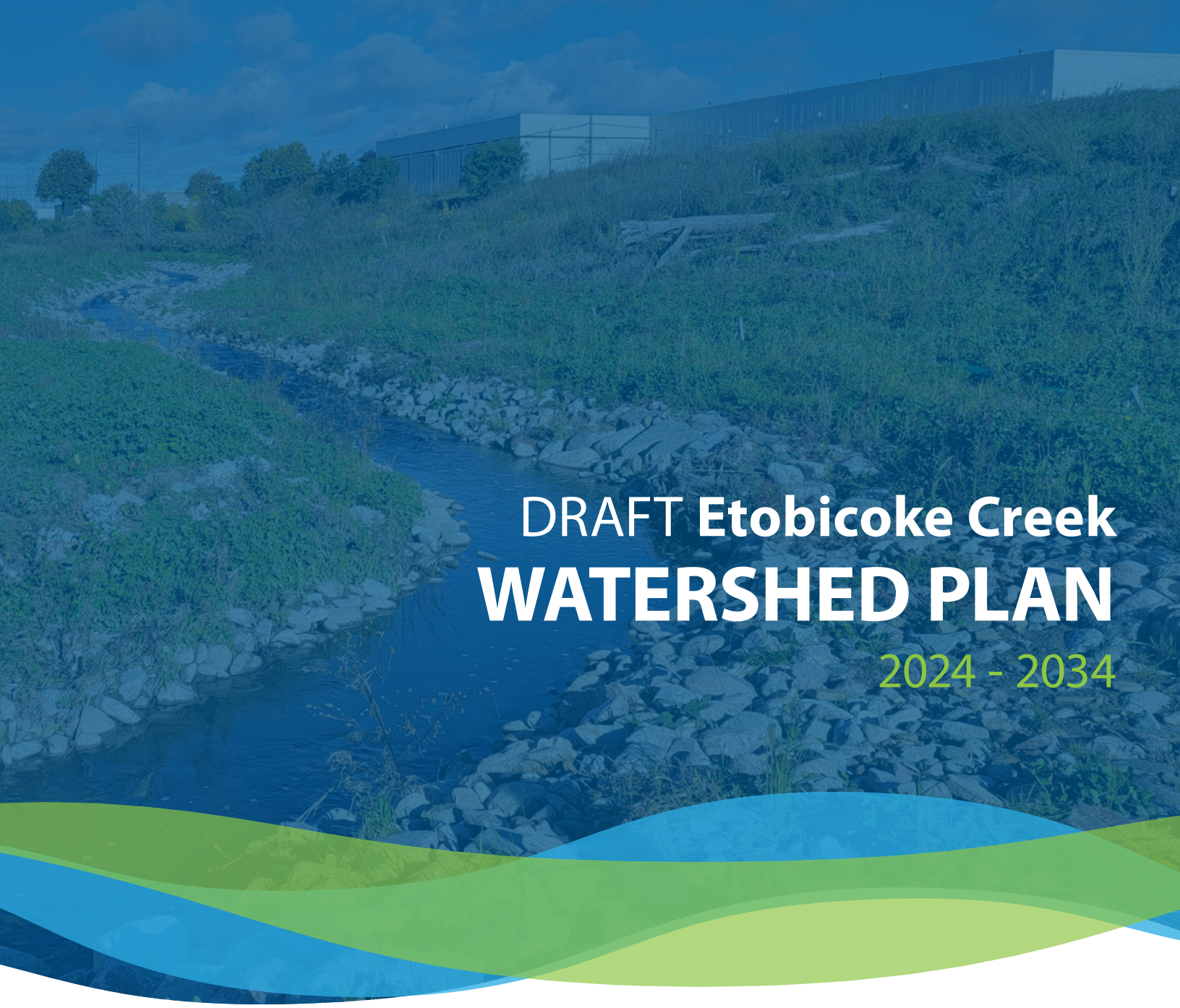


DRAFT **Etobicoke Creek**
WATERSHED PLAN
2024 - 2034

TORONTO

Region of Peel
working with you

MISSISSAUGA

BRAMPTON
Flower City
brampton.ca

TOWN OF CALEDON

MISSISSAUGAS OF THE CREDIT FIRST NATION

Toronto Pearson

Toronto and Region
Conservation
Authority

The Land and Water

Etobicoke Creek Watershed is covered by Treaty 13 (Toronto Purchase), Treaty 14 (Head of the Lake Purchase), and Treaty 19 (Ajetance Purchase) signed with the Mississaugas of the Credit. The land in the watershed is the territory of the Mississaugas of the Credit, and the traditional territory of the Haudenosaunee and the Wendat peoples, and is now home to many diverse First Nations, Inuit, and Métis peoples. Treaties 13 and 14 reserved Etobicoke Creek as a fishery for the Mississaugas of the Credit.

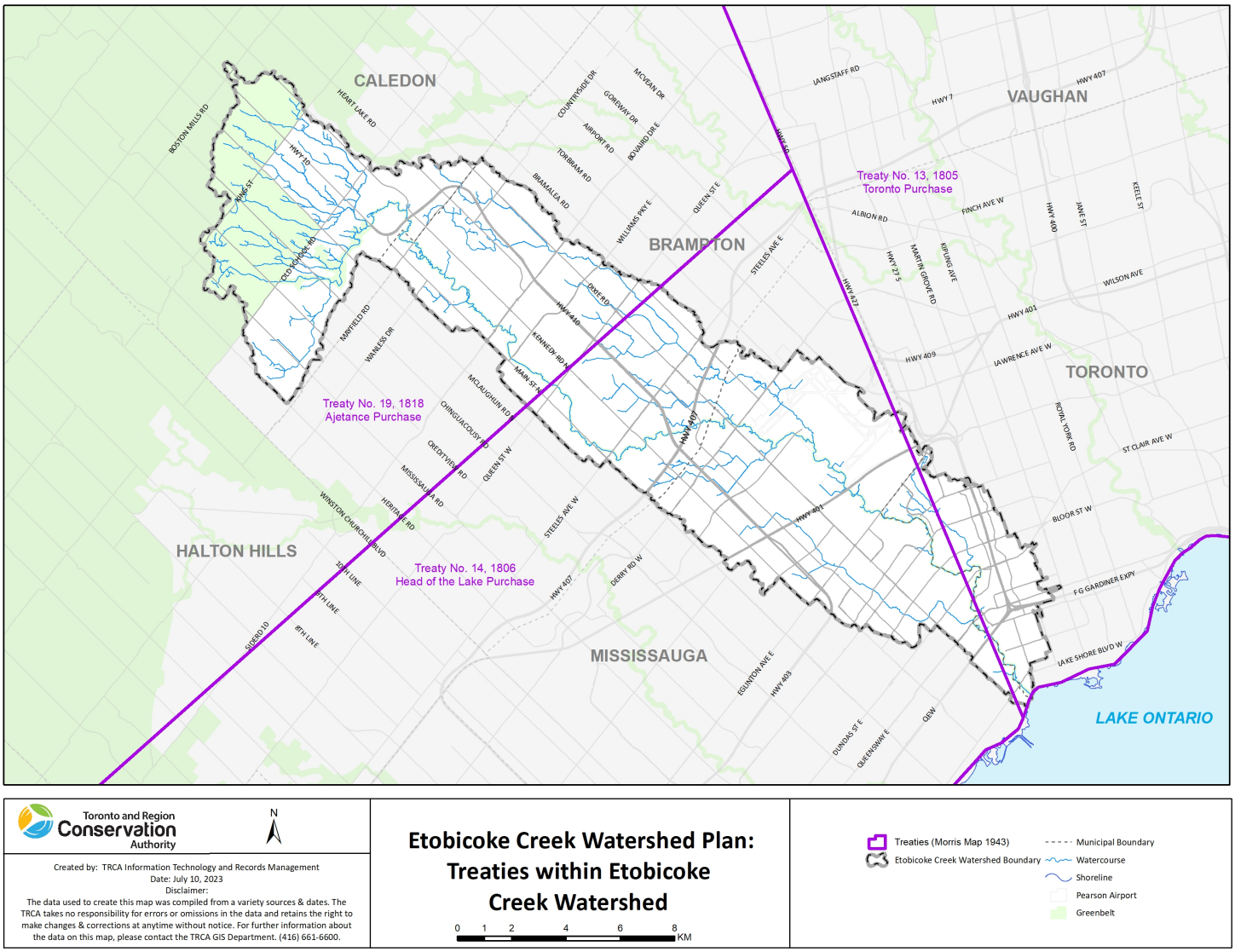


FIGURE 1: Treaties Map

The Mississauga peoples used the land around Etobicoke Creek seasonally and as a salmon fishery before being displaced by settlers. This led to a collapse of the traditional economy.

The Mississaugas relationship to water is embedded in their creation story, its teaching, and prophecies.

This story, Kiinwi Debaadjmowin, tells us that everything is interconnected as intricate systems. This interconnectedness is explained in the first seven fires of creation. Creation birthed life through the projection of first thought and heartbeat. The seven fires grew in succession – the stars, the sun, the moon, movement, seeds of life, Earth, and human beings.

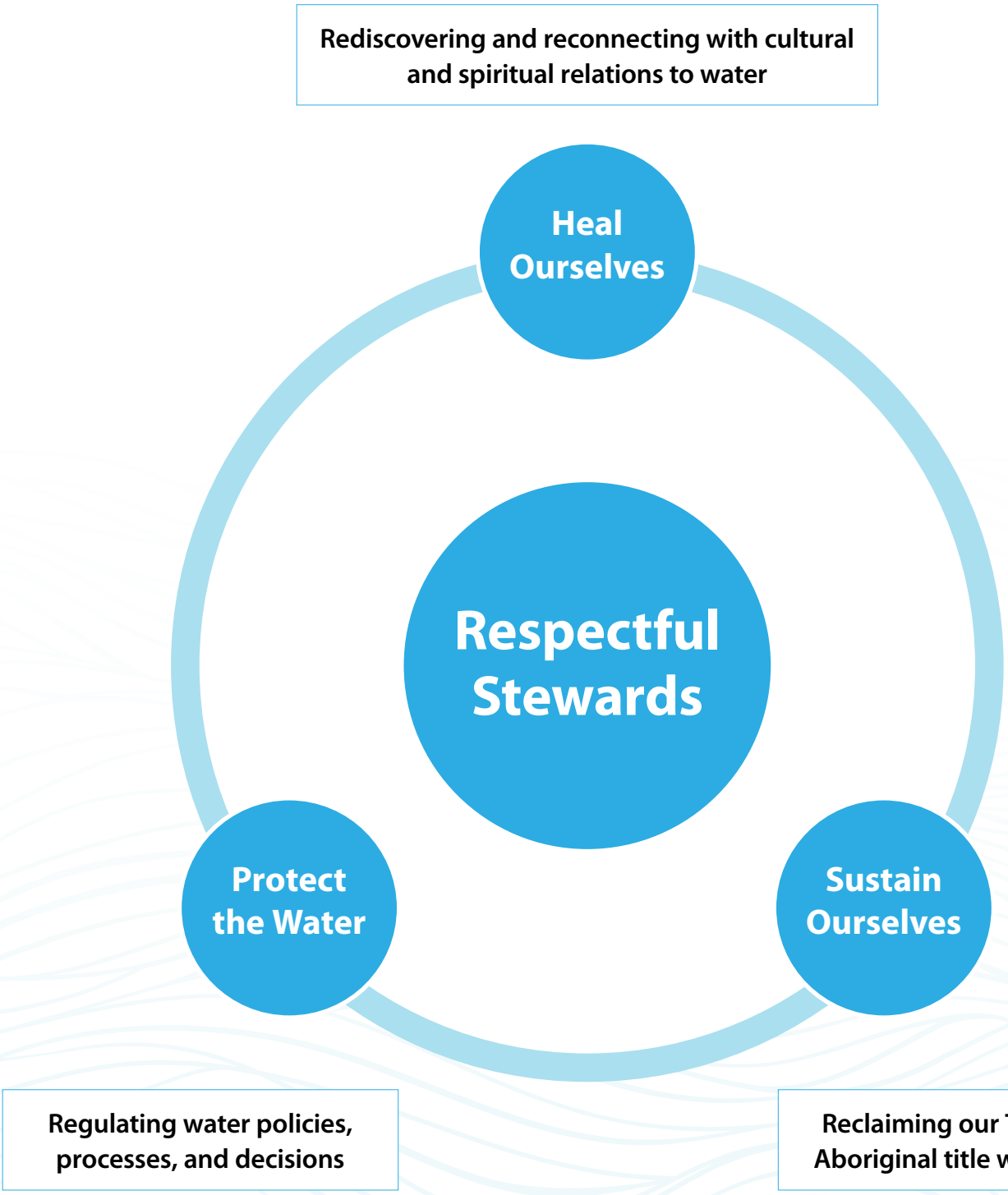


FIGURE 2:
Mississaugas of the Credit First Nation Water Framework Principles for Reconciliation

Executive Summary

A watershed is an area that is drained by a river and its tributaries. Healthy watersheds provide numerous ecosystem services such as, supporting biodiversity, providing clean drinking water, reducing flood and erosion hazards, protecting the quality and quantity of water, and improving climate resiliency. Due to the importance of healthy watersheds, they merit collaborative efforts to ensure their long-term sustainability.

Ontario's provincial planning framework recognizes that watershed planning is important to inform land use and infrastructure planning decisions. The purpose of a watershed plan is to understand current and potential future watershed conditions, and identify measures to protect, enhance, and restore watershed health. Watershed planning integrates natural systems into land use and infrastructure decision-making, and climate adaptation planning. It helps identify natural features and areas to protect and develop mitigation measures to minimize the impacts of various land use types and climate change.

