ha will discharge to Fletcher's Creek, 21.0 ha will discharge to East Huttonville Creek, and 16.0 ha will discharge to West Huttonville Creek (Crozier, 2024). The receiving channels for Fletcher's Creek and East Huttonville Creek consist of constructed corridors that contain hydraulically sized substrates based on post-development flows (GEO Morphix, 2024). Stormwater management ponds outletting to Fletcher's Creek were sized based on unitary release rates provided in previous studies, and thus the receiving corridors are expected to remain unaffected by runoff from the proposed development (AMEC, 2011).

As the contributing area to Fletcher's Creek is reduced by approximately 28 ha and is relatively minor under post-development conditions (less than 10%), an erosion exceedance assessment was not deemed necessary for the watercourse. Similarly, the contributing areas from the subject lands to West and East Huttonville Creek will also be minor under the proposed conditions relative to their respective total drainage area. Post-development flows were guided by previously established unitary release rates from studies completed within the West and East Huttonville Creek subwatersheds and the Fletcher's Creek subwatershed, thus eliminating the need for erosion assessments (AMEC, 2011; Wood, 2021; Stonybrook Consulting, 2011; Urbantech et al. 2016). Summaries of previous studies are provided in Appendix Z, The focus of the erosion mitigation assessment is therefore on potential impacts to Etobicoke Creek.

11.5.2. Etobicoke Creek Erosion Thresholds

Erosion thresholds are used to determine the magnitude of flow required to potentially entrain and transport bed and/or bank material (Garcia, 2008; Villard and Parish, 2003). As such, they are used to inform erosion mitigation strategies in channels influenced by conceptual flow and stormwater management plans. Reaches are selected based on erosion-sensitivity within the potential zone of impact downstream of the SWM outlets for the proposed development, where access to the watercourse is granted. The erosion threshold is a theoretical value, typically expressed as a critical discharge or shear stress, at which entrainment of sediment would occur based on the physical properties of the bed and bank materials. Due to variability between bed and bank composition and structure, erosion thresholds are determined for both bed and bank materials. The lower of the bed and bank erosion thresholds is adopted, as it provides the more conservative and limiting erosion threshold estimate for the subject reaches.

Within the Primary Study Area, all proposed SWM Ponds discharging to the Alloa Drain or its tributaries will outlet to realigned natural corridors with substrates that will be hydraulically sized based on post-development flows. As such, no erosion concerns are anticipated within the subject lands due to stormwater discharge. Post-development flows will eventually traverse the Mayfield West lands east of Chinguacousy Road, where multiple studies have previously received approval.

An erosion threshold was modelled by Amec (2014) from detailed field observations of Reaches MEC-R05 and MEC-R02 along Etobicoke Creek as part of the Mayfield West Phase 2 Final Report for the Town of Caledon. These detailed assessments included two erosion-sensitive reaches along Etobicoke Creek; MEC-R05, located approximately 2 km downstream from the subject lands, and MEC-R02, located approximately 2.8 km downstream from the subject lands. The erosion threshold is the theoretical point, typically expressed as a critical discharge or shear stress, at which entrainment of sediment would occur based on the morphology of the channel and characteristics of the bed and bank materials. Both of the subject erosion thresholds were accepted by the TRCA and are outlined in the Mayfield West Phase 2 Final Report (Amec, 2014). Channel Parameters and results from the erosion threshold assessment are provided below in Table 57.

TABLE 57: CHANNEL PARAMETERS AND EROSION THRESHOLD RESULTS FOR ETOBICOKE CREEK

Channel Parameter	Etobicoke Creek	
	MEC-R05*	MEC-R02*
Channel Characteristics		
Average bankfull width (m)	6.94	5.92
Average bankfull depth (m)	0.45	0.70
Channel gradient (%)	0.04	0.14
D_{50} (mm)	1.6	3
D_{84} (mm)	8	17.8
Manning's n roughness coefficient	0.025	0.029
Average bankfull discharge (m^3/s)	1.59	5.18
Average bankfull velocity (m/s)	0.41	0.92
Drainage area (ha)	2,161**	2,373**
Erosion Threshold		
Material	Fine bed sediments	Fine bed sediments
Reference	N/A	N/A
Critical velocity (m/s)	0.41	0.72
Threshold shear stress (N/m^2)***	1.56	5.26
Threshold depth (m)***	0.39	0.38
Critical discharge (m^3/s)	**0.56**	**0.68**
Unitary threshold ($m^3/s/ha$)	**0.000259**	**0.000286**

** Mayfield West Phase 2 Secondary Plan EIS-MP Part A (AMEC, 2014)*
*** Drainage area from provided by Urbantech (2025)*
**** Calculated from GEO Morphix's in-house model based on bankfull channel and bed sediment inputs*

11.5.3. Etobicoke Creek Terrain Analysis

Analysis of a high-resolution spatial dataset was used to interpret channel and valley geomorphic features within Etobicoke Creek to support the previously defined and erosion thresholds. Stream channels are inherently dynamic features of the natural landscape, and a detailed review of channel and valley geomorphology using spatial datasets is useful to gain insight into how a given fluvial system has adjusted and is likely to adjust, over time. In particular, the use of high-resolution bare-earth digital terrain models (DTMs) derived from airborne LiDAR surveys allows for detailed, broad-scale mapping and analysis of geomorphic features.

Remote sensing data in the form of LiDAR-derived bare-earth DTMs with a horizontal resolution of 1.0 x 1.0 m (2015 and 2023 data) were obtained from a publicly available dataset maintained by MNRF. The bare-earth elevation raster datasets were used to generate hillshade models to interpret and analyze geomorphic features. The DTMs were compared to evaluate potential land surface changes (i.e., relative increases or decreases in surface elevation) in the vicinity of

erosion-sensitive reaches downstream of the subject lands along Etobicoke Creek (i.e., MEC-R05 and MEC-R02) in the intervening period since the erosion thresholds were defined in 2014. This was achieved by generating a land surface change raster, or a DEM of Difference (DoD), which highlights areas of elevation change between two survey periods. The DoD was generated by subtracting the elevation values recorded in the more recent 2023 elevation raster from the elevation values recorded in the earlier 2015 elevation raster. Based on this method, areas of elevation decrease in the vicinity of the watercourse may indicate potential erosion, while areas of elevation increase may indicate areas of potential aggradation. The DoD was overlaid on the 2023 hillshade raster to show the spatial distribution and magnitude of land surface changes over the given period. The hillshade and DoD mapping is provided as standalone figures in Appendix L or within the Erosion Report in Appendix Z of this Report.

The DoD shows limited land surface change within the floodplain and channel of Reach MEC-R05. Local elevation decreases between 0.50 m to 1.0 m were detected at discrete locations within the channel and floodplain. These locations were isolated and discontinuous, suggesting a lack of systemic geomorphic change within the reach. For example, there is one instance of elevation decrease along the outside of a meander bend within the reach, at the last bend upstream of the straightened section at the McLaughlin Road crossing, and no other indicators of elevation change in the immediate vicinity. Another instance of elevation decrease visible within the channel appears to have been caused by fluctuating water levels in a relatively deep pool upstream of a historic farm crossing, which was removed some time between 2017 and 2018 according to satellite imagery available on Google Earth Pro. Other elevation decreases are spatially dispersed within the floodplain, set back from the channel, and do not appear to be associated with channel geomorphic processes or valley slope processes. Based on the DoD analysis, minimal geomorphic change has occurred between 2015 and 2023, indicating the previously defined erosion thresholds for Reaches MEC-R02 and MEC-R05 remain representative of the receiving watercourse.

11.5.4. Etobicoke Creek Erosion Exceedance Analysis

In support of the proposed Stormwater Management (SWM) plan, an erosion exceedance analysis was completed for Etobicoke Creek (CVC, 2015; TRCA, 2012). Runoff from the development will largely be directed to Etobicoke Creek via eight (8) SWM Ponds discharging to Alloa Drain within the Primary Study Area. Contributions from the subject lands to Etobicoke Creek will consist of approximately 18% of the total drainage area for the watercourse at Reach MEC-R05. The proposed SWM strategy for the ponds directing flow to Etobicoke Creek includes interception and infiltration of runoff via LIDs. Two scenarios were modelled: a 'no mitigation' scenario, which includes the stormwater management ponds but excludes LIDs, and a mitigation scenario, which includes 10.9 mm of initial abstraction to account for the hydrological influence of proposed LID features. To account for potential uncertainty in the uncalibrated catchment-wide continuous hydrological simulation model, a sensitivity analysis was undertaken to analyze hydrological conditions under a high runoff scenario (runoff coefficient of 0.47), a baseline scenario (runoff coefficient of 0.28) and a low runoff scenario (runoff coefficient of 0.11).

Using the erosion thresholds defined in the Mayfield West Phase 2 Secondary Plan EIS-MP Part A (AMEC, 2014) for the subject reaches, the pre- and post-development hydrological simulation

modelling provided by Urbantech (2025), the effect of the proposed development on erosion potential within the receiving watercourse was completed by GEO Morphix based on the following four indices:

- Cumulative time of exceedance (tex)
- Number of exceedance events
- Cumulative effective volume (CEV)
- Cumulative effective work/stream power index (CEWI)

These indices were developed in response to limitations of traditional peak flow-based stormwater design approaches (Villard and Parish, 2003; Villard and Ness, 2006). They have been applied in various southern Ontario jurisdictions, including Conservation Halton (CH), TRCA and CVC. These indices, as a product, provide an evaluation of the number of events, as well as the duration and magnitude of sediment transport (Villard and Ness, 2006). The most relevant indicator is the cumulative effective stream power, as it reflects both the duration and magnitude of erosion exceedance events.

The post- and pre-development hydrological modelling reflects changes to the hydrological regime resulting from the change in landuse within the catchment. Continuous flow data was provided by Urbantech (2025) in 15-minute increments spanning from 1960 to 1999 for existing and future conditions with and without proposed LID mitigation measures. The hydrological modelling was analyzed to calculate the erosion indices and identify changes in erosion potential within the erosion-sensitive reaches MEC-R02 and MEC-R05. A selection of pre- and post-development hydrographs overlain with the respective erosion thresholds is provided in Appendix Z.

Erosion exceedance modelling results indicate that the proposed stormwater management plan, including LID strategies, effectively mitigates the risk of increases in erosion potential within the receiving watercourse. The erosion exceedance modelling results indicate a minor decrease in erosion potential under the high runoff scenario, no change in erosion potential under the baseline scenario, and an inconsequential increase in erosion potential under the low runoff scenario for both assessed reaches. We note that the cumulative effective work index (ωeff; CEWI) is considered the most relevant index for erosion potential, as it reflects both the flow magnitude and exceedance duration of a given erosion event. Results over +/-5% are potentially significant enough to result in a measurable change in erosion potential within the receiving watercourse when the absolute change in the erosion metric is significant. Of secondary relevance is the cumulative effective volume (CEV) indicator, representing the total discharge volume that exceeds the established critical discharge throughout the modelling record. A representative selection of pre-development and post-development hydrographs is included in Appendix Z. Table 58 summarizes the results of the erosion exceedance assessment for Reach MEC-R02 for the "no mitigation" and "mitigation" scenarios under all three assessed runoff conditions (i.e., low, baseline, and high flow scenarios).

TABLE 58: EROSION EXCEEDANCE RESULTS FOR REACH MEC-R02.

MEC-R02 – Baseline Scenario					
Scenario Cumulative (1960-1999)		CEV (m3)	ωeff (N/m2)	tex (hrs)	# Of Exceedances
Qcrit = 0.68 (no LID mitigation)	(PRE)	60,469,240	16,551	8,398	860
	(POST)	68,028,575	19,003	11,092	966
	Change (%)	**12.50**	**14.82**	**32.08**	**12.33**
Qcrit = 0.68 (with LID mitigation)	(PRE)	60,469,240	16,551	8,398	860
	(POST)	62,464,547	17,411	10,132	939
	Change (%)	**3.30**	**5.20**	**20.65**	**9.19**
MEC-R02 – High Runoff Scenario					
Scenario Cumulative (1960-1999)		CEV (m3)	ωeff (N/m2)	tex (hrs)	# Of Exceedances
Qcrit = 0.68 (no LID mitigation)	(PRE)	1.56E+08	43,985	16,048	1,453
	(POST)	1.44E+08	41,914	17,430	1,484
	Change (%)	**-7.60**	**-4.71**	**8.61**	**2.13**
Qcrit = 0.68 (with LID mitigation)	(PRE)	1.56E+08	43,985	16,048	1,453
	(POST)	1.38E+08	40,026	16,671	1,469
	Change (%)	**-11.88**	**-9.00**	**3.88**	**1.10**
MEC-R02 – Low Runoff Scenario					
Scenario Cumulative (1960-1999)		CEV (m3)	ωeff (N/m2)	tex (hrs)	# Of Exceedances
Qcrit = 0.68 (no LID mitigation)	(PRE)	14,033,647	4,401	2,952	353
	(POST)	21,333,228	6,853	5,783	499
	Change (%)	**52.01**	**55.72**	**95.93**	**41.36**
Qcrit = 0.68 (with LID mitigation)	(PRE)	14,033,647	4,401	2,952	353
	(POST)	16,917,677	5,460	4,530	446
	Change (%)	**20.55**	**24.05**	**53.46**	**26.35**

Cumulative effective discharge volume (CEV) and cumulative effective work index (CEWI) modelled using the baseline runoff scenario demonstrate an increase of 12.5% and 14.8%, respectively, under the "no mitigation" scenario. The duration and number of exceedances also increase by 32.1% and 12.3%, respectively. These results indicate that under baseline runoff conditions, a minor to moderate increase in erosion potential is expected for Etobicoke Creek if no LIDs are implemented. Under baseline runoff, the "mitigation" scenario demonstrates that

accounting for LID mitigation strategies (simulated by implementing 10.9 mm of initial abstraction) would reduce the relative pre-to-post-development change in CEV and CEWI to 5% or less over existing conditions. Thus, increases in erosion potential within Etobicoke Creek are not anticipated for the baseline runoff scenario with LID mitigation strategies.

A sensitivity analysis using high and low runoff scenarios was also completed to account for potential uncertainty in the catchment-wide continuous hydrological simulation model. Results from the high runoff exceedance modelling indicate that under both the "no mitigation" and "mitigation" scenarios, CEV and CEWI are expected to decrease following development. Etobicoke Creek at Reach MEC-R02 exhibits evidence of erosion, and the minor to moderate decreases in erosion potential under the high runoff scenarios may help mitigate active erosion within the watercourse (AMEC, 2014). Conversely, results from the low runoff scenario show a significant increase in erosion indices under the "no mitigation" scenario, and a moderate increase under the "mitigation" scenario. While the relative modelled increases in CEV and CEWI under the low runoff scenario are significant, the absolute increases in CEWI over the 40 modelled years are minor compared to the baseline and high runoff scenarios, accounting for approximately 27 N/m2 per year. Therefore, results from the sensitivity analysis indicate that under a broad range of hydrological scenarios, the proposed development is not expected to negatively impact erosion processes within Etobicoke Creek if the proposed SWM and LID mitigation measures are applied.

Results from Reach MEC-R05 are generally consistent with those from MEC-R02, with the baseline "mitigation" scenario effectively addressing potential increases in erosion resulting from the proposed development. Table 59 summarizes the results of the erosion exceedance assessment for MEC-R05.

TABLE 59: EROSION EXCEEDANCE RESULTS FOR REACH MEC-R05.

MEC-R05 – Baseline Scenario					
Scenario Cumulative (1960-1999)		**CEV (m3)**	**ωeff (N/m2)**	**tex (hrs)**	**# Of Exceedances**
Qcrit = 0.56 (no LID mitigation)	(PRE)	59,447,078	5,960	8,100	964
	(POST)	66,994,006	6,959	11,808	1,194
	Change (%)	**12.70**	**16.77**	**45.77**	**23.86**
Qcrit = 0.56 (with LID mitigation)	(PRE)	59,447,078	5,960	8,101	964
	(POST)	61,136,555	6,335	10,630	1,158
	Change (%)	**2.84**	**6.29**	**31.23**	**20.12**
MEC-R05 – High Runoff Scenario					
Scenario Cumulative (1960-1999)		**CEV (m3)**	**ωeff (N/m2)**	**tex (hrs)**	**# Of Exceedances**
Qcrit = 0.56 (no LID mitigation)	(PRE)	1.51E+08	14,159	14,951	1,606
	(POST)	1.38E+08	13,419	17,366	1,651

	Change (%)	**-8.70**	**-5.22**	**16.15**	**2.80**
Qcrit = 0.56 (with LID mitigation)	(PRE)	1.51E+08	14,159	14,951	1,606
	(POST)	1.31E+08	12,775	16,373	1,643
	Change (%)	**-13.15**	**-9.77**	**9.52**	**2.30**
MEC-R05 – Low Runoff Scenario					
Scenario Cumulative (1960-1999)		**CEV (m3)**	**ωeff (N/m2)**	**tex (hrs)**	**# Of Exceedances**
Qcrit = 0.56 (no LID mitigation)	(PRE)	14,249,114	1,552	3,078	420
	(POST)	23,088,591	2,639	6,918	766
	Change (%)	**62.04**	**70.01**	**124.77**	**82.38**
Qcrit = 0.56 (with LID mitigation)	(PRE)	14,249,114	1,552	3,078	420
	(POST)	18,119,442	2,059	5,430	728
	Change (%)	**27.16**	**32.64**	**76.41**	**73.33**

Cumulative effective discharge volume (CEV) and cumulative effective work index (CEWI) modelled using the baseline runoff scenario demonstrate an increase of 12.7% and 16.8%, respectively, under the "no mitigation" scenario. The duration and number of exceedances also increase by 45.8% and 23.9%, respectively. Consistent with results from MEC-R02, this indicates that under baseline runoff conditions, a minor to moderate increase in erosion potential is expected for Etobicoke Creek if no LIDs strategies are implemented. The "mitigation" scenario under baseline runoff demonstrates a negligible increase in CEV and CEWI of 2.8% and 6.3%, respectively. While the increase in CEWI following the baseline "mitigation" scenario slightly exceeds the +/-5% threshold, the increase is not anticipated to significantly impact Reach MEC-R05, a low-sinuosity, low gradient segment of the watercourse (AMEC, 2014). A review of LiDAR data (MNRF, 2023) for the watercourse indicated no evidence of valley wall contact and gently sloping banks, suggesting bank erosion and planform adjustment. Thus, results from the baseline scenario indicate that the proposed SWM plan adequately addresses erosion concerns along Reach MEC-R05.

The two sensitivity scenarios (high and low runoff) were also analyzed for MEC-R05. Results from the high runoff scenario are consistent with those from MEC-R02, with minor to moderate decreases in CEV and CEWI anticipated for both the "no mitigation" and "mitigation" scenarios. These decreases are not anticipated to result in any significant change in channel form or function, as the number and magnitude of post-development exceedances are still sufficient in maintaining annual sediment mobilization events. The low runoff scenario results are also generally consistent with those from MEC-R02, suggesting large to moderate relative increases in CEV and CEWI. These relative increases correspond to an average of less than 13 N/m^2 of additional work per year. Thus, while the relative pre-to-post development change in erosion indices are relatively high under the low runoff scenario, they are associated with modest

absolute increases, which are not anticipated to alter the pattern and rates of erosion along MEC-R05.

Overall, results from the erosion exceedance modelling along Reaches MEC-R05 and MEC-R02 demonstrate that the proposed development is not expected to alter the pattern and rates of erosion along Etobicoke Creek. The baseline runoff scenario with SWM and LID mitigation strategies results in negligible changes in the two most relevant erosion metrics. The sensitivity analysis indicates that under the modelled subwatershed-scale hydrological scenarios, erosion indices may decrease (high runoff scenario) or increase (low runoff scenario), but that these changes are not anticipated to significantly alter geomorphic processes within Etobicoke Creek.

11.6 Surface Water Quality

Surface water quality sampling locations were established during spring 2024 at road crossings in the Primary Study Area to characterize baseline water quality. Additional locations were added to the monitoring network in 2025 (refer to Section 7.6 for details related to the surface water monitoring program). Potential changes to water quality from residential development is anticipated and should be mitigated by proper design of SWM ponds to meet discharge quality criteria. Buffers and riparian enhancement should reduce agricultural runoff to reduce nutrient loading under existing conditions. Stormwater management systems will be designed to Enhanced (Level 1) Quality Control for the removal of 80% Total Suspended Solids, based on MOE (2003) SWMF & Design Guidelines.

11.7 Fisheries

The fisheries impact assessment includes an in-depth review of all in-water and near-water works that have potential to impact direct and indirect fish habitat features in the Primary Study Area (and Secondary Study Area, as applicable). At this time, realignment and rehabilitation works are proposed for the Alloa Drain and the various tributaries that flow into the Alloa Drain. These works will be futher assessed in detail to determine potential impacts (EIR), and mitigation measures to be implemented will be recommended. The impact assessment will also consider whether further permitting (*e.g.* DFO Request for Review) is required during Detailed Design. Given the historical alterations and current impacted nature of the aquatic features in the Primary Study Area and surrounding subwatershed, such as straightening of watercourses/drainage features and removal of riparian vegetation, the proposed realignment and rehabilitation works are anticipated to be a net benefit to fish habitat in the region because the activities provide an opportunity to restore riparian vegetation and the natural channel morphology (*e.g.* riffles/runs/pools) of these features.

11.8 Terrestrial System

The impact assessment will require a fully completed field program and analysis of all data collected. An Environmental Impact Report (EIR) will be prepared to evaluate any direct and/or indirect impacts and proposed mitigation related to construction of the proposed development concept within the Primary Study Area. The impact assessment will include an evaluation of the potential for impact in the context of the Key Natural Heritage Features (KNHFs) identified during the study, including the requirement to remove and relocate Wetland #7 and Tributary #3, the

pond and portions of the Alloa Drain (see Figure 19). Consideration of reasonable minimum feature buffers have been identified however final buffers will be confirmed through the completion of an EIR in support of detailed design.

Section 15 of this report summarized the measures that have been identified in provincial, municipal and conservation authority documents. These constitute an environmental management framework of legislation, regulations, policies, and guidelines. This framework addresses the key approaches to identify, assess, protect, reinforce and manage the natural heritage system in the Primary Study Area. The following are key elements related to approach and targets:

Systems Approach (PPS, 2024)

- Watersheds are the ecologically meaningful scale for integrated and long-term planning
- "Natural heritage system means a system made up of natural heritage features and areas, and linkages intended to provide connectivity (at the regional or site level) and support natural processes which are necessary to maintain biological and geological diversity, natural functions, viable populations of indigenous species, and ecosystems. These systems can include natural heritage features and areas, federal and provincial parks and conservation reserves, other natural heritage features, lands that have been restored or have the potential to be restored to a natural state, areas that support hydrologic functions, and working landscapes that enable ecological functions to continue."
- "The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of natural heritage systems, should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features and areas, surface water features, and ground water features."

Features to be Protected with no development permitted:

- Significant Wetlands

Features to be Protected, unless it can be demonstrated that development will have no negative impacts on the natural features and their ecological functions:

- Significant Valleylands
- Significant Woodlands
- Significant Wildlife Habitat
- Habitat for Endangered and Threatened Species
- Fish Habitat

Buffers

- Region of Peel Settlement Area Boundary Expansion Scoped Subwatershed Study, 2022
    - A minimum 30 metres vegetation protection zone is required for the majority of natural heritage features including wetlands, seepage areas and springs, fish habitat, permanent and intermittent streams, lakes, and significant woodlands; Buffers for

features of the NHS will be established through detailed studies (e.g., detailed Subwatershed Study, Secondary Plan, etc.).

- For streams and watercourses with well defined valley features, the minimum 30 metres is to be measured from the stable top of bank, as determined by the conservation authority.

- Future Caledon Official Plan, 2024

  - Buffers in the New Community Areas and New Employment Areas shown on Schedule F1, Urban System, are to be informed by both existing conditions and sensitivities, and the anticipated impacts that a buffer is being used to mitigate.

  - Based on the above, minimum buffer widths will be established in local subwatershed or equivalent studies prepared to the satisfaction of the Town to support secondary planning and development in New Community Areas and New Employment Areas. The minimum buffer widths will be established as part of an initial assessment of the general land uses contemplated adjacent to the Natural Environment System and the significance of any of the components of the Natural Environment System being studied.

  - The final buffer width within New Community Areas and New Employment Areas will be determined through an environmental impact study, prepared to the satisfaction of the Town, at the development stage when additional information is available to determine the nature of adjacent uses and related impacts on the Natural Environment System and may include increases or decreases to the buffer widths identified through the secondary planning process. When determining the final buffer width, consideration will be given to the following matters:

    a) enhancement and mitigation opportunities such as vegetative planting within the buffers or fencing on abutting lands;

    b) achieving adequate buffers to stormwater management components, which may necessitate wider buffer widths;

    c) the intensity of the abutting land uses as illustrated through specific plans for such uses (i.e., grading, setbacks, maintenance, servicing, built form including height, location of buildings and structures and other activities); and,

    d) the ecological functions, characteristics, significance and sensitivity of the feature the buffer is required from.

- CVC (Watershed Planning and Regulation Policies – April 2010):

  - A minimum of 30 metres is maintained from any wetland, or 15 metres from the limit of hazardous land, whichever is greater (applies to single family residential development).

- TRCA (Valley and Stream Corridor Management Program):

- Minimum 10 metre buffer from staked top of bank, stable slope line, contiguous vegetation, and/or regulatory floodplain.

Enhanced Natural Heritage System

- Region of Peel and Town of Caledon target for the Alloa Secondary Plan notes the requirement to increase natural cover within the Plan area by 30%

- The Etobicoke Creek Headwaters subwatershed contains the last remaining nonurbanized portions of the watershed, and therefore presents the majority of opportunities to restore natural land cover

Net ecological gain is a major objective of the development of the Alloa Planning Area.

In April 2010, MNRF released the Second Edition of the Natural Heritage Reference Manual, which is a guiding document to support the application of the natural heritage policies contained in the PPS (2024). The application of Environment Canada (2013) guideline targets to highly fragmented landscapes in southern Ontario, which have been under intensive use for agriculture for more than a century, has been challenging. Jurisdictions (such as TRCA with its Terrestrial Natural Heritage System) have generally promoted the application of these targets outside of urbanizing areas. The need to balance other planning objectives (such as those under the Provincial Planning Statement, 2024) has resulted in compromises. In this regard, the Second Edition of the Natural Heritage Reference Manual (MNR 2010) states (ref. Section 3.4.6.2):

"Every natural heritage system, however, will be different. There is no minimum size for a system or minimum percentage of a planning area or its natural features that must be included in the system. Therefore, the extent of the natural heritage systems identified in the noted examples represents what was appropriate and achievable in those situations."