The development of this watershed plan has been a collaborative effort between Toronto and Region Conservation Authority (TRCA), the City of Toronto, Region of Peel, City of Mississauga, City of Brampton, Town of Caledon, Mississaugas of the Credit First Nation (MCFN), and the Greater Toronto Airports Authority (GTAA). Additional First Nations and Indigenous communities, stakeholders, and members of the public have been involved throughout the watershed planning process.

Etobicoke Creek is a heavily urbanized watershed with eight subwatersheds at the western end of TRCA's jurisdiction. Urbanization and climate change will continue to stress the health and resiliency of the watershed. This watershed plan recognizes these challenges and identifies actions to protect, enhance, and restore the health of the Etobicoke Creek watershed.

The development of the Etobicoke Creek Watershed Plan was a multi-stage process that consisted of:

1 Watershed Characterization (i.e. Existing Conditions)

The key issues with the Etobicoke Creek watershed are:

- Aquatic habitat conditions are poor, and the watershed has a high amount of runoff and in-stream barriers.
- There is a low amount of natural cover and habitat quality is generally 'poor'. The remaining natural cover is highly vulnerable to the effects of climate change.
- Surface water quality is generally poor compared to other TRCA watersheds.
- The watershed has six Flood Vulnerable Clusters with a total area of 508 hectares and can be categorized as medium or high erosion sensitivity.

2 Future Management Scenario Analysis (i.e. Future Conditions)

This stage examined different potential future management scenarios to understand how watershed conditions may change. Four potential future management scenarios assessed the impacts of different land uses and different levels of watershed enhancements (e.g. improvements to stormwater management, increased natural cover, and increased urban forest canopy), as well as the impacts of climate change.

- **Scenario 1: Urban Expansion with Minimal Enhancements** – further urbanization in the Headwaters with no enhancements to natural cover and stormwater management.
- **Scenario 2: Urban Expansion with Mid-Range Enhancements** – further urbanization in the Headwaters with moderate enhancements to natural cover and stormwater management.
- **Scenario 3: Urban Expansion with Optimal Enhancements** – further urbanization in the Headwaters with optimal enhancements to natural cover and stormwater management.
- **Scenario 4: Existing Urban Boundary with Optimal Enhancements** – current urban boundary is maintained with optimal enhancements to natural cover and stormwater management.

These future management scenarios helped determine how the watershed will respond to potential future land use and climate changes (i.e. will conditions improve, stay the same, or deteriorate). Scenario analysis does not result in decisions about the type and configuration of land uses. Instead, scenario analysis helps to inform municipal planning decisions.

The future scenario analysis results demonstrate that:

- Surface and groundwater conditions, aquatic habitat quality, and sensitive species will be impacted as urbanization and impervious surface amounts increase although enhancements to natural cover, urban forest, stormwater management, and low impact development implementation will help mitigate these impacts.
- Even with optimal natural cover enhancements, this watershed remains below recommended federal guidelines for natural cover quantity, but the recommended natural cover and urban forest enhancements will provide various ecosystem and socio-economic benefits and increase climate resiliency.
- Changes in water quality parameters demonstrate the impacts of urbanization and climate change and highlight the benefits of improved stormwater management and natural cover enhancements to help address some of the concerns.
- Optimal enhancements to natural cover and stormwater management help reduce peak flow levels, though not as effectively when climate change is factored in. Land use changes can manage peak flows for all design storms through enhancements and interventions (if TRCA's stormwater management criteria for the Etobicoke Creek Headwaters is applied), but climate change will cause peak flows to exceed current stormwater infrastructure design standards.
- Increasing enhancements to natural cover and stormwater management help mitigate erosion, which would otherwise increase with further urbanization.

3 Implementation Planning

This stage involved the development of a management framework with three goals, eight objectives, ten indicators, and 38 management actions outlining how to protect, enhance, and restore watershed health. The management framework is designed to address existing watershed issues and mitigate impacts from potential future land uses and climate change. The management framework is focused on:

- Achieving more sustainable land use and infrastructure development patterns through the use of low impact development and green infrastructure, improved stormwater management, mitigating flood and erosion risk, and improving rural land stewardship.
- Protecting, enhancing, and restoring the Water Resource System and improving aquatic habitat connectivity.
- Protecting, enhancing, and restoring the Natural Heritage System and increasing urban forest cover.

A monitoring and evaluation program was also developed to track implementation progress and evaluate whether watershed conditions are improving.

Through the implementation of the Etobicoke Creek Watershed Plan, all watershed partners and stakeholders can contribute to a healthier, more sustainable, and more resilient watershed that can provide long-term benefits to all residents.

WATERSHED VISION:

Etobicoke Creek watershed is protected and restored to a cleaner, healthier, and more natural state, to sustain its waterways, ecosystems, and human communities.

FIGURE 3:
Heart Lake Aerial Image

FIGURE 4:
What is a Watershed?

WHAT IS A WATERSHED?

An area that is drained by a river and its tributaries. Wherever you are right now, you are in a watershed.

WATERSHEDS DELIVER IMPORTANT BENEFITS

Human – provide safe drinking water and food, and help to reduce flooding and erosion.

Economic – produce energy, and supply water for agriculture, industry and homes.

Environment – promote a healthy water cycle, and provide vital habitat for wildlife and plants.

What is the Natural Heritage System?

Consists of natural features and areas, including wetlands, forests, meadows and valleylands, that are needed to maintain biodiversity and healthy ecosystems.

How can agriculture impact a watershed?

Agricultural areas provide valuable greenspace and reduce stormwater, since precipitation can penetrate the soil. On the other hand, agricultural fields can release harmful contaminants into waterways as excess nutrients (e.g. phosphorous) and pesticides. Soil erosion from fields can increase the amount of sediment in waterways negatively affecting aquatic ecosystems.

What is the Water Resource System?

Consists of groundwater and surface water features and areas, including streams, lakes, groundwater recharge areas and springs, needed to sustain healthy aquatic and terrestrial ecosystems, and human water supply.

How can urbanization impact a watershed?

Since impervious surfaces (roads, buildings, parking lots) prevent water from penetrating into soil, stormwater runoff can carry contaminants into waterways and increase the likelihood of flooding. Infrastructure and land use development can degrade habitat, reducing the quality and quantity of natural systems and their connectivity.

What causes flooding?

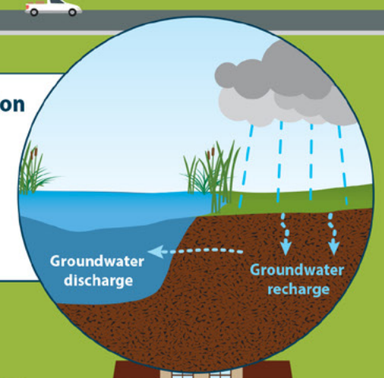
Rivers naturally flood with heavy rain or snowmelt, but flooding can become a problem when buildings and other structures are placed in floodplains. Climate change and urbanization can make flooding worse.

How can salt impact a watershed?

Chlorides can contaminate drinking water and negatively affect the health of aquatic species.

Surface and Groundwater Interaction

Rain and melting snow penetrate the soil in permeable areas draining into an aquifer (i.e. groundwater recharge areas). That groundwater can then discharge at springs into streams, wetlands or other surface water features.



What is stormwater?

Rain and melting snow rushes off roofs, sidewalks and parking lots into pipes and pours into streams and lakes. Without proper stormwater control and treatment, flooding and erosion can increase, waterways can become polluted and local ecosystems can be damaged.

Benefits of the Urban Forest

All trees in a city collectively help to remove pollutants from air and water, reduce stormwater runoff, cool communities, save energy, and improve human health and well-being.

Table of Contents

Table of Contents

LIST OF FIGURES

LIST OF TABLES

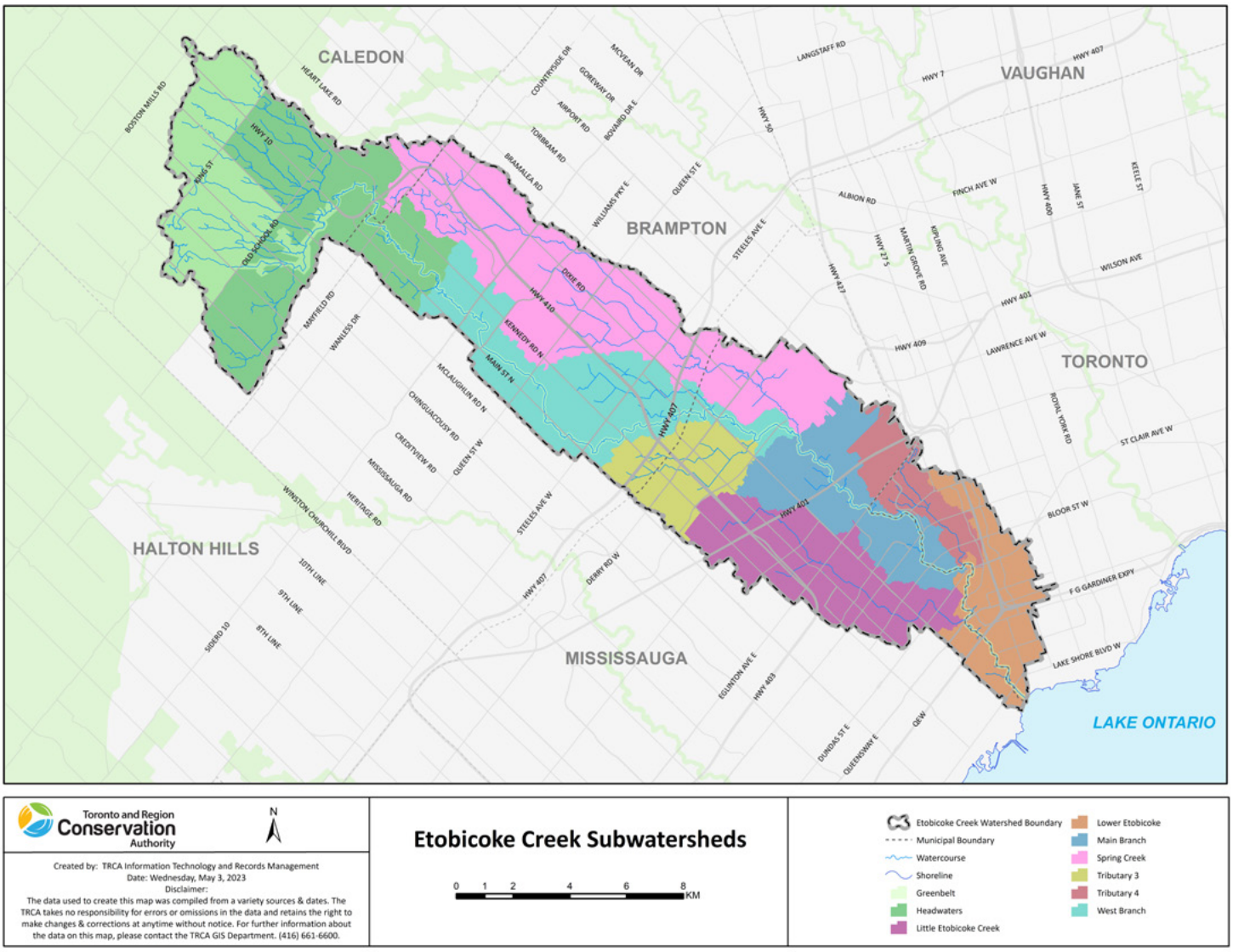
ACRONYMS

CEW	Cumulative Effective Work
CTC	Credit Valley - Toronto and Region - Central Lake Ontario
CWQG	Canadian Water Quality Guidelines
ECWP	Etobicoke Creek Watershed Plan
ELC	Ecological Land Classification
ESGRA	Ecologically Significant Groundwater Recharge Area
FBI	Family Biotic Index
FVC	Flood Vulnerable Cluster
GTA	Greater Toronto Area
GTAA	Greater Toronto Airports Authority
HDF	Headwater Drainage Feature
IBI	Index of Biotic Integrity
LAM	Landscape Analysis Model
LID	Low Impact Development
MCFN	Mississaugas of the Credit First Nation
NHS	Natural Heritage System
PPS	Provincial Policy Statement
PWQO	Provincial Water Quality Objectives
ROP	Regional Official Plan
SGRA	Significant Groundwater Recharge Area
TOE	Time of Exceedance
TRCA	Toronto and Region Conservation Authority
TSS	Total Suspended Solids
WRS	Water Resource System

1. Introduction and Background

The Etobicoke Creek watershed is at the western end of TRCA's jurisdiction and is heavily urbanized. The watershed begins in the Greenbelt in the Town of Caledon before flowing south through the City of Brampton and City of Mississauga, and ultimately entering Lake Ontario in the City of Toronto. The watershed consists of eight subwatersheds as shown in **Figure 5**.

FIGURE 5:
Etobicoke Creek Subwatersheds



This watershed plan represents a collaborative effort between TRCA, the City of Toronto, Region of Peel, City of Mississauga, City of Brampton, Town of Caledon, MCFN, and the GTAA.

This watershed plan was developed by determining the current state of the watershed, assessing potential future land use management scenarios and the impacts of climate change, where possible, and determining an appropriate management framework to ensure the long-term sustainability and resiliency of the watershed.

This watershed plan has a ten-year time frame. Through regular monitoring and evaluation, including adaptive management, the watershed plan will be updated, or refined, as needed on an ongoing basis.

The last watershed plan for Etobicoke Creek was developed in 2002, with some technical updates completed in 2010. Since then, watershed science has advanced, and provincial policies have explicitly recognized the importance of watershed planning.