Given the conceptual working scale of the land use scenarios, the identification of appropriate environmental factors and measures has required scoping of the potential long list of targets to those which can be reasonably estimated at this scale. The future NHS must be in conformity with applicable legislation and policies at the federal (*Fisheries Act*), Provincial (Provincial Planning Statement (2024), Ministry of Environment policies and regulations) as well as addressing policies, guidelines and objectives in accordance with TRCA and CVC mandates, Region of Peel Official Plan (2022) and the Future Caledon Official Plan (2024).

The following is a summary of the terrestrial factors and measures that were applied to achieve the Alloa Enhanced Natural Heritage System as summarized in Table 62. The factors evaluate the potential impacts of the Alloa Secondary Plan Land Use Plan on quantity measures (i.e. amount of riparian, wetland, and natural cover) and quality measures (native biodiversity functions, natural system protection requirement). These factors reflect commonly used indicators of natural heritage system health and integrity. For example, TRCA used quantity and quality as key factor categories in the development of their Updated Target Natural Heritage System (2022). Similarly, these measures were a significant part of the suite of targets used in the testing of secondary plan versions for the Mount Pleasant lands, located immediately south of the current Alloa Planning Area.

The measures at this stage are strictly focused on the natural environment component of the enhanced natural heritage system. The urban elements of "green development" such as urban canopy, active parkland, energy efficiency and transit efficiency are not included in this screening as there is insufficient detail as to the character of the future urban areas at this time.

Summary of Terrestrial Measures

Table 62 provides details on the considerations for application of measures for the proposed Alloa Land Use Plan (see Figure 20).

Riparian Cover

The Riparian Cover evaluation examines the length of existing and future riparian habitat potentially supported by the Secondary Plan in each scenario. The evaluation noted herein is based on whether key low to medium constraint watercourses will be integrated into the urban area within defined riparian corridors (which do not exist under agricultural uses today).

Wetland Cover

The Wetland Cover evaluation examines the extent to which the proposed Alloa Secondary Plan protects existing wetland habitat, and what opportunity is afforded for additional wetland cover (likely within riparian zones, buffers and linkages).

Natural Cover

The Natural Cover evaluation examines the extent to which the Alloa Secondary Plan protects existing natural cover, and what opportunities are afforded for additional natural cover within both aquatic and terrestrial corridors. Natural cover includes upland forest, wetland, successional and aquatic habitat.

Native Biodiversity Functions

The Native Biodiversity Functions evaluation examines the extent to which the Alloa Secondary Plan supports local and landscape scale native biodiversity. The evaluation is based on a number of indicators including: 1) protection of habitat of Threatened and Endangered species; 2) diversity of ELC communities; 3) Significant Wildlife Habitat; 4) Significant Woodlands and 5) Level of connectivity. Scenarios which place more development in proximity to highly functioning areas will contribute more impacts to these functions.

Natural System Protection

The Natural System Protection evaluation examines the extent to which the Alloa Secondary Plan minimizes municipal management and resources, to ensure that the natural system is sustainable through time. The evaluation reflects the relative length of natural system edge placed adjacent to urban land uses; higher edge exposure will trigger greater management and resource needs once development occurs. It will also require greater allocation of land to protective functions (i.e. buffers).

Criteria and Assumptions

There are a number of criteria and assumptions upon which the terrestrial impact assessment is based:

1. Agricultural land uses will continue where urban land uses are not designated and will remain in agriculture for the long term.

2. Natural system components located within active agricultural areas are less likely to be expanded or restored than those dedicated within public Open Space.

3. Linkages to the Huttonville Creek natural heritage system will move forward as currently proposed by the City of Brampton within the Mount Pleasant Secondary Plan.

4. Linkages that incorporate aquatic and wetland habitat will be more functional than those that lack these features.

5. Linkages that flank existing natural features along one side can serve to reduce buffer needs while enhancing functions such as forest interior.

6. Buffers and restoration will serve to reinforce the protection and functionality of natural features by filling in gaps in cover and smoothing the edges of features that are currently uneven, irregular, or do not presently exist.

11.9 Climate Change

The LSS Terms of Reference requires that an impact assessment be conducted to "consider the impacts of climate change to the Natural Heritage System and Water Resources System, and the manner in which the proposed development and management plan may exacerbate or mitigate these impacts." Shifting climate conditions are documented in the reports entitled Future Climate Projections for the Town of Caledon (2018), Climate Projections for TRCA's Etobicoke Creek Watershed Plan (2021), and the online Climate Atlas of Canada.

Table 60 presents an ensemble average of 16 climate models for the historical and future (RCP 8.5) climate periods. Based on the modeling conducted, the following trends are likely to be observed within the Secondary Plan Area:

- Increased number of extreme heat days and extreme precipitation days
- Warmer mean temperatures across all seasons, including winter, which means more precipitation will fall as rain rather than snow
- Higher annual and seasonal precipitation
- Longer growing seasons and increased growing degree days
- More favourable conditions for pests and disease

TABLE 60: CLIMATE TRENDS FOR THE TRCA ETOBICOKE CREEK WATERSHED UNDER THE RCP 8.5 SCENARIO (TRCA, 2021)

Climate Parameter	Detailed Parameter	Historical 1971-2000	Current 2011-2040	Future 2041-2070	Trend
Mean Temperature (°C)	Annual	7.3	8.8	10.4	↑
	Winter	-4.9	-3.2	-1.6	↑
	Spring	5.4	6.6	8.1	↑
	Summer	19.3	20.7	22.5	↑
	Fall	9.3	10.8	12.4	↑
Maximum Temperature (°C)	Max Annual Temperature	12.0	12.9	14.7	↑
	Max Winter Temperature	-0.7	2.5	2.1	↑
	Max Spring Temperature	10.5	11.6	12.8	↑
	Max Summer Temperature	24.8	25.9	27.7	↑
	Max Fall Temperature	13.3	15.0	16.6	↑
Minimum Temperature (°C)	Min Annual Temperature	2.7	3.7	6.1	↑
	Min Winter Temperature	-9.5	-6.7	-5.5	↓
	Min Spring Temperature	0.6	2.8	3.5	↑
	Min Summer Temperature	14.5	15.1	17.4	↑
	Min Fall Temperature	5.3	6.6	8.6	↑
Extreme Heat (days/year)	Days Above 35°C	0.9	2.7	6.7	↑
	Days Above 30°C	11.3	20.3	33.2	↑
	Days Above 25°C	48.1	65.2	84.7	↑
Extreme Cold (days/year)	Days Below -20°C	9.6	5.5	2.7	↓
	Days Below -10°C	48.1	35.3	23.6	↓
	Days Below 0°C (freezing days)	142.8	126.2	109.6	↓
Total Precipitation (mm)	Annual (mm/year)	986.2	1022.7	1095.8	↑
	Winter (mm/season)	191.8	210.0	237.4	↑
	Spring (mm/season)	237.4	246.6	264.8	↑

	Summer (mm/season)	283.1	283.1	292.2	↑
	Fall (mm/season)	264.8	274.0	283.1	↑
Extreme Precipitation	Max Precipitation in 1 day (mm)	29.4	45.9	49.3	↑
	Max Precipitation in 3 days (mm)	63.7	65.9	69.9	↑
	Simple Daily Intensity Index (SDII) (mm/day)	2.7	2.8	3.0	↑
	95th Percentile Precipitation (mm)	42.3	41.8	42.2	↑
	99th Percentile Precipitation (mm)	13.8	13.6	13.8	↑
Dry Days (days/year)	Total Annual	180.5	178.3	176.3	↓
	Total Annual Consecutive Dry Days	21.4	20.8	19.8	↓
Growing Season	Growing Season Start Date (day of year)	May 12	May 2	Apr. 26	↑
	Growing Season End Date (day of year)	Oct. 23	Nov. 1	Nov. 9	↑
	Growing Season Length (days/year)	166	184	198	↑
Agricultural Variables	Corn Heat Units	3318.2	3805.4	4319.5	↑
	Growing Degree Days (Base 0°C)	3309.2	3711.1	4145.1	↑
	Canola Growing Degree Days (Base 4°C)	2334.0	2676.9	3055.0	↑
	Forage Crops Growing Degree Days (Base 5°C)	2118.5	2447.1	2811.5	↑
	Corn and Bean Growing Degree Days (Base 10°C)	1195.8	1452.1	1750.7	↑
	Growing Degree Days - Risk of Presence of Pests (Base 15°C)	518.6	704.2	931.7	↑
Ice and Snow	Freeze-Thaw Cycles (cycles per year)	76.2	70.2	64.6	↓
	Ice Potential (days per year)	21.2	18.3	15.0	↓

Consistent with the TRCA approach, a climate change impact assessment approach is employed using the "If-Then-So" method – a qualitative approach consistent with traditional risk-based assessments. Climate shifts in precipitation and heat can potentially influence the following design elements in the LSS:

- Channel Block / Floodplain Hazard
- Culvert Sizing
- Erosion
- Storm Sewer Sizing
- SWM Pond Block
- Wetland Water Balance
- LID Features / Site Water Balance

The potential impacts to these design elements are described in Table 61, along with the sources to assess the impact.

TABLE 61: POTENTIAL CLIMATE CHANGE IMPACTS TO THE SECONDARY PLAN AREA

LSS Design Element		Potential Climate Impact	Potential Impact Rationale	Climate Data Source
Channel Block / Floodplain Hazard		✗ No	An increase in the intensity and frequency of 100-year precipitation could lead to increased runoff to streams and rivers that impact people, property, and assets located in or near the rivers / streams. However, these impacts are not anticipated as the channel corridor and flood hazards are delineated based on the Regional storm conveyance, which were determined to be more conservative than the100-year 8.5 SSP5-8.5 climate scenario (see Appendix J)	TRCA data for 100-year climate period under SSP5-8.5
Culvert Sizing		✗ No		
Erosion		☑ Yes	An increase in the intensity and frequency of precipitation could lead to increased flows and velocities in the creeks that cause erosion of creek embankments and damage to in-stream / near stream assets.	Climate-adjusted continuous precipitation and temperature data were unavailable at the time of the assessment

			The need for adaptation measures for erosion, such as sizing of stone protection, should be evaluated during the FSR/EIR/detailed design stage if climate-adjusted continuous precipitation and temperature data are available from the Town / TRCA.	
SWM Pond Block		✗ No	Changes to the intensity and frequency of precipitation could lead to changes in runoff and extended detention, which could cause vegetation stress, longer drawdown times, and overland flooding impacts to nearby property and assets. However, no quantity control impacts are expected as the SWM pond capacity is based on the Regional storm conveyance, which was determined to be more conservative. (see Appendix J) The need for adaptation measures such as extended detention orifice controls should be evaluated during the FSR/detailed design stage if climate-adjusted continuous precipitation and temperature data are available from the Town / TRCA.	Climate Atlas of Canada, IDF_CC Tool for 2-year to 100-year storms
Wetland Water Balance		☑ Yes	Changes in precipitation and temperatures / evaporation could lead to more or less frequent inundation that impacts the water balance and wetland hydroperiods. In the absence of available climate-adjusted continuous precipitation and temperature data, the historical extreme (wet and	Climate-adjusted continuous precipitation and temperature data were unavailable at the time of the assessment

			dry) years are used as the basis for design impact assessment. The need for adaptation measures to ensure hydroperiods are maintained in future climate conditions should be evaluated during the detailed design stage if climate-adjusted continuous precipitation and temperature data are available from the Town / TRCA. This may introduce additional infrastructure that requires maintenance / replacement over time.	
LID Features / Site Water Balance		☑ Yes / ✗ No	Changes in precipitation and temperatures / evaporation could lead to more or less runoff, variable inundation, and vegetation stress. Under less rainfall conditions, there could potentially be insufficient recharge, while under more rainfall conditions the water balance will continue to be met. To be conservative, LIDs capacity is not factored into pond calculations, allowing for greater contingency under future climate conditions. The need for adaptation measures for LID features should be evaluated during the FSR/detailed design stage if climate-adjusted continuous precipitation and temperature data are available from the Town / TRCA.	Climate-adjusted continuous precipitation and temperature data were unavailable at the time of the assessment

The Alloa Local Subwatershed considers the identified potential impacts of climate change while both vetting the existing conditions from the Alloa Secondary Plan Area and when preparing the proposed land use concept and associated supporting infrastructure. To design a community that is resilient to climate change, the following items have been (and will continue to be) considered as the studies for this area advance.

These include:

- **Flood hazards** in the adjacent creeks have been established using the Regional event (Hurricane Hazel) which is based on an historic event that remains more conservative than future climate change scenarios. As such, the extent of existing or proposed flood hazards will not be affected by increased intensity, frequency and duration of storm events due to climate change.

- As there is the potential for increased frequency of flows in the creeks due to climate change, the impacts of these flows on **erosion** protection measures should be considered at detailed design. While this will not affect channel block sizes or the Secondary Plan, it could impact the sizing of stone protection or other mitigation measures.

- All proposed **stormwater management facilities** within the study area have been designed to control, and in the case of Etobicoke Creek facilities, over-control the Regional rainfall event. Due to the use of this historical storm in the sizing, the pond blocks are not anticipated to increase as a result of climate change.

- To assess if **stormwater sewers/downstream culverts** are able to withstand the impacts of climate change during more frequent and/or intense events, the proposed sizes will be reevaluated at the detailed stage of the design when considering the potential for increased frequency, duration and intensity of storm events. The storm sewers in the community are currently designed to convey the 10-year storm event in accordance with Caledon standards. This requirement is more conservative than other GTA municipalities which only require storm sewers be designed to convey the 5-year event. The storm sewer design can be updated once the Town has published updated IDF parameters incorporating climate change or using the Climate Atlas as directed by Town staff.

- In **parks and site plan blocks**, the potential for storing stormwater and utilizing it for irrigation should be explored in future studies to decrease reliance on municipal water during drought conditions. Increased irrigation demand due to potential drought should be considered in the final water distribution analysis. This can be mitigated through public education, signage, and the incorporation of efficient fixtures and irrigation methods. These can be considered through detailed design and in coordination with the Town and Region.

- **Proposed roadways** within the development will be designed to avoid excessive flooding during large storms as well as ensuring adequate conveyance of flows. This can be accomplished by verifying the capacity in the roadways during detailed design compared to the 100-year event, as well designing and implementing adequate catchbasins to capture the flows.

- Where feasible based on soil / groundwater constraints and where considered necessary to meet water balance requirements, **LIDs** such as green roofs (in the site plan / high density blocks), infiltration measures, tree pits, etc., can be utilized in the design to

mitigate the effects of climate change by encouraging the recharge of the groundwater system to reduce stormwater runoff (i.e., managing more frequent runoff events).

- Potential impacts of climate change on feature based **water balance for the wetlands** will continue to be evaluated and have considered extreme conditions (wet / dry years). Mitigation could include utilizing stormwater to feed the wetlands and preparing monitoring plans for post-development to evaluate the health of the wetlands.

- The greatest impact of climate variability on the hydrogeological system will be the exaggeration of historical extremes in both wet and dry seasons. As such, impacts to **groundwater** in the area will primarily be seen by increased and decreased groundwater static levels, respectively. During wet seasons, the impact on the functioning of the system will be realized through increased groundwater discharge to wetlands and other surface water features, but also increases in seasonal high groundwater levels. This will have the potential to increase wetland depths and increase the time of inundation as the periodic pooling will have a greater influence from groundwater. Similarly, the baseflow to watercourses could increase. In both scenarios, the potential threat of flooding could increase with the increase in water volume. With respect to seasonal high groundwater, the most significant impact would be to the functioning of stormwater management features designed to infiltrate as separation to the groundwater table could decrease, effectively causing a backup in infiltration through groundwater mounding. Likewise, infrastructure could interact with groundwater. During dry seasons, the impacts will work in reverse, depleting recharge to some groundwater supported features. Through the lens of well users in the area, reduced recharge to local aquifers could result in reduced supply capacities.

- With regards to the creation of greenways and associated restoration, compensation, and offsetting habitat creation the palette of **planted species** utilized shall consider the wide range of climate scenarios that may affect sustainability and overall resilience. Careful attention during detailed design to fully consider moisture indexes, sun/shade, wind, soil matrix, microclimate, and the use of ecologically correct plant assemblages, etc., to support a comprehensive restoration plan.

11.10 Transportation Master Plan Considerations

The mobility network proposes a system of continuous collector roads that aims to minimize impacts to the NHS; however, the identified constraints are such that crossings cannot be avoided.

In the Phase 1 lands, four crossings of the NHS system are proposed (see Figure 22). These are at Street C, Street F, Street D, and Street B. The crossings are considered essential to the function of the Secondary Plan area, particularly as the crossings ensure the viability of transit and active transportation by providing the grid system with continuity within the lands. Without such a grid system of collector roadways, transit would not be easily programmed to ensure that over 95 percent of future residents will be within 400 metres of a transit stop. The crossings will minimize distance between origins and destinations within the Secondary Plan area, ensuring that walking

and cycling are viable modes of transport for everyday use as well as recreationally. These types of trips would be home based trips to schools, parks, and local commercial operations in the mixed-use areas.

Without these essential crossings, the success of Town, Region, and Provincial policies relating to the promotion of active transportation and transit use to reduce single occupancy vehicle use will be impaired, with its attendant increase in roadway congestion and tailpipe emissions.

Of particular note is the need for continuity of Street B, which is the extension of Tim Manley Avenue and will connect directly to the Mayfield West Transit Hub. Discontinuity of Street B will impair transit and cycling trips to the transit hub, forcing less attractive circuitous routes for these modes of transportation. From an automobile perspective, discontinuity would also result in additional turning movements for motorists which would otherwise be more direct through movements to access the boundary road network. It should be noted that Street B is currently the only continuous collector road that links the western limits of the Alloa Secondary Plan through the Mayfield West Secondary Plan and Mayfield West Transit Hub. Street B therefore becomes a key multimodal transportation corridor linking new these new communities within south Caledon. Further information can be found in Section 6.1.1 of the Transportation Needs Assessment (Crozier 2024).

Crossings in Significant Woodland will require further detailed study as a part of completing the required Environmental Impact Report to support future planning stages of plan development.

12.0 Summary of Impact Assessment Outcomes

Each Environmental Factor discussed in the previous section has been assessed based on available characterization by the Alloa LSS Consulting Team (2024) and Impact Assessment results for the Alloa Secondary Plan lands using Positive, Neutral, and Negative descriptions. These descriptions generally indicate the relative impacts (as per the Environmental Factor under consideration) for the Land Use Plan land uses (see Figure 20). There has been no weighting of each criterion, however it is understood that certain factors are recognized as being more important than others. This assessment has been used to complement the full evaluation of the Land Use Plan.

12.1 Phase 2 Integration and Summary of Impact Assessment

The information presented in Table 62 indicates the assessment of overall impacts of the Alloa Secondary Plan. The assessment confirms that the proposed enhanced natural heritage system provides increases in natural cover, fish habitat, and other key elements including wildlife corridors and flood control. This conclusion is based upon the following:

- The proposed Alloa Secondary Plan enhances the Natural Heritage System (NHS) significantly from the existing condition.
- Fish habitat within the Alloa Drain will be enhanced through realignment and rehabilitation works that restore riparian vegetation, in-stream habitat, and channel morphology. Any potential impacts to fish habitat from adjacent development activities can be mitigated through stormwater management techniques.

"The Alloa Secondary Plan will include the creation of approximately 6,800 m of new natural channel, a 200% increase in natural cover, and 3.5 ha of constructed wetland"

- LID practices and enhancements to the riparian corridor.
- The proposed Land Use Plan respects all identified constraints to development and provides opportunities for creating and enhancing an NHS.
- The proposed Land Use Plan provides significant opportunities for ecological enhancement of the existing condition thus creating a net ecological gain.

TABLE 62: ALLOA SECONDARY PLAN LAND USE PLAN ASSESSMENT: ENVIRONMENTAL IMPACTS

Discipline	Environmental Factor	Measure	Proposed Land Use Plan	Comments
Hydrogeology	Groundwater Recharge and Discharge	Potential changes to groundwater recharge and discharge	**NEUTRAL** • Site development leads to an increase in impervious area and decreased infiltration which may affect groundwater recharge and discharge to Alloa Drain/ Etobicoke Creek • Through the design of the Alloa Drain and its constructed wetlands as well as the use of LID measures on a site specific basis, the pre-to-post development water balance can be maintained. No change in groundwater recharge or discharge is expected. • Fletchers Creek is not supported by groundwater discharge from within the study area	Potential impacts to groundwater recharge within the study area and groundwater discharge to the Alloa Drain/Etobicoke Creek/system can be mitigated through the Alloa Drain design and SWM and LID measures to maintain pre-development discharge rates and water balance
	Aquifers and Groundwater Users	Potential changes to groundwater quality and quantity	**NEUTRAL** • No significant aquifers were identified through borehole drilling or MECP water well database. • Site is not located within a wellhead protection area or atop a significant groundwater recharge area. • The site is located atop a highly vulnerable aquifer. • Local groundwater users obtain potable water from the Queenston Shale bedrock aquifer formation, which at the site, is confined below the thick Halton Till Aquitard. Due to the depth and confined nature the Queenston Shale aquifer, changes to land use or construction activities at the site will not adversely affect local groundwater users.	No significant impact to groundwater users or water supply aquifers due to the development is anticipated. Groundwater users draw water from a confined aquifer located approximately 30 meters below ground level and this aquifer is replenished primarily through lateral groundwater movement from the escarpment in the west. Any dewatering to facilitate the construction of the development will be minimal and within the units above 30 mbgl. Groundwater users in the area will be surveyed and offered to have their well monitored during and post construction to ensure no adverse impacts are observed.
	Pre-to-Post Development Water Balance	Potential changes to site water balance	**NEUTRAL** • Site development leads to an increase in impervious area, which results in increased runoff and decrease in infiltration volumes. • Without mitigation, water budget calculations show a 60% decrease in infiltration post-development • Through the design of the realigned Alloa Drain, infiltration is proposed through the constructed wetlands. Similarly, LID features on a site specific basis will help to maintain the pre-to-post development water balance. No change in infiltration is expected. • Site is not located within a wellhead protection area or significant groundwater recharge area	Potential impacts to groundwater recharge are mitigated through the design of the realigned Alloa Drain as well as site specific SWM and LID measures to maintain pre-development infiltration rates and water balance. Proposed LID features that can be used to further enhance infiltration include biorentention facilities, infiltration trenches, dry SWM ponds and other alternative measures. LID features are to be designed on a site specific basis at the detailed design stage.
Hydrology/Hydraulics	**Flooding Potential for** Downstream (off-site) Properties	Change in floodplain boundary outside of the Secondary Plan limits	**NEUTRAL** The post-development floodplain boundary outside of the Secondary Plan limits may change from existing conditions due to the future Highway 413 corridor (impact is not known	As MTO progresses detailed design for the future Hwy. 413, information can be incorporated into hydrologic and hydraulic models to further assess the impact outside of the Secondary Plan area.

Discipline	Environmental Factor	Measure	Proposed Land Use Plan	Comments
			at this time, but the size of the floodplain is not expected to increase.	
	Flood Potential for Proposed Development Areas (on-site)	Extent (length and width) of Regulatory Floodplain across proposed development areas. This is only applicable to Etobicoke Creek.	**NEUTRAL** Regulatory Floodplain for Etobicoke Creek will be contained within the limits of the proposed Alloa Drain channel re-alignment. A reduction in riparian storage is anticipated.	Regulatory Floodplain for Etobicoke Creek does not impede development areas under post-development modeling. Proposed changes to channel design, while reducing riparian storage, do not adversely impact downstream flows. A more efficient trapezoidal channel design improves flow conveyance, and the loss of storage primarily comprises dead storage that does not significantly contribute to flow dynamics.
Stream/Fluvial Geomorphology	**Maintenance of channel/HDF length** (for high and medium constraint watercourses and "Protection" and "Conservation" HDFs s)	Length (m) of streams that are being maintained	**POSITIVE** • All red (protection) and yellow (conservation) HDFs are to be maintained or proposed to be re-aligned or re-located • Natural channel segments (i.e. not municipal drains) that are ranked as high constraint are to be protected and remain in place (i.e., upstream portion of Reach AD1-2 and Reach LD4-1) • Natural channel segments (i.e., not municipal drains) that are medium constraint may be e realigned and rehabilitated using natural channel design principles (i.e., downstream portion of Reach AD1-2) • The Alloa Secondary Plan provides approximately 6,820 m of new designed channels and HDFs using natural design principles and will create an additional 990 m of channel/feature length when compared to existing conditions	All channels proposed for protection or conservation are either retained in place or realigned and replicated. The proposed realignments will result in increased channel length, will reinstate a more natural channel form, will increase substratevariability, and will contain enhanced floodplains when compared to the existing conditions. The post-development condition will significantly increase restored and enhanced habitat area. In the post-development condition, it is assumed that municipal drain maintenance activities will cease, resulting in dynamically stable channels and a more complex natural heritage system overall.
	Erosion Hazards	Erosion hazard extents are respected	**POSITIVE** • Proposed natural corridor designs can accommodate the erosion hazard associated with realigned channels • Erosion hazard limits on natural watercourses to remain in place are to be respected • Proposed crossings are of adequate span to address the erosion hazard and accommodate natural channel processes (i.e., sediment transport and flow conveyance) from a fluvial geomorphology perspective	No impacts to existing or proposed infrastructure or public health and safety are anticipated as a result of the proposed development
	Erosion potential based on stormwater discharge to receiving watercourses	Erosion Thresholds – based on critical discharge calculations that indicate the minimum flows that are necessary to initiate sediment movement of	**NEUTRAL** • Run-off from the development that will be directed to East and West Huttonville Creek and Fletcher's Creek will consist of less than 10% of their respective drainage areas at their crossings with Highway 7. These relatively minor contributions indicate that the development is	Results from the erosion exceedance modelling along Reaches MEC-R05 and MEC-R02 demonstrate that the proposed development is not expected to alter the pattern and rates of erosion along Etobicoke Creek.