1.1 RATIONALE AND POLICY BASIS

Watershed planning is a vital process for understanding the current conditions of a watershed (i.e. watershed characterization), and identifying measures to protect, enhance, and restore the health of a watershed. Watershed plans provide a comprehensive and integrated understanding of the form and function of the natural hazards, features, and areas that comprise the water resource and natural heritage systems. Additionally, watershed planning helps to inform how land use and infrastructure planning influence and affect the health of the watershed. This subsection will explain the provincial policy basis for watershed planning and the roles of municipalities and TRCA in implementing the policy framework.

Provincial Watershed Planning Policy Basis

Ontario's planning policy framework recognizes the importance of watershed planning to inform land use and infrastructure decision-making. Policies in the Provincial Policy Statement, 2020 (PPS), the Growth Plan for the Greater Golden Horseshoe, 2020 (Growth Plan), and the Greenbelt Plan, 2017, provide direction related to watershed planning.

PPS policies encourage a coordinated approach to planning that recognizes the watershed as the ecologically meaningful scale for integrated and long-term planning. The PPS also emphasizes the importance of protecting, improving, and restoring the quality and quantity of water by minimizing potential negative impacts. Growth Plan and Greenbelt Plan policies also require watershed planning to be undertaken by municipalities to support the protection, enhancement, and restoration of the quality and quantity of water within a watershed.

Watershed planning is also to be used to identify the Water Resource System (WRS), inform decisions on allocation of growth, and inform planning for water, wastewater, and stormwater infrastructure.

Provincial policies also recognize the importance of protecting, enhancing, and restoring the Natural Heritage System (NHS) to maintain long-term ecological and hydrologic functions. The integrated nature and importance of the natural heritage and water resource systems are discussed in greater detail in **Section 2 - Water Resource and Natural Heritage Systems**.

Municipalities are required to demonstrate conformity with the PPS and applicable provincial plans through the municipal planning process and their Official Plans.

The purpose of Ontario's *Clean Water Act, 2006* is to protect existing and future sources of drinking water. Under the Act, source protection committees are responsible for preparing source protection plans. The Credit Valley – Toronto and Region – Central Lake Ontario (CTC) Source Protection Plan applies in the Etobicoke Creek watershed. The CTC Source Protection Plan is a strategy and suite of policies developed by residents, businesses, and municipalities, which outlines how water quality and quantity for drinking water systems, not including private well owners, will be protected. The CTC Source Protection Plan includes its own set of policies that are not repeated in this watershed plan. The management actions identified in this watershed plan complement the requirements of the CTC Source Protection Plan by including the need to protect water resources, which will support clean and safe drinking water.

Finally, Ontario's planning policies recognize the importance of the Great Lakes. Etobicoke Creek flows into Lake Ontario. The various Great Lakes agreements, legislation, and policies set binational, national, and provincial commitments to protect and restore the Great Lakes. This watershed plan is intended to improve conditions in the Etobicoke Creek watershed, thereby reducing negative impacts to Lake Ontario.

Role of Municipalities

Municipalities in Ontario are organized into single-tier or two-tier systems. Upper-tier municipalities, such as the Region of Peel, are comprised of multiple lower-tier municipalities (e.g. City of Mississauga). The role of regional government is to address issues and concerns across broader geographic areas, as set out under the *Municipal Act* and other provincial legislation. The City of Toronto is a single-tier municipal government, which means it assumes all municipal responsibilities as set out under the *City of Toronto Act* and other provincial legislation.

Municipalities implement the watershed planning requirements of provincial legislation, plans, and the PPS.

Watershed planning helps municipalities make informed decisions on where and how to grow in a way that minimizes and/or mitigates impacts to watershed health. Watershed plans can also be an excellent resource to municipalities to inform greenlands securement and management planning and green infrastructure and/or stormwater management retrofit planning, and to contribute to urban revitalization strategies where natural heritage restoration or flood remediation strategies may be needed.

Role of TRCA

Conservation Authorities (CAs) are established and governed under the *Conservation Authorities Act*. The purpose of the Act is to provide for the organization and delivery of programs and services that further the conservation, restoration, development, and management of natural resources in watersheds. While conservation authorities are not the decision-makers in land use and infrastructure planning, they play an important role by advising municipalities and infrastructure providers on matters related to natural hazards, wetlands, and source protection, and by collecting and providing scientific data on watershed management and resilience to climate change outside the plan review function. Conservation authorities also have a development permit regulation under section 28 of the Act for conservation authority regulated areas consisting of river and stream valleys, wetlands, watercourses, and shorelines.

Through its watershed expertise, TRCA, in collaboration with its partner municipalities, MCFN, and the GTAA, has developed this watershed plan to help inform municipal growth management and various other initiatives including ecosystem restoration planning, land management/acquisition, and low impact development and green infrastructure implementation.

1.2 LOCAL CONTEXT AND CONSIDERATIONS

The Etobicoke Creek watershed is approximately 22,404 hectares in size and is the westernmost watershed in TRCA's jurisdiction. It is bordered by the Credit River watershed to the west and the Mimico Creek and Humber River watersheds to the east.

Etobicoke Creek also forms the western boundary of the Toronto Purchase (Treaty #13 in 1805) and the eastern boundary of the Head of the Lake Purchase (Treaty #14 in 1806) and lies within the Ajetance Purchase (Treaty #19 in 1818). The Toronto Purchase reserved the Mississaugas exclusive fishing rights in Etobicoke Creek.

The Etobicoke Creek watershed is heavily urbanized (approximately 60% as of 2019) and contains a large amount of industrial and commercial land uses, including the majority of Lester B. Pearson International Airport. The only remaining rural portions of the watershed fall within the Headwaters subwatershed in the Town of Caledon. This watershed has one of the lowest amounts of natural cover in TRCA's jurisdiction.

Mouth of Etobicoke Creek

Historically, the mouth of Etobicoke Creek was a wetland providing extensive habitat along the Lake Ontario shoreline. The first engineered alteration of the lower part of the Creek was in 1929, when the sandbar across the mouth was reinforced to allow the extension of an adjacent road.

When Hurricane Hazel hit in 1954, the water level in the channel was at least four times its capacity, destroying homes and causing seven deaths. Over the next few years, municipal and provincial governments purchased the land in the flood plain, converting the area into Marie Curtis Park. By 1959, no trace of the original creek mouth remained. Today, the flood plain lands are owned by TRCA, but managed by the City of Toronto.

Brampton Esker

The Etobicoke Creek watershed is home to the only esker in TRCA's jurisdiction. An esker is a long, winding ridge of sand and gravel deposited by glacial meltwaters, which flowed through crevasses and channels within or beneath an ice sheet.

The Brampton Esker's northern end is located just to the north of Mayfield Road and runs south for approximately eight kilometres to Queen Street. It is around 1.8 km wide with its eastern edge following Highway 410. The sands and gravels of the Brampton Esker hold and purify water as it percolates downward, making the esker an important groundwater resource and the source of Spring Creek, a tributary of Etobicoke Creek.

FIGURE 6: Open House on Watershed Plan, May 2022 (Mississauga) *(left)*
FIGURE 7: Open House on Watershed Plan, May 2022 (Brampton) *(right)*

1.3 PARTNERS AND STAKEHOLDERS

The development of this watershed plan commenced in early 2020 through the establishment of a Steering Committee consisting of representatives from TRCA, the City of Toronto, Region of Peel, City of Mississauga, City of Brampton, Town of Caledon, MCFN, and GTAA. Credit Valley Conservation was also involved in the Steering Committee to ensure consistency in watershed planning approaches between neighbouring watersheds.

Throughout this process, First Nations and Indigenous communities, stakeholders, watershed residents, and the general public have been engaged to increase awareness of watershed planning and solicit feedback on components of the watershed plan.

EARLY 2020 – MID 2021

Engaged on watershed vision and key issues of concern to undertake watershed characterization. Released comprehensive Watershed Characterization Report in June 2021.

MID 2021 – MID 2022

Developed potential future management scenarios and carried out technical analyses, culminating in the release of the Future Management Scenario Analysis Report in July 2022. Engaged on the results of the watershed characterization and future management scenarios stages, and on the objectives and indicators for the watershed plan and priorities for action.

MID 2022 – MID 2023

Developed the management framework for the watershed plan and the draft watershed plan and engaged on the draft watershed plan.

Engagement Summary reports were prepared throughout the watershed planning process and provide details of the engagement activities. These reports are referenced in **Section 9 - References** and are publicly available.

Feedback received from First Nations and Indigenous communities, partners, stakeholders, watershed residents, and the general public was invaluable to the development of this watershed plan. The Etobicoke Creek Watershed Plan reflects the diversity of issues and concerns raised throughout the process and represents an achievable plan to improve watershed conditions.

2. Water Resource and Natural Heritage Systems

The land (i.e. terrestrial) and water (i.e. aquatic) features and areas that maintain watershed and ecological health consist of two integrated systems: the Water Resource System (WRS) and the Natural Heritage System (NHS). Together, these systems provide essential ecosystems services, such as water storage and filtration, cleaner air, support to biodiversity and habitats, carbon storage, and improving resiliency to climate change. Maintaining extensive, connected, and high-quality features and areas of both systems is essential for the long-term health and sustainability of the watershed, as shown in **Figure 4**.

Identifying, protecting, enhancing, and restoring both systems is a key policy requirement of the Growth Plan and the Greenbelt Plan.

Table 1 explains the features and areas of both systems.

TABLE 1:
Water Resource and Natural Heritage Systems

Water Resource System	Natural Heritage System
A system consisting of groundwater features and areas, surface water features (including shoreline areas), and hydrologic functions, which provide the water resources necessary to sustain healthy aquatic and terrestrial ecosystems and human water consumption.	A system made up of natural heritage features and areas, and linkages identified to provide habitat connectivity and support natural processes, which are necessary to maintain biodiversity and ecosystem functions.
The WRS consists of: **Key Hydrologic Areas** • Significant Groundwater Recharge Areas (SGRAs), including Ecologically Significant Groundwater Recharge Areas (ESGRAs) • Highly Vulnerable Aquifers • Significant Surface Water Contribution Areas **Key Hydrologic Features** • Permanent Streams • Intermittent Streams • Inland Lakes and their Littoral Zones • Seepage Areas and Springs • Wetlands*	The NHS consists of: • Significant Wetlands* • Significant Coastal Wetlands • Other Coastal Wetlands in Ecoregions 5E, 6E, and 7E • Fish Habitat* • Significant Woodlands • Significant Valleylands in Ecoregions 6E and 7E (excluding islands in Lake Huron and the St. Mary's River) • Habitat of Endangered Species and Threatened Species • Significant Wildlife Habitat • Significant Areas of Natural and Scientific Interest (ANSIs) • Sand Barrens, Savannahs, Tallgrass Prairies, and Alvars • Federal or Provincial Parks, and Conservation Reserves
***Notes:** Wetlands are important features in both systems. Wetlands are shown as features in the mapping for the WRS and as natural cover in the NHS mapping in **Section 7 - Maps**. Fish habitat in the NHS overlaps with features and areas in the WRS. The majority of these terms are defined in the Growth Plan. Some, but not all the definitions, have been included in the Glossary (**Section 8 - Glossary**). Not all these features or areas are necessarily present in the Etobicoke Creek watershed.	

The importance of these systems is reflected in the management framework in **Section 5 - Management Framework**, as the protection, enhancement, and restoration of each system is a goal of this watershed plan.

See **Section 7 - Maps** for maps of each system.

How was the WRS delineated?

The key hydrologic areas and key hydrologic features of the WRS were delineated using various techniques and methodologies. The key hydrologic areas and key hydrologic features of the WRS shown in the maps in **Section 7 - Maps** include updates/refinements made for the watershed plan (and are consistent with TRCA's updated 2022 WRS). There are some slight changes from the WRS maps presented in the Watershed Characterization Report which is referenced in **Section 9 - References** and is publicly available.

Highly Vulnerable Aquifers and SGRAs were delineated through Technical Rules established under the *Clean Water Act, 2006* for the purposes of source protection planning. ESGRAs were delineated using a model developed by the Oak Ridges Moraine Groundwater Program. The model results for ESGRAs were used to minimize the land area covered by these areas while still maintaining a high level of protection of hydrologic function for these ecosystems. Significant Surface Water Contribution Areas were delineated by overlaying SGRAs and ESGRAs to ensure areas of both volume contribution and recharge-discharge connections to sensitive features are a prevalent component of the WRS.

Each of the five key hydrologic features were delineated using a combination of satellite imagery, ArcHydro GIS, and field site verification.

While not a defined component of the WRS, Headwater Drainage Features (HDFs) are important surface water features that help maintain downstream aquatic health. HDFs are small, temporary streams, swales, or wetlands. HDFs were delineated through an assessment of existing data, satellite imagery, and field sampling. HDFs were classified according to TRCA's Evaluation, Classification, and Management of Headwater Drainage Features Guidelines as permanent (i.e. important hydrology functions), intermittent (i.e. valued or contributing hydrology functions), or unknown (i.e. either valued/contributing hydrology functions or limited hydrology functions). The assessment of HDFs conducted as part of this watershed planning process should be considered preliminary, with additional field verification to be completed if there is to be alteration to lands in the Headwaters. This is reflected in the management actions identified in **Section 5 - Management Framework**.

How was the Watershed Refined Enhanced NHS Delineated?

The features and areas of the watershed refined enhanced NHS were delineated using a robust systems-based methodology that incorporated multiple ecological criteria generated through models (e.g. habitat connectivity model, Landscape Analysis Model), information from recent satellite imagery, monitoring data, field site verification, and expert-based knowledge.