Discipline	Environmental Factor	Measure	Proposed Land Use Plan	Comments
		the bed material. If these or larger flows are sustained for a prolonged period of time, then excessive erosion could occur.	unlikely to alter erosion processes within Fletcher's Creek and East and West Huttonville Creek. Additionally, the receiving corridors to Fletcher's Creek and East Huttonville Creek are lined with hydraulically sized substrate corresponding with post-development flows. • The hydrological modelling was analyzed to calculate erosion indices and identify changes in erosion potential within the erosion-sensitive reaches MEC-R02 and MEC-R05 of Etobicoke Creek • The baseline runoff scenario with SWM and LID mitigation strategies results in negligible changes in the two most relevant erosion metrics • The sensitivity analysis indicates that under the modelled subwatershed-scale hydrological scenarios, erosion indices may decrease (high runoff scenario) or increase (low runoff scenario)	
Water Quality	**Potential changes in water quality due to development**	In-stream water quality of select parameters	**NEUTRAL** • Potential changes to water quality from residential development should be mitigated by proper design of SWM ponds to meet discharge quality criteria. • Also, buffers and riparian enhancement should reduce agricultural runoff to reduce nutrient loading under existing conditions.	Stormwater management systems will be designed to Enhanced (Level 1) Quality Control for the removal of 80% Total Suspended Solids, based on MOE (2003) SWMF & Design Guidelines.
Fisheries and Aquatic Habitat (see also Hydrogeology, Hydrology/Hydraulics, Stream/Fluvial Geomorphology, Water Quality, and Terrestrial)	**Sensitivity of Fish Habitat and fishcommunity**	Number of fish species and abundance of fish, presence of direct/indirect fish habitat, quality of direct fish habitat.	**POSITIVE** • New and retained channels will have setbacks from proposed development to buffer fish habitat • Road crossings of the Alloa Drain and other tributaries – design will have to mitigate impacts to maintain/restore fish passage and naturalize crossings for fish use. • Over 6,800m of new designed channels using natural channel design principles will be created within the Alloa Secondary Plan area	Works in-water and near-water that may impact direct and indirect fish habitat features will be assessed to determine which mitigation measures need to be implemented, and whether further permitting (i.e., DFO Request for Review) is required during subsequent detail design stages. The new designed channels are anticipated to improve and restore fish habitat features within the study area given the historical impacts/altered nature of fish habitat within the LSWA.
	Benthic Invertebrate Community Structure	Changes in community indices	**NEUTRAL** • Benthic invertebrate community dependent upon water and sediment quality • Proper construction methods and mitigation and functioning SWM ponds should minimize impacts to these parameters	Sampled benthic invertebrate communities will be evaluated based on the number of individuals collected, taxonomic richness and various benthic community health metrics such as the Ephemeroptera/ Plecoptera/Trichoptera Index, community diversity and the Hilsenhoff Biotic Index. The calculated parameters from the dataset will be used to help establish baseline benthic community health. If benthic sampling continues, the data may be compared to assess how the proposed land use may impact benthic communities.
Terrestrial (see also Fisheries and Aquatic Habitat)	**Riparian Cover** (extent to which plan supports riparian habitat)	Length (km) of riparian habitat	**POSITIVE** • Addition of terrestrial linkages southward to Huttonville Creek in the form of terrestrial corridors (2)	All scenarios anticipated to increase length and quality of riparian cover relative to existing conditions

Discipline	Environmental Factor	Measure	Proposed Land Use Plan	Comments
			• Creation of permanent "natural channel" watercourse features to the Alloa Drain/Lyons Drain/Etobicoke Creek system • Increased natural cover along Alloa Drain and all confined floodplain areas part of the Alloa Drain/Lyons Drain/Etobicoke Creek system	Through the conversion of valleylands from agricultural to public Open Space it is assumed that direct agricultural impacts to riparian cover will cease
	Wetland Cover (extent to which scenario supports wetland habitat)	Area (ha) in wetland cover; potential degradation resulting from adjacent land use	**POSITIVE** Additions to wetland cover types and creation of wetland cover within the Alloa Drain corridor and other aquatic corridors within the plan area	All alternatives are anticipated to maintain or increase wetland cover; wetland functions likely compromised to some extent, where intense urban uses are located in vicinity Additional wetland cover creation within the Alloa Drain and other aquatic corridors will add to goal of "net benefit" and increased natural cover.
	Natural Cover (extent to which scenario supports habitat provided by natural cover)	Area (ha) in natural cover (upland forest, wetland and aquatic areas combined)	**POSITIVE** • Integrates all existing natural heritage features by way of confirmed floodplain area natural channel/naturalization which consolidates and links existing facilities and increases natural cover by 200% (55.6 ha existing, 166.5 ha post development) •	The Alloa Drain will be realigned using natural channel principles and the existing floodplain area will be reconfigured and confined in a significant greenway corridor. Additional floodplain areas within the Alloa Secondary Plan area will also be reconfigured to corridors and/or NHS where diverse features, functions, and uses can be considered at detailed design. The reconfirmed NHS will exhibit naturalized area and will be considered additional natural cover along with naturalized buffers to existing natural heritage features.
	Native Biodiversity Functions (Extent to which plan supports local and landscape scale native biodiversity)	Based on the following indicators: 1) habitat of Threatened and Endangered species; 2) diversity of ELC communities; 3) Significant Wildlife Habitat; 4) Significant Woodlands ; and 5) Level of connectivity	**POSITIVE** • ESA permissions and approvals to be secured, as necessary, for impacts to Threatened and Endangered Species *(i.e.* SAR Bats, Bobolink, Eastern Meadowlark). • Overall diversity of natural features/ communities protected • All Significant Woodlands are retained and protected through adequate buffers that will be enhanced through seeding and/or woody plantings, a "net benefit" • Known Endangered or Threatened species are present within the proposed development area • Overall diversity of natural features/communities protected • Significant Woodlands are retained and any identified impacts will be mitigated and/or compensated for. Buffers to Significant Woodlands will be enhanced through seeding and/or woody plantings, a "net benefit" • A 200% increase in diverse natural cover will be implemented as part of the proposed Alloa Secondary Plan	With respect to connectivity, the Alloa Drain corridor provides a connection to the functional areas of the Etobicoke Creek valleylands.

Discipline	Environmental Factor	Measure	Proposed Land Use Plan	Comments
	Natural System Protection (Extent to which plan minimizes municipal management/resources to ensure natural heritage system is sustainable)	Length of natural system edge adjacent to land uses associated with varying degrees of post development impact (e.g. encroachment)	**NEGATIVE** • There are woodland edges and greenway corridors containing planned municipal trails • The woodland and wetland buffers will be in municipal ownership and will be naturalized and will require ongoing management • SWM facilities to be naturalized to the extent possible	During detailed design, efforts can be made to specific planting materials that can be sustained through potential wet and dry climate extremes.

The following mitigation measures would nevertheless be required to reduce the extent of the impacts to the affected environmental systems:

- Wetland cover within proposed linkages should be increased to the extent possible, with the preferred objective of creating a net increase in wetland cover from the existing condition.
- Habitat of provincially Threatened and or Endangered birds and bats will be compensated per the requirements of the ESA in consultation with MECP.
- Canopy should be created within the urban landscape, buffers, and corridors to increase the overall canopy cover.
- Impacts to physical aquatic habitat from adjacent construction should be mitigated.
- Low Impact Development Best Management Practices should be implemented where appropriate in to mitigate impacts to groundwater discharge and reduce runoff volumes.
- Stormwater management measures should include an erosion control component.
- Additional stormwater quantity controls beyond conventional post-to-pre control at the site outlet should be implemented for the development areas within the Etobicoke Creek watershed to mitigate the risk of flooding for downstream properties.
- Stormwater quality controls should be implemented for all new development areas as per current Provincial Standards.

13.0 Next Steps

Upon completion of Phases 1 and 2 of the LSS, Phase 3 can be completed to address the following:

1. Synthesis of Phases 1 and 2 to provide all related conclusions, recommendations, and management/mitigation strategies.

2. Finalize the requirements for long-term monitoring in consultation with the Region of Peel, Town of Caledon, Agencies and Stakeholders.

3. Provide a Comprehensive Adaptive Management Plan to provide a framework linking site specific studies and monitoring data into a management plan to ensure that mitigation, enhancement and restoration initiatives meet intended objectives.

4. Provide an assessment of how the proposed Land Use Plan conforms with all levels of policy and provide recommendations where required.

   Provide guidelines for any additional site-specific environmental studies as required for any future planning submission(s).

Phase 3: Management Strategies, Implementation, and Monitoring Plan

14.0 Overview of Phase 3: Management Strategies, Implementation, and Monitoring Plan

The purpose of Phase 3: Management Strategies, Implementation, and Monitoring Plan is to identify a strategy to implement the environmental goals, objectives, targets, and other related recommendations and management measures during the design/development and approvals process.

15.0 Policy Conformance Review

Provincial and municipal planning policies and regulations guide the determination of land use with regards to constraints and opportunities within the Alloa Planning Area. Any site alteration or modification must be consistent with the policies and regulations that apply to both the Primary and Secondary Study Areas. Further to the detailed review of various land use planning policies in the Alloa Secondary Plan Planning Justification Report, prepared by Glen Schnarr & Associates Inc. (August 2025) this section provides a review of relevant land use planning policies as they relate to natural heritage features and functions and water resources within the Primary and Secondary Study Areas.

15.1 Provincial Planning Statement, 2024

The Provincial Planning Statement (2024) (PPS) is issued under the authority of section 3 of the *Planning Act*. The PPS applies to decisions that affect planning matters on or after October 20, 2024. Section 3 of the *Planning Act* requires that decisions affecting planning matters "shall be consistent with "the policy statements issued under the Act.

Chapter 2 of the PPS outlines policies associated with future development and land use patterns. Policies within this chapter encourage land use patterns within settlement areas that are based in part on a mix of land uses which efficiently use land and resources.

Section 2.9 of the PPS outlines policies associated with energy conservation, air quality and climate change. Policy relevant to this Study includes:

2.9.1 Planning authorities shall plan to reduce greenhouse gas emissions and prepare for the impacts of a changing climate through approaches that:

a) support the achievement of compact, transit-supportive, and complete communities;
b) incorporate climate change considerations in planning for and the development of infrastructure, including stormwater management systems, and public service facilities;
c) support energy conservation and efficiency;
d) promote green infrastructure, low impact development, and active transportation, protect the environment and improve air quality; and
e) take into consideration any additional approaches that help reduce greenhouse gas emissions and build community resilience to the impacts of a changing climate.

As noted above in Phases 1 and 2 of this report, the existing natural heritage features have been delineated, and serve as development constraints within the Primary Study Area. The development constraints are further protected by a range of buffers in which development is

prohibited. The delineation of the natural heritage features and their associated buffers contribute to the conservation of biodiversity which allows urbanization and the continuation of existing natural heritage features to co-exist and flourish.

Chapter 3 of the PPS outlines policy regarding infrastructure and facilities. Section 3.1 of the PPS outlines general policy regarding infrastructure, including that infrastructure shall be provided in an efficient manner while accommodating projected needs.

Section 3.6 of the PPS outlines policy regarding sewage, water and stormwater. Policy relevant to this Study includes:

3.6.1 Planning for sewage and water services shall:

b) ensure that these services are provided in a manner that:
1. can be sustained by the water resources upon which such services rely;
3. protects human health and safety, and the natural environment, including the quality and quantity of water; and

c) promote water and energy conservation and efficiency;
d) integrate servicing and land use considerations at all stages of the planning process;

3.6.2 Municipal sewage services and municipal water services are the preferred form of servicing for settlement areas to support protection of the environment and minimize potential risks to human health and safety. For clarity, municipal sewage services and municipal water services include both centralized servicing systems and decentralized servicing systems.

3.6.8 Planning for stormwater management shall:

a) be integrated with planning for sewage and water services and ensure that systems are optimized, retrofitted as appropriate, feasible and financially viable over their full life cycle;
b) minimize, or, where possible, prevent or reduce increases in stormwater volumes and contaminant loads;
c) minimize erosion and changes in water balance including through the use of green infrastructure;
d) mitigate risks to human health, safety, property and the environment;
e) maximize the extent and function of vegetative and pervious surfaces;
f) promote best practices, including stormwater attenuation and re-use, water conservation and efficiency, and low impact development; and
g) align with any comprehensive municipal plans for stormwater management that consider cumulative impacts of stormwater from development on a watershed scale.

With respect to stormwater management, the land use plan provides for stormwater management facilities which will be designed to meet quality control, quantity control and erosion control targets as specified in the Etobicoke Creek Hydrology Update (April 2013), the Subwatershed Study for the Huttonville and Fletcher's Creeks (June 2011) and the Heritage Heights Subwatershed Study Phase 2 Report (March 2022). The proposed stormwater management system will ensure no adverse impacts to downstream watercourses from an erosion or flooding perspective. Drainage areas and SWM facilities have been located to maintain existing overall drainage patterns and subwatershed drainage divides. Low impact

development technology will be considered throughout the development area, where practical, and will contribute to a pre to post development water balance.

Section 3.8 of the PPS outlines policies regarding energy supply, including:

3.8.1 Planning authorities should provide opportunities for the development of energy supply including electricity generation facilities and transmission and distribution systems, energy storage systems, district energy, renewable energy systems, and alternative energy systems, to accommodate current and projected needs.

Section 3.9 of the PPS outlines policies regarding public spaces, recreation, parks, trails, and open space:

3.9.1 Healthy, active, and inclusive communities should be promoted by:

b) planning and providing for the needs of persons of all ages and abilities in the distribution of a full range of publicly-accessible built and natural settings for recreation, including facilities, parklands, public spaces, open space areas, trails and linkages, and, where practical, water-based resources;

Chapter 4 of the PPS outlines policy regarding the wise use and management of resources. Section 4.1 addresses the protection of Natural Heritage Features in relation to development. Relevant sections state:

4.1.1 Natural features and areas shall be protected for the long term.

4.1.2 The diversity and connectivity of natural features in an area, and the long-term ecological function and biodiversity of *natural heritage systems*, should be maintained, restored or, where possible, improved, recognizing linkages between and among *natural heritage features* and *areas, surface water features* and *ground water features.*

4.1.3 Natural heritage systems shall be identified in Ecoregions 6E & 7E1, recognizing that natural heritage systems will vary in size and form in settlement areas, rural areas, and prime agricultural areas.

4.1.4 *Development* and *site alteration* shall not be permitted in:

a) significant wetlands in Ecoregions 5E, 6E and 7E, and

b) significant coastal wetlands

4.1.5 *Development* and *site alteration* shall not be permitted in:

a) *significant wetlands* in the Canadian Shield north of Ecoregions 5E, 6E and 7E;
b) *significant woodlands* in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Mary's River);
c) *significant valleylands* in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Mary's River);
d) *significant wildlife habitat*; and
e) *significant areas of natural and scientific interest;* and

f) coastal wetlands in Ecoregions 5E, 6E and 7E that are not subject to policy 2.1.4(b)

unless it has been demonstrated that there will be no *negative impacts* on the natural features or the *ecological functions*.

4.1.6 *Development* and *site alteration* shall not be permitted in *fish habitat* except in accordance with *provincial and federal requirements.*

4.1.7 *Development* and *site alteration* shall not be permitted in *habitat of endangered species* and *threatened species*, except in accordance with *provincial* and *federal requirements*.

4.1.8 *Development and site alteration* shall not be permitted *on adjacent lands* to the *natural heritage features and areas* identified in policies 2.1.4, 2.1.5 and 2.1.6 unless the *ecological function* of the *adjacent lands* has been evaluated and it has been demonstrated that there will be no *negative impacts* on the natural features or on their *ecological functions*.

All existing natural features and areas have been delineated by a constraint line which will prevent development from occurring within the features and dedicated to the Town of Caledon in an as-is condition for long term protection. New terrestrial corridors connecting the existing natural heritage features within the Primary Study Area to the Alloa Drain system will create an enhanced Natural Heritage System (NHS) that will provide linkages and improve the ecological function and biodiversity of the existing natural heritage features and functions. Further, the NHS will provide linkages to existing terrestrial and aquatic corridors south of Mayfield Road and east of Chinguacousy Road. Buffering to the NHS will create a spatial separation between the development areas and the various natural features. It is through this buffering and planned buffer enhancements that no negative impacts will occur to the natural features or their ecological function. The identified NHS within the Alloa Secondary Plan represents a 200% increase in the net natural vegetated cover, where a 30% increase was a Regional and Town target.

Policies within Subsection 4.2, Water, relevant to this report include:

4.2.1 Planning authorities shall protect, improve or restore the *quality and quantity of water* by:

a) using the *watershed* as the ecologically meaningful scale for integrated and long-term planning, which can be a foundation for considering cumulative impacts of development;

b) minimizing potential *negative impacts*, including cross-jurisdictional and cross-*watershed* impacts;

c) identifying *water resource systems*;

d) maintaining linkages and functions of *water resource systems*;

e) implementing necessary restrictions on development and site alteration to:

1. protect all municipal drinking water supplies and designated vulnerable areas; and

2. protect, improve or restore vulnerable surface and ground water, and their hydrologic functions;

f) planning for efficient and sustainable use of water resources, through practices for water conservation and sustaining water quality; and

g) ensuring consideration of environmental lake capacity, where applicable.

4.2.2 Development and site alteration shall be restricted in or near sensitive surface water features and sensitive ground water features such that these features and their related hydrologic functions will be protected, improved or restored, which may require mitigative measures and/or alternative development approaches.

The Alloa Drain and wetlands are the sensitive surface water features within the Primary Study Area.

The watershed and water resource systems are being protected or improved within the Primary Study Area through the design of the NHS and the comprehensive stormwater management requirements for the Secondary Plan. A comprehensive stormwater management plan has been completed that demonstrates the avoidance of negative impacts on watershed conditions and the water resource system, including quality and quantity. Development within all key hydrologic areas and the NHS are also avoided. An overview of the proposed comprehensive adaptive management plan and monitoring plan to protect and improve water resource systems withing the Primary Study Area as well as the preferred management strategy are also included in this report.

Chapter 5 of the PPS outlines policies associated with future development and natural and human-made hazards. Policies within this Section relevant to this report include:

5.2.2 Development shall generally be directed, in accordance with guidance developed by the Province (as amended from time to time), to areas outside of:

b) hazardous lands adjacent to river, stream and small inland lake systems which are impacted by flooding hazards and/or erosion hazards; and

c) hazardous sites.

5.2.3 Development and site alteration shall not be permitted within:

c) areas that would be rendered inaccessible to people and vehicles during times of flooding hazards, erosion hazards and/or dynamic beach hazards, unless it has been demonstrated that the site has safe access appropriate for the nature of the development and the natural hazard; and

d) a floodway regardless of whether the area of inundation contains high points of land not subject to flooding.

5.2.4 Planning authorities shall prepare for the impacts of a changing climate that may increase the risk associated with natural hazards.

5.2.5 Despite policy 5.2.3, development and site alteration may be permitted in certain areas associated with the flooding hazard along river, stream and small inland lake systems:

b) where the development is limited to uses which by their nature must locate within the floodway, including flood and/or erosion control works or minor additions or passive non-structural uses which do not affect flood flows.

5.2.6 Development shall not be permitted to locate in hazardous lands and hazardous sites where the use is:

a) an institutional use including hospitals, long-term care homes, retirement homes, pre-schools, school nurseries, day cares and schools;

b) an essential emergency service such as that provided by fire, police and ambulance stations and electrical substations; or c) uses associated with the disposal, manufacture, treatment or storage of hazardous substances.

5.2.7 Where the two zone concept for flood plains is applied, development and site alteration may be permitted in the flood fringe, subject to appropriate floodproofing to the flooding hazard elevation or another flooding hazard standard approved by the Minister of Natural Resources and Forestry.

5.2.8 Further to policy 3.1.6, and except as prohibited in policies 3.1.2 and 3.1.5, development and site alteration may be permitted in those portions of hazardous lands and hazardous sites where the effects and risk to public safety are minor, could be mitigated in accordance with provincial standards, and where all of the following are demonstrated and achieved:

a) development and site alteration is carried out in accordance with floodproofing standards, protection works standards, and access standards;

b) vehicles and people have a way of safely entering and exiting the area during times of flooding, erosion and other emergencies;

c) new hazards are not created and existing hazards are not aggravated; and d) no adverse environmental impacts will result.

As noted in Phases 1 and 2 of this report and as illustrated by the proposed constraints delineations shown on the associated mapping, proposed areas of development, outside of the exceptions noted in the PPS, remain outside of the natural hazards associated with the Primary Study Area. Most notably, no encroachment of the floodlines which have been developed and refined by the TRCA and the Consultant Team is to occur within the Primary Study Area. Further refinements will be required through the subsequent planning processes to ensure the policies of Section 3.1 of the PPS are achieved.

Given the extent of the Study Area, it is anticipated a large amount of earthworks will be required to develop the land. Proper reuse and/or export of excess soils will be addressed through the planning processes and development approvals by the various proponents.

15.2 Greenbelt Plan, 2017

The Greenbelt Plan identifies where urbanization should not occur in order to provide permanent protection to the agricultural land base and the ecological and hydrological features, areas and functions occurring within the Greenbelt Plan Area.

Section 3.2 of the Greenbelt Plan provides policies related to the Natural System within the Protected Countryside. The Natural System is made up of a "Natural Heritage System" and a "Water Resources System". The Natural Heritage System includes core areas and linkage areas of the Protected Countryside containing the highest concentration of the most sensitive and/or significant natural features and functions. The Water Resource System is made up of both ground and surface water features and areas and their associated functions, which provide the water resources necessary to sustain healthy aquatic and terrestrial ecosystems and human water consumption.

Section 3.2.5 provides policies relating to Key Natural Heritage Features and Key Hydrologic Features. The Natural Heritage System within the study area represents a water resource system and contains various Key Natural Heritage and Hydrologic features including fish habitat, wetlands, the Etobicoke Creek and significant valleylands. The Greenbelt Plan does not generally allow for development or site alteration within key natural heritage or key hydrologic features within the Natural Heritage System with the exception of forest, fish and wildlife management, conservation and flood or erosion projects, infrastructure and other limited purposes. Further, the Greenbelt Plan requires a minimum 30-metre vegetation protection zone from the outside boundary of any key natural heritage feature or key hydrologic feature.

There are no areas of Greenbelt within the Primary Study Area. A small portion of lands in the northern part of the Secondary Study Area have been identified as Greenbelt.

15.3 Region of Peel Official Plan, 2022

The Region of Peel Official Plan provides an outline of strategies to guide growth and development in the Region. The Primary Study Area is defined on Schedule E-1 as a 2051 New Urban Area and part of the Urban System. The Primary Study Area is further defined as part of the Region's Strategic Growth Areas as noted on Schedule E-2 and as a Designated Greenfield Area as noted on Schedule E-3.

Section 2.14 of The Region's OP describes the Greenlands System as a "*fundamental component of the Region's natural environment that depends on the natural landscape to be linked, where ecologically appropriate, into a network of natural heritage features, areas and corridors.*" Pockets of existing natural heritage features within the Primary Study Area are included in the Region's Greenland System which is presented on Schedule C-1. A portion of these features are further noted as *Core Areas* of the Greenlands System as presented on Figure 7 of the Official Plan. As noted in Section 2.14.15, development and site alteration is prohibited within the Core Areas of the Greenlands System with some exceptions including flood control projects, essential infrastructure, and passive recreation provided that there will be no negative impacts on the natural feature or their function.

No development is proposed within the Core Areas of the Greenlands System.

The Secondary Study Area also contains areas of the Greenlands System, including Core Areas. No development is proposed in the Secondary Study Area.

15.4 Town of Caledon Future Caledon Official Plan, 2024

Future Caledon, the Town of Caledon Official Plan, provides a land use strategy that will guide the Town's development, housing, transportation, employment, and community facilities to the year 2051. Although Future Caledon has been adopted by Town of Caledon Council, final approval is required from the Ministry of Municipal Affairs and Housing. Future Caledon includes community planning structure comprised of the Urban System, Rural System, and a Natural Environment System.

The Natural Environment System is comprised of:

a) *Core Areas of the Greenlands System as identified and protected in the Region of Peel Official Plan, and which are designated Natural Features and Areas by this Plan;*

b) *Natural Areas and Corridors and Potential Natural Areas and Corridors of the Greenlands System as identified and protected in the Region of Peel Official Plan, and which are designated Supporting Features and Areas by this Plan;*

c) *the Greenbelt Plan Natural Heritage System;*

d) *the Greenbelt Plan Urban River Valleys;*

e) *the Natural Heritage System for the Growth Plan;*

f) *the Natural Core Area and Natural Linkage Area designations within the Oak Ridges Moraine Conservation Plan;*

g) *the Escarpment Natural Area and Escarpment Protection Area designations within the Niagara Escarpment Plan;*

h) *Provincially significant Earth Science Areas of Natural and Scientific Interest*

i) *regionally significant Earth Science Areas of Natural and Scientific Interest; and,*

j) *The water resource system which includes permanent and intermittent streams, wetlands, seepage areas and springs, kettle lakes, highly vulnerable aquifers and significant groundwater recharge areas and Areas of High and Low Aquifer Vulnerability within the Oak Ridges Moraine Conservation Plan Area.*

Objectives and policies related to the Natural Environment System are further described in Section 13 of the Future Caledon OP.

Schedule D1, Natural Environment System, illustrates that although the Primary Study Area is within the Urban System, the lands do include pockets of Natural Features and Areas, Supporting Features and Areas, and Permanent and Intermittent Steams. Schedule D2a, New Urban Area Preliminary Natural Environment System also includes Potential Linkages and Potential Enhancement Areas. Lands in the Secondary Study Area, as illustrated on Schedules D1 and D2a are located within the Rural System and include Natural Features and Areas, Supporting Features and Areas, and Permanent and Intermittent Steams.

Development is not proposed within the Natural Environment System.

15.5 Conservation Authority Policies

On April 1, 2024, changes to sections of the *Conservation Authorities* Act came into effect and a new regulation under the Act was enacted. Ontario Regulation (O. Reg.) 41/24, Prohibited Activities, Exemptions and Permits, replaces the individual regulations for each Conservation Authority. Under Section 28 of the *Conservation Authorities* Act and O. Reg 41/24, Conservation Authorities are responsible for regulating development activities in and adjacent to natural and hazardous areas in order to avoid the loss of life and damage to property as a result of flooding and erosion. The Regulation Limit follows the maximum extent of the combined floodplain and meander belt limits which represents a 15 m allowance from the greater of the regulatory floodplain and erosion hazard limits or 30 m adjacent to a Provincially Significant Wetland. Under this regulation, permission is required from the Conservation Authority to develop within regulated areas. A permit is required for certain development activities within regulated areas including,:

- Activities to straighten, change, divert, or interfere in any way with the existing channel of a river, creek, stream, or watercourse, or to change or interfere in any way with a wetland.
- Development activity in: hazardous lands, wetlands, river or stream valleys, areas adjacent or close to the shoreline of Lake Ontario.

Acquisition of this permission requires the completion of a Permit Application to be filed with the appropriate Conservation Authority.

Portions of the Primary Study Area are within the TRCA and CVC Regulation Limits. This situation does not prohibit development on the Primary Study Area but requires that a permit be obtained from the TRCA and/or CVC prior to commencement of any construction activities.

Etobicoke Creek Watershed Plan

The Etobicoke Creek Watershed Plan, 2024 (ECWP) is a comprehensive strategy and planning document developed by the Toronto and Region Conservation Authority in collaboration with local municipal and regional governments. The ECWP outlines the actions required to protect, enhance, and restore the health of the Etobicoke Creek Watershed and mitigate impacts from land use and climate change. Table 8 of the ECWP describes the TRCA's Land Use Objectives and the management actions to mitigate the impacts from land use on the watershed. Once the ECWP receives final approval, it is intended to be in effect for 10 years.

The proposed Land Use Plan and associated management strategies meet the land use objectives and management actions as outlined in the ECWP, including the creation of an enhanced Natural Heritage System and increasing urban forest cover.

Water Balance for Protection of Natural Features

Appendix D of the TRCA's Stormwater Management Criteria document contains the TRCA's guidelines for requirements to maintain the hydrologic function of any natural heritage features that have been recommended for protection. The objective for the Guiding Principles is stated in Section 1.1 of Appendix D as follows:

> *"The objective of protecting a natural feature's specific water balance is to ensure that the changes anticipated post development do not exceed the feature's capacity to respond and adapt, allowing for its long-term perpetuation and sustainability, while minimizing the resources/interventions needed to manage and maintain it. This is really an assessment of risk. The desire is to maintain the physical and biological complexity of the system and not move to a more simplified system."*

Water balance requirements for wetlands, woodlands and watercourses are defined as well as the steps involved to complete the water balance. This LSS includes an overview of the water resource system as well as the preferred management strategy for the system outlined herein.

15.6 Endangered Species Act (2007)

Ontario's *Endangered Species Act, 2007* (ESA) provides regulatory protection to Endangered and Threatened species prohibiting harassment, harm and/or killing of individuals and destruction of their habitats. Habitat is broadly characterized in the ESA as the area prescribed by a regulation as the habitat of the species or an area on which the species depends, directly or indirectly, to carry out its life processes including reproduction, rearing of young, hibernation, migration or feeding.

The various schedules of the ESA included under O. Reg. 230/08 identify SAR in Ontario. These include species listed as Extirpated, Endangered, Threatened and Special Concern. As noted above, only species listed as Endangered and Threatened receive protection from harm and destruction to habitat on which they depend.

Consultation is required with MECP to determine permitting requirements, potential compensation prior to any site alteration.

15.7 Federal Fisheries Act

The *Fisheries Act* includes protections for fish and fish habitat in the form of standards, codes of practice, and guidelines for projects near water. The *Fisheries Act* provides protection against the "death of fish, other than by fishing", [Section 34.4(1)] and the "harmful alteration, disruption or destruction of fish habitat", [Section 35(1)], otherwise known as HADD. In cases where impacts to fish and fish habitat cannot be avoided, and the project does not fall within waterbodies where Fisheries and Oceans Canada (DFO) review is not required, proponents are asked to submit a request for review to their Fish and Fish Habitat Protection Program regional office to determine approval requirements.

All projects are encouraged to avoid causing the death of fish and a HADD of fish habitat, using measures to protect fish and fish habitat that include standards and codes of practice for common works, undertakings, and activities.

15.8 Development of Planning Objectives

During the process of developing the Planning Objectives, a sub-set of criteria was established to provide methods/concepts of how the Planning Objectives may be achieved. These

methods/concepts were presented as opportunities to be included in the design of the development and are generally summarized as follows:

Natural Heritage System (NHS)

- Protect and enhance existing woodlands, wetlands and wildlife corridors
- Scenic views and vistas integrated into community structure
- Integrate existing heritage landscapes (hedgerows) into introduced open space features
- Link existing and introduced open spaces where appropriate
- Integrate trails and pathways as part of an interconnected pedestrian and cycling network
- Trail and pathway locations to mitigate potential impacts to sensitive environments
- Inform homeowners of the importance and function of the NHS and related responsibilities

Low Impact Development (LID) / Sustainable Design

- Consideration for all LID measures as a key foundation for open space and built form design
- Innovative approach to urban stormwater management
- Prevent, retain, detain, use and treat runoff through hydrologically functioning landscapes
- Minimize or disconnect impervious surfaces and increase flow paths
- Preserve naturally vegetated areas and soil types that slow runoff and allow infiltration
- Integrate existing landscape heritage elements into open space features, where feasible
- Site layout and grading should be integrated with existing grade conditions, where feasible
- Consider underground parking or parking integrated into built form to reduce surface paving
- For lighting, achieve a balance between safety / security and energy consumption
- Establish 'green building' practices for publicly and privately developed built form
- Building placement should consider orientation for sun and wind

Parks And Open Spaces

- Hierarchy of park spaces with flexible design and programming options
- Alternative private urban park spaces that are designed for higher density mixed-use areas
- Create unique parks that are distinguished through theme, programming, layout and facilities
- Park type and location to be appropriate for adjacent street classification
- Ensure a range of passive and active recreation opportunities for all age groups

- Integrate path connections as a component of the community trail network
- Generally, all residential areas to be within a 5 minute walk to a park or open space feature
- Parks shall be designed as focal points within the neighbourhood or community
- Where feasible, situate parks within a highly visible location within the community or at the terminus of views

Transit-Oriented Development

- Reduce commuter travel time and dependence on automobile
- Provide a comprehensive, interconnected and accessible bus transit service
- Ensure convenient access to available modes of transit and service types
- Generally, all neighbourhood areas to be within a 400m radius (5 min. walk) of a transit stop

Transportation

- Balance street transportation function with pedestrian street zone and land use
- Establish hierarchy of roadways and transportation, as well as urban design function
- Human-scaled street rights-of-way and pavement widths
- Transit is enabled for roads designated as part of the transit network
- Address on-street parking as a key function of streets within mixed-use areas
- Provide lane-based built form product as appropriate to street/building function
- Provision for multi-use paths along collector roads as part of the overall cycling network
- Provision for multi-use paths within boulevards along arterial roads
- Reconsider current standards related to intersection offsets, turning movements, etc.
- Consider road standards that help achieve a uniquely urban, compact 'village' character

Neighbourhood Structure

- Create pedestrian scaled neighbourhoods -
    - Walkable (400 metre walking radius)
    - Interconnected street / block pattern (modified grid)
    - Limited block lengths
    - Multiple, safe and convenient connections
    - Sidewalks on both sides of the street along key streets
- A hierarchy of roads based on a modified grid pattern
- A patterned community with discernible edges, gateways, centres and corridors
- Identifiable neighbourhoods with major uses (parks, schools, etc.) as organizing elements
- Built form type and architectural design to support neighbourhood structure

- Commercial and civic buildings to reinforce major commercial and mixed-use areas
- System of parkland, corridors, stormwater management ponds and NHS to function as primary organizing element
- Location of schools to facilitate easy pedestrian, cycling access
- Integration of SWM ponds as an extension of the NHS to facilitate linkages

Streetscape

- Design of streets shall emphasize pedestrian safety and comfort
- Variety of building typologies and styles to reinforce attractive, animated street zone
- Strong building/street relationship
- Adopt principles of Crime Prevention through Environmental Design (CPTED)
- Create a uniquely urban boulevard treatment and 'main street' character along Urban Corridors and major collector roads.
- Family of gateway features ('kit of parts') at key areas used to help brand the community
- Street tree planting strategy to enhance street identification
- Integrate lay-by street parking for convenient access to retail / service amenities

  Integrate transit facilities (stops, shelters, seating) with boulevard design at bus stops

16.0 Development of Land Use Plan

16.1 Planning Objectives

The Planning Objectives of the Secondary Plan described below are intended to guide development within the Secondary Plan and ensure consistency in implementation of Secondary Plan policy. The planning objectives for the Alloa Secondary Plan include:

a) Support climate change mitigation and adaptation by reducing greenhouse gas emissions and by preparing for the impacts of climate change that pose a threat to buildings, infrastructure, natural systems, safety, and the well-being of residents and the local economy;
b) Identify and conserve cultural heritage resources and incorporating them into the community design;
c) Support and achieve a high standard of urban design to help create a healthy, complete community that is accessible, walkable, attractive, thriving, innovative and inclusive.
d) Facilitate a sustainable, environmentally sound and diverse local economy.
e) Create opportunities for a broad mix and range of housing types, densities, sizes and tenures that are suitable for different incomes, ages, lifestyles, and families, including the provision of affordable housing, and contribution towards the achievement of Regional housing targets;

f) Provide for a range of employment uses within Employment Areas to achieve the employment targets while ensuring compatibility with surrounding land uses;
g) Provide adequate community service facilities, as necessary, to keep pace with development;
h) Provide an inter-connected transportation network, that includes road, pedestrian, cycling and transit infrastructure, that connects to the surrounding arterial road system and surrounding communities, provides active transportation opportunities and promotes transit;
i) Ensure services, including the necessary sanitary, stormwater and water services, are in place and operative prior to or concurrent with development;
j) Design a stormwater management system that protects features and functions of the natural heritage system and water resources system;
k) Ensure the costs of services, public facilities and infrastructure required to permit and support the development of the lands in the Plan Area are financially sustainable.
l) Protect and enhance the features within the Natural Environment System; and,
m) Provide a well-connected, cohesive and publicly accessible system of parks, open spaces, trails and community facilities that provide a range of multi-seasonal recreational, leisure and social opportunities for people of all ages, abilities and interests.

16.2 Water Resource System

A comprehensive water resource system that considers all aspects of water management has been developed for the Primary Study Area/Alloa Secondary Plan Area. The following components of the water resource system are summarized below:

Flood hazards: Flood hazards in the adjacent creeks have been established using the Regional event (Hurricane Hazel) which is based on an historic event. As such, the extent of existing or proposed flood hazards will not be affected by increased intensity, frequency and duration of storm events due to climate change.

Stormwater Management: All proposed stormwater management facilities within study have been designed to control, and in the case of Etobicoke Creek facilities, over-control the Regional event. Due to the use of this historical storm in the sizing, the pond blocks are not anticipated to increase as a result of climate change.

Environmental features / wetlands: Potential impacts of climate change on feature based water balance for the wetlands will continue to be evaluated and will consider extreme conditions (wet / dry years). Mitigation could include utilizing stormwater to irrigate the wetlands and preparing monitoring plans for post-development to evaluate the health of the wetlands.

Site water balance: Where feasible based on soil / groundwater constraints, LIDs such as green roofs (in the site plan / high density blocks), infiltration measures, tree pits, etc., in will be utilized in the design to mitigate the effects of climate change (i.e., managing more frequent runoff events).

Erosion: As there is the potential for increased frequency of flows in the creeks due to climate change, the impacts of these flows on erosion protection measures should be considered at

detailed design. While this will not affect channel block sizes, it could impact the sizing of stone protection or other mitigation measures.

16.3 Transportation Master Plan

The transportation network proposed to support the Alloa Secondary Plan is a hybrid system that recognizes the role of the automobile, while supporting a foundation for the establishment of transit service with strong active transportation connections within and beyond the community. As the Primary Study Area abuts multijurisdictional infrastructure including the future Highway 413 (MTO), Regional roads of Mayfield Road and Mississauga Road and Town roads of Chinguacousy Road and Creditview Road, the proposed network takes advantage of planned capital improvements to help maximize the use of existing/planned infrastructure.

The internal collector road network supports a grid structure that facilitates connectivity to the neighbouring communities of Mayfield West, east of the Primary Study Area; Mount Pleasant to the south, and the future Heritage Heights Secondary Plan Area to the southwest. Recognizing constraints of the Natural Heritage System, two east-west and two-north south collector road crossings are proposed within the Phase 1 lands, while one north-south and three east-west crossings are proposed within the Phase 2 lands (see Figure 21). The network was designed to minimize the occurrence of crossings throughout the Plan Area, and when crossings occurred to conceptually locate them in areas that minimized impacts while considering the mobility and connectivity requirements. The proposed network also supports a connected active transportation system comprised of on-road and off trail routes that connect residents to key land uses such as parks, schools, and commercial uses in addition to the boundary road network.

The grid system proposed will also support the establishment of a future transit network that will leverage existing and planned Brampton Transit service, and a proposed bus stop network where 95% of all residents are located within 400 m of future transit stops. These transit routes will also allow direct connections to the Mayfield West transit hub, Mount Pleasant GO Station, or the Highway 413/Mayfield Road Transit Station without the need to drive, contributing to increased sustainable mode share.

The mobility network proposes a system of continuous collector roads that aims to minimize impacts to the NHS; however, the identified constraints are such that crossings cannot be avoided.

In the Phase 1 lands east of Creditview Road, four crossings of the NHS system are proposed. These are at Street C, Street F, Street D, and Street B. The crossings are considered essential to the function of the Secondary Plan area, particularly as the crossings ensure the viability of transit and active transportation by providing the grid system with continuity within the lands. Without such a grid system of collector roadways, transit would not be easily programmed to ensure that over 95 percent of future residents will be within 400 metres of a transit stop. The crossings will minimize distance between origins and destinations within the Secondary Plan area, ensuring that walking and cycling are viable modes of transport for everyday use as well as recreationally. These types of trips would be home based trips to schools, parks, and local commercial operations in the mixed-use areas.

Without these essential crossings, the success of Town, Region, and Provincial policies relating to the promotion of active transportation and transit use to reduce single occupancy vehicle use will be impaired, with its attendant increase in roadway congestion and tailpipe emissions.

Of particular note is the need for continuity of Street B, which is the extension of Tim Manley Avenue and will connect directly to the Mayfield West Transit Hub. Discontinuity of Street B will impair transit and cycling trips to the transit hub, forcing less attractive circuitous routes for these modes of transportation. From an automobile perspective, discontinuity would also result in additional turning movements for motorists which would otherwise be more direct through movements to access the boundary road network. It should be noted that Street B is currently the only continuous collector road that links the western limits of the Alloa Secondary Plan through the Mayfield West Secondary Plan and Mayfield West Transit Hub. Street B therefore becomes a key multimodal transportation corridor linking new these new communities within south Caledon. Further information can be found in Section 6.1.1 of the Transportation Needs Assessment (Crozier 2024).

16.4 Enhanced Natural Heritage System Integration and Linkages

The Alloa Secondary Plan: Land Use Plan includes lands identified Natural Environment System Area. This land use defines the Natural Heritage System based on environmental constraints to development that were identified through field studies that were completed over time by a multi-disciplinary team within the Primary Study Area (see Figures 19 and 22) and also based on second source data for the Secondary Study Area.

The Alloa Secondary Plan was prepared after careful consideration of the existing natural heritage features (see Figure 20) and reconfiguration of existing floodplain to create greenway corridors that provide both confined flood storage and opportunities for increased natural cover including wetland areas, creation of new watercourse channels using natural channel principles, routes for active transportation and LID infrastructure (see Figure 22). The enhanced Natural Heritage System has been designed to accommodate regional storm conditions while also providing and celebrating the extensive greenway corridors that are central to the proposed Land Use Plan. The greenway corridors provide opportunities for flood control, a significant increase in natural cover (200% increase), habitat diversity, active transportation, and interpretation.

17.0 Development and Analysis of Preferred Management Strategy

17.1 Performance Measures

Through the completion of Phase 2: Subwatershed Impact Assessment, various evaluation factors were considered in detail with the objective of assessing whether the proposed Land Use Plan and associated management strategies were anticipated to adequately protect and enhance the natural heritage features and functions in accordance with governing legislation and policies. These interdisciplinary criteria were evaluated using an integrated approach, with respect for the interconnected relationships between the natural systems.

These evaluation factors may be further refined to formulate specific and quantifiable performance measures by which the effectiveness of the chosen management plan may be assessed on an ongoing basis (see Table 63). The identified performance measures and corresponding management objectives have been summarized in the Comprehensive Adaptive Management Plan and Monitoring Plan (see Table 72).

17.2 Water Resource System

17.2.1. Surface Water Features, Areas, and Functions

Watercourses

The Alloa Drain bisects the Primary Study Area and flows east towards a branch of the Etobicoke Creek. Maintenance of the watercourse features on and surrounding the site are key to preserving the hydrologic function of the Etobicoke Creek Headwaters, Fletcher's Creek and Huttonville Creek Subwatersheds. Management of aquatic species, communities, and geomorphological features is required.

17.2.2. Hydrogeological

Wetland Water Balance

The Alloa Lands are home to 7 wetlands named Wetlands #1 – #7, some of which form part of the Etobicoke Creek Headwater Wetland Complex and Etobicoke Creek Headwater Wetland II Complex. Provincial studies recognize these features as "provincially significant" or consider them to be ecologically valuable according to criteria outlined by the Ontario Wetland Evaluation System. The onsite systems are identified as swamps or marsh by provincial mapping and have further been classified by Beacon and Azimuth noted in the LSS in Phases 1 and 2 herein.

Based on the monitoring results captured to date it appears that Wetland #1 and Wetland #2 operate as primarily inundated features that recharge the groundwater seasonally. Less than 28 % of the areas surrounding Wetland #1 and Wetland #2 will be developed and the remainder of the lands are dedicated to Natural Heritage. Therefore, given the short period of recharge occurring, it is interpreted that groundwater recharge will be nearly maintained in the post development scenario and minor mitigation will be implemented.

Upward vertical groundwater gradients are observed primarily in the northeast quadrant of the site. Wetlands #3 – #6 appear to have some groundwater component in their functioning and groundwater discharge does occur seasonally. The rate and volume of discharge is expected to be limited due to the low permeability of the surficial soils.

TABLE 63: ALLOA SECONDARY PLAN LOCAL SUBWATERSHED PERFORMANCE MEASURES

Indicator	Measurable Parameter	Target	Relevant Disciplines	Notes	Source
Risk of Flooding	Peak Flow Rate	Control post-development flows to pre-development levels (no increased risk from development)	Water Resources		Conservation Authorities Act
Water Balance	Surface water quantity	Maintaining and, where appropriate, enhancing and restoring quantity of surface water entering Wetland Core Areas, Core Fishery Resource Areas, and Valley and Stream Corridors	Water Resources Fisheries Terrestrial		Future Caledon OP Region of Peel SABE
Water Balance	Groundwater recharge	Protect, maintain and, where appropriate, enhance and restore the quantity of groundwater recharge and discharge and the flow distribution of groundwater	Hydrology/Hydrogeology Fisheries Terrestrial		Future Caledon OP Region of Peel SABE
Water Quality	Provincial Water Quality Objectives	Maintaining and, where appropriate, enhancing and restoring quality of surface water entering Wetland Core Areas, Core Fishery Resource Areas, and Valley and Stream Corridors	Water Resources Fisheries Terrestrial		Future Caledon OP Region of Peel SABE
Water Quality	Total Suspended Solids	Percent TSS Removal	Water Resources Fisheries	Guidelines specifically related to criteria for stormwater management design	MOE 2003 BMP Guidelines
Groundwater Discharge	Existing Stream Baseflow	No Reduction. To be determined on a Subwatershed catchment basis (or other functionally related area).	Hydrogeology Fisheries Terrestrial	The Existing Stream Baseflow is an indicator of the minimum habitat available for fish and affects stream thermal stability (Measured Base Flows).	Future Caledon OP
Recharge Areas	Average Recharge on a Subwatershed Basis	No Reduction. To be determined on a subwatershed catchment basis (or other functionally related area).	Hydrogeology Fisheries Terrestrial	The Average Recharge on a Subwatershed catchment basis is directly related to the natural water balance. Any reduction in recharge over the area of the subwatershed catchment may indicate increased runoff and decreased stream baseflow.	Future Caledon OP
Water Table Elevations	Average Water Table Elevation	No Reduction. To be determined on a subwatershed catchment basis (or other functionally related basis).	Hydrogeology Fisheries Terrestrial	The Average Water Table Elevation is an indicator of the natural water table elevation. A lowering of the water table may indicate a reduction in groundwater supplies and a reduction in groundwater discharge to streams and wetlands.	Future Caledon OP
Property and structures at risk of fluvial erosion	Meander belt width (as a component of stream corridors)	No increase or provide a net decrease in number of properties/ structures within the meander belt width	Fluvial Geomorphology Terrestrial (stream corridor definition)	Meander belt width to be assessed on a reach basis for channels with defined bed and banks.	Planning Act/PPS (2020) Conservation Authorities Act / CA Regulations Future Caledon OP TRCA Belt Delineation Procedures, 2015 CVC Fluvial Geomorphic Guidelines, 2015
Morphological form and function	Length of channel with characteristic morphological form and function.	Maintenance of open length of channel of similar morphological form and / or function.	Fluvial Geomorphology Fisheries	Where there is no defined morphological form, target should focus on maintenance of downstream function - i.e. delivery of flow and sediment.	Conservation Authorities Act / CA Regulations CVC Fluvial Geomorphic Guidelines, 2015 Mount Pleasant Subwatershed Study; Evaluation, Classification and Management of Headwater Drainage Features, 2014.

Indicator	Measurable Parameter	Target	Relevant Disciplines	Notes	Source
In-stream erosion potential	Duration of flows exceeding erosion threshold	No significant increase or provide decrease in duration of flows above erosion threshold.	Fluvial Geomorphology Surface Water	Erosion thresholds to be defined at representative and/or sensitive sites in terms of critical discharge based on field data.	Planning Act/PPS Conservation Authorities Act / CA Regulations Future Caledon OP Stormwater Management, Planning and Design Manual (MOE, 2003) CVC Fluvial Geomorphic Guidelines, 2015.
Fish productive capacity	Amount (length or area) of habitat available and abundance or biomass per unit of habitat	No net loss or provide net gain in fish productive capacity	Fisheries	Fish biomass or abundance usually used as a surrogate for productivity. Target is no net loss, or provide a net gain where appropriate, on a subwatershed catchment basis. Success in achieving target to be determined by monitoring.	Future Caledon OP Peel Region OP Region of Peel SABE Fisheries and Oceans Canada Habitat Conservation and Protection Guidelines, Second Edition (1998)
Fish community	Indicator species presence, total and relative abundance	No deterioration, and provide improvement where appropriate, in fish community	Fisheries	Indicator species and indices vary by watershed. Targets apply to both onsite and downstream habitats. Success in achieving target to be determined by monitoring.	Fisheries Act, Conservation Authorities Act, Planning Act/PPS, Future Caledon OP Region of Peel SABE Mount Pleasant Community Subwatershed Study; Etobicoke Creek Headwaters Subwatershed Study; Humber River Watershed Plan. Evaluation, Classification and Management of Headwater Drainage Features, 2014
Benthic invertebrates	Indicator species presence, total and relative abundance (including indices based on these aspects)	No deterioration, and provide improvement where appropriate, in benthic invertebrate community	Fisheries	Indicator species and indices vary by watershed. Targets apply to both onsite and downstream habitats. Success in achieving target to be determined by monitoring.	Fisheries Act, Conservation Authorities Act, Planning Act/PPS, Future Caledon OP Region of Peel SABE Mount Pleasant Community Subwatershed Study; Etobicoke Creek Headwaters Subwatershed Study; Humber River Watershed Plan, Evaluation, Classification and Management of Headwater Drainage Features, 2014
Endangered species	Amount of contributing habitat (HDFs and connected wetlands).	Net gain in contributing habitat	Fisheries	Confirm the presence/absence of Redside Dace (RSD) considerations. If there are RSD considerations, stormwater management will need to address water quality interests of Redside Dace including water temperature and TSS. Constructed wetlands for SWM are preferred for contributing to Redside Dace recovery." Success to be achieved through integrated planning and SWM monitoring program Success to be achieved through integrated planning and SWM monitoring program.	Endangered Species Act Future Caledon OP Region of Peel SABE Redside Dace Recovery Strategy, Government Response Statement, Habitat Definition, Guidelines for Developing Areas (draft)
Woodlands	Percent Woodland Cover (Local and Regional Scales)	Local - Calculated on subwatershed basis; to be a component of providing a 30% increase in natural cover over existing conditions	Terrestrial	The Percent of the Subwatershed Forested is an indicator of the sustainability of the natural environment and an indicator of the ability of native forests to provide sustainable watershed benefits such as improving air quality, sequestering carbon, etc.	Planning Act/PPS Peel Region OP Region of Peel SABE Future Caledon OP Greenbelt Plan & Technical Guidelines Other Guidance - Huttonville-Fletchers Creeks Subwatershed Study; Etobicoke Creek Headwaters Subwatershed Study; TRCA Terrestrial Natural Heritage System Strategy; CVC Terrestrial Ecosystem Enhancement Model; CVC Wetland Restoration Strategy; Environment Canada, How Much Habitat is Enough
Wetlands	Percent Wetland Cover (Local and Regional Scales)	Local - Calculated on subwatershed basis; net gain over existing to be a component of providing a 30% increase in natural cover over existing conditions	Terrestrial	The Percent of the Subwatershed in Wetlands is an indicator of the sustainability of the natural environment.	Planning Act/PPS Peel Region OP Region of Peel SABE Future Caledon OP Greenbelt Plan & Technical Guidelines Conservation Authorities Act / CA Regulations Other Guidance - CVC Wetland Restoration Strategy TRCA Terrestrial Natural Heritage System Strategy; Huttonville-Fletchers Creeks Subwatershed Study; Etobicoke Creek Headwaters Subwatershed Study; Environment Canada, How Much Habitat is Enough

Indicator	Measurable Parameter	Target	Relevant Disciplines	Notes	Source
Forest Interior	Total Interior Area i.e. >100 m from an edge (Local and Regional Scales)	Local - Calculated at feature level and on a subwatershed basis; net gain over existing	Terrestrial	The Percent of Forested Habitat > 100 m from edge (a cumulative total of this area over the total watershed) is an indicator of a high quality terrestrial habitat that supports a unique assemblage of species that are generally intolerant of urban environments.	Planning Act/PPS Peel Region OP Region of Peel SABE Future Caledon OP Greenbelt Plan & Greenbelt Technical Guidelines Other Guidance Huttonville-Fletchers Creeks Subwatershed Study; Etobicoke Creek Headwaters Subwatershed Study;; Environment Canada, How Much Habitat is Enough
Species at Risk	SAR presence and abundance (Local and Regional Scales; Note: Some SAR are easily detected and monitored; secretive wildlife are most effectively monitored as a Regional initiative)	SAR sustained or increased in abundance; demonstrate overall benefit to the species	Terrestrial & Avian	Species at Risk protection and management is guided by ESA Regulations and Recovery Strategies (where available). Consultation required with MECP to determine permitting requirements, potential compensation.	Endangered Species Act(2007) and Regulations Planning Act/PPS Greenbelt Act & Greenbelt Technical Guidelines Peel Region OP Region of Peel SABE Future Caledon OP
	SAR occupied or contributing habitat(s) present	SAR Habitats maintained or enhanced; demonstrate overall benefit to the species	Fisheries, Avian, Terrestrial	Species at Risk protection and management is guided by ESA Regulations and Recovery Strategies (where available). Consultation required with MECP to determine permitting requirements, potential compensation.	Endangered Species Act(2007) and Regulations Planning Act/PPS Greenbelt Plan & Technical Guidelines Peel Region OP Region of Peel SABE Future Caledon OP
Significant Wildlife Habitat (SWH)	SWH Criteria met (Local and Regional Scales; some SWH categories are readily monitored; secretive wildlife are most effectively monitored as a Regional initiative)	SWH protected, sustained or enhanced where possible at local and regional scales	Terrestrial, Avian	The Region of Peel and Town of Caledon have policies and draft criteria for the determination of Significant Wildlife Habitat within their jurisdictions. SWH encompasses Seasonal Concentration Areas, Rare Vegetation Communities, Specialized, Habitats of Species of Conservation Concern, and Animal Movement Corridors. (Note: federal and provincial Special Concern SAR, and Local/Regional "Special Status Species" are covered under SWH)	Planning Act/PPS Peel Region OP Future Caledon OP Greenbelt Plan & Technical Guidelines
Significant Valleylands	SV Criteria met (Local and Regional Scales)	SV protected and enhanced	Terrestrial/Fisheries	The Region of Peel and Town of Caledon have adopted policies and criteria for the determination of Significant Valleylands within their jurisdictions.	Planning Act/PPS Peel Region OP Future Caledon OP Conservation Authorities Act / CA Regulations Greenbelt Plan & Technical Guidelines
	Long-term stable top- of-bank	Development to occur outside of long-term stable top of bank	Geotechnical		Greenbelt Plan & Technical Guidelines Conservation Authorities Act / CA Regulations
Riparian Cover (1)	Width of riparian buffer (Local to Regional Scale)	15 m from streambank (warmwater); 30 m from streambank (cool/coldwater)	Fisheries	The Width of the Buffer (width in m) in natural vegetation is an indicator of the buffer's ability to provide key functions (attenuation of water quality/quantity, stream microclimate, shading, etc.).	Conservation Authorities Act / CA Regulations Lakes & Rivers Improvement Act Greenbelt Plan & Technical Guidelines Future Caledon OP TRCA Valley and Stream Corridor Management Program; CVC Watercourse & Valleyland Protection Policies Other guidance: Huttonville-Fletchers Creeks Subwatershed Study; Etobicoke Creek Headwaters Subwatershed Study; Environment Canada, How Much Habitat is Enough?