The features and areas of the watershed refined enhanced NHS were identified for their ecological value as existing and potential (i.e. areas targeted for restoration and enhancement) natural cover, to:

- Increase natural cover (e.g. forests, wetlands, meadows, etc.) quantity and quality by improving habitat patch size, shape, and connectivity in and around natural areas.
- Protect and restore biodiversity by incorporating multiple habitat types and mitigating the impacts of urban development on habitat function.
- Incorporate natural system vulnerabilities to climate change in planning processes to build a watershed refined enhanced NHS that is more sustainable and resilient.

FIGURE 8:
Before and After, Kings Park Stream Restoration (Mississauga)

FIGURE 9:
Etobicoke Creek, West of Pearson International Airport

3. Existing Watershed Conditions

Watershed characterization is a vital stage of the watershed planning process, which helps to understand current conditions in the watershed. As part of this watershed planning process, a technical report on watershed characterization was developed. This section summarizes key components of those technical analyses.

3.1 CONTEXT AND BACKGROUND

TRCA used the most recently available data and scientific methodologies to undertake watershed characterization. The complete Watershed Characterization Report is referenced in **Section 9 - References** and is publicly available.

The technical components outlined in **Table 2** were assessed as part of watershed characterization.

TABLE 2:
Summary of Technical Analyses for Watershed Characterization

Water Resource System	Natural Heritage System and Urban Forest
Involved the comprehensive delineation of the features and areas that comprise the WRS. Additionally, assessments of the condition and health of riparian corridors, fish and benthic communities, groundwater, streamflow, and aquatic habitat were undertaken. The presence of in-stream barriers was also characterized.	Involved the comprehensive delineation of the features and areas that comprise the NHS and urban forest. Habitat quantity, quality, terrestrial biodiversity, habitat connectivity, and climate vulnerabilities were assessed for the NHS. The amount of tree canopy, its composition, diversity, and health were assessed for the urban forest.
Water Quality	**Natural Hazards**
Involved the assessment of surface water quality parameters of concern and trends over time, as well as chemicals of emerging concern, microplastics, and spills.	Involved the characterization of flood and erosion risk in the watershed.

In addition to the technical components outlined in **Table 2**, watershed characterization also included the following technical analyses:

- **Stormwater management** - including an assessment of the proportion of the watershed with various levels of stormwater control (e.g. quantity or quality control).
- **Restoration planning** - including an assessment of completed restoration projects in the watershed and refinement of existing restoration opportunities.

3.2 HISTORICAL AND CURRENT LAND USES

The Etobicoke Creek watershed is heavily urbanized, resulting in low amounts of natural and rural land cover. **Table 3** illustrates land use change in the watershed from 2002 to 2019 for three generalized land use classifications: urban, rural, and natural. The amount of impervious cover (i.e. hard surfaces that prevent precipitation from penetrating the ground) was also calculated for these time periods.

TABLE 3:
Land Use Change

	2002 (area%)	**2012** (area%)	**2002 – 2012** (% change)	**2019** (area%)	**2012 – 2019** (% change)
URBAN	53%	56%	**+6%**	60%	**+5.4%**
RURAL*	33%	31%	**-5%**	28%	**-9%**
NATURAL	14%	13%	**-10%**	12%	**-3%**
IMPERVIOUS COVER (i.e. hard surfaces)	43%	46%	**+6%**	48%	**+5%**

*Rural includes land use classifications such as agriculture, golf courses, open space, hydro corridors, etc. These types of land uses cannot be considered natural, nor can they be considered urban as they have low amounts of impervious surfaces.

3.3 CURRENT STATE OF THE WATERSHED

Based on the watershed characterization technical analyses conducted (discussed in **Subsection 3.1 - Context and Background**), there are four key issues in the Etobicoke Creek watershed:

1 **WATER RESOURCE SYSTEM:** aquatic habitat conditions are poor, and the watershed has a high amount of runoff and in-stream barriers.

Among larger watersheds in TRCA's jurisdiction (i.e. >200 km^2), Etobicoke Creek has the second highest annual runoff at 402 mm/year, second only to the Don River.

The average habitat rating for fish is 'fair' and for benthic communities is 'poor'.

There has been little to no change in aquatic habitat quality since 2002. It is important to note that the amount of impervious surfaces in a watershed impacts the natural flow regime of watercourses, water temperature, and water quality which subsequently impacts aquatic species and ecosystems through changes in aquatic habitat quality. Environment Canada provides recommendations on impervious cover percentages and has defined the quality of aquatic habitat based on the amount of impervious cover in a catchment area where 'sensitive' quality habitat occurs when there is 0-10% impervious cover, and declines in aquatic habitat quality are demonstrated when impervious cover is greater than 11% (with greater than 25% impervious cover being non-supporting) (Environment Canada 2013, Schueler 1994). Therefore, to minimize impacts to aquatic habitat health, it is recommended that the impervious cover percentage (effective impervious cover) remains below 25%. See **Appendix A** for more details.

Additionally, there are a large number of in-stream barriers that prevent the movement of species and only approximately 50% natural cover within the riparian corridor (i.e. within 30 metres of streams).

2 **NATURAL HERITAGE SYSTEM AND URBAN FOREST:** there is a low amount of natural cover and habitat quality is generally 'poor'. The remaining natural cover is highly vulnerable to the effects of climate change.

Only approximately 12% of the watershed consists of natural cover, well below recommended targets (at least 30%) for long-term sustainability and resiliency.

There are some 'fair' quality habitat patches in the Headwaters, which support some sensitive plant and animal species.

Urban forest canopy cover (i.e. trees and tall shrubs) is approximately 15% and has remained stable from 2009 to 2018.

3 **WATER QUALITY:** surface water quality is generally poor compared to other TRCA watersheds.

Contaminants of particular concern include chlorides (e.g. from road salts), phosphorus (e.g. from fertilizers), *E. coli* bacteria (e.g. from sewage and animal wastes), and metals such as copper and zinc (e.g. from industrial sources and / or roadways).

Exceedances of chlorides and nitrates were also observed in groundwater.

4 **NATURAL HAZARDS:** the watershed has six Flood Vulnerable Clusters (FVCs) with a total area of 508 hectares (see **Figure 10**) and can be categorized as medium or high erosion sensitivity.

Table 4 provides a summary of certain watershed conditions and trends for each of these four key issues. Trends are assessed as changes from the baseline period (2002 – 2010) to current period (2011 – 2020). See the full Watershed Characterization Report for more details.

Difference between urban forest and natural cover

The term **urban forest** is used to describe the trees and woody shrubs located on all private and public property within a watershed, including urbanized spaces (i.e. along roads) and in forests. The percentage of urban forest cover is determined by the area covered by the canopies of all trees and shrubs in both built and natural areas.

Natural cover is the area of the watershed covered by natural habitats, including forests, meadows, and wetlands.

Natural cover includes habitats with varying amounts of trees and shrubs. Meadows for example are open habitats that do not contain trees. Although meadows are natural cover, they are not part of the urban forest. Conversely, the urban forest includes trees in built portions of the watershed that are not part of natural cover. For these reasons, the amount of natural cover and the amount of urban forest in a watershed will not be equal.

TABLE 4:
Summary of Watershed Characterization Results

	Current Conditions	Trend Assessment Between Baseline (2002 – 2010) and Current (2011 – 2020)
WATER RESOURCE SYSTEM		
Riparian Corridors	50% natural cover within corridor	Slight improvement (+1%)
Fish Community Health	Average IBI[1] Score: 22.7 (Fair)	No change
Benthic (i.e. insects, worms, molluscs) Community Health	Average FBI[2] Score: 6.57 (Poor)	No change
NATURAL HERITAGE SYSTEM / URBAN FOREST		
Habitat Quantity (i.e. total natural cover)	2,617 hectares 12% of watershed	Decrease (-14%)
Habitat Quality	Average LAM[3] Score: 7.51 (Poor)	No change
Urban Forest (i.e. canopy cover)	3,290 hectares 15% of watershed	No change
Urban Forest Health	Average condition is 80% (good) 20% are in poor or critical condition, dying or dead	Average condition declined by 4%, with the proportion of trees in poor condition or dead increased by 6%
WATER QUALITY		
Total Suspended Solids **(CWQG[4] = 30 mg/L)**	88% of samples met CWQG	Decrease (-6% or 6% fewer samples met objective in 2015-2019)
Chloride **(CWQG, chronic = 120 mg/L, acute = 640 mg/L)[5]**	7% of samples met chronic CWQG 70% of samples met acute CWQG	Decrease (-6%) for chronic Increase (+3%) for acute

[1]IBI stands for Index of Biotic Integrity and measures a set of metrics (number of fish species, presence of sensitive species, abundance, and food chain classifications) to assign a rating of very good (>38), good (28-37.9), fair (20-27.9), or poor (<20).

[2]FBI refers to Family Biotic Index, which is often used to assess the quality of water in rivers and has a rating scale of excellent (0-3.75), very good (3.76-4.25), good (4.26-5.0), fair (5.01-5.75), fairly poor (5.76-6.50), poor (6.51-7.25), or very poor (7.26-10).

[3]LAM, known as Landscape Analysis Model, combines the metrics of patch size (larger patches support larger populations), patch shape (habitat fragmentation), and matrix influence (influence of surrounding land uses) to determine an average score. LAM has a rating scale of excellent (13-15), good (11-12), fair (9-10), poor (6-8), or very poor (0-5).

[4]Canadian Water Quality Guidelines, are federal water quality guidelines for various parameters.

[5]Chronic refers to long-term exposure, compared to acute, which refers to short-term exposure.

	Current Conditions	Trend Assessment Between Baseline (2002 – 2010) and Current (2011 – 2020)
WATER QUALITY *(continued)*		
Total Phosphorus **(PWQO[6] = 30 ug/L)**	29% of samples met PWQO	Decrease (-2%)
Copper **(PWQO = 5 ug/L)**	72% of samples met PWQO	Decrease (-26%)
Zinc **(PWQO = 20 ug/L)**	78% of samples met PWQO	Decrease (-27%)
E. coli **(PWQO = 100 CFU / 100 mL)**	21% of samples met PWQO	Increase (+8%)
NATURAL HAZARDS		
Flooding (peak flows) **Based on 100-year[7] inflow at points for each of the six FVCs**	Brampton Central FVC = 78.8 m^3/s	Range from -1% to +7%[8]
	Avondale FVC, West Tributary = 23.5 m^3/s Avondale FVC, East Tributary = 29.8 m^3/s	Range from -0.4% to +1%[9] Range from +2% to +12%
	Little Etobicoke FVC = 37.1 m^3/s	Increase (+2%)
	Dixie / Dundas FVC = 106.9 m^3/s	Increase (+3%)
	Longbranch FVC = 359.0 m^3/s	Increase (+1%)

[6]Provincial Water Quality Objectives, refers to provincial water quality standards for various parameters.

[7]100-year refers to a rainfall event that statistically has a one percent chance of occurring in any given year, at any given place. This does not mean it will only occur once every 100 years.

[8]The Brampton Central and Avondale FVCs are the furthest upstream and closest to the areas of urban expansion in recent years and thus more sensitive to flows, so the trend is reported as a range (best and worst case). All other FVCs are reported as a single percent change.

[9]See previous footnote.

	Current Conditions	Trend Assessment Between Baseline (2002 – 2010) and Current (2011 – 2020)
NATURAL HAZARDS *(continued)*		
Flooding (peak flows) **Based on 100-year[7] inflow at points for each of the six FVCs**	West Mall FVC, West Tributary = 304.7 m^3/s West Mall FVC, East Tributary = 36.5 m^3/s	Increase (+1%) Increase (+1%)
Erosion Sensitive Stream Reaches[10] **(35 stream reaches were assessed)**	22 'Highly' erosion sensitive stream reaches 12 'Moderately' erosion sensitive stream reaches	Increase (+8) 'Highly' erosion sensitive stream reaches Decrease (-8) 'Moderately' erosion sensitive stream reaches[11]

[10]Current conditions are based on erosion sensitivity for 2020, while the trend is compared to 2010.

[11]Two of the stream reaches for 2010 are categorized as both moderate and high erosion sensitivity, and are thus included as both high and moderate in these numbers.