Indicator	Measurable Parameter	Target	Relevant Disciplines	Notes	Source
Riparian Cover (2)	Percent of stream length buffered (Local to Regional Scale)	minimum 75% of stream length in natural vegetation	Fisheries	The Percent of Stream Length Buffered (length of natural stream buffer along the stream) is an indicator of its ability to provide key functions.	Conservation Authorities Act / CA Regulations Lakes & Rivers Improvement Act Future Caledon OP Greenbelt Plan & Technical Guidelines TRCA Valley and Stream Corridor Management Program; CVC Watercourse & Valleyland Protection Policies Other guidance: Huttonville-Fletchers Creeks Subwatershed Study; Etobicoke Creek Headwaters Subwatershed Study; Environment Canada, How Much Habitat is Enough?
Vegetation Communities	Av. No. of ELC communities per vegetation patch (Local and Regional Scale)	Net gain on a Subwatershed basis	Terrestrial	The Average Number of different ELC Community Types per Vegetation Patch is an indicator of diversity. Higher numbers of communities indicate higher diversity of natural habitats. Ecological Land Classification is the provincial system for characterizing natural habitats based on vegetation.	Planning Act/PPS Future Caledon OP Region of Peel SABE Greenbelt Plan & Technical Guidelines
Biodiversity	Percent native species (Local and Regional Scales; most effectively monitored as a Regional initiative)	Maintain, restore or improve on a subwatershed system basis	Terrestrial	Sect. 2.1.2 of PPS states: The diversity and connectivity of natural features in an area, and the long-term *ecological function* and biodiversity of *natural heritage systems*, should be maintained, restored or, where possible, improved, recognizing linkages between and among *natural heritage features and areas*, *surface water features* and *ground water features*.	Planning Act/PPS Region of Peel SABE
Natural Area Protection	Buffer effectiveness (Local Scale)	Natural feature buffers established; effectiveness at preventing encroachment and protecting natural features demonstrated.	Terrestrial	During the course of completing the Local Subwatershed Study, appropriate buffer widths and their location will be determined and ultimately confirmed during completion of detailed EIR. Feature Based Water Balance is to be undertaken to support detailed design.	Planning Act/PPS Future Caledon OP, Region of Peel SABE Greenbelt Plan & Technical Guidelines Conservation Authorities Act / CA Regulations Other guidance: Huttonville-Fletchers Creeks Subwatershed Study; Etobicoke Creek Headwaters Subwatershed Study; TRCA Terrestrial Natural Heritage System Strategy; CVC Terrestrial Ecosystem Enhancement Model; CVC Wetland Restoration Strategy Environment Canada, How Much Habitat is Enough?
Natural Corridors and Linkages	Hydrologic integrity (Local and Regional Scales)	Ground and surface water regimes that support natural functions are maintained	Hydrology Hydrogeology	Requirements and opportunities to maintain water balance to natural features are to be investigated as part of site design (see Water Balance)	Planning Act/PPS Future Caledon OP Other guidance: Huttonville-Fletchers Creeks Subwatershed Study; Etobicoke Creek Headwaters Subwatershed Study;
	Corridor component width, diversity, and effective linkage of natural features (Local and Regional Scales)	Net gain in corridor cover and functions on a subwatershed basis	Fisheries Terrestrial	The width of the corridors (m) in natural vegetation is an indicator of the corridor's ability to support key functions (species passage, feeding/foraging needs, residency) minor linkage/landscape corridors of 90+ m, and major linkage/landscape corridors of 160+m have been demonstrated to provide for the habitat needs of common as well as specialized species.	Planning Act/PPS Future Caledon OP, Region of Peel SABE Greenbelt Plan & Technical Guidelines Conservation Authorities Act / CA Regulations Other guidance: TRCA Valley and Stream Corridor Management Program; CVC Watercourse & Valleyland Protection Policies Huttonville-Fletchers Creeks Subwatershed Study; Etobicoke Creek Headwaters Subwatershed Study; TRCA Terrestrial Natural Heritage System Strategy; CVC Terrestrial Ecosystem Enhancement Model; CVC Wetland Restoration Strategy; (Environment Canada, How Much Habitat is Enough?

Indicator	Measurable Parameter	Target	Relevant Disciplines	Notes	Source
Habitat Restoration (1)	Number and area of natural areas restored (Local and Regional Scales)	Net gain on a subwatershed basis	Terrestrial/Fisheries	To be determined on a subwatershed basis, considering connection outside the area, and in consideration of other subwatershed targets and cumulative watershed targets.	Planning Act/PPS Future Caledon OP, Region of Peel SABE Greenbelt Plan & Technical Guidelines Other guidance: TRCA Terrestrial Natural Heritage System Strategy; CVC Terrestrial Ecosystem Enhancement Model; CVC Wetland Restoration Strategy
Habitat Restoration (2)	Number of special habitats restored (for SAR, SSS) (Local and Regional Scales)	Net gain on a subwatershed basis	Terrestrial/Fisheries	To be determined on a subwatershed basis, considering connection outside the area, and in consideration of other subwatershed targets and cumulative watershed targets.	Planning Act/PPS Future Caledon OP Region of Peel SABE Greenbelt Plan & Technical Guidelines Other guidance: Huttonville-Fletchers Creeks Subwatershed Study; Etobicoke Creek Headwaters Subwatershed Study;

Given that the wetlands are provincially significant, pre- to post-development runoff and infiltration function at Wetlands #1 – #6 must be maintained. Based on the findings of the feature based water balances completed by both Urbantech and Crozier, no significant surpluses or deficits for either surface runoff or infiltration are anticipated. As such, no further mitigation is required.

Groundwater Quantity

The Alloa Lands are predominantly underlain by aquitard materials of the Halton Till. Although the silty and clayey tills of the Halton Till are considered to be moderate to low permeability, groundwater recharge still occurs on the lands. Highest infiltration potential based on soil type is shown at the centre of the site and along the Alloa Drain. Sandier materials are observed in the shallow subsurface and may allow for slow groundwater recharge.

The majority of groundwater recharge that supports the baseflow of the Alloa Drain within the Primary Study Area is interpreted to originate within the high permeability alluvial sediments. As these lands will not be altered by the Alloa Secondary Plan, limited changes to groundwater supported baseflow from this surficial aquifer is expected.

Locally, various groundwater wells are still actively used for domestic and agricultural purposes. A reduction in static water level in these wells could result in reduced groundwater supplies to surrounding users.

Management strategies should be employed where water taking for short- or long-term dewatering purposes is required in the Primary Study Area as prolonged decreases in water table elevations could result in the depletion of nearby groundwater resources.

Groundwater Quality

As noted prior, the Alloa Lands are governed by the policies and practices outlined in the CTC Source Protection Plan and are located atop a Highly Vulnerable Aquifer. The HVA is interpreted to be the aquifer used for domestic purposes located approximately 30 mbgl. There is over 10 m of low permeable clay and silt covering the aquifer unit, limiting vertical flow to the aquifer unit. Therefore, no significant impact to the HVA is anticipated. Nonetheless, some shallower dug wells in the area do make use of locally coarser stratigraphy, therefore, where activities noted above are planned within the future development, care should be taken to develop a mitigation plan to the satisfaction of the municipality's Risk Management Official.

Additionally, contaminant management plans or other source water protection materials may be required to facilitate activities on the development lands, including for the duration of construction practices.

Site Wide Water Balance

Without mitigation strategies, the proposed development of the Primary Study Area has the potential to impact the natural water balance of the site and surrounding area. The proposed development will introduce impervious surfaces and decrease soil infiltration in the area. Due to the removal of vegetation combined with the reduction in soil infiltration, some of the precipitation will become surplus water and direct runoff from the development.

Increased runoff from the development and reduction in soil infiltration will be addressed using appropriate stormwater management (SWM) techniques and the introduction of LID structures, as required. The selection of LIDs should be determined based on the soil, groundwater, and surface conditions with an overall objective of sustainability, functionality, and low maintenance.

Infiltration-based LID practices should be incorporated to meet water balance deficits and erosion retention targets. Before draft plan approval, localized hydrogeological and geotechnical studies should be conducted to confirm areas suitable for infiltration. Where infiltration is not feasible due to groundwater or soil driven constraints, LIDs that rely on plants or filtration may be used to improve water quality, slow, or reduce runoff volumes, and mitigate erosion.

Given the seasonally high groundwater conditions across the Alloa Lands, appropriate groundwater separation (> 1 m separation from base of LID to the seasonally high groundwater level) is not functionally feasible in all areas of the plan. See Figure 27 for plan of LID opporunities.

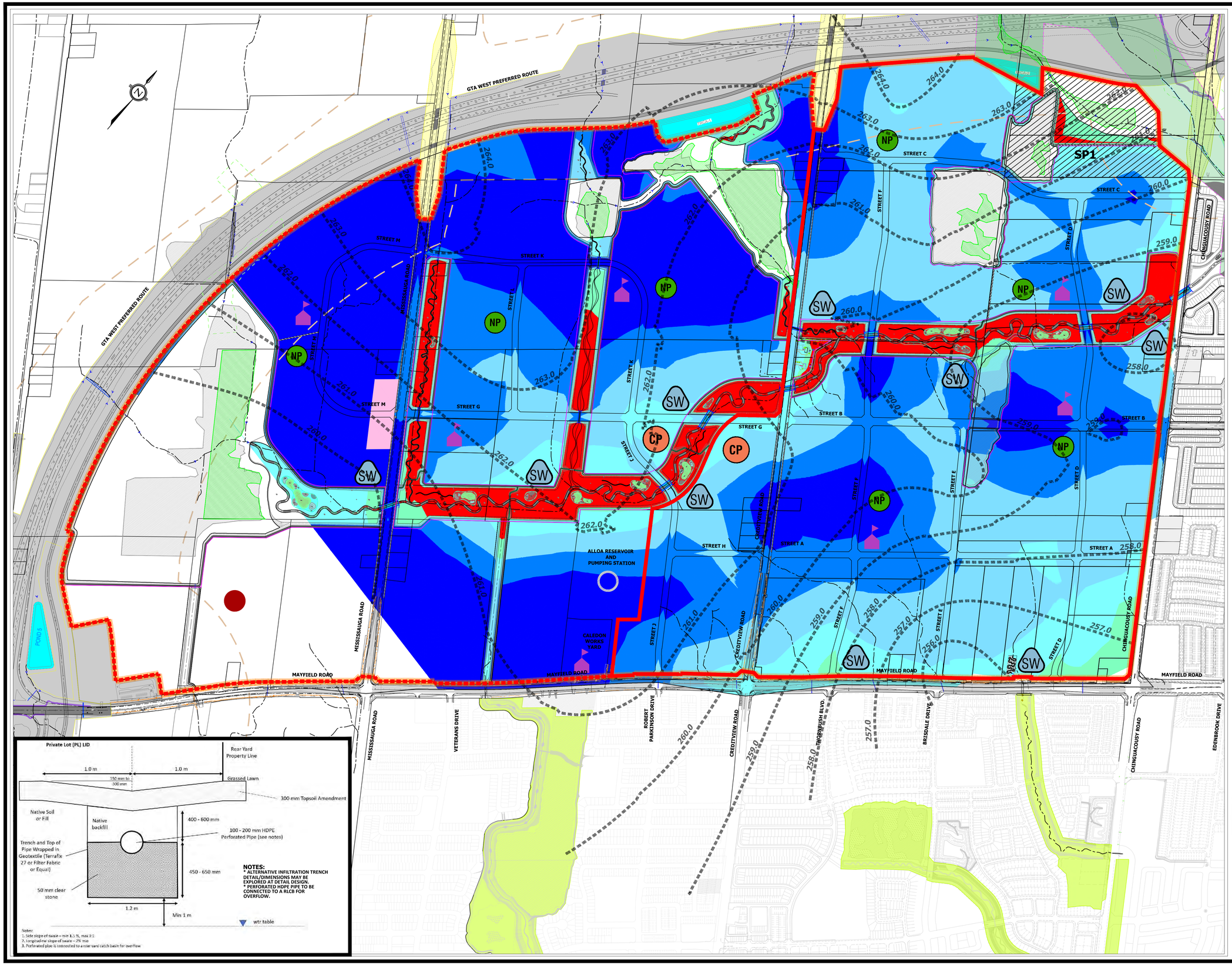
Climate Considerations

Given that seasonal climatic variability could increase stress on the groundwater system, strategies to maintain or enhance the natural functioning of the system will be key to ensure that impacts as a result of extreme swings do not exacerbate potential developmental impacts.

17.3 Stormwater Management

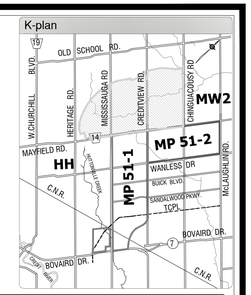
The stormwater management requirements for the Alloa Secondary Plan Area are based on the criteria as specified in the Etobicoke Creek Hydrology Update (April 2013), the Subwatershed Study for the Huttonville and Fletcher's Creeks (June 2011) and the Heritage Heights Subwatershed Study Phase 2 Report (March 2022). The Scoped Subwatershed Study for the Settlement Area Boundary Expansion in the Region of Peel (January 2022) was also referenced to confirm that SWM criteria proposed in this report align with the SABE study.

The following sections outline the specific SWM criteria for the various outlets from the subject area to Etobicoke Creek, Huttonville Creek and Fletchers Creek, as per the applicable studies.



NOTES:
* ALTERNATIVE INFILTRATION TRENCH DETAIL/DIMENSIONS MAY BE EXPLORED AT DETAIL DESIGN.
* PERFORATED HDPE PIPE TO BE CONNECTED TO A RLCB FOR OVERFLOW.

K-plan



LEGEND:

- ALLOA BOUNDARY
- ALLOA PHASE 1 BOUNDARY
- ALLOA PHASE 2 BOUNDARY
- EXISTING WOODLOT
- EXISTING WETLAND
- 260.0 INTERPRETED HIGH GROUNDWATER CONTOUR AND ELEVATION BASED ON AVAILABLE MONITORING DATA

INTERPOLATED DEPTH TO HIGH WATER TABLE FROM PROPOSED GRADE:

- ABOVE PROPOSED GRADE
- 0m to 1.0m BELOW PROP. GRADE (NOT SUITABLE FOR LID IMPLEMENTATION)
- 1.0m to 2.0m BELOW PROP. GRADE (FEASIBILITY OF LID MEASURES TO BE FURTHER EXPLORED)
- 2.0m to 3.0m BELOW PROP. GRADE (SUITABLE FOR LID IMPLEMENTATION)
- 3.0m to 4.0m BELOW PROP. GRADE (SUITABLE FOR LID IMPLEMENTATION)
- >4.0m BELOW PROP. GRADE (SUITABLE FOR LID IMPLEMENTATION)

LID NOTES:

* REFER TO DRAWING 2B FOR PRELIMINARY ALLOA GRADING PLAN.
* ALLOA STORMWATER MANAGEMENT CRITERIA SHOULD INTEGRATE REQUIREMENTS FOR STORM SEWER SYSTEM DESIGN, QUANTITY AND QUALITY CONTROLS, EROSION CONTROLS, WATER BALANCE CONSIDERATIONS, AND COMPLIANCE WITH CLI ECA.
* RECOMMENDED LID OPTIONS APPROPRIATE FOR THE PLANNING AREA AND FOCUSING ON SUSTAINABLE STORMWATER MANAGEMENT STRATEGIES TO BE FURTHER EXPLORED WITH THE TOWN AT THE TERTIARY PLAN LEVEL. WHEREVER POSSIBLE, STORMWATER INFRASTRUCTURE REQUIRED UNDER THE CONSOLIDATED LINEAR INFRASTRUCTURE (CLI) ENVIRONMENTAL COMPLIANCE APPROVAL (ECA) WILL BE LOCATED ON PUBLIC LANDS TO ENSURE ACCESS FOR MAINTENANCE. IF SUCH INFRASTRUCTURE MUST BE LOCATED ON PRIVATE PROPERTY, APPROPRIATE LEGAL INSTRUMENTS, AS APPROVED BY THE TOWN, MUST BE IN PLACE TO ENSURE LONG-TERM MAINTENANCE.
* IF REQUIRED TO ACHIEVE WATER BALANCE, REAR-YARD INFILTRATION TRENCHES COULD BE IMPLEMENTED ON PRIVATE PROPERTIES, AND SHOULD BE GENERALLY LOCATED WHERE THE GROUNDWATER IS >2M BELOW PROPOSED GRADE TO ALLOW FOR MINIMUM 1M CLEARANCE FROM TRENCH BOTTOM TO WATER TABLE. REFER TO A TYPICAL INFILTRATION TRENCH DETAIL IN THIS DRAWING.
* IN THE EVENT THAT THE TOWN DEVELOPS STANDARD RIGHT-OF-WAY LID REQUIREMENTS, AND WHERE SUCH ACCOMMODATION NECESSITATES ADDITIONAL RIGHT- OF-WAY WIDTH BEYOND THE STANDARD ROAD CROSS-SECTION, APPLICANTS SHALL BE REQUIRED TO PROVIDE THE NECESSARY WIDENING AS A CONDITION OF DEVELOPMENT APPROVAL. THE DESIGN AND IMPLEMENTATION OF THESE FEATURES SHALL BE COORDINATED WITH THE TOWN TO ENSURE ALIGNMENT WITH CLI-ECA REQUIREMENTS AND TO MAINTAIN OVERALL FUNCTIONALITY OF THE TRANSPORTATION AND SERVICING NETWORK.

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ALLOA SECONDARY PLAN
TOWN OF CALEDON
REGIONAL MUNICIPALITY OF PEEL
SERVICING STUDY

INTERPOLATED DEPTH TO GROUNDWATER

PROJECT No.	DATE	SCALE	DWG No.
20-665	JULY 2025	1:6,000	3E

17.3.1. Erosion Control Requirements

Settlement Area Boundary Expansion

The SABE Scoped Subwatershed Study provided recommended ranges of unit volumes for Extended Detention erosion control for Huttonville Creek, Fletcher's Creek and Etobicoke Creek. The erosion control recommendations from the SABE study are summarized in Table 64 below.

TABLE 64: EROSION CRITERIA, UNIT VOLUMES (SABE)

	Unit Volume (Ranges) (m^3/impervious ha)		
	Huttonville Creek	Fletcher's Creek	Etobicoke Creek
Extended Detention	200 - 325	250	325

A summary of the erosion control recommendations from the SABE Scoped Subwatershed Study is provided in Appendix Z. The SABE report targets have been further confirmed / refined based on the studies completed for the respective watersheds including the Mayfield West Comprehensive EIS, the Huttonville-Fletchers Subwatershed Study, the Block 51-1 / East Huttonville Creek EIR/FSR and the Block 51-2 / Fletchers Creek EIR/FSR studies.

Etobicoke Creek

Erosion targets for Etobicoke Creek were established in the Mayfield West Comprehensive Environmental Impact Study and Management Plan (December 2014). As per the Mayfield West EIS, the erosion unitary target flow to be applied to the subject Alloa area within the Etobicoke Creek subwatershed is 0.00031 m3/s/ha, and the target unitary storage for erosion control is 325 m3/ impervious ha.

Huttonville & Fletchers Creek

As per the Subwatershed Study for the Huttonville and Fletcher's Creeks (June 2011), the subject Alloa area outlets to flow node H3 of East Huttonville Creek and flow nodes F2 and F3 of Fletcher's Creek. As per the Heritage Heights Subwatershed Study Phase 2 Report (March 2022), part of the Primary Study Area also drains to flow node HW (Huttonville West). Table 65 summarizes the unit target rates and unit target volumes for the required erosion control for the portion of the subject site draining to the West Huttonville Creek, East Huttonville Creek and Fletcher's Creek, as per the HFSWS and HHSWS.

It should be noted that the erosion threshold for East Huttonville Creek and Fletcher's Creek was subsequently updated and further refined, based on discussions with CVC as part of the Mount Pleasant Sub-Area 51-1 and 51-2 EIR-FSR (August 2016). The agreed-upon erosion target unit flow rate for East Huttonville and Fletcher's Creek was revised to 0.00041 m3/s/ha. The updated unit flow rate for erosion control is to be applied to the portion of subject Alloa area discharging to East Huttonville Creek and Fletcher's Creek.

TABLE 65: EROSION CONTROL CRITERIA (EAST HUTTONVILLE CREEK & FLETCHER'S CREEK)

Subwatershed	Unit Flow Rates ($m^3/s/ha$)	Unit Volume (m^3/impervious ha)
West Huttonville Creek	0.00061 (HHSWS)	425
East Huttonville Creek	0.00052 (HFWS – superseded) 0.00041 (EIR/FSS – approved)	200
Fletcher's Creek	0.00025 (HFWS – superseded) 0.00041 (EIR/FSS – approved)	250

The proposed SWM plan for the subject Alloa area will be designed according to the erosion control criteria outlined in the subwatershed studies for Etobicoke Creek, Huttonville Creek and Fletcher's Creek (as discussed above).

17.3.2. Quantity Control Requirements

Settlement Area Boundary Expansion

The Settlement Area Boundary Expansion (SABE) Scoped Subwatershed Study provided recommended ranges of unit volumes for 100-year and Regional level quantity control for Huttonville Creek, Fletcher's Creek and Etobicoke Creek. The quantity control recommendations from the SABE study are summarized in Table 66 below.

TABLE 66: QUANTITY CONTROL CRITERIA, UNIT VOLUMES (SABE)

Design Storm	Unit Flow Rates (Ranges) (m3/impervious ha)		
	Huttonville Creek	Fletcher's Creek	Etobicoke Creek
100-Year Storm	550 - 1150	600 - 1250	400 – 1250
Regional Storm	975 - 1200	0 - 1225	0 - 1200

The SABE report targets have been further confirmed / refined based on the studies completed for the respective watersheds including the Mayfield West Comprehensive EIS, the Huttonville-Fletchers Subwatershed Study, the Block 51-1 / East Huttonville Creek EIR/FSR and the Block 51-2 / Fletchers Creek EIR/FSR studies as described below.

Etobicoke Creek

As per the Etobicoke Creek Hydrology Update (MMM Group, April 2013), the subject area falls within the Etobicoke Creek Headwater (Basin 1) and contributes drainage to flow nodes A, B and D, as per Figure J-1 of the hydrology study. The 12-hour AES storm distribution was used for the Etobicoke Creek hydrology model to assess the 2 to 100-year peak flows under existing and future conditions. The last 12 hours of the Regional storm (Hurricane Hazel) was also simulated with AMC III conditions. Based on this assessment, target unit flow rates were determined for each catchment within Basin 1 of the Etobicoke subwatershed. These unit target rates reflect controlling post-development flows to 60% of existing flows, which was the criteria identified for the Etobicoke Creek headwater basins to ensure mitigation of downstream flow increases.

As there are several catchments within Basin 1, each with specific unit target flow rates, catchment 89 was selected as the basis for the quantity control criteria for the 2 to 100-year storms for the portion of the subject Alloa area within the Etobicoke Creek subwatershed, as this catchment has the most conservative unit flow rates. Similarly, the unit flow rate for catchment 85 was selected for the Regional storm, as it was the most conservative. Table 67 below summarizes the unit target rates for the required quantity control for the portion of the subject site draining to Etobicoke Creek Basin 1.

TABLE 67: QUANTITY CONTROL CRITERIA, UNIT FLOW RATES (ETOBICOKE CREEK, BASIN 1)

Design Storm	Unit Flow Rates (m3/s/ha)
2-Year Storm	0.00272
5-Year Storm	0.00483
10-Year Storm	0.00648
25-Year Storm	0.00877
50-Year Storm	0.01059
100-Year Storm	0.01255
Regional Storm	0.05155

In addition to the required storage to control the subject Alloa area within the Etobicoke Creek subwatershed to the unit flow rate for the Regional storm event, an additional unit storage of 214 m3/ha is required for Regional controls to account for the first 36 hours of the Regional event preceding the peak during the last 12 hours.

A summary of the Basin 1 quantity control requirements and unit flow rates from the Etobicoke Creek Hydrology Update is provided in Appendix AA.

Huttonville & Fletcher's Creeks

As per the Subwatershed Study for the Huttonville and Fletcher's Creeks (June 2011), the subject area contributes drainage to flow nodes HW, F2 and F3, as per Figure 3G of the subwatershed study. As per the Heritage Heights Subwatershed Study Phase 2 Report (March 2022), part of the Primary Study Area also drains to flow node HW (Huttonville West). Tables 68 and Table 69 summarize the unit target rates for the required quantity control for the portion of the subject site draining to Huttonville Creek and Fletcher's Creek.

TABLE 68: QUANTITY CONTROL CRITERIA, UNIT FLOW RATES (HUTTONVILLE CREEK AND FLETCHER'S CREEK)

Design Storm	Unit Flow Rates [1] ($m^3/s/ha$)		
	Flow Node HW	Flow Node F2	Flow Node F3
25-Year Storm	0.0096	0.0083	0.0083
100-Year Storm	0.017	0.0250	0.0260
Regional Storm	0.0618	N/A	N/A

1 While only the 25-year and 100-year targets were provided in the HFSWS, the other storms targets have historically been determined through interpolation and subsequently confirmed through model verification. No targets for the regional storm were provided in the HFSWS; only the model verification determined if the provided storage and flow control adequately mitigated the post-development flow increase.

TABLE 69: QUANTITY CONTROL CRITERIA, UNIT VOLUMES (HUTTONVILLE CREEK AND FLETCHER'S CREEK)

Design Storm	Unit Flow Rates [1] (m^3/impervious ha)		
	Flow Node HW	Flow Node F2	Flow Node F3
25-Year Storm	675	500	700
100-Year Storm	1000	850	900
Regional Storm	925	446	Not required

1 While only the 25-year and 100-year targets were provided in the HFSWS, the other storms targets have historically been determined through interpolation and subsequently confirmed through model verification.

A summary of the quantity control requirements from the Subwatershed Study for the Huttonville and Fletcher's Creeks is provided in Appendix AA.

The proposed SWM plan for the subject Alloa area will be designed according to the quantity control criteria outlined for Etobicoke Creek and Huttonville / Fletcher's Creek (Tables 66 to 69). The proposed SWM design, based on the subwatershed studies for Etobicoke Creek, Huttonville Creek and Fletcher's Creek will then be verified against the recommended ranges for quantity control volumes in the SABE Scoped Subwatershed Study.

17.3.3. Thermal Mitigation

Thermal mitigation practices are recommended in the Subwatershed Study for the Huttonville and Fletcher's Creeks and in the SABE Scoped Subwatershed Study. Thermal mitigation can be achieved by implementing effective stormwater management facility measures (shading, orientation, outlet design, floating islands, etc.), including LIDs. The target SWM facility discharge temperature for thermal mitigation is 24°C (per CVC study "Thermal Impacts of Urbanization including Preventative and Mitigation Techniques" (draft, December 2010)). Thermal mitigation options will be further reviewed at the Tertiary Plan stage and refined through Draft Plans.

17.3.4. Sensitivity Analysis

As per the LSS Terms of Reference, the subwatershed study model should be calibrated to confirm criteria, particularly as it relates to erosion analysis / frequent flows for wetland and site water balance. However, as discussed at the April 23rd, 2025 workshop with agency staff and peer review staff, a sensitivity analysis could be completed in lieu of calibration (until such time as calibration data is available to refine the continuous hydrologic model). The existing conditions flows and ultimate conditions / proposed SWM criteria have therefore been tested under a baseline (i.e. current TRCA Visual OTTYMO model) and high / low flow scenarios. The Sensitivity Analysis memo in Appendix J confirms that the currently proposed criteria are adequate as it relates to quality, quantity and erosion control, but that specific scenarios could be used for evaluation of wetland water balance (high flow scenario), site wide water balance (low flow scenario), and erosion analysis (low flow scenario) as a conservative measure until such time as the model is calibrated and conclusions are refined. It should be noted that the baseline scenario agreed most with observed / accepted values of runoff coefficient and unit flow rates based on frequency analysis.

17.3.5. Climate Change Criteria (SWM)

The LSS Terms of Reference requires consideration of climate change as it relates to SWM criteria / evaluation of future conditions and infrastructure. The approach to climate change consideration was discussed at the April 23rd, 2025 workshop with agency staff and peer review consultants.

It was identified that while accepted approaches exist to evaluate climate-related impacts to the IDF parameters (single event), these impacts do not affect the LSS / Secondary Plan scope of work or general block sizing. For example, IDF parameters may impact the sizing of storm sewers, number of catchbasins, and modelled return period flows for establishing the 2-year to 100-year flows and volumes in ponds, but the pond blocks, channel blocks, and other major infrastructure (road crossings) have been sized based on the conservative Regional storm criteria (control to 60% of existing Regional flows + 214 m^3/ha of additional storage).

It was also confirmed in a follow-up memo (see Appendix E in the Urbantech Scope Servicing Study (August 2025) submitted under separate cover), that the Regional storm governs in all cases as it relates to establishing flood flows in the channel for the subject lands, versus the 100-year or climate-adjusted 100-year storm.

Climate change may impact continuous flows and the related wetlands, site wide water balance, and erosion impacts. However, it was agreed that there is no "climate adjusted" continuous data set (temperature and rainfall) that could be used for the continuous model assessment.

The sensitivity analysis memo in Appendix J provides a range of impacts that could be considered in lieu of a continuous, climate-adjusted data set. Furthermore, TRCA indicated that provision of adequate LID measures / infiltration could counteract the long-term effects of climate change, including more frequent / more intense rainfall events. If a climate-adjusted continuous data set becomes available, it could be used to further assess wetland water balance, site wide water balance, and erosion impacts for future climate scenarios.

Please refer to the *Alloa Secondary Plan Scoped Servicing Study* (Urbantech, August 2025), Section 3.3.6 and the 100-year vs. Regional Storm Analysis Memo (Appendix E) for additional information submitted under separate cover.

17.4 Fluvial Geomorphology

Part A of the SWS prepared by Wood (2022) provided preliminary guidance for the management of watercourses within the Region of Peel Settlement Area Boundary Expansion (SABE) Area. Management strategies were presented based on hydrology, geomorphology, hydrogeology and aquatic and terrestrial/riparian habitat characteristics. The SWS suggested that as a conservative approach, the integrated constraint ranking be established by utilizing the most limiting individual constraint observed for each reach to provide guidance on the overall management of a given feature.

High constraint watercourses were defined as reaches that attract Conservation Authority regulation (i.e., natural hazards) and are high quality systems that are to remain open and be protected in the post-development condition. Localized rehabilitation is permitted where it may benefit the system (Wood, 2022). Medium constraint watercourses were defined as reaches that also attract Conservation Authority regulation but are typically impacted by historical land uses/modifications and can be realigned. Natural channel and environmental design principles are to be utilized for any proposed realignments (Wood, 2022). Low constraint features were subject to confirmation as part of future studies but were considered to include reaches that were ephemeral, poorly defined and resembled HDFs. The management of low constraint watercourse reaches was to be refined based on site-specific field work (Wood, 2022). These categories are consistent with historical watercourse and drainage feature management strategies, where HDFs have traditionally been classified as low constraint features. GEO Morphix prepared HDF management classifications based on site specific field observations and generally following TRCA and CVC (2014) guidelines, which are documented in Section 7.5.4 and Appendix M of the LSS. The LSS integrated constraint rankings documented herein therefore focus on high and medium categories only.

Preliminary geomorphic constraint rankings were assigned for all watercourse reaches as part of the SWS (Wood, 2022) however, the LSS focuses on integrated constraint rankings for natural watercourse reaches only, as municipal drains are managed and maintained as infrastructure by the municipality under the Drainage Act, 1990. There are two natural watercourse reaches within the Secondary Plan Area. Reach AD1-2 (formerly MEC-R4(8a) in the SWS) is located the northeast corner of the Primary Study Area and is a tributary of the Alloa Drain. Reach LD4-1 (formerly MEC-R5(2c) in the SWS) is located in the north central portion of the Primary Study Area and is a tributary of the Lyons Drain. Although Reach AD1-2 was characterized as a watercourse reach, it was assigned a preliminary geomorphic constraint ranking of low in the SWS. Reach LD4-1 was characterized as an HDF and was therefore not assigned a geomorphic constraint ranking in the SWS (Wood, 2022).

Table 70 outlines high and medium constraint ranking parameters, building upon criteria provided in the SWS (Wood, 2022) for each discipline. Table 71 summarizes the individual constraint rankings and overall constraint ranking for each reach.

TABLE 70: NATURAL WATERCOURSE REACH INDIVIDUAL CONSTRAINT RANKING DESCRIPTIONS

Discipline / Reach Parameter	High	Medium
Hydrology	• Reach has a regulated floodplain and a large contributing drainage area (≥ 200 ha) • Conveyance function cannot be easily replicated through design	• Reach has a regulated floodplain and a contributing drainage area of approximately 50 to 200 ha • Conveyance function can be replicated through design
Geomorphology	• Watercourse consists of a defined channel having well-developed morphology (e.g. riffle-pool sequences) and substrate sorting • Reach contains a well-defined valley or floodplain • Reach is identified as Significant Valleylands	• Reach may or may not have well-defined morphology • Reach maintains geomorphic function (i.e., flow and sediment conveyance) • Chennel exhibits geomorphic instability/degradation due to historic modifications and/or land uses and would benefit from rehabilitation
Aquatic	• Perennial flow regime that is generally associated with continuous/seasonal groundwater discharge or wetland storage/ponds • Supports (or has the potential to support) high quality/sensitive habitat (e.g., spawning) • Habitat function or flow regime cannot be easily replicated • Reach is occupied by an aquatic species at risk that is protected under provincial or federal legislation	• Intermittent/seasonal flow regime that is generally associated with seasonal high groundwater discharge or seasonally extended contributions from wetlands or ponds • Provides intermittent direct fish habitat • Potential for permanent refuge habitat in channel pools, wetlands or other waterbodies
Terrestrial/Riparian	• Reach flows through/directly adjacent to significant terrestrial habitat complexes	• Reach provides a linkage function

TABLE 71: INDIVIDUAL CONSTRAINT RANKING BASED ON DISCIPLINE AND OVERALL REACH CONSTRAINT RANKING

Discipline / Parameter	Reach AD1-2	Reach LD4-1
Hydrology	Medium	Medium
Geomorphology	Medium	Medium
Aquatic	Medium	Medium
Terrestrial/Riparian	Medium/High*	High
Overall Constraint Ranking	**Medium/High***	**High**

**Upstream portion of the channel flows through provincially significant Wetland #6 and is high constraint. The downstream portion of the reach flows through an agricultural field and is medium constraint.*

The downstream portion of Reach AD1-2 flows through an actively cultivated agricultural field and consists of a historically straightened feature, while the upstream portion of the reach flowed through Wetland #6, which has been evaluated as provincially significant. From a geomorphic perspective, the reach lacked riffle-pool sequences (i.e., dominated by runs) and the channel bed and banks consisted of clay, silt and sand. The tributary is characterized as containing direct fish habitat and having an intermittent flow regime. Two overall constraint rankings have been assigned to this reach based on the extent of Wetland #6 as its significance results in an overall high constraint ranking for the upstream portion of the reach. Where the tributary traverses the agricultural field, it is assigned a medium overall constraint ranking.

Reach LD4-1 consisted of a short, sinuous reach within Wetland #3, which is provincially significant. The reach lacked riffle-pool morphology and channel bed materials consisted of largely clay to gravel. Fish habitat was characterized as permanent direct, however, the reach does not contain high quality or sensitive fish habitat. As the reach is located entirely within the PSW, it was assigned an overall constraint ranking of high. These constraint rankings are shown in Appendix K.

The existing total length of the Alloa Drain Reaches AD2, AD3, AD4, AD5, and AD6 proposed for rehabilitation is approximately 4,024 m, with the realigned corridor providing a total linear length of approximately 4,529 m. The existing total length of the Lyons Drain Reaches LD1, LD2, LD4-4, LD4-3D and LD5 proposed for rehabilitation is approximately 896 m, with the realigned corridors providing a total linear length of approximately 1,090 m. The existing total length of Reaches AD5-1, AD5-2, AD5-3, and AD5-4 proposed for rehabilitation is approximately 911 m, with the realigned corridors providing a total linear length of approximately 1,142 m. The realigned sinuous channels will produce systems more similar to what would occur in nature, resulting in an increased total channel length of 990 m for all reaches.

Therefore, the proposed channels will significantly increase the restored and enhanced habitat area. The proposed designs will have cross-sectional dimensions closer to a naturalized watercourse conveying similar flows and will significantly improve morphologic form and function per unit length. The realignment and naturalization designs provide opportunities for improved riparian conditions and well-developed bankfull channels with morphological and sedimentological variability. Proposed wetlands and habitat features in the realigned corridors will provide a range of hydroperiods, increase habitat diversity and enhance floodplain form.

17.4.1. HDF Management Recommendations

Per Section 7.5.4 of this report, management classifications have been assigned to each HDF reach based on the approach outlined by TRCA and CVC (2014), which evaluates and classifies various HDF attributes and functions. The management classification is selected based on a combined evaluation of all attributes, specifically with regard to hydrological regime, riparian conditions, as well as aquatic and terrestrial habitat (TRCA and CVC, 2014).

Each of the classifications come with specific management requirements, which are:

- *Protection* – Important functions: protect and/or enhance the existing feature and its riparian zone and groundwater discharge or wetland in-situ
- *Conservation* – Valued functions: maintain, relocate, and/or enhance drainage feature and its riparian zone corridor
- *Mitigation* – Contributing functions: replicate or enhance functions through enhanced lot level conveyance measures for downstream connection
- *No Management Required* – Limited functions: no feature and/or functions associated with the feature are present on the ground and/or there is no downstream connection

A management classification for each HDF reach is illustrated in Appendix K (see Reach Delineation, Appendix A) and a detailed description is also provided in Appendix K of the LSS. For multiple reaches, modifiers are noted where they influence the final management outcome. For example, Highway 413 may result in significant modifications to the headwaters and wetlands of Etobicoke Creek along the northern and western limits of the Alloa Secondary Plan Area. In the case of tributary FC1, the ultimate management classification was influenced by previously approved studies that directed the enclosure of the drainage feature for approximately 600 m downstream of Mayfield Road.

In general, HDFs that had limited hydrology and function and were situated within agricultural fields are proposed for removal. Where HDFs are located within wetlands and woodlots, they are to be protected. Where HDFs contribute flow to downstream wetlands, mitigation management classifications have been assigned. Conversely, where wetlands are located upstream of an HDF and there is a hydrologic connection, the feature is to be conserved.

17.5 Enhanced Natural Heritage System

The Alloa Secondary Plan Land Use Plan (see Figure 20) identifies land use designations defining a Natural Heritage System (NHS). During preparation of the Land Use Plan, efforts were made to confirm existing natural heritage features from the Primary Study Area. Once confirmed, key natural heritage features were protected on the landscape and appropriate buffers/setbacks to these features were applied (see Figure 22). Linkages between key natural heritage features were strategically located to provide connectivity between and to facilitate linkages to existing natural heritage features and corridors south of Mayfield Road and east of Chinguacousy Road where feasible. This NHS provides opportunity for net increase in woodland area, wetland area and for wildlife movement and habitat enhancements. The NHS also provides opportunities for recreation and a community trail network.

Natural heritage features and functions included in the NHS include: Provincially Significant Wetlands (PSW), watercourses (Alloa Drain plus key headwater drainage features), significant woodlands and associated buffers to features.

Restoration Initiatives in the context of the Alloa Secondary Plan include all efforts within the Primary Study Area to restore/increase natural cover, offset and compensate for features that are being removed, impacted, or relocated and to provide enhancements to existing features to add diversity or resiliency in the face of climate change extremes.

The Specifications for ecological restoration need to be area specific within the Primary Study Area/Alloa Secondary Plan and shall generally follow the TRCA Post-Construction Restoration Guidelines (July 2004). Pre-consultation with the Town of Caledon and Conservation Authority (within Regulated Areas) shall be required to confirm the objective for each area to be naturalized. The goal of the comprehensive subwatershed level restoration effort is to provide a vibrant, diverse, and sustainable enhanced natural heritage system that responds well to the range of anticipated climate extremes, provides wildlife habitat and interpretive and active transportation environments for the future Alloa Community residents.

Within the Alloa Secondary Plan area, preliminary minimum buffers have been applied to all identified and field verified natural heritage features using 10m outside of dripline along woodland edges, 30m outside of all mapped wetland boundaries, and 10m from flood hazard. It should be noted that 10m and 30m, and 10m buffers were considered reasonable starting points given that no buffers presently exist for most natural heritage features because agricultural tilling and cropping is presently conducted right up to the feature boundary. Most buffers will have to be created and naturalized. Final buffer widths will be determined through further detailed scientific analysis and completion of an Environmental Impact Report (EIR) that may identify the need for increase or decrease to buffers specific to varied site specifications and settings.

In the Alloa Secondary Plan, all buffers and planned greenway corridors require naturalization typically considering the TRCA – Post Construction Restoration Guidelines. Site specific final buffer scenarios will need to be developed to the satisfaction of the Town for unique situations where community trails and/or LID infrastructure is proposed within minimum buffer zones per the Future Caledon Official Plan 13.9.6. As part of preparing the required EIR in support of future draft plans of subdivision submissions robust rationale shall be provided to explain recommended buffer widths and restoration treatments.

With regards to natural channel design and enhanced natural heritage system corridors, soil horizons can store significant amounts of organic carbon. Design features that reuse existing materials help keep carbon on the landscape. Plant materials such as riparian and wetland seed mixes, live stakes, young saplings, and young trees further sequester carbon. Constructed wetlands, with their vegetation and sediment-rich areas, provide additional carbon storage. Different wetlands have varying levels of carbon sequestration.

The Alloa Secondary Plan Enhanced Natural Heritage System shall adopt a design approach that prioritizes variability and resilience over strict optimization for specific targets. This is essential for adapting stream corridors to the impacts of climate change. This approach ensures the long-

term ecological and physical integrity of these systems, supporting a broader range of conditions and enhancing overall resilience.

18.0 Preferred Management Strategy

18.1 Water Resource System

18.1.1. Hydrogeological

Wetland Water Balance

The exact location and type of LID system will be determined for the draft plan submissions, as it is important to set aside sufficient space in suitable areas of the development for specific LID types. Low impact development practices may include but are not limited to rain gardens, vegetated swales, soak away pits, infiltration trenches, bioretention cells, permeable pavement, and infiltration chambers (among others).

Rooftop drainage is considered clean runoff as it has not carried debris, chemicals, sediment or salt from roadways, parking lots, yards. It is recommended that rooftop drainage from the low density residential areas be diverted to a rooftop drainage collector and directed to the wetlands to maintain their hydroperiods, as required. Appropriate LID features may be incorporated to dissipate energy from the rooftop drainage collectors and improve water quality (if necessary) prior to discharge.

The following list summarizes the feasibility of potential LID strategies to satisfy feature-based water balances within the catchment area for each wetland:

- **Wetland 1 Catchment:** Majority of the developed area is situated in an area of D type soils and seasonally high groundwater levels are < 1 mbgl. Infiltration is functionally feasible only in areas where soils have an infiltration rate of above 15 mm/hr (Type A – C soils) and grading allows for 1 m separation from the base of the structure to the groundwater level.
- **Wetland 2 Catchment:** Soils are conducive to infiltration (Type C) . Underground systems may be suitable here if groundwater separation can be achieved.
- **Wetland 3 Catchment:** Soils are conducive to infiltration (Type C) . Underground systems may be suitable here if groundwater separation can be achieved.
- **Wetland 4 Catchment:** Majority of this area will remain as Natural Heritage. Low impact measures can be implemented within the natural heritage buffer as long as alternative locations have been eliminated to the greatest extent feasible (Ontario Nature, 2014).
- **Wetland 5 Catchment:** Soils are conducive to infiltration (Type C) . Underground systems may be suitable here if groundwater separation can be achieved.
- **Wetland 6 Catchment:** Majority of this area will remain as Natural Heritage. Low impact measures can be implemented within the natural heritage buffer as long as alternative locations have been eliminated to the greatest extent feasible (Ontario Nature, 2014).
- **Wetland 7 Catchment:** Soils are conducive to infiltration (Type C) . Underground systems may be suitable here if groundwater separation can be achieved.

Groundwater Quantity

The maintenance of static groundwater levels should be strived for in all scenarios within the Primary and Secondary Study Area. As activities within the Primary Study Area have the potential to impact downgradient groundwater users, a protocol for reporting impacts to groundwater well usage should be implemented in concert with the municipality's Risk Management Official (RMO).

At the draft plan stage, detailed construction and long-term dewatering rates and anticipated zones of influence for the proposed development will be determined. Any well users within the zone of influence will also be determined and any adverse impacts to water use will be investigated in detail.

It is recommended that a door-to-door survey be conducted prior to construction to establish baseline conditions and identify any existing water quality and/or quantity issues that are occurring. Homeowners will have the opportunity to participate in having their well monitored prior to, during and post-construction. Wells will be monitored manually and automatically and compared to baseline conditions. If impacts are observed, the activity causing the impact will be paused and mitigation efforts will be employed. Homeowners shall be given a contact person or phone line such that issues can be reported.

A detailed dewatering assessment including impact to nearby well users should be completed further in the development process once detailed site plan information for each parcel is prepared. The impact assessment should include a door-to-door well survey to confirm the location of and use of a neighbouring well and document any baseline water quality or quantity concerns. A monitoring and mitigation plan for well users during water taking should be prepared for each water taking proposed.

It should be noted that a number of private water wells are located within the Alloa Secondary Plan lands. Once no longer required, all water wells should be decommissioned in accordance with Ontario Regulation 903 prior to construction to prevent a pathway to contamination of the water supply aquifer.

Groundwater Quality

The quality of groundwater shall be maintained through the implementation of stormwater management controls that introduce clean runoff to infiltration features. In addition, activities intended for the Primary Study Area must respect the source water protection policies noted in previous sections and consider using appropriate instruments to ensure the responsible management of groundwater quality.

Groundwater Feature Based Water Balance

As noted above, Wetlands #1, #2, #4, #5 and #6 are supplemented with seasonal groundwater discharge, precipitation and surface water runoff and therefore, low impact development structures or other engineered methods are recommended to maintain flows to these particular wetlands. Runoff contributions and groundwater contributions should match the wetland hydroperiod in the post-development condition as close as possible to ensure the community can thrive.

Where functionally feasible, low impact development or alternative engineered measures should be used to maintain site wide recharge. Proposed mitigation measures are presented within the Stormwater Management Section (18.1.2) below.

The Primary Study Area is capped by the silts and clays of the Halton Till, a low permeable unit known as a regional aquitard. No significant shallow aquifers within 20 m of surface were identified and local groundwater users draw water from the Queenston Formation, found in the area greater than 20 m below ground surface. The majority of aquifer recharge within the Queenston is received upgradient from the Niagara Escarpment or areas where the unit is hydraulically connected to the Formation. Since the water supply aquifer is confined locally, no adverse effects on groundwater users in the area are anticipated due to the development.

Parts of the Primary Study Area overlay a highly vulnerable aquifer as identified within the CTC Source Protection Plan. While it is anticipated that no adverse impacts to the water supply aquifer will occur due to the development, there are policies outlined within the CTC Source Protection Plan that must be considered in the land use planning process.

The HVA within the Primary Study Area is considered to have a vulnerability score of 6 and therefore the CTC Source Protection Plan contains low to moderate threat polices that require action at the draft plan level. The polices encourage regional municipalities and Towns to require salt management plans and or contaminant management plans at the detailed design stage to protect the groundwater resource in the area. According to the Peel 2041 Regional Official Plan Review, Protection Water Resources Source Protection Plan Implementation (November 2018), the local risk management official must be consulted to ensure that the policies are followed at later stages of development.

Climate Considerations

To accommodate for increased seasonal variability, it is recommended that groundwater mitigation strategies be designed for a greater range of extreme seasonal variability. This will require increased compensation for groundwater recharge and discharge scenarios. Essentially, designing for increased variability in line with recommended policies outlined by the Town, Region and Conservation Authorities.

Recommendations

Prior to Construction

It is anticipated that the development construction within the Primary Study Area will be phased and occur over a span of many years. Therefore, it is recommended that the construction monitoring measures be established at least 6-months prior to construction to ensure sufficient data coverage and data has been calibrated.

During Construction

It is recommended that the groundwater monitoring and surface water monitoring networks remain in place during construction to the extent that the development allows. Monitoring shall occur on a continuous basis throughout construction.

Water levels at all surface water monitors and groundwater monitoring wells should be collected using manual and automatic techniques. Water levels should be compared to the dataset collected by Crozier presented in this report to compare to historical levels. If a significant change is noted, the source of the change shall be investigated and validated such that design changes can be made if required. Any iterations to the feature-based water balance model and site wide water balance model shall be incorporated to investigate the significance of the change.

The findings of the wetlands monitoring work will be reported throughout various stages of development. If a deficit or excess of water is observed within the sub-wetlands, adaptive management is required. The objective of adaptive management is to maintain the target existing hydroperiod.

An annual report shall be prepared and submitted to the review agencies for comment and any input/recommendation.

Post Construction

As part of the Comprehensive Adaptive Monitoring Plan for the LSS, continuous monitoring for a minimum of 3-years post-construction at select monitoring well and surface water monitor locations is recommended. Roughly bi-annual manual measurements (in the fall and the spring) shall be taken and all monitors shall have an automatic level logger deployed. Observational checks of overall wetland health shall be carried out and stressors (i.e. tree health, declining populations etc.) should be noted and mitigated accordingly.

An annual report will be prepared to present the data collected, share the updated and calibrated models and assess any significant changes. The report shall be submitted to the review agencies for comment and input.

For future development stages, the post-implementation monitoring plan shall outline triggers for action, and the associated adaptive management options should post-implementation monitoring identify an excess or deficit in wetland water storage. The post-implementation monitoring plan will begin once the site is stabilized and development has slowed (80 to 85% of build-out, including mitigation measures). In consultation with the Town, TRCA and CVC, the duration and reporting frequency will be confirmed. Data collection, frequency, and methodology will follow the development phase monitoring plan. Additional monitoring may be required to assess the effectiveness of implemented mitigation measures.

Following the monitoring period and to the satisfaction of all agencies, the monitoring wells can be removed and decommissioned per O.Reg. 903. The surface water monitors can also be removed and disposed of accordingly.

18.1.2. Stormwater Management

The stormwater management plan proposed in support of the Alloa Secondary Plan is designed to satisfy the required SWM criteria, as outlined in Section 17.3. Stormwater Management, including quantity, quality and erosion control will be provided for the Secondary Plan area by several SWM wet pond facilities, on-site controls and LID measures.

As per Drawing 3D in the Urbantech Scoped Servicing Study (Figure 28), the preliminary storm servicing plan identifies ten (10) proposed SWM pond facilities to achieve the SWM requirements for the proposed neighbourhood/residential areas. Two (2) of the SWM pond facilities are located in the Fletcher's Creek subwatershed, which will be designed to meet the SWM criteria from the HFSWS. Eight (8) of the SWM pond facilities are located in the Etobicoke Creek subwatershed, which will be designed to meet the SWM criteria as per the Etobicoke Creek Hydrology Update and Mayfield West EIS.

Urbantech Drawing 3D (see Figure 29)shows multiple employment blocks in the southwest corner of the subject area, which drain to flow node H3 in the East Huttonville Creek, and flow node F2 in Fletcher's Creek. These employment blocks are to be controlled by on-site controls to achieve the required SWM criteria.

The minor and major drainage systems for the subject lands will be designed to convey storm runoff to the proposed SWM facilities described above, prior to the outlets at Huttonville Creek, Fletcher's Creek and Etobicoke Creek. The minor storm system is to convey flows up to the 10-year design storm to be conveyed via storm sewers without surcharge, in accordance with the Town of Caledon's standards and IDF parameters. The major storm system will consist of internal road network designed with sufficient capacity to allow excess flows up to the 100-year design storm to be conveyed via overland flow within the proposed ROW limits.

Ultimate storm outlets across boundary roads will be coordinated with coincident road widening projects by the Region of Peel and Town of Caledon (e.g., Mayfield Road and Chinguacousy Road improvement projects).