FIGURE 10:
FVCs and Brampton Esker

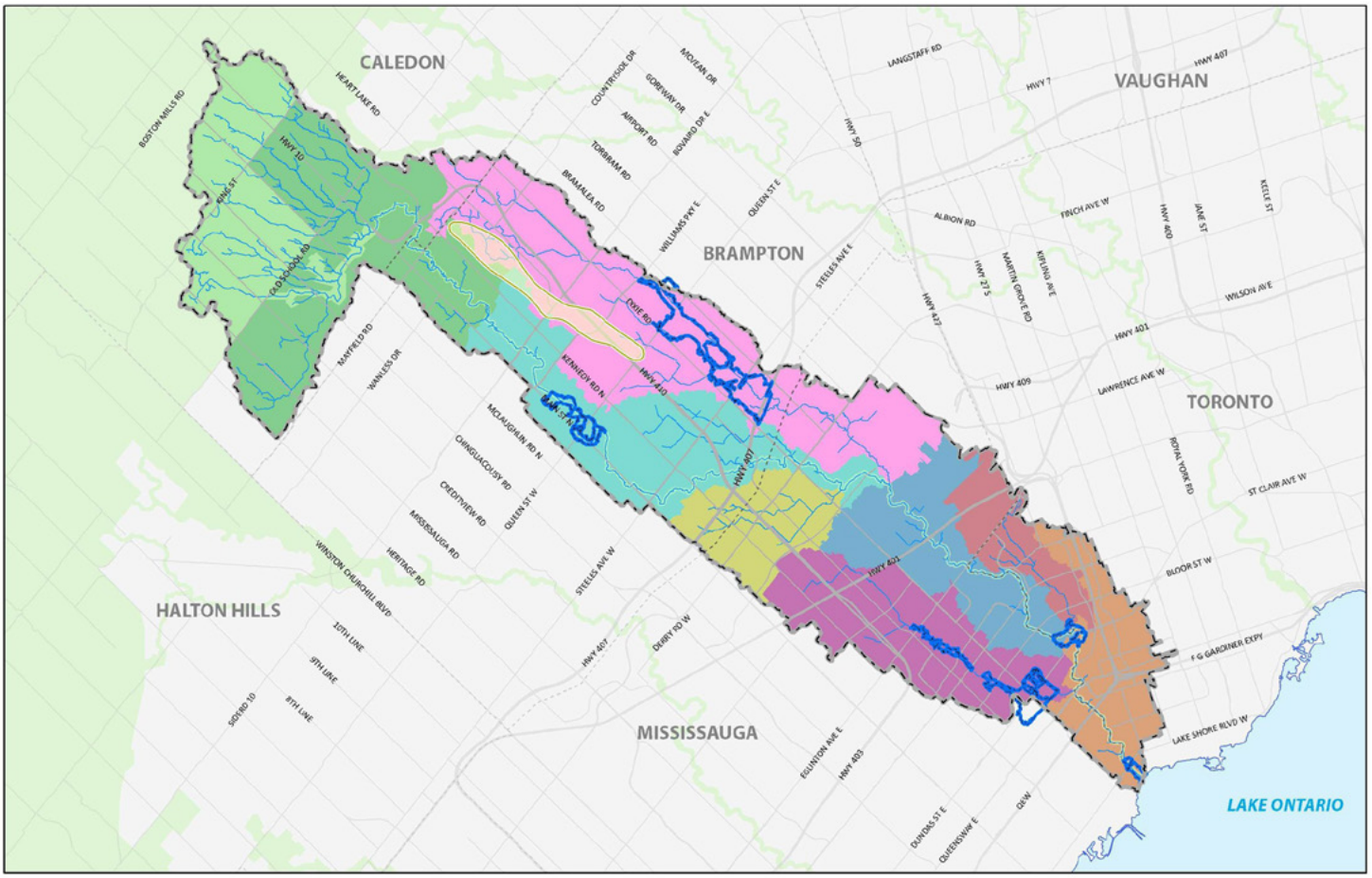


FIGURE 11:
Etobicoke Creek Just South of QEW

4. Future Watershed Conditions

Another important stage of the watershed planning process is assessing potential future conditions based on future land use scenarios and the impacts of climate change. The results of watershed characterization discussed in **Section 3 - Existing Watershed Conditions** informed the development of the future land use scenarios. An additional technical report documenting the results of the Future Management Scenario Analysis stage was produced, which is referenced in **Section 9 - References** and is publicly available.

4.1 FUTURE STRESSORS

To determine appropriate future land use scenarios, it is necessary to identify potential future stressors on a watershed. For Etobicoke Creek, the high levels of urbanization and low amounts of natural cover are key determinates of watershed health. Due to growth pressures in Peel Region, further urbanization in the currently rural part of the Headwaters of the Etobicoke Creek watershed is expected.

Climate change is expected to increase precipitation, annual average temperatures, and the frequency of extreme weather events, which will add further strain on a watershed like Etobicoke Creek. There are already six FVCs in this watershed and significant erosion risk, which is likely to increase with more frequent and intense precipitation events without significant watershed interventions. The fragmented and low quality and quantity of natural cover decreases the likelihood of ecosystem resilience to extreme weather events.

Climate change and further urbanization in the Headwaters were factored into the future management scenario analysis, as much as possible, to determine how these key stressors will potentially impact watershed health. For example, the flood risk analysis and water quality analysis included climate projections into watershed modelling, while climate vulnerabilities and the thermal regime were incorporated into the terrestrial and aquatic impact assessments respectively.

The management framework for the watershed plan outlined in **Section 5 - Management Framework** recognizes these two future stressors and identifies management actions to minimize and mitigate the impacts of urban development, while protecting, enhancing, and restoring ecosystems to improve climate adaptation and ecosystem resilience.

4.2 FUTURE SCENARIOS

An effective way to assess how a watershed will respond to potential future change is to develop, analyze, and compare several possible future management scenarios, each reflecting a different composition of land uses and mitigation measures. As a result, future management scenario analysis is a tool to compare how possible future land uses might affect watershed health.

Future management scenario analysis is a technical exercise to ensure management actions are based on the best available science. The results of modelling and technical impact assessments helped to guide the development of the management framework in **Section 5 - Management Framework**, and will support municipalities in land use and infrastructure planning.

The future management scenarios analyzed as part of this watershed planning process are hypothetical future land uses, and do not represent specific municipal planning decisions. In other words, the scenarios do not constitute a land use decision, or a particular recommendation on land use patterns and specific management interventions.

For the Etobicoke Creek watershed, the future management scenarios were designed to:

- Project potential future land use change based on growth projections by examining different land use and infrastructure practice scenarios to 2051 (i.e. planning horizon for municipal Official Plans).
- Assess the effects of different levels of ecosystem restoration and enhancement (e.g. increase in natural cover quantity and quality) on watershed conditions.
- Assess the effects of different levels of stormwater control on watershed conditions.
- Assess the potential impacts of climate change on watershed conditions, where possible.

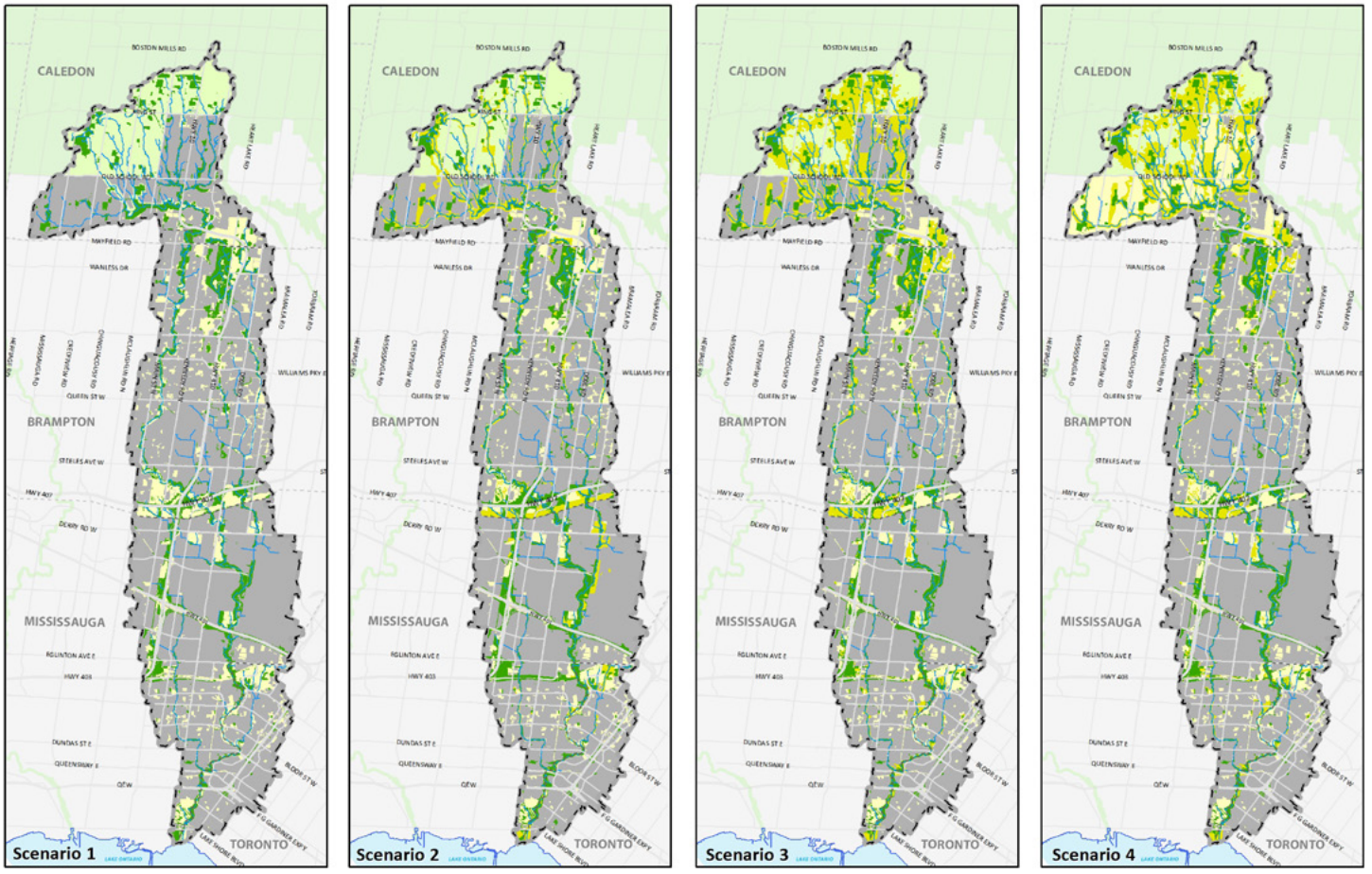
Four future management scenarios were assessed (see **Figure 12**). The baseline for comparison is the current conditions of the watershed as identified in **Section 3 - Existing Watershed Conditions**. **Table 5** provides a description and rationale for each of the four future management scenarios.

TABLE 5:
Summary of Future Management Scenarios

	Description	Rationale
Scenario 1: **Urban Expansion with Minimal Enhancements**	Assumes urbanization of the remaining whitebelt* lands in the Headwaters. No enhancements to natural cover or stormwater management.	Compares current conditions to further urbanization in the Headwaters with minimal other watershed enhancements.
Scenario 2: **Urban Expansion with Mid-range Enhancements**	Same as Scenario 1, with some enhancements to stormwater management, urban forest, and natural cover. Includes the potential Greater Toronto Area West Highway (i.e. Highway 413).	Compares additional watershed interventions to Scenario 1 to determine the relative benefits of the enhancements.
Scenario 3: **Urban Expansion with Optimal Enhancements**	Same as Scenario 1, with a greater level of enhancements to stormwater management, urban forest, and natural cover than Scenario 2.	Compares an even higher level of watershed interventions to Scenario 1 to determine the relative benefits of the enhancements.
Scenario 4: **Existing Urban Boundary with Optimal Enhancements**	Same as Scenario 3, except the current urban boundary is maintained in the Headwaters.	Compares the same high level of interventions as Scenario 3 without further urbanization to determine the relative benefits of the enhancements and maintaining the existing urban boundary.

***Note:**
The whitebelt refers to lands between the built boundary of urban settlement areas and the boundary of the Greenbelt Plan Area.

FIGURE 12:
Future Management Scenarios



At the time that the future management scenarios were developed and analyzed, many municipalities were in the process of updating their Official Plans, thus mapping (including the projected urban boundaries) may differ from mapping in municipal Official Plans. However, these differences are not expected to change the key messages of the analyses, which still provide useful insights to inform decision-making.

See the full Future Management Scenario Analysis technical report for more information on the assumptions that went into each scenario.

4.3 SCENARIO ANALYSIS

The key findings of the Etobicoke Creek watershed future management scenario analyses are organized into four watershed components: WRS, NHS and Urban Forest, Water Quality, and Natural Hazards. **Table 6** provides further details on potential future watershed conditions associated with each future management scenario for each of these watershed components. Potential future conditions are expressed by percent change for each component.

For all the calculations of percent change, Scenario 1 is compared to current conditions, while Scenarios 2, 3, and 4 are compared to Scenario 1. This is to compare and assess the relative benefits of the different levels of enhancements in Scenarios 2, 3, and 4 against the minimal enhancements in Scenario 1. To aid in interpreting the results in **Table 6**, percent change is colour-coded to indicate whether watershed conditions improve, are roughly equal, deteriorate, or significantly deteriorate from a hydrological or ecological perspective.

- **>+5% change**, watershed conditions improve
- **0 to +5% or 0 to –5% change**, watershed conditions stay roughly the same
- **-6% to –10% change**, watershed conditions deteriorate
- **>-10% change**, watershed conditions significantly deteriorate

It is important to note that percent change is identified by the thresholds listed solely based on watershed conditions and not whether the report value is a positive or negative number. For example, a decrease in chloride concentrations or peak flows is a good thing from a hydrological or ecological perspective and would be presented as a positive percent change in **Table 6**.

As noted earlier, future management scenario analysis does not result in decisions about the type and configuration of land uses. Instead, future management scenario analysis helps to inform decisions through the municipal planning process.

It is the responsibility of the applicable municipality to determine the ultimate land use configuration for any future changes in the watershed.

Appropriate mitigation strategies are developed during the detailed planning strategies for new developments. These mitigation strategies may include assessments on the appropriate levels of stormwater controls, the use of green infrastructure, and opportunities for ecological restoration.

TABLE 6:
Summary of Future Management Scenario Results

WATER RESOURCE SYSTEM

Watershed Plan Component		CURRENT CONDITIONS (2019)	SCENARIO 1 Urban Expansion + Minimal Enhancements (compared to Current Conditions)	SCENARIO 2 Urban Expansion + Mid-range Enhancements (compared to Scenario 1)	SCENARIO 3 Urban Expansion + Optimal Enhancements (compared to Scenario 1)	SCENARIO 4 Existing Urban Boundary + Optimal Enhancements (compared to Scenario 1)
WATER RESOURCE SYSTEM						
Riparian Corridors	Area (ha)	600	600	758	797	797
	% change	**N/A**	**0%**	**26%**	**33%**	**33%**
Aquatic Habitat Quality[12]	Area (ha)	10,719	11,663	11,531	11,220	10,538
	% change	**N/A**	**-9%**	**1%**	**4%**	**10%**
Groundwater recharge[13]	mm/yr	133	119	124	128	138
	% change	**N/A**	**-11%**	**4%**	**8%**	**16%**
Groundwater discharge[14]	mm/yr	118	107	111	114	122
	% change	**N/A**	**-9%**	**4%**	**7%**	**14%**

[12]This is based on the amount of impervious cover in the watershed as a metric of aquatic habitat quality. Aquatic habitat quality is expected to decrease as impervious cover increases (and it is recommended that effective impervious cover remains below 25%).

[13]The current conditions results for groundwater recharge are based on the model results from the future management scenario analysis rather than baseflow analysis completed during watershed characterization.

[14]See footnote 13.

NATURAL HERITAGE SYSTEM / URBAN FOREST

Watershed Plan Component		CURRENT CONDITIONS (2019)	SCENARIO 1 Urban Expansion + Minimal Enhancements (compared to Current Conditions)	SCENARIO 2 Urban Expansion + Mid-range Enhancements (compared to Scenario 1)	SCENARIO 3 Urban Expansion + Optimal Enhancements (compared to Scenario 1)	SCENARIO 4 Existing Urban Boundary + Optimal Enhancements (compared to Scenario 1)
NATURAL HERITAGE SYSTEM / URBAN FOREST						
Habitat quantity (natural cover)	Area (ha)	2,617	2,617	4,153	5,108	5,108
	% change	**N/A**	**0%**	**59%**	**95%**	**95%**
Habitat Quality	Average LAM score	7.56	7.33	7.47	7.74	7.91
	% change	**N/A**	**-3%**	**2%**	**6%**	**8%**
Urban forest (canopy cover)	Area (ha)	3,290	3,290	4,338	5,947	5,984
	% change	**N/A**	**0%**	**32%**	**81%**	**82%**

WATER QUALITY

Watershed Plan Component		CURRENT CONDITIONS (2019)	SCENARIO 1 Urban Expansion + Minimal Enhancements (compared to Current Conditions)	SCENARIO 2 Urban Expansion + Mid-range Enhancements (compared to Scenario 1)	SCENARIO 3 Urban Expansion + Optimal Enhancements (compared to Scenario 1)	SCENARIO 4 Existing Urban Boundary + Optimal Enhancements (compared to Scenario 1)
WATER QUALITY[15]						
Chlorides[16]	% change	N/A[17]	30%	-49%	-3%	-6%
TSS	% change	N/A[17]	-21%	68%	135%	186%

[15]Percent change for water quality is based on averages for all stream segments. Results for chlorides are presented as winter season only, while TSS results are for all seasons.

[16]Based on modelling results, average chloride concentrations decreased overall under all future management scenarios. However, the magnitude of the decrease was variable, especially in the winter season. In Scenario 1, chloride concentrations decreased from current conditions (percent change by 30%) reflecting positive watershed conditions despite urbanization. This is largely due to implications of climate change that result in reduced salt use. In Scenario 2, chloride concentrations were higher than Scenario 1 due to the proposed GTA West Highway and the additional expected road salting in winter months. Lastly, Scenarios 3 and 4 had similar (but slightly greater) chloride concentrations than Scenario 1 again suggesting that changes in urbanization and enhancements had less of an impact compared to climate change implications resulting in reduced salt use. Please see the Etobicoke Creek Watershed Future Management Scenario Analysis technical report (referenced in Section 9 and publicly available) for more details on the water quality results. It is important to note that, although climate change seems to be driving a decrease in chloride concentrations in the watershed, concentrations are already high, affecting aquatic life.

[17]Due to the partially calibrated nature of the water quality model, absolute concentrations are not being reported. Instead, percent change observed in the model is reported for the future scenarios, with Scenario 1 still being compared to current conditions.

NATURAL HAZARDS - FLOODING

Watershed Plan Component		CURRENT CONDITIONS (2019)	SCENARIO 1 Urban Expansion + Minimal Enhancements (compared to Current Conditions)	SCENARIO 2 Urban Expansion + Mid-range Enhancements (compared to Scenario 1)	SCENARIO 3 Urban Expansion + Optimal Enhancements (compared to Scenario 1)	SCENARIO 4 Existing Urban Boundary + Optimal Enhancements (compared to Scenario 1)
NATURAL HAZARDS - FLOODING[18]						
Flood risk (100-year storm at Dixie/Dundas FVC without climate change)	Peak flow (m^3/s)	107	108	106	91	91
	% change	**N/A**	**-1%**	**3%**	**16%**	**16%**
Flood risk (100-year storm at Dixie/Dundas FVC with climate change)	Peak flow (m^3/s)	107	134	132	121	121
	% change	**N/A**	**-26%**	**1%**	**10%**	**10%**
Flood risk (5-year storm at Dixie/Dundas FVC without climate change)	Peak flow (m^3/s)	63	64	59	42	42
	% change	**N/A**	**-1%**	**8%**	**34%**	**34%**
Flood risk (5-year storm at Dixie/Dundas FVC with climate change)	Peak flow (m^3/s	63	68	64	47	47
	% change	**N/A**	**-9%**	**7%**	**31%**	**31%**

[18]See the full Future Management Scenario Analysis technical report for full flood and erosion risk results. For the purposes of this watershed plan, a sample from two design storms at one FVC is used to illustrate changes in flood risk associated with the future management scenarios. For erosion risk, the Headwaters and Lower Etobicoke subwatersheds are shown with results for Cumulative Effective Work and Time of Exceedance.

NATURAL HAZARDS - EROSION

Watershed Plan Component		CURRENT CONDITIONS (2019)	SCENARIO 1 Urban Expansion + Minimal Enhancements (compared to Current Conditions)	SCENARIO 2 Urban Expansion + Mid-range Enhancements (compared to Scenario 1)	SCENARIO 3 Urban Expansion + Optimal Enhancements (compared to Scenario 1)	SCENARIO 4 Existing Urban Boundary + Optimal Enhancements (compared to Scenario 1)
NATURAL HAZARDS - EROSION[18]						
Erosion risk based on Cumulative Effective Work Index[19] (CEW) in Headwaters	**% change**	**N/A[20]**	**-128%**	**18%**	**35%**	**58%**
Erosion risk based on CEW in Lower Etobicoke	**% change**	**N/A[21]**	**-13%**	**35%**	**48%**	**53%**
Erosion risk based on Time of Exceedance[22] (TOE) in Headwaters	**% change**	**N/A[23]**	**-104%**	**17%**	**32%**	**48%**
Erosion risk based on TOE in Lower Etobicoke	**% change**	**N/A[24]**	**-8%**	**36%**	**51%**	**54%**

[19]Cumulative Effective Work index, CEW, provides a measure of the energy expended by the channel above the threshold discharge, or critical shear stress value. Larger values of CEW imply greater potential for erosion of the channel material.

[20]The continuous erosion modelling conducted calculated CEW in Newtons/metre, but only the results as percent change for the future management scenarios are shown here.

[21]See footnote 20.

[22]Time of Exceedance, TOE, provides a measure of the total amount of time over which the threshold, or critical flow, is exceeded in the channel. Larger values of TOE imply a larger total time period during which the channel could erode.

[23]The continuous erosion modelling conducted calculated TOE in hours, but only the results as percent change for the future management scenarios are shown here.

[24]See footnote 23.

The following summary illustrates expected changes to watershed conditions based on available information and assessments conducted as part of this watershed planning process. The management framework in **Section 5 - Management Framework** identifies what is necessary to protect, enhance, and restore watershed conditions.

Summary of implications:

Water Resource System	• Aquatic habitat quality will decrease as impervious surface amounts increase (and will likely become non-supporting if effective impervious cover exceeds 25%). • With increasing urbanization, more sensitive fish species will be replaced with species more tolerant of disturbance, and benthic communities will shift towards more pollution tolerant species. • With natural cover enhancements, the number of coolwater, coldwater, and stable temperature stream reaches could increase and make the system more resilient to climate change. • Groundwater discharge and recharge will be negatively affected in the Headwaters without enhancements to natural cover, urban forest, stormwater management, and LID implementation.
Natural Heritage System and Urban Forest	• Even with optimal natural cover enhancements, this watershed remains below recommended federal guidelines for natural cover quantity and TRCA's terrestrial NHS target, but any increase will provide a benefit to biodiversity and other ecosystem services. • There are opportunities to increase the quantity and quality of the urban forest to provide ecosystem goods and services, increase climate resiliency, and provide socio-economic benefits.
Water Quality	• Changes in water quality parameters (e.g. TSS and chlorides) demonstrate the impact of urbanization and the benefits of improved stormwater management and natural cover enhancements in a changing climate.
Natural Hazards	• Optimal enhancements to natural cover and stormwater management help reduce peak flow levels, though not as effectively when climate change is factored in. • Land use changes can manage peak flows for all design storms through enhancements and interventions (if TRCA's stormwater management criteria for the Etobicoke Creek Headwaters is applied), but climate change will cause peak flows to exceed current stormwater infrastructure design standards. • Increasing enhancements to natural cover and stormwater management help mitigate erosion, which would otherwise increase with further urbanization.

What does this mean?

These results demonstrate the importance of ensuring that land use and infrastructure planning decisions are made to minimize and mitigate impacts to the watershed regardless of potential future land use configurations. The results also clearly demonstrate the benefits of increased watershed enhancements to the quantity of quality of natural cover and urban forest, improved stormwater management, and greater use of LID infrastructure.

The results of this future management scenario analysis emphasize the importance of protecting, enhancing, and restoring the WRS and NHS as identified in this watershed plan.

Climate change, combined with a heavily urbanized and already degraded watershed, has the potential to further reduce watershed health and increase the risk to watershed residents and infrastructure (i.e. through more frequent and intense flooding and erosion).

The management framework outlined in **Section 5 - Management Framework** is designed to address existing watershed issues and the implications of these future management scenarios by identifying actions to improve watershed conditions and increase resiliency to the impacts of climate change, by:

- Limiting impervious cover as much as possible, or mitigating it through the use of green infrastructure and LID.
- Increasing natural cover and improving terrestrial and aquatic habitat quality through targeted ecological restoration and urban forest canopy enhancements.
- Ensuring municipal policies and programs are in place to achieve best management practices and mitigate the impacts of urban development on watershed health.

FIGURE 13:
Etobicoke Creek Trail South of 401

5. Management Framework

The role of municipalities in watershed planning is to implement the watershed planning requirements/guidance of provincial legislation, plans, and the PPS. Watershed planning helps municipalities make informed decisions on where and how to grow in a way that minimizes and/or mitigates impacts to watershed health. Watershed plans can also be an excellent resource to municipalities to inform various initiatives including greenlands securement and management planning and green infrastructure and/or stormwater management retrofit planning, and to contribute to urban revitalization strategies where natural heritage restoration or flood remediation strategies may be needed.

The management framework for the Etobicoke Creek Watershed Plan represents what needs to be done to protect, enhance, and restore watershed health. The management framework consists of goals, objectives, indicators, and management actions (described in **Table 7**).

TRCA developed this management framework in collaboration with its partners and based on feedback from stakeholders and the public.

The management framework was developed to address the issues identified during the watershed characterization stage and to mitigate potential future stressors (i.e. urban expansion, climate change) as identified during the future management scenario analysis stage. Regardless of potential future land use, the management framework is designed to minimize and mitigate potential future watershed impacts.

Each of the goals are complementary, with no one goal being more important than another. To fully realize the vision for the Etobicoke Creek watershed, collaborative and comprehensive implementation of all aspects of this management framework is essential. Management actions are grouped under the most relevant objective and are also in no particular order.

TABLE 7:
Management Framework Explanation

Management Framework Components	Description
GOALS	Represent the outcomes to achieve.
OBJECTIVES	Are the specific statements about desired results, or steps to be undertaken, to achieve the goal.
INDICATORS	Explain how progress on implementing the objectives is going to be tracked or measured.
MANAGEMENT ACTIONS	Specifically explain what needs to be done, and by what partner, to accomplish the relevant objective.

The management framework consists of three goals, eight objectives, ten indicators, and 38 management actions (see **Figure 14**).

The management actions apply to the entire watershed, unless otherwise specified. For example, there are specific management actions for the Town of Caledon in the Headwaters subwatershed in the event of future urban expansion. The majority of the other management actions directed at municipal partners apply to areas of the watershed that already have urban land uses. The management actions are numbered to correspond with their applicable goal and objective.

FIGURE 14:
Overview of Management Framework

GOAL 1

Land Use

Achieve sustainable land use and infrastructure development patterns to improve watershed conditions and enhance climate resiliency.

OBJECTIVE 1
Minimize the impacts of human land uses through the adoption and implementation of sustainability policies, low impact development (LID), and green infrastructure.

Indicator:
Complete LID or green infrastructure projects in each of the identified priority areas (**Map 1**).

OBJECTIVE 2
Retrofit, upgrade, and install stormwater infrastructure using best available technologies to reduce the impacts of untreated runoff entering receiving waters.

Indicator:
Evaluate improvements to stormwater management across the watershed through municipal tracking and reporting on stormwater assets, drainage areas (i.e. sewersheds), and service levels.

OBJECTIVE 3
Reduce the risks associated with natural hazards through enhanced flood and erosion mitigation.

Indicators:
Flooding: implement risk reduction measures in 50% of Flood Vulnerable Clusters.

Erosion: work towards remediating the 11 infrastructure hazard sites identified in **Map 2**.

OBJECTIVE 4
Encourage the use of agricultural best management practices to minimize agricultural runoff and improve rural land stewardship.

Indicator:
Track the number of landowners that implement best management practices.