Please refer to the Urbantech Scoped Servicing Study (August, 2025) for additional details regarding SWM Pond Design.

18.1.3. Erosion Assessment – Stormwater Management

In addition to applying the erosion criteria to the proposed SWM facilities, an erosion assessment was undertaken by GEO Morphix in order to evaluate the downstream impacts of the subject development and effectiveness of the proposed SWM measures within Etobicoke Creek. This erosion assessment was completed using an erosion threshold exceedance model and continuous hydrology modelling, where the continuous model output from the Visual OTTHYMO hydrology model was used to compare the exceedance of the erosion threshold under both pre- and post-development conditions. As per the Sensitivity Analysis Memo, provided in Appendix J, the "low runoff" and "high runoff" scenarios were evaluated as part of the erosion assessment in order to confirm that the most conservative runoff conditions were considered with regards to erosion.

The SWM measures considered as part of the continuous hydrology modelling for the erosion assessment include the proposed SWM ponds and on-site storage facilities, as well as Low Impact Development (LID) measures. The LIDs considered for the subject site are to accommodate 11 mm of retention over the impervious surfaces of the proposed development in order to reduce downstream erosion impacts for the most conservative "low runoff" scenario as part of the sensitivity analysis.

As per the Fluvial Geomorphology Assessment and Conceptual Natural Corridor Designs (prepared by GEO Morphix, dated August 2025 and included in Appendix M), the restoration concept for Wetland 7 along the Alloa Drain includes fourteen (14) wetlands, which will provide water balance mitigation via a combined surface water volumetric storage capacity of 20,791 m^3, to be infiltrated in the corridor. The storage capacity provided by the LIDs in the Wetland 7 corridor equates to 7 mm over the total impervious site area of 295 ha. Therefore, a remaining 4 mm of on-site retention is required in order to achieve the total 11 mm of retention for erosion mitigation.

The location and preliminary design of the proposed LIDs within the subject site is to be determined at the Tertiary Plan / FSR stage, and subject to groundwater conditions throughout the site.

As per the Erosion Threshold and Exceedance Assessment prepared by GEO Morphix (August 2025), it was determined that the proposed SWM plan is effective in mitigating downstream erosion impacts within the receiving watercourse.

As agreed, through consultation with CVC, previously approved erosion thresholds and target release rates will be used to inform the stormwater management strategy for the Fletchers Creek and Huttonville Creek subwatersheds. It is acknowledged that erosion mitigation analysis are ongoing as part of studies within the Heritage Heights lands. As information becomes available it will be integrated in the LSS, where appropriate. Notably, the drainage area within the Secondary Plan Area associated with West Huttonville Creek and Heritage Heights is relatively small and no SWM Pond is proposed to direct drainage to this subwatershed.

18.1.4. Low Impact Development Measures

While end of pipe facilities provide the minimum required SWM controls, the use of LID (Low Impact Design) stormwater management measures can be helpful to reduce the amount of runoff by increasing on site retention, infiltration, and evapotranspiration. The use of LIDs in a "treatment-train" approach has long been endorsed by the TRCA and CVC.

As per Section 18.1.3, a total retention volume of 11 mm is required in order to achieve the required erosion mitigation, 7 mm of which is to be provided by a combination of the proposed surface storage capacity within restored Wetland 7, and the remaining 4 mm is to be provided by on-site retention over the impervious area within the portion of site within the Etobicoke Creek Subwatershed.

There are many LID measures available for use. The evaluation and ultimate recommendation(s) for the Alloa Secondary Plan will consider technical feasibility, cost, maintenance requirements, and operational feasibility. While some LID approaches may be technically feasible, they may ultimately be cost-prohibitive or pose challenges in terms of maintenance and operation,

particularly on a scale of this magnitude. Additional information is required regarding land use, phasing, built form, hydrogeology and geotechnical prior to further study. Additional geotechnical / hydrogeological studies may be required prior to finalizing and confirming the selection of LID techniques.

Some examples of possible LIDs that are typical for this type of development and will be reviewed for the Alloa Secondary Plan area include:

Downspout Disconnection:

Roof leader discharge to pervious surfaces such as lawns or to LID measures provides a source of clean water that can be infiltrated. This is a low / no maintenance, lot-level control that is typically implemented by default.

Infiltration Trench:

These are rectangular trenches lined with geotextile fabric, filled with clean granular stone or void-forming materials. They are suitable for sites with limited space for infiltration, such as narrow strips of land between buildings or properties, or along road rights-of-way. They primarily handle roof and walkway runoff.

Bioretention:

This infiltration practice utilizes the natural properties of soil and vegetation to treat runoff from paved areas and remove contaminants. Variations can include the inclusion or exclusion of an underdrain and impermeable liner. Bioretention can help achieve Stormwater Management (SWM) objectives related to water quality, water balance, and erosion control.

Rain Barrel:

Water collected in rain barrels can serve as a non-potable source for various purposes like toilet flushing, urinals, and irrigation. Rain barrels can contribute to meeting SWM objectives related to water quality, water balance, and erosion control.

Soil Cells:

A modular storage system designed to support the growth of large trees and provide effective stormwater management through processes like absorption, evapotranspiration, and interception.

Infiltration Chambers:

Infiltration chambers provide large volume of underground void space, all the while maintaining the necessary structural stability for sub-surface Best Management Practices (BMPs). They consist of a variety of proprietary modular structures that can be installed beneath paved parking lots or landscaped areas. Typically featuring open bottoms, perforated side walls, and optional stone-filled reservoirs below, these chambers are versatile in treating runoff from roofs, walkways, parking lots, and roads, given proper sedimentation pre-treatment measures. Due to their significant storage capacity, this technology is often utilized in areas where little to no space is available for other stormwater BMP solutions.

18.1.5. Fluvial Geomorphology/Conceptual Corridor Design – Climate Adaptation

Urbanized Landscapes: Degrees of Freedom and String and Beads

Urbanization significantly impacts hydrology and sediment supply, often more than climate change. To ensure the long-term success of watercourse restoration in the face of hydrological and sediment regime changes due to urbanization and climatic change, resilient channel designs are essential. These designs should enable the channel to adjust naturally over time. Several concepts, such as Degrees of Freedom and Strings and Beads, enhance the resilience of constructed channels to adapt to changes in hydrology and sediment regime.

Degrees of Freedom:

Strings and Beads: This concept likens rivers to beads on a string, flowing through higher gradient, confined channels to low-gradient, unconfined alluvial reaches (Stanford et al., 1996; Wohl et al., 2017). This arrangement affects inputs and outputs in the hydrological cycle, carbon cycle, and overall resilience.

To ensure long-term resilience and maintain the physical and ecological integrity of stream corridors in the face of climate change, it is essential to incorporate greater design variability rather than optimizing for specific ecological or physical targets based on averages.

Key Points:

Importance of Design Variability:

- Balancing physical and ecological targets with the provision of greater physical variability is more effective for long-term resilience.
- Increased design variability helps to accommodate natural variability in hydrological regimes over time, which is crucial for adapting to climate change.

Strategies for Resilient Design:

- Implementing design elements that increase the range of hydroperiods to support diverse ecological functions.
- Enhancing infiltration and retention on-site to improve water balance and support carbon sequestration.
- Creating complex channel and floodplain configurations to maintain diverse habitat conditions and improve resilience against climatic variations.

Post-Development Stream Corridors:
Implementing a function-based design approach that includes:

- Micro-topography
- Depressional storage
- Swales directing flows to pocket wetlands
- Enhanced soil horizon and granular-rich, inorganic layer
- Undersized/right-sized channel to promote floodplain connectivity

Improving Post-Development Hydrology:

- Interception of direct runoff from tablelands
- Interception of overbank flood flows
- Increase infiltration/decrease runoff
- Increase residence time/decrease peak flows

The function is influenced by local subsurface conditions. For example, sand/gravel seams can enhance storage and connectivity between adjacent wetlands, reducing infiltration deficits and maintaining water balances post-development.

Channel Corridor Carbon Sequestration: Soil horizons store significant amounts of organic carbon. Design features that reuse existing materials help keep carbon on the landscape. Plant materials such as riparian and wetland seed mixes, live stakes, young saplings, and young trees further sequester carbon. Constructed wetlands, with their vegetation and sediment-rich areas, provide additional carbon storage. Different wetlands have varying levels of carbon sequestration.

In summary, adopting a design approach that prioritizes variability and resilience over strict optimization for specific targets is essential for adapting stream corridors to the impacts of climate change. This approach ensures the long-term ecological and physical integrity of these systems, supporting a broader range of conditions and enhancing overall resilience.

18.1.6. Climate Change/Climate Adaptation Overall Considerations

The LSS Terms of Reference outlines the need for "guidance to address climate change considerations, particularly demonstrating compliance with the Town of Caledon's Community Climate Change Action Plan and the Peel Region's Climate Change Master Plan."

The Resilient Caledon Community Climate Change Action Plan identifies how the Town of Caledon intends to respond to potential climate-related challenges including changes in the frequency of extreme weather (droughts, floods, etc.). In order to design a community that is resilient to climate change, the following items have been (and will continue to be) considered as the studies for this area advance.

Flood hazards: Flood hazards in the adjacent creeks have been established using the Regional event (Hurricane Hazel) which is based on an historic event. As such, the extent of existing or proposed flood hazards will not be affected by increased intensity, frequency and duration of storm events due to climate change.

Erosion: As there is the potential for increased frequency of flows in the creeks due to climate change, the impacts of these flows on erosion protection measures should be considered at detailed design. While this will not affect channel block sizes, it could impact the sizing of stone protection or other mitigation measures.

Stormwater Management: All proposed stormwater management facilities within study have been designed to control, and in the case of Etobicoke Creek facilities, over-control the

Regional event. Due to the use of this historical storm in the sizing, the pond blocks are not anticipated to increase as a result of climate change.

Storm Sewers: To ensure stormwater sewers/downstream culverts are able to withstand the impacts of climate change during more frequent and/or intense events, the proposed sizes will be reevaluated at the detailed stage of the design when considering the potential for increased frequency, duration and intensity of storm events. The storm sewers in the community are currently designed to convey the 10-year storm event in accordance with Caledon standards. This requirement is more conservative than other GTA municipalities which only require storm sewers be designed to convey the 5-year event. The storm sewer design can be updated once the Town has published updated IDF parameters incorporating climate change.

Irrigation: In parks and site plan blocks, the potential for storing stormwater and utilizing it for irrigation should be explored in future studies to decrease reliance on municipal water during drought conditions. Increased irrigation demand due to potential drought should be considered in the final water distribution analysis. This can be mitigated through public education, signage, and the incorporation of efficient fixtures and irrigation methods.

Roadways: Proposed roadways within the development will be designed to avoid excessive flooding during large storms as well as ensuring adequate conveyance of flows. This can be accomplished by verifying the capacity in the roadways compared to the 100-year event, as well designing and implementing adequate catchbasins to capture the flows.

Site water balance: Where feasible based on soil / groundwater constraints, LIDs such as green roofs (in the site plan / high density blocks), infiltration measures, tree pits, etc., in will be utilized in the design to mitigate the effects of climate change (i.e., managing more frequent runoff events).

Environmental features / wetlands: Potential impacts of climate change on feature based water balance for the wetlands will continue to be evaluated and have considered extreme conditions (wet / dry years). Mitigation could include utilizing stormwater to irrigate the wetlands and preparing monitoring plans for post-development to evaluate the health of the wetlands.

18.2 Natural Heritage Systems

The Provincial Policy Statement (PPS) defined an NHS as "a system made up of natural heritage features and areas, and linkages intended to provide connectivity (at the regional or site level) and support natural processes which are necessary to maintain biological and geological diversity, natural functions, viable populations of indigenous species, and ecosystems". The land management strategy identified in the Alloa Secondary Plan: Land Use Plan identifies and protects significant natural heritage features and functions and establishes naturally vegetated connections among significant features. The scale of connectivity spans watersheds and hence represents regional scale. As such, the NHS established in the Land Use Plan is consistent with provincial direction with respect to identification/delineation of an NHS and hence is the preferred management strategy applied to the Alloa Secondary Plan Area/Primary Study Area lands to establish an NHS.

18.2.1. Key Components of the Enhanced Natural Heritage System

As a part of the Phase 2: Subwatershed Impact Assessment, the natural heritage inventory as described in Phase 1: Characterization and Integration, was evaluated and used to establish the baseline conditions for both the Primary and Secondary Study Areas. Key components of the NHS that were identified through this evaluation include the following:

- Habitat for Threatened or Endangered Species
- Locally Significant Wetlands
- Provincially Significant Wetlands
- Candidate Significant Woodlands
- Candidate Significant Wildlife Habitat:
- Direct/Indirect Fish Habitat

18.2.2. Natural Heritage System, Buffers, and Linkages

A green development approach has been considered for the development of the NHS for the Alloa Secondary Plan Area given the presence of several natural heritage features and opportunities for linkages external to the Primary Study Area. The relevant Principles identified for the Alloa Secondary Plan, include Principle a) (Support climate change and adaptation), Principle i) (Design a stormwater management system the protects the natural environment), Principle k) (Protect and enhance the natural environment system) and Principle l (Provide a well-connected, accessible public open space recreation system). The green development approach functionally integrates the future built environment with the core natural features, corridor and other linkages, and buffer areas/uses.

18.2.3. Natural Heritage System Phasing and Construction Practises

The Natural Heritage System may be phased and multiple, staged permits may be required from the applicable agency to accommodate phasing of the NHS provided that the Conditions of Approval for individual Draft Plans of Subdivision addresses phasing of the NHS implementation including interim strategies if needed.

During construction, the risk of sedimentation is highest to wetlands. To minimize the potential for erosion and off-site transport of sediment into surface water and wetland features, the project will implement Best Practises related to erosion and sediment control (ESC). The following ESC measures are most important for the protection of wetland:

- Retain the existing vegetation and stabilize ground with vegetation where possible
- Limit the duration of soil exposure and/ or phase construction
- Limit the size of the disturbed area
- Maintain overland sheet flow and avoid concentrating flow
- Store and stockpile soil away from watercourses, drainage structures, wetlands, and the top of slopes.

18.2.4. Recommendations

General recommendations have been included for client consideration as the approved Alloa Secondary Plan advances to more detailed planning and approval stages. Certain recommendation details may be subject to change as more information becomes available with regard to Draft Plans of Subdivision.

Species At Risk

It should be noted that the absence of a protected species in the Primary Study Area does not indicate that they will never occur in the area. Given the dynamic character of the natural environment, there is constant variation in habitat use. Care should be taken in the interpretation of presence of species of concern including those listed under the ESA. Changes to policy or the natural environment could result in shifts, removal, or addition of new areas to the list of areas currently considered candidate KNHFs. This LSS is intended as a point in time assessment of the potential to impact SAR (based on the data collected and analyzed to date); it is not intended to provide long term "clearance" for SAR. While there is no expectation that the assessment should change significantly, it is the responsibility of the proponent to ensure that they are not in contravention of the ESA at the time that site works are undertaken. A review of the assessment provided in this report by a qualified person should be sufficient to provide appropriate advice at the time of the onset of future works.

The individual Black Ash observed in the Primary Study Area are recommended for further species-specific investigation in the form of a Black Ash Health Assessment to confirm their health status and the extent to which any of the individual trees meet the criteria for protection under ESA O. Reg. 6/24 (MECP, 2024a) (*e.g.* ≥8cm DBH and assessed as "healthy" as per provincial assessment criteria) and 7/24 (MECP, 2024b). This work should be completed as part of the EIR scope of work required to support Draft Plans of Subdivision.

Worker Training

Worker training would assist workers in the identification of SAR with potential to occur in the area. Workers should be instructed to stop work and contact the MECP immediately if any SAR are encountered in the work area. Individuals working in the study area should ensure that SAR are not harmed during construction or killed by heavy machinery, vehicles, or other equipment.

The contractor should educate all site personnel to ensure that, if identified, SAR are not wantonly injured or killed, and to ensure that damage to features which could constitute habitat is avoided. Information should be conveyed through a SAR expert and include:

- Species habitat and identification;
- Requirements under the ESA including avoidance of harm to the species and damage to relevant habitat;
- Appropriate action to take if the species is encountered;
- How to record sightings and encounters; and,
- That care should be taken when undertaking construction activities to avoid harming the species or damaging/destroying habitat.

- The expert should be a qualified biologist who specializes in ecology/biology or SAR.
- Adaptive Management and Mitigation
- Migratory Breeding Birds and Bats

Activities involving removal of trees/vegetation should be restricted from occurring during the avian breeding season. Migratory birds, nests and eggs are protected by the *Migratory Birds Convention Act*, 1994 (MBCA) and the *Fish and Wildlife Conservation Act,* 1997 (FWCA). Environment and Climate Change Canada (ECCC; 2023) outlines dates when activities in any region have potential to impact nests. In Zones C1 and C2, tree/vegetation clearing should be avoided April 1-August 31 of a given year in recognition of Neotropical migratory breeding birds. If works require tree/vegetation clearing between April 1-August 31, screening by an ecologist with knowledge of bird species present in the area should be undertaken to ensure that the vegetation has been confirmed to be free of nests prior to clearing.

If vegetation removals are proposed between the above dates, for "simple" habitat such as hedgerows and disturbed areas, a bird nest screening by a qualified person could be undertaken to ensure that the vegetation has been confirmed to be free of nests prior to clearing. Bird nest screenings should occur within 48 hours of the initiation of site works in a given area. Bird nest screenings are typically infeasible within "complex" habitats such as woodlands/forests, and therefore adhering to timing windows is the recommended approach for bird nest avoidance in these areas.

In consideration of the possibility of SAR bats/SAR bat habitat being identified, activities that may require tree removal, particularly in any woodlands in the study area should be avoided **April 1-September 30** of any given year during the active period for bat species (if present) that may use snag trees for maternity and/or day roosting. It is anticipated that adherence to this **April 1-September 30** timing restriction will, in addition to mitigating against potential impacts to migratory breeding birds, avoid impacts to individual SAR bats, therefore remaining in compliance with Section 9 of the ESA affording individual protection to Endangered species.

Erosion and Sediment Controls

Diligent application of erosion and sediment controls (ESCs) based on Best Management Practices is recommended for all future construction activities to minimize the extent of accidental or unavoidable impacts to adjacent vegetation communities and wildlife habitat. Prior to the commencement of works, silt fencing should be applied along the length of directly adjacent natural or naturalized features. Given the scale of the proposed development, routine inspection/maintenance (*e.g.* monthly) of silt fencing should occur throughout construction to help mitigate against possible indirect impacts to KNHFs on adjacent lands. It is recommended that ESCs be maintained until vegetation is re-established post-construction.

Material storage (*e.g.* soil stockpiles, fuel, *etc.*) should be located over 30m from natural features where feasible (*e.g.* wetlands, woodlands, fish habitat, SAR habitat). Material storage areas should be contained with ESCs to avoid potential indirect impacts to natural features on or adjacent to the property.

Operations

All maintenance activities (including refueling) required during future construction should be conducted at least 30m away from natural features to prevent accidental spillage of deleterious substances that may harm natural environments.

Snow fencing or equivalent should be installed at the limit of the work area to prevent accidental intrusion of machinery operations into adjacent undisturbed natural areas.

The contractor is recommended to have a Contaminant and Spill Management Plan in place prior to initiation of works. This Plan should include keeping an emergency spill kit on site at all times. In the event of a spill, the contractor must report it immediately to the provincial Spills Action Centre (SAC).

Fish and Fish Habitat

Development and construction activities in the study area should have regard for fish and fish habitat features, and utilize BMPs during construction as follows:

- All ESC measures are to be installed prior to any ground disturbance and shall be maintained until all disturbed soils have been restored and stabilized following construction. Along watercourses, wetland and pond features, it is recommended that heavy duty sediment fence be installed;
- All in-water construction is to occur in the dry and in isolation of flow. Cofferdam installation and bypass flow management, if required, should follow DFO's *Interim standard: in-water site isolation* Code of Practice (DFO, 2023);
- Downstream flow quantity and quality is to be maintained at all times during and after construction;
- If in-water work is required in direct fish habitat, fish salvage should be completed by a qualified Fisheries Ecologist in isolated work areas prior to dewatering. All fish salvage requires a License to Collect Fish for Scientific Purposes from MNR;
- All dewatering required in an isolated work area is to discharge water into a filter bag (*i.e.* envirobag or equivalent). Filter bags should be placed a minimum of 30m from fish habitat on stable, vegetated ground to allow fines to settle out of the water. Monitoring of dewatering operations should occur throughout the construction process to ensure water is free of fines before entering the watercourses;
- In-water work in both direct and indirect features shall only be permitted from July 15-March 15 of a given year unless granted otherwise by MNRF and/or DFO;
- All stone should be placed below the high-water mark in direct fish habitat should be natural and rounded material;
- If metre bags or "sandbags" are used for work area isolation (*i.e.* as a temporary cofferdam), the contractor should ensure the bags do not contain sand, and alternatively, utilize stone/pea gravel. All materials used for site isolation must be removed at the conclusion of in-water work;
- All site disturbance should be minimized to the extent possible;

- Disposal of material should occur in a timely fashion to minimize risk of entry into the watercourse; and,
- All machinery maintenance/refueling is recommended to maintain a minimum distance of 30m from retained woodlands, wetlands and fish habitat to prevent accidental spillage of deleterious substances.

Opportunities for improvement to watercourses/drains in the study area:

- Improve riparian vegetation along features to promote shading and lower thermal impacts on fish habitat.
- Reinstate natural meandering profile where possible to improve diversity of fish habitat, create deeper refuge pools, and create spawning habitat/oxygenation from riffle features.
- Reduce deep incision/slope of channel banks to restore connection to riparian lands, reduce flow velocity during storm events, and reduce scouring of banks.
- Eliminate online pond along Tributary 3 to prevent introduction of invasive species (*i.e.* Goldfish).

18.3 Endangered Species Act/Species At Risk – Planning Approvals

Species at Risk protection and management is guided by Ontario's *Endangered Species Act* (ESA) Regulations and Recovery Strategies (where available). Consultation required with MECP to determine permitting requirements, potential compensation. Once all in-season field work is completed, a fulsome Species At Risk (SAR) assessment can be finalized and included as part of the Environmental Impact Report (EIR). Once all the field data for the Primary Study Area have been collected and analyzed regarding SAR, including the dawn breeding bird, nocturnal breeding bird and bat acoustic monitoring data, the final LSS will include a fulsome rendering of an assessment of SAR and SAR habitat in the study area. Provisionally, the following SAR/SAR habitat have been observed in the field/confirmed in the Primary Study Area and is provided as preliminary constraints information:

- **Threatened or Endangered**: Black Ash (Woodlands E-F); Eastern Meadowlark; Bobolink; SAR bats including Little Brown Myotis (and consideration for possible SAR bats using houses, barns or outbuildings for roosting); Redside Dace (Tributary #4 - potential contributing habitat) and,
- **Special Concern**: Eastern Wood-pewee (Woodlands A-C, E, H-I), Wood Thrush (Woodland E).

The approximate locations of the observed SAR are presented in Figure 2B in Appendix R. Woodland A, although it is technically located within the Secondary Study Area, has been included above because it is within 120m of the Primary Study Area (*i.e.* adjacent lands). Only species designated Threatened or Endangered receive individual and habitat protections under Section 9 and Section 10 of the ESA. Special Concern species will be further discussed in the context of SWH (Habitat for Special Study/Concern and Rare Wildlife Species) as part of the update but are noted briefly below.

The individual Black Ash observed in the Primary Study Area are recommended for further species-specific investigation in the form of a Black Ash Health Assessment to confirm their health status and the extent to which any of the individual trees meet the criteria for protection under ESA O. Reg. 6/24 (MECP, 2024a) (*e.g.* ≥8cm DBH and assessed as "healthy" as per provincial assessment criteria) and 7/24 (MECP, 2024b).

Ontario's *Endangered Species Act,* 2007 (ESA) provides regulatory protection to Threatened and Endangered species prohibiting harm and/or killing of individuals and destruction of their habitats. On June 4, 2025, the province of Ontario adopted *Bill 5, Protect Ontario by Unleashing Our Economy Act, 2025* ("Bill 5"), which received Royal Assent the following day. Upon adoption of Bill 5, several amendments to how protections apply to Threatened and Endangered species came into force, including (but not limited to) a revised definition of "habitat" for flora and fauna, removal of species protections against "harassment", and enabling the province to add or remove species from the Species at Risk in Ontario List. The revisions to the provincial ESA that came into effect upon adoption of Bill 5 represent interim changes to regulatory protections and other requirements for Species at Risk in Ontario. It is understood the province currently intends to repeal the ESA later in 2025 and replace with the *Species Conservation Act*, 2025 (SCA), in doing so will implement additional amendments to regulatory requirements for Threatened and Endangered species. Of particular relevance to the development approvals process, the SCA will include a Protected Species in Ontario List regulation that will not necessarily include all Threatened and Endangered species in the province. It is also understood that the Protected Species in Ontario List may provide protections to certain species on a regional level, applying to only some portions of the province. Where impacts to Threatened and Endangered species appearing on the Protected Species in Ontario List may occur, the SCA will introduce a "registration first" approach that will set out rules for proponents to follow as a condition of carrying out the impactful activity. It is understood that this system will replace the existing ESA Permitting process for the large majority of species and occurrences, and will be accessible through an online Species Conservation Registry system. It is anticipated that the full details regarding the overhauled regulatory process for Threatened and Endangered species will be available later in 2025 or early 2026.

18.4 Evaluation of Management Options

The performance measures included within the Comprehensive Adaptive Management Plan and Monitoring Plan (see Section 20 herein) outline targets for maintenance and enhancement of each indicator component of the Natural Heritage System. The Preferred Management Strategy will be selected and evaluated on the basis of these parameters.

19.0 Guidelines for Site-Specific Studies

All proposed design and guidance provided herein is in support of the Subwatershed Study only. The LSS information provided is subject to refinement as the planning process advances into detailed design. It is recommended that specific terms of reference be prepared and submitted for each project component to confirm agreement between all stakeholders in advance of work proceeding. Terms of reference and the completion of associated work scopes in support of detailed design will need to be competed for and in support of:

- Preparation of a Comprehensive Environmental Implementation Report to guide Tertiary Planning and Draft Plans of Subdivision
    - with special attention to be paid to development of a woodland compensation plan in concert with the Town of Caledon staff, related to proposed removal of a conifer plantation (noted on Figure 19)
- Functional Engineering Studies
- Potential Environmental Assessment (EA) Process (if triggered)
- Other Related Detailed Design Studies (to be confirmed)

20.0 Comprehensive Adaptive Management Plan (CAMP)

To adequately evaluate the effectiveness of the proposed management strategy, a Comprehensive Adaptive Management Plan (CAMP) will be implemented with adaptive/ mitigative measures to alter the management strategy as and if necessary. The CAMP will form the framework through which the performance of the recommended maintenance/ enhancement strategies will be measured. The CAMP will be developed to distinguish between natural variation in ecosystem function, and potential impacts resulting in land use changes.