GOAL 2

Water Resource System

Protect, enhance, and restore the areas and features that comprise the Water Resource System (including aquatic habitat) for ecosystem resilience and sustainability.

OBJECTIVE 1
Implement appropriate policies and programs that identify, protect, enhance, and restore the areas and features that comprise the Water Resource System.

Indicator:
Complete restoration projects at 75% of identified priority aquatic sites (**Maps 4A and 4B**).

OBJECTIVE 2
Improve aquatic habitat connectivity and reduce the impacts of pollutants on aquatic health.

Indicator:
Maintain, or improve, aquatic health rankings.

GOAL 3

Natural Heritage System and Urban Forest

Protect, enhance, and restore the Natural Heritage System and urban forest within the watershed to improve ecosystem resilience and sustainability.

OBJECTIVE 1
Improve the quality and quantity of the Natural Heritage System through ecosystem and biodiversity protection, enhancement, and restoration.

Indicators:
Habitat Quantity: increase total natural cover in the watershed.

Habitat Quality: maintain, or improve, terrestrial ecosystem quality rankings.

OBJECTIVE 2
Increase urban forest canopy cover throughout the watershed to improve social and environmental well-being.

Indicator:
Increase canopy cover in the watershed to achieve a minimum target of 16%.

5.1 LAND USE / INFRASTRUCTURE GOAL

GOAL 1

Achieve sustainable land use and infrastructure development patterns to improve watershed conditions and enhance climate resiliency.

This goal focuses on the policy, land use, and infrastructure planning processes that influence the health of the watershed. Management actions (outlined in **Table 8**) focus on mitigating the impacts of current urban development or agricultural lands uses and minimizing future impacts from potential urban expansion. Due to the heavily urbanized nature of this watershed, utilizing the highest urban development standards, improving stormwater management, mitigating natural hazards, and improving agricultural land uses will be essential to ensure the long-term health of watershed ecosystems and to improve climate resiliency.

The decision of whether to proceed with the construction of the Greater Toronto Area (GTA) West Highway (Highway 413) rests with the province. Some municipal Councils (e.g. Region of Peel Council, March 2021) within the Etobicoke Creek watershed have rescinded their support for this transportation corridor and have passed motions in opposition to the Highway while urging the province to consider alternatives. This watershed plan includes a management action (1.1.3) intended to mitigate watershed impacts of this Highway, as much as possible, which is directed at the Ministry of Transportation should construction of the Highway proceed.

TABLE 8:
Land Use Management Actions

Land Use Objective	Management Actions
LAND USE OBJECTIVE 1 Minimize the impacts of human land uses through the adoption and implementation of sustainability policies, low impact development (LID), and green infrastructure.	**1.1.1** Municipal partners, in collaboration with TRCA, to adopt green development policies, or standards, requiring new developments and redevelopments, to utilize low impact development and green infrastructure techniques to limit the impacts of impervious cover and maintain predevelopment water balance consistent with or exceeding provincial standards or guidance. Understanding that the provincial guidance has not yet been finalized, the current recommendation is; a. through the control hierarchy of: i. retention (i.e. infiltration, reuse, or evapotranspiration) ii. LID volume capture and release (i.e. LID filtration) iii. stormwater volume detention and release (only once maximum control from steps i and ii have been exhausted) b. shall strive to meet the hydrology model recommended watershed runoff volume control target of the 90th percentile of a 12-hour event, where rainfall depth is approximately 27-29 mm c. shall adhere to best practices for water quality, erosion, and sediment control
	1.1.2 Municipal partners, in collaboration with TRCA, to review and update existing policies, bylaws, guidelines, standards, secondary plans, and master plans to: a. ensure consistency with the goals and objectives of this watershed plan b. ensure best practices are implemented and the highest standards applied across the watershed for matters related to: i. safeguarding against natural hazard risks ii. Water Resource System and Natural Heritage System protection, enhancement, and restoration iii. improving water quality and protecting water quantity for drinking water and ecological needs c. establish a policy evaluation process to assess the effectiveness of policy frameworks consistent with the monitoring of watershed and local trends (i.e. if indicators are not improving, what needs to be done?)
	1.1.3 Prior to the construction of the GTA West Highway, if approved, the Ministry of Transportation should include in design and construction authorizations: a. appropriate mitigation measures to ensure the natural hazard risks of flooding and erosion will not increase b. appropriate mitigation measures to demonstrate how the Natural Heritage System and Water Resource System will be protected, enhanced, and restored, including ecosystem compensation (once the protection hierarchy of avoid, minimize, and mitigate has been applied) c. appropriate mitigation measures to maintain ecological function and wildlife connectivity

Land Use Objective	Management Actions
LAND USE OBJECTIVE 1 Minimize the impacts of human land uses through the adoption and implementation of sustainability policies, LID, and green infrastructure.	**1.1.4** Municipal partners, in collaboration with other levels of government and TRCA, to work to reduce the amount of chlorides entering the watershed by: a. continuing to implement best management practices for winter de-icing procedures on public property b. continuing education and outreach on salt management for private property
	1.1.5 TRCA, in collaboration with municipal partners, will: a. update relevant stormwater management criteria guidance (consistent with the provincial standards/guidelines) to focus on retention (infiltration and reuse) and filtration to minimize the impacts of new development through the use of LIDs and green infrastructure b. continue to advocate to the Province to update the stormwater volume control guidelines and regulatory framework at the local level
LAND USE OBJECTIVE 2 Retrofit, upgrade, and install stormwater infrastructure using best available technologies to reduce the impacts of untreated runoff entering receiving waters.	**1.2.1** Municipal partners, in collaboration with TRCA, to prioritize on-site control through LID or green infrastructure in the priority areas identified on **Map 1**, or as opportunities arise through municipal capital planning for linear projects (i.e. road improvements) or other initiatives (e.g. sustainable community retrofit projects).
	1.2.2 Municipal partners, in collaboration with TRCA, through stormwater master planning to continue to: a. utilize best management practices for stormwater management and consistent design criteria to manage runoff quantity, quality, erosion, and water balance b. implement or continue to advance municipal stormwater cost recovery funding options (e.g. stormwater charges) to reduce effective impervious surfaces in the watershed c. examine opportunities to retrofit outdated stormwater infrastructure and install controls in areas without management through long-term planning and investment strategies (recommended target for watershed to be less than 25% effective impervious cover to minimize impacts to aquatic ecosystem health through the implementation of LIDs and green infrastructure) d. adaptively manage stormwater infrastructure through operation and maintenance schedules and procedures e. take a watershed approach to master planning by coordinating efforts and investment strategies with neighbouring watershed municipalities f. factor in the impacts of climate change on stormwater infrastructure

Land Use Objective	Management Actions
LAND USE OBJECTIVE 2 Retrofit, upgrade, and install stormwater infrastructure using best available technologies to reduce the impacts of untreated runoff entering receiving waters.	**1.2.3** For new developments, municipal partners to have regard for TRCA criteria that requires hydrologic analysis and erosion threshold assessments downstream of potential stormwater detention facilities (e.g. stormwater ponds) that need to demonstrate no negative, or adverse, downstream impacts, prior to municipal approvals.
	1.2.4 The Greater Toronto Airports Authority, in collaboration with TRCA, to implement appropriate stormwater management measures to improve the quality and quantity of stormwater from airport lands.
	1.2.5 Municipal partners, in collaboration with TRCA, to continue to advance stormwater infrastructure retrofit projects that minimize impacts to the NHS and are outside of the floodplain and identify opportunities for more natural infrastructure solutions.
LAND USE OBJECTIVE 3 Reduce the risks associated with natural hazards through enhanced flood and erosion mitigation.	**1.3.1** TRCA, in collaboration with municipal partners, will: a. focus first on Special Policy Areas to continue to characterize flood risk within Flood Vulnerable Clusters b. develop outreach initiatives to educate the public on roles and responsibilities when living in a flood risk area c. enhance flood forecasting and warning systems d. undertake detailed technical studies and Environmental Assessments e. support implementation of flood mitigation strategies in each Flood Vulnerable Cluster
	1.3.2 Municipal partners, in collaboration with TRCA, to implement appropriate flood mitigation measures at the six Flood Vulnerable Clusters as recommended in relevant studies and reports.
	1.3.3 TRCA, in collaboration with municipal partners, to educate property owners in high flood risk areas about proper lot level practices (e.g. removing hydraulic impairments).
	1.3.4 During planning for transportation infrastructure improvement projects, or new crossings, the City of Toronto, Region of Peel, and lower-tier municipalities to implement best management practices for siting and design in accordance with TRCA's Valley and Stream Corridor Crossings Guideline, to facilitate hydraulic and hydrologic functions of crossings to avoid and / or mitigate flood risk, slope instability, and erosion risk.

Land Use Objective	Management Actions
LAND USE OBJECTIVE 3 Reduce the risks associated with natural hazards through enhanced flood and erosion mitigation.	**1.3.5** TRCA and municipal partners will continue to prioritize the maintenance of their respective erosion and flood control assets and the remediation of infrastructure hazard sites based on erosion and flood risk.
	1.3.6 TRCA will continue to work towards remediating infrastructure hazard sites at risk of erosion on a reach-based approach in collaboration with municipal partners (see **Map 2** for 11 sites forecasted for remediation between 2019 and 2029).
	1.3.7 TRCA will regularly collect Light Detection and Ranging (LiDAR) data to allow for robust geospatial analyses of significant terrain movement, and to monitor erosion hazards threatening essential infrastructure and degrading erosion control structures (TRCA assets), and will provide accurate base mapping for flood mapping and modelling projects.
LAND USE OBJECTIVE 4 Encourage the use of agricultural best management practices to minimize agricultural runoff and improve rural land stewardship.	**1.4.1** In collaboration with the agricultural community and provincial ministries, TRCA, the Region of Peel, City of Brampton, and Town of Caledon, to identify opportunities to expand best management practices that reduce agricultural runoff and improve water management, such as: a. using cover crops, and/or leaving crop residue b. adopting no till farm practices during the non-growing season c. conducting soil testing for nutrients and adjusting fertilizer application rates, if required
	1.4.2 In collaboration with the agricultural community, rural land owners, and provincial ministries, TRCA, the Region of Peel, City of Brampton, and Town of Caledon, to identify opportunities to improve rural land stewardship practices through: a. improving education and outreach about the benefits of utilizing best management practices to improve habitat (e.g. meadows for sensitive bird species) and how efforts can have mutual benefits towards agricultural practices (e.g. windrows, reduced erosion, pollinator habitat, etc.) b. incentivizing increased tree canopy and naturalized vegetation buffers between agricultural lands and natural and/or Water Resource System features and areas c. incentivizing the implementation of Environmental Farm Plans and other rural land stewardship programs (e.g. TRCA's Rural Clean Water Program)

5.2 WATER RESOURCE SYSTEM GOAL

GOAL 2

Protect, enhance, and restore the areas and features that comprise the Water Resource System (including aquatic habitat) for ecosystem resilience and sustainability.

This goal focuses on ensuring policies are in place for the long-term protection of the WRS, while implementing programs to enhance and restore aquatic habitat and riparian corridors. The WRS is presented in **Maps 3A** and **3B**. The areas and features that comprise the WRS are to be protected in accordance with the management actions outlined below, and municipal and provincial policies.

The WRS in the Etobicoke Creek watershed is currently stressed, with limited natural cover, poor water quality, and poor aquatic habitat conditions. Implementing the management actions in **Table 9** will be essential to enhancing the health of the WRS and adapting to climate change.

TABLE 9:
WRS Management Actions

WRS Objective	Management Actions
WRS OBJECTIVE 1 Implement appropriate policies and programs that identify, protect, enhance, and restore the areas and features that comprise the Water Resource System.	**2.1.1** The City of Toronto, Region of Peel, and lower-tier municipalities, in collaboration with TRCA, to ensure the protection of the Water Resource System (**Map 3A** and **Map 3B**) and its functions by: a. updating Official Plans and zoning bylaws to identify and protect the Water Resource System b. assessing existing standards, policies, and guidelines for land use and infrastructure development to ensure they reflect provincial policy direction to protect, enhance, and restore the quality and quantity of water c. avoiding development near key hydrologic features through the establishment of appropriate buffers d. requiring the implementation of appropriate mitigation measures where avoidance of key hydrologic areas is not possible, to maintain hydrologic functions
	2.1.2 The Town of Caledon, in collaboration with TRCA, to require Headwater Drainage Feature classification and relevant management approaches as per the Evaluation, Classification and Management of Headwater Drainage Features Guidelines, prior to planning approvals in the Headwaters subwatershed.

WRS Objective	Management Actions
WRS OBJECTIVE 1 Implement appropriate policies and programs that identify, protect, enhance, and restore the areas and features that comprise the Water Resource System.	**2.1.3** The Town of Caledon, in collaboration with the Region of Peel and TRCA, to establish policies to ensure that the Headwaters of Etobicoke Creek maintains less than 25% effective impervious cover (in accordance with **Appendix A**) as urbanization increases to minimize impacts to aquatic ecosystem health, and to demonstrate through a subwatershed plan (or equivalent), prior to the approvals of any secondary plans in the Headwaters, that: a. key hydrologic features will be protected and hydrologic functions maintained b. where avoidance of key hydrologic areas is not possible, appropriate mitigation measures are to be implemented to maintain downstream hydrologic functions c. there will be no negative or adverse downstream effects, such as increased flooding, erosion, or deteriorated water quality through a hydraulic analysis (to quantify and map depth and extent of impacts) and other relevant modelling
	2.1.4 TRCA, in collaboration with municipal partners, to prioritize the restoration of aquatic sites identified on **Map 4A** and **Map 4B**, which have been selected for contributing to the following: a. enhancing habitat quality and watershed connectivity b. enhancing natural cover within riparian corridors c. ensuring biodiversity persists d. improving watershed resiliency to climate change
	2.1.5 The City of Brampton to ensure development applications for high density on the Brampton Esker (**Map 5**) include a hydrogeological study to confirm foundation stability and groundwater control, prior to planning approvals.
	2.1.6 The City of Brampton and TRCA, in collaboration with the Region of Peel, to develop an alternative groundwater control strategy for the Highway 410/ Bovaird Drive area to prepare for the potential situation that dewatering by the Turnberry Golf Club ceases or becomes ineffective.

WRS Objective	Management Actions
WRS OBJECTIVE 2 Improve aquatic habitat connectivity and reduce the impacts of pollutants on aquatic health.	**2.2.1** TRCA, in collaboration with municipal partners and landowners, to remove the priority barriers to fish movement identified on **Map 6**.
	2.2.2 TRCA and municipal partners, in collaboration with industrial and commercial landowners and the province, to: a. identify high risk spill areas and implement effective spill prevention and contingency plans in accordance with provincial regulations b. educate commercial and industrial property owners on effective maintenance of oil and grit separators, and other pollution control infrastructure
	2.2.3 TRCA and municipal partners to participate in research initiatives to identify sources of microplastics and emerging chemicals of concern, and to work with other levels of government to manage and ideally remove these pollutants from the environment.

5.3 NATURAL HERITAGE SYSTEM GOAL

GOAL 3

Protect, enhance, and restore the Natural Heritage System and urban forest within the watershed to improve ecosystem resilience and sustainability.

This goal focuses on policies and programs to protect, enhance, and restore the quantity and quality of the NHS and urban forest within the watershed. The watershed refined enhanced NHS is shown in **Map 7** and the management actions are outlined in **Table 10**. The priority areas for urban forest canopy enhancements are shown in **Map 10**.

It is the responsibility of municipalities to adopt a NHS that is consistent with provincial policy and informed by the goals and objectives of the Etobicoke Creek Watershed Plan. The watershed refined enhanced NHS, developed as part of this watershed plan, includes areas with existing natural cover and areas that are targeted to be potential natural cover through restoration. It also includes contributing areas, which are built or unbuilt areas that can provide additional habitat and connectivity benefits through the use of green infrastructure.

Assuming that the potential natural cover areas are restored, the watershed refined enhanced NHS achieves approximately 23% natural cover across the watershed (up from approximately 12% currently). This is still below recommended guidelines and the scientific literature for a sustainable and resilient system. However, given the heavily urbanized nature of this watershed, the watershed refined enhanced NHS represents a significant and realistic improvement that will have significant benefits for overall watershed health, biodiversity, and climate resiliency.

Urban forests provide valuable terrestrial habitat, help manage stormwater, provide clean air, and have other socio-economic benefits (e.g. regulating temperatures, improving personal well-being). Including the urban forest under this goal recognizes the integrated nature of natural areas and the ecological value of additional tree canopy in parks, on streets, or on private property. See **Appendix B** for more details on the tiered enhancement opportunities identified in the management actions related to urban forestry.

TABLE 10:
NHS Management Actions

NHS Objective	Management Actions
NHS OBJECTIVE 1 Improve the quality and quantity of the Natural Heritage System through ecosystem and biodiversity protection, enhancement, and restoration.	**3.1.1** Municipal partners, in collaboration with TRCA, to establish habitat targets through programs and policies to increase natural cover within the watershed as follows: a. increase forest cover to at least 14% of total watershed area b. increase wetland cover to at least 3% of total watershed area c. increase meadow cover to at least 5% of total watershed area
	3.1.2 The City of Toronto, Region of Peel, and lower-tier municipalities, to ensure the protection, enhancement, and restoration of a watershed refined enhanced Natural Heritage System consistent with the goals and objectives of this watershed plan (**Map 7**) by: a. designating in their Official Plans, at a minimum, existing natural cover as identified in **Map 7** b. including policies in their Official Plans to identify enhancement and restoration opportunities for potential natural cover areas as identified in **Map 7** c. assessing existing standards, guidelines, and policies for land use and infrastructure development to ensure they reflect best practices to maintain, restore, or enhance the designated Natural Heritage System d. avoiding infrastructure development (i.e. buildings and structures) and minimizing infrastructure linear feature crossings in a designated Natural Heritage System e. adopting municipal policies for ecosystem compensation that meet or exceed TRCA's Guideline for Determining Ecosystem Compensation, where development in a designated Natural Heritage System is unavoidable f. applying a minimum vegetation protection zone along natural heritage features at the boundary of a designated Natural Heritage System (a minimum 30 metre vegetation protection zone is recommended, unless otherwise determined through an appropriate environmental study or provincial policy) g. requiring development and site alterations be designed and approved to prevent encroachment into a designated Natural Heritage System.

NHS Objective	Management Actions
NHS OBJECTIVE 1 Improve the quality and quantity of the Natural Heritage System through ecosystem and biodiversity protection, enhancement, and restoration.	**3.1.3** TRCA, in collaboration with municipal partners, and the Greater Toronto Airports Authority, to prioritize the restoration and enhancement of the terrestrial sites identified on **Map 4A** and **Map 4B** (while ensuring aviation safety), which have been selected for contributing to: a. increasing habitat quantity b. enhancing habitat quality and connectivity c. ensuring biodiversity persists d. reducing climate vulnerabilities
	3.1.4 TRCA, in collaboration with municipal partners, to explore opportunities to secure the sites identified on **Map 8** for ecological protection and to increase the public land ownership and connectivity within the watershed.
	3.1.5 All municipalities, in collaboration with TRCA and the Greater Toronto Airports Authority, are to expand the Etobicoke Creek trail network to create a connected and safe active recreation network from Lake Ontario to the Headwaters that minimizes potential impacts to the Natural Heritage System by: a. ensuring proper trail management and signage b. providing education and outreach on the importance of the Natural Heritage System c. promoting community stewardship to maintain and monitor the Natural Heritage System for improper trail usage (e.g. off-trail compaction and erosion), illegal dumping, and invasive species, while encouraging community restoration programs (e.g. tree plantings) d. engaging with MCFN to develop interpretative trail signage on the importance of water and the relationship between Treaties and the Etobicoke Creek, and include appropriate Indigenous placemaking
	3.1.6 Municipal partners, in collaboration with TRCA, to improve wildlife passage at priority road crossings identified on **Map 9**.
	3.1.7 Municipal partners, in collaboration with TRCA, to include in green development standards or guidelines, urban design requirements to improve conditions for biodiversity and habitat, such as green roofs, bird safe windows, wildlife crossings, etc., especially within contributing areas of the Natural Heritage System.

NHS Objective	Management Actions
NHS OBJECTIVE 2 Increase urban forest canopy cover throughout the watershed to improve social and environmental well-being.	**3.2.1** The City of Toronto, Region of Peel, and lower-tier municipalities, in collaboration with TRCA, will undertake strategic tree planting as per the priority planting areas identified on **Map 10** to achieve tree canopy cover targets for each subwatershed, or municipality, as follows: - Lower Etobicoke = 23.3% - Main Branch = 15% - Tributary 3 = 12.2% - Tributary 4 = 14.7% - Little Etobicoke = 15.1% - Spring Creek = 16% - Headwaters (Greenbelt portion) = 13.3% **City of Toronto = 24%** **City of Mississauga = 12.5%** **City of Brampton = 20%** **Town of Caledon = 11.3%** **Note:** See management action 3.2.2 for the non-Greenbelt portion of the Headwaters. Municipalities may have specific canopy cover targets that exceed these watershed targets. This watershed plan encourages achieving the highest possible amount of canopy cover across the watershed.
	3.2.2 The Town of Caledon, in collaboration with the Region of Peel, will require a minimum of 30% canopy cover target for any new developments in areas of the Headwaters subwatershed outside of the Greenbelt by: a. requiring developments to submit tree planting plans prior to planning approvals that are based on area specific data b. adopting tree preservation by-laws to retain mature trees c. ensuring green development standards contain progressive planting policies for all aspects of a development (e.g. right-of-ways, lots, parks, etc.).
	3.2.3 The City of Toronto, Region of Peel, and lower-tier municipalities, in collaboration with TRCA, will develop, or update, urban forest management plans or strategies that: a. enhance tree and soil conservation in accordance with Preserving and Restoring Healthy Soil: Best Practices for Urban Construction at all public and private property b. implement the tree canopy cover targets as identified in management action 3.2.1 by focusing planting in the priority areas identified on **Map 10** c. identify and promote opportunities for sustainable community retrofits in the priority areas identified on **Map 10** d. encourage an urban forest with diverse and native (or non-invasive) tree species and class sizes e. ensure consistent policies and bylaws for tree conservation on public and private lands f. develop, or expand, programs for native tree planting on public and private lands

FIGURE 15:
Etobicoke Creek at Centennial Park (Toronto)

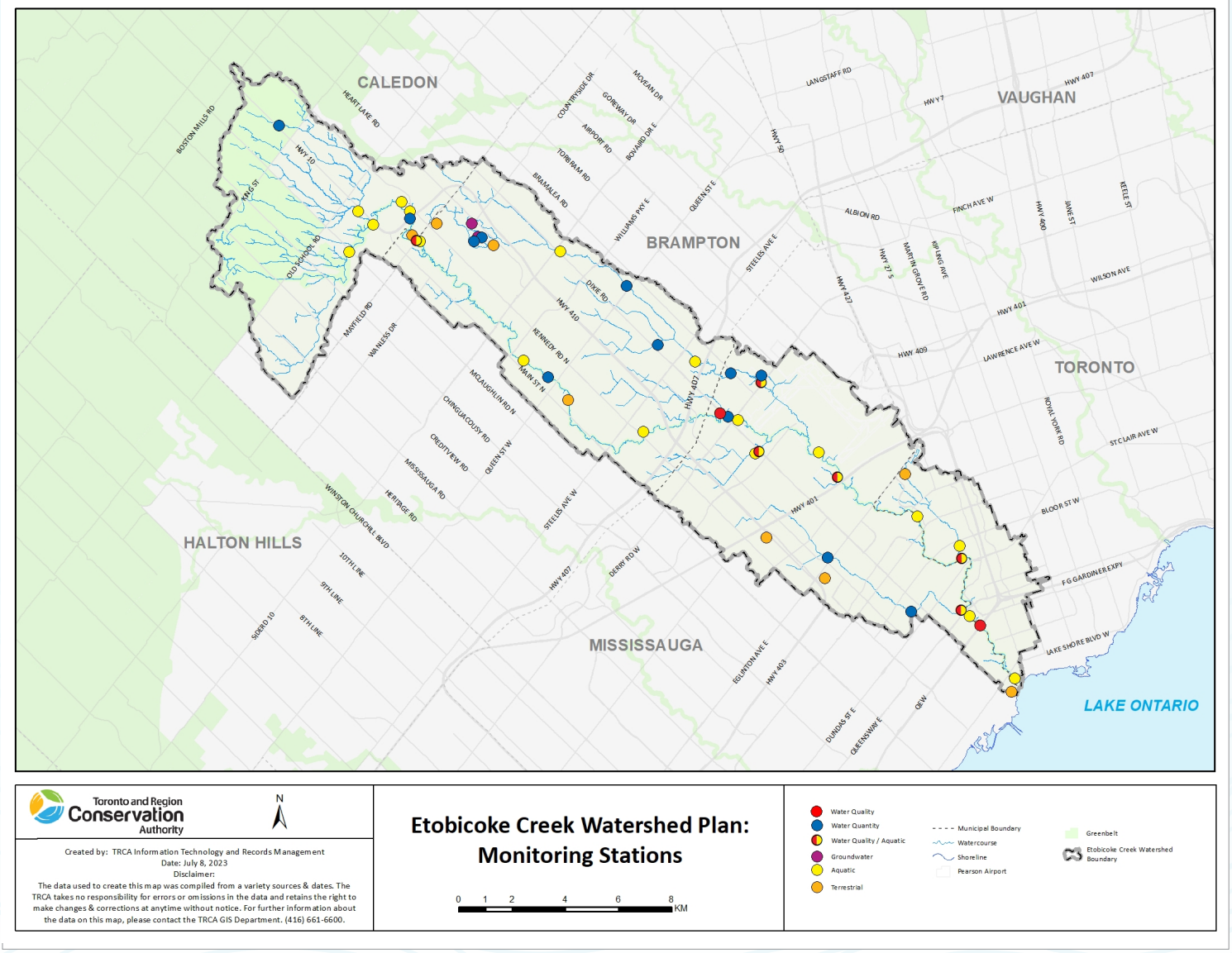
6. Monitoring and Evaluation

Regular and ongoing monitoring of watershed conditions will help assess trends and track implementation of this watershed plan. Monitoring will help determine what is working to maintain or improve conditions and what, if necessary, needs to change should conditions deteriorate.

The Etobicoke Creek watershed monitoring program is designed to evaluate watershed health and specific indicators associated with the objectives of this watershed plan. The location of the various types of monitoring stations is identified on the map in **Figure 16**.

Table 11 identifies the monitoring frequency, what is monitored, and why those things are monitored for the various types of stations identified.

FIGURE 16:
Monitoring Stations



Toronto and Region Conservation Authority

N

Created by: TRCA Information Technology and Records Management
Date: July 8, 2023
Disclaimer:
The data used to create this map was compiled from a variety sources & dates. The TRCA takes no responsibility for errors or omissions in the data and retains the right to make changes & corrections at anytime without notice. For further information about the data on this map, please contact the TRCA GIS Department. (416) 661-6600.

Etobicoke Creek Watershed Plan: Monitoring Stations

0 1 2 4 6 8 KM

- Water Quality