Monitoring criteria and adaptive mitigation measures will be required for the following environmental systems:

- Surface Water Quality
- Surface Water Quantity
- Groundwater
- Terrestrial Resources
- Aquatic Resources
- Meteorological

A generalized CAMP protocol/ summary has been developed and outlined in Table 72.

It is intended that remuneration will be provided from the Alloa Landowners Group to the Town of Caledon to implement the CAMP protocol.

TABLE 72: PROPOSED COMPREHENSIVE ADAPTIVE MANAGEMENT PLAN AND MONITORING PLAN (CAMP) ALLOA SECONDARY PLAN

SYSTEM	GENERAL PARAMETER	PERFORMANCE MEASURE INDICATOR	PROTOCOL(S)	FREQUENCY/DURATION	LOCATION/AREA	MONITORING OUTCOME	ADAPTIVE MANAGEMENT RESPONSE
SWM Performance Monitoring - Surface Water Quality	TSS	Water Quality (TSS Removal)	TSS samples will be collected from the inlets and outlets of selected SWMP locations for a minimum of seven (7) precipitation events (i.e., ≥ 10 mm of rain in a 12-hour period) Samples to be collected using automated samplers to allow for several samples to be collected during an event	Minimum of seven (7) precipitation events per year of two years post-construction..	Selected SWMP locations TBD	• Characterize urban water quality impacts • Verify stormwater quality mitigation performance	Apply findings and results to future development to reduce long-term impacts.
	3. Benthic invertebrates		N/A See 20b this table	To be determined by the Town of Caledon through collaboration with the Conservation Authorities	TBD		
	4. Stream Temperature	Water Quality (Temperature)	Continuous monitoring near the pond inlets and outlets	Continuous monitoring for a minimum of 2 years once the pond is operational, and to continue for two years after 90% buildout and initial clean out of the facility.	Alloa Drain only	• Verify stormwater quality thermal mitigation performance	Apply findings and results to future development to reduce long-term impacts.
SWM Performance Monitoring - Surface Water Quantity	5. Peak Flows 6. Drawdown Time 7. Base Flow	Risk of Flooding	Continuous pond water level and temperature monitoring will be conducted near the pond inlet between April 1st and December 1st of each monitoring year. The pond sensor should be surveyed to a benchmark elevation for analysis comparisons. Install staff gauge at the pond inlet headwall structure for reference. Continuous discharge monitoring to be conducted between April 1 and December 1 at facility inlets and outlets to indicate the SWM facility's response to rainfall events. Continuous monitoring of inflow and outflow water temperature (April 1st to December 1st) within SWM facilities to monitor impacts of stormwater discharge on receiving watercourses, for information purposes. Continuous monitoring of inflow and outflow water temperature (April 1st to December 1st) within SWM facilities to monitor impacts of stormwater discharge on	Minimum of 2 years once the pond is operational, and to continue for two years after 90% buildout and initial clean out of the facility For a period 3 years after construction of stormwater management facilities	TBD	• Review of monitoring results would allow evaluation of the effectiveness of proposed SWM controls • Comparison of rating curve for the SWMP to monitored data to ensure measured hydraulics are consistent with the SWMP design	Identify whether there are differences between measured and modelled hydraulics. In the unlikely event that there is a deficiency in construction, rectify pond operation to be consistent with engineering design

SYSTEM	GENERAL PARAMETER	PERFORMANCE MEASURE INDICATOR	PROTOCOL(S)	FREQUENCY/DURATION	LOCATION/AREA	MONITORING OUTCOME	ADAPTIVE MANAGEMENT RESPONSE
			receiving watercourses, for information purposes.				
	8. Water Budget	Water Balance (Surface Water Quantity and Groundwater Discharge)	Groundwater and Surface Water Levels Water level trends correlated to the established baseline conditions are necessary to assess changes to groundwater recharge and surface water runoff resulting from development. Continued monitoring of wetland water levels is required to observe changes to the established hydroperiods and to determine the effectiveness of mitigation measures, including the proposed LIDs	Wetland groundwater and surface water levels to be continuously monitored (i.e., 1-hour interval) using dataloggers at established locations. Dataloggers must be re-established at monitoring locations prior to construction. Manual measurements and logger downloads should be collected seasonally until buildout and for 3-years following construction. Consideration should be given to the timing and staging of buildout in the monitoring program.	Monitoring locations associated with onsite wetlands and where groundwater monitoring wells will not disrupt construction.	Comparison between monitoring data and established wetland hydroperiods Impacts due to changes in recharge, runoff and stormwater management can be assessed Effectiveness of LIDs and mitigation measures	Opportunity to re-assess stormwater management and feature based LIDs for the effected location. Adaptive strategies for increasing or decreasing the volume/ timing of water entering wetland features through the proposed LID measures.
Surface Water Quantity	9. Stream Stability Downstream of SWM Facilities	Channel adjustment compared to natural rates.	Stream Morphology Setup a) Access permitting, establish detailed monitoring locations along the Alloa Drain downstream of proposed stormwater management facilities b) Survey 10 cross-sections and characterize substrate composition (50 pebble counts per cross- section or collect sediment samples, as appropriate) c) Add a minimum of two monumental cross-sections (as part of the 10 cross-sections) d) Document bank properties (height, angle, material, vegetation, root depth, undercuts and in-situ shear strength) e) Survey the longitudinal profile (energy gradient, top and bottom of riffles, max pool depth) with benchmark f) Install a minimum of two erosion pins at each monumented cross-section g) Collect photographs at the same vantage point during each monitoring visit Monitoring of the sites after the initial setup h) Re-survey monumented cross-sections to assess change in cross-sectional shape i) Repeat pebble counts at monumented cross-sections or	Access permitting, measure natural channel adjustments for a period of two years prior to development. Once SWMPs are operational, monitor annually for five years	TBD	Evaluate any channel adjustments in the context of anticipated natural variability and the potential response of the channel to a change in upstream land uses Substantive changes in channel cross-section dimensions (i.e., > 10%) change of average width and depth) will require further study by a fluvial geomorphologist.	Any channel adjustments should be evaluated in the context of adjacent existing and ongoing development activities within the Etobicoke and Fletchers Creek watersheds that may also contribute to channel adjustments beyond that anticipated due to natural variability. Apply findings and results to future development to reduce long-term impacts. Assess if channel adjustments are due to development of the Alloa Secondary Plan Area development and if so, determine if intervention is necessary to limit hazards and maintain channel functions.

SYSTEM	GENERAL PARAMETER	PERFORMANCE MEASURE INDICATOR	PROTOCOL(S)	FREQUENCY/DURATION	LOCATION/AREA	MONITORING OUTCOME	ADAPTIVE MANAGEMENT RESPONSE
			collect a bed sample, as appropriate j) Re-survey of the longitudinal profile tied to the benchmark – indicates incision/aggradation of the bed, change in riffle and pool gradients and lengths k) Re-measure erosion pins Collect photographs at the same vantage point				
Groundwater	11. Baseflow	Mid-summer flow conditions along permanently flowing streams compared to historical baseflow conditions	Collection of spot flow measurements at established stations along permanently flowing streams and assess the flow compared to historical flows and groundwater inputs.	Flow Rate – Spot Flow Measurements and Conditions Monitoring Period • Seasonally for a duration of 3 years post-buildout • Baseflow water quality spring and fall at 3 year intervals for: ○ Inorganic parameters ○ Nitrogen ○ Metals	TBD	Impacts on baseflow due to grading and servicing efforts.	Opportunity to re-assess SWMP for enhanced infiltration
	12. Groundwater Level and Chemistry	To assess any changes to groundwater elevation, flow direction and chemistry established within the baseline conditions study.	Collection of manual measurements at select monitoring wells and piezometers coupled with automatic readings. Results should be compared to historical readings while considering wet and dry years. For groundwater chemistry, samples should be collected from the same wells each year where possible for consistency.	Groundwater levels seasonally until buildout and then seasonally for a duration of 3 years post-buildout Where additional monitoring sites related to site specific studies or the FBWB are selected continuous recording (i.e., 1h interval) is recommended. Chemical analysis once (1) during construction and once (1) within 3-years of buildout for: ○ Inorganic parameters ○ Nutrients (i.e., nitrate and phosphate) ○ Dissolved metals	TBD	• Impacts due to changes in recharge and stormwater management can be assessed • Changes in groundwater quality from baseline can be assessed.	Opportunity to re-assess SWMP for enhanced infiltration or redirection of stormwater runoff. Opportunity to alter land-use practices to protect groundwater quality.
Terrestrial Resources	**13. Biodiversity**						
	13. Wildlife Diversity						
	13a. Bird Diversity	Biodiversity (Birds) Species at Risk Special Status Species Significant Wildlife Habitat	Point count surveys follow Forest Bird Monitoring Program (FBMP) protocols, but include all habitat types, not just forested lands.	Initiate prior to any site alteration and repeat at 3 year intervals until 80% build out of each phase of development.	TBD	• Identifies trends in avian diversity and species guilds. • Information can be related to overall diversity targets and/or threshold values • that may indicate system stress or impairment. • Stations along Alloa Drain corridor and constructed greenways to be integrated into regional monitoring network. • Identifies potential stressors to the avian community	• Apply findings and results to future development to reduce long-term impacts.

SYSTEM	GENERAL PARAMETER	PERFORMANCE MEASURE INDICATOR	PROTOCOL(S)	FREQUENCY/DURATION	LOCATION/AREA	MONITORING OUTCOME	ADAPTIVE MANAGEMENT RESPONSE
	13b. Amphibian Richness	Biodiversity (Amphibian) Special Status Species Significant Wildlife Habitat	Point counts surveys using Marsh Monitoring Program (MMP) protocols, but not limited to marsh habitats.	Initiate prior to any site alteration and repeat at 3 year intervals until 80% build out of each phase of development.	TBD	• Identifies trends in amphibian diversity. • Information can be related to overall diversity targets and/or threshold values that may indicate system stress or impairment. • Stations in new corridors and linkages assess effectiveness of wetland habitat creation. Stations in along Alloa Drain can be integrated into regional monitoring network.	• Identify potential stressors to amphibian community and implement an appropriate management strategy to eliminate or reduce impacts. • Wetland performance review may be warranted if amphibian breeding is not sustained. • Apply findings and results to improve current habitats and to guide future development to reduce long-term impacts.
	13c. Other Wildlife (mammals, reptiles, insects)	Biodiversity (other wildlife) Special Status Species Significant Wildlife Habitat	Incidental observations during bird diversity, amphibian richness, and vegetation surveys	Initiate prior to any site alteration and repeat when other biological surveys are being conducted.	TBD	• Information can be related to overall diversity targets and/or threshold values that may indicate system stress or impairment. • Complimentary to regional monitoring network.	• Identify potential stressors to other wildlife and implement an appropriate management strategy to eliminate or reduce impacts. • Apply findings and results to future development to reduce long-term impacts.
	14. Natural Cover						
	14a. Natural Cover Type Forest & Wetland (21) Riparian (33)	Vegetation Communities Significant Wildlife Habitat	Classify natural cover according to standard ELC vegetation types.	Initiate prior to any site alteration and repeat in every five (5) years.	TBD	• Identifies relative changes to natural cover types. Can be used to assess whether targets are being attained. • Complimentary to Regional, TRCA and CVC land cover target and analysis programs.	• Refine vegetation management strategies to achieve desired natural cover representation. • Apply findings and results to future development phases.
	14b. Amount of Natural Cover (21,22)	Woodlands Wetlands Forest Interior	Aerial Photo Interpretation & GIS Analysis	Initiate prior to any site alteration and repeat every five (5) years.	TBD	• Identify net changes to amount of natural cover by type. • Data can be used to assess whether targets are being attained. • Complimentary to Regional, TRCA and CVC land cover target and analysis programs.	• Refine vegetation management strategies to achieve natural cover quantity objectives. • Apply findings and results to future development phases.
	15. Habitat Quality						
	15a. Age, Structure & Composition	Biodiversity Species At Risk Special Status Species Significant Wildlife Habitat	Ecological Monitoring and Assessment Network (EMAN) Terrestrial Volunteer Monitoring Program (TVMP) standards (Forests) CVC/TRCA/Town standards (Wetlands)	Local Scale - Initiate prior to any site alteration and repeat at five (5) year intervals until 80% build out of each phase of development. Regional Scale – Initiate prior to any site alteration and repeat at five (5) year intervals until 80% build out of each phase of development.	TBD	• Identifies trends in the condition of representative natural habitats	• Refine vegetation management strategies to achieve natural cover quantity objectives. • Apply findings and results to future development phases.

SYSTEM	GENERAL PARAMETER	PERFORMANCE MEASURE INDICATOR	PROTOCOL(S)	FREQUENCY/DURATION	LOCATION/AREA	MONITORING OUTCOME	ADAPTIVE MANAGEMENT RESPONSE
	15b. Health	Natural Area Protection	EMAN Forest Health Standards	Local Scale - Initiate prior to any site alterations and repeat at five (5) year intervals until 80% build out of each phase of development. Regional Scale - Initiate prior to any site alteration and repeat at five (5) year intervals until 80% build out of each phase of development.	TBD	• Monitoring can identify vegetation health issues that may indicate system stress or impairment. • Identifies potential stressors to vegetation health.	• Implement and appropriate management strategy to eliminate or reduce impacts.
	15c. Disturbance	Natural Area Protection	EMAN TVMP standards.	Local Scale - Initiate prior to any site alterations and repeat at five (5) year intervals until 80% build out of each phase of development. Regional Scale - Initiate prior to any site alteration and repeat at five (5) year intervals until 80% build out of each phase of development.	TBD	• Identifies the type, magnitude, frequency and location of disturbance to the natural environment.	• Implement an appropriate management strategy to eliminate or reduce direct human impacts to the natural environment.
	15d. Invasive Species	Biodiversity (Plant)	EMAN TVMP standards.	Local Scale - Initiate prior to any site alterations and repeat at five (5) year intervals until 80% build out of each phase of development. Regional Scale - Initiate prior to any site alteration and repeat at five (5) year intervals until 80% build out of each phase of development.	TBD	• Identifies trends in invasive species populations that may indicate system stress or impairment.	• Implement and/or refine vegetation management strategy to eliminate or reduce the threat of invasive species populations on the natural environment.
	15e. Indicator Species	Biodiversity (Plant) Significant Wildlife Habitat	Map populations of significant & sensitive flora and estimate their abundance. Refer to TRCA and CVC lists of Rare or Sensitive Indicator Species	Initiate prior to any site alteration and repeat on five (5) year intervals until 80% build out of each phase of development.	TBD	• Identifies trends in sensitive and significant plant species populations. The status of these populations can be an indicator of habitat quality.	• Implement and/or refine management strategy to protect rare species populations.
	16. Buffer Integrity						
	16a. Structure & Composition	Natural Area Protection Habitat Restoration	Transect based sampling across retained natural features from one development edge to another using EMAN TVMP – Gradient Sampling Protocols. Experimental design to use distance from development as an independent variable.	Initiate monitoring prior to any site alteration, repeat in year 0, 5, 10 & 15 from date of occupancy of lands adjacent to each transect.	TBD	• Will provide quantitative data to describe changes to buffer structure and composition over time.	• Implement management strategies as necessary to achieve desired buffer form.
	18b. Buffer Condition	Natural Area Protection Habitat Restoration	Record evidence of human related disturbances according to type, magnitude and frequency and photo document. Use ELC Disturbance Categories.	Initiate monitoring prior to any site alteration, repeat in year 0, 5, 10 & 15 from date of occupancy of lands adjacent to each segment.	TBD	• Identifies the type, magnitude and frequency of human related disturbances within buffer zones.	• Implement management strategies to reduce stress and restore buffer functions. • Develop and enforce By-Laws • Educate residents

SYSTEM	GENERAL PARAMETER	PERFORMANCE MEASURE INDICATOR	PROTOCOL(S)	FREQUENCY/DURATION	LOCATION/AREA	MONITORING OUTCOME	ADAPTIVE MANAGEMENT RESPONSE
	18c. Survivorship	Natural Area Protection Habitat Restoration	Estimate survivorship of planted material in buffer zones using transect based sampling.	Monitor annually for 3 years following installation to confirm 'free to grow' (woody cover emerged above surrounding meadow cover).	TBD	• To evaluate the effectiveness of restoration plantings. What levels of survivorship being achieved for woody and non-woody material?	• Rectify planting failures to achieve desired density and height. Re-evaluate restoration targets.
	19. Linkages & Restoration Areas (22,33)						
	19a. Dimensions, Structure & Composition	Habitat Restoration	Use transect based sampling to document structure and composition across linkage features and corridor using EMAN TVMP – Gradient Sampling Protocols	Initiate monitoring prior to any site alteration, repeat in year 0, 5, 10 & 15 from date of occupancy of lands adjacent to each transect.	TBD	• To assess the form and condition of linkage features.	• Develop and implement a management strategy to maintain desired linkage objectives where feasible. • Apply findings to future development to reduce long-term impacts.
	19b. Amphibian Movement	Habitat Restoration	Monitor spring amphibian movements in created linkages using double courses of drift fencing. Monitor amphibian road kills at road crossings of linkages and corridor during spring.	Initiate in year 0, and once again at 80% build out of each phase of development.	TBD	• To assess amphibian movement in created linkages immediately following construction and under the post- development condition. • To identify alternate amphibian movement pathways.	• Incorporate design elements to facilitate amphibian migration. • Add directional wildlife fencing or other measures to reduce road kills. • Enhance breeding habitat by extending hydroperiods or enlarging pools.
	19c. Survivorship	Habitat Restoration	Estimate survivorship of planted material using transect based sampling.	Monitor annually for 3 years following installation to confirm 'free to grow' (woody cover emerged above surrounding meadow cover).	TBD	• To evaluate the effectiveness of restoration plantings. What levels of survivorship being achieved for woody and non-woody material?	• Rectify planting failures to achieve desired density and height. Re-evaluate restoration targets.
Aquatic Resources	20a. Benthic Invertebrates (Regional scale, conducted by relevant agencies)		Regional-scale cumulative effects monitored using established TRCA Regional monitoring program in Alloa Drain and established CVC Effectiveness Monitoring Strategy protocol in Huttonville Creek watershed, or current equivalent.	As per established TRCA and CVC schedules.	TBD	• Identifies trends/changes in benthic community using various indices. • New locations, if required, focus on impacts related to the pending development	• Investigate causes if negative impacts observed. • Apply findings and results to future development.
	20b. Benthic Invertebrates (Local Scale)		Local scale monitoring proposed in Etobicoke Creek watershed along the Alloa Drain Corridor using current CVC Effectiveness Monitoring protocol or equivalent.	Annually for three years following establishment of seasonal or permanent flow.	TBD.	• Indication of habitat quality if permanent aquatic habitat is created.	• None - for information only.

SYSTEM	GENERAL PARAMETER	PERFORMANCE MEASURE INDICATOR	PROTOCOL(S)	FREQUENCY/DURATION	LOCATION/AREA	MONITORING OUTCOME	ADAPTIVE MANAGEMENT RESPONSE
	21a. Stream Temperature (Regional scale, conducted by relevant agencies)		Regional-scale cumulative effects monitored using established TRCA Regional monitoring program in Etobicoke Creek along the Alloa Drain Corridor and established CVC Effectiveness Monitoring Strategy protocol in Huttonville Creek watershed, or current equivalent.	As per established TRCA and CVC schedules.	TBD	• Identifies trends/changes in water temperature. • New locations, if required, focus on impacts related to development	• Investigate causes if negative impacts observed. • Apply findings and results to future development.
	21b. Stream Temperature (Local scale)		Refer to Parameter #4.	Refer to Parameter #4.	TBD	Refer to Parameter #4.	Refer to Parameter #4.
	22a. Fish Habitat and Community (Regional scale, conducted by relevant agencies)		Regional-scale cumulative effects monitored using established TRCA Regional monitoring program in Etobicoke Creek along the Alloa Drain Corridor and established CVC Effectiveness Monitoring Strategy protocol in Huttonville Creek watershed, or current equivalent.	As per established TRCA and CVC schedules.	TBD	• Identifies trends in fish community and habitat. • New locations, if required, focus on impacts related to the pending development	• Investigate causes if negative impacts observed • Apply findings and results to future development.
	22b. Fish Habitat and Community (Local scale)		No local scale monitoring proposed in Etobicoke Creek watershed along the Alloa Drain Corridor using current CVC Effectiveness Monitoring protocol or equivalent.	Annually for three years following establishment of seasonal or permanent flow.	TBD	• Indication of habitat quality if permanent aquatic habitat is created.	• None - for information only.
	23. Redside Dace (Regional scale, conducted by relevant agencies)		Extent of occupied habitat downstream from the Alloa Secondary Plan to be monitored as part of Redside Dace monitoring program conducted by others. Protocols to be determined by monitoring agency.	To be recommended by the monitoring agency and confirmed by the Town of Caledon.	TBD	To be recommended by the monitoring agency and confirmed by the Town of Caledon.	To be recommended by the monitoring agency and confirmed by the Town of Caledon.
	24. Riparian Zone Cover (included in #32)						
Fluvial Geomorphology – Constructed Corridors	Assess conformance of the constructed watercourses, drainage features, wetlands and outfalls with design drawings and monitor form and function.	Detailed Design Drawings / Issued For Construction Drawings	Construction activities will be overseen by the channel designer. Field fitting and adjustments are often required due to the dynamic nature of natural systems, and it is therefore beneficial to have an experienced inspector that can provide proper direction when necessary.	Observation to occur at key times in the construction process (e.g., confirm pre-construction conditions, examine lay-out and initial site channel construction, inspect channel and constructed features before flow activation)	All realigned corridors	• Ensure design is constructed as intended and that any field fitting is completed appropriately	Not appliable
	Channel stability and stream erosion (bed, bank, and riparian vegetation).	As-built drawings / initial post-construction monitoring survey following construction completion	Monitoring location establishment along each realigned corridor: Longitudinal profile of representative section of channel • 10 cross-sectional surveys • Substrate composition (i.e., Wolman pebble counts)	Visual inspection after a high flow event. Years 1, 2, 3, 5 and 9 following construction Seasonal visual inspections (i.e., spring and fall)	All realigned corridors	No action required should the realigned corridors be assessed as within the range of natural variability Substantive changes in channel cross-section dimensions (i.e., > 10% change of average width and depth) will require further study by fluvial geomorphologist.	Provide insight on channel processes and function Compile information regarding the response of the channel to a change in land use and configuration Assess if channel adjustments are due to development and if so,

SYSTEM	GENERAL PARAMETER	PERFORMANCE MEASURE INDICATOR	PROTOCOL(S)	FREQUENCY/DURATION	LOCATION/AREA	MONITORING OUTCOME	ADAPTIVE MANAGEMENT RESPONSE
			• Two monumented cross-sections (as part of the 10 cross-sections) • Bank properties (height, angle, material, vegetation, root depth, undercuts and in-situ shear strength) • Long profile survey (energy gradient, top and bottom of riffles, max pool depth) with benchmark • Erosion Pins – min. of 1 in each bank • Monumented photographs Monitoring after Initial Site Setup: • Re-survey two monumental cross-sections to assess change in cross-sectional shape • Substrate composition (i.e., Wolman pebble counts) • Re-survey of the area tied to the benchmark – indicates incision/aggradation of the bed • General observations including identification of any erosion issues, monumented photographs, annual survey of prescribed plant materials	Annual surveys of monumented cross-sections			determine if intervention is necessary to limit hazards and maintain functions. Apply findings and results to future development to reduce long-term impacts.
Other	25. "New" Rainfall		Rainfall Measurement Rainfall drives all hydro-meteorological processes. As such, it is important to have a good understanding of the amount and temporal distribution of rainfall, in order to be able to assess all environmental processes. Intensity measuring gauge with maximum timestep of 10 minutes.	Rainfall – Continuous Monitoring Period - same as Flow Rate	TBD	• Allows assessment of volumetric runoff response • Allows further verification hydrologic model	Potential to update hydrologic model local through calibration/verification based on rainfall and stream flow results and optimize facility performance.
	26. "New" Snow Course		Note: "New" snow course is not required as sufficient existing sites are available.				

21.0 Conclusion

Phase 1 of this LSS includes a comprehensive inventory of existing natural features and conditions from the Alloa Secondary Plan Area/Primary Study Area. Data collection commenced in 2022 and was completed in 2024 and groundwater monitoring continues to present day. The findings from the completion of all historical data known from the site together with collected field inventory data, has confirmed all of the natural heritage features to be considered throughout all phases of the study. Together with natural heritage features all water resource related components have also been considered to thoroughly understand the environmental dynamics of the lands within both the Primary and Secondary Alloa Study Areas. The information gained through Phase 1established the NHS framework to which the Land Use Plan was fitted.

"the Consultant Team has considered qualitative climate adaptation measures to be implemented as part of the Alloa Secondary Plan"

Phase 2 of this LSS evaluated the Alloa Land Use Plan for compatibility with both the natural heritage features and water resource considerations. One of the major challenges within the plan area was confinement of the sprawling existing floodplain across the site. It was determined that through creation of reconfigured containment corridors, flood management can be achieved and at the same time the creation of opportunities for significant expansion of the Natural Heritage System are provided. Another feature of the Alloa Land Use Plan is the proposed transformation of the degraded Alloa Drain, a municipal drain used to facilitate agricultural run-off, into a significant greenway corridor. This greenway corridor links to a series of additional north-south greenway corridors that provide flood storage and opportunities for habitat diversity, natural cover creation, active transportation, etc. It was also determined through detailed study that the pre to post site and features based water balance can be achieved. The proposed restoration initiatives within the Secondary Plan Area will increase natural cover by 200% over existing and will create 6,800m of new natural channel conveyances. A net increase in wetland area will also be achieved through 3.5ha of constructed wetland within the corridor system. All of these elements were adopted within the Alloa Secondary Plan which was approved by the Town of Caledon on July 8, 2025.

Phase 3 of this LSS establishes the performance measures by which each component of the environmental system was evaluated and will be monitored for compliance with the objectives. Post development adaptive management responses were identified where possible to improve performance where required.

This LSS endeavoured to address the Provincial Policy Statement (2024), Region of Peel Official Plan (2022), the related Scoped Subwatershed Studies completed to support SABE (2022), Future Caledon Official Plan (2024), the Etobicoke Creek Watershed Plan *ECWP) (2024), Resilient Caledon (2021), and the *Conservation Authorities Act*. This LSS also endeavoured to fully consider the Land Use Impact Actions of the ECWP while also incorporating considerations of

climate change adaptation and providing guidance for the future detailed design stages of the Alloa Secondary Plan Area.

We believe that the Alloa Land Use Plan recommended herein has had full regard for the Planning Objectives and policies applicable the Alloa Secondary Plan Area and achieves both the community planning objectives and net ecological benefits.

Respectfully submitted,

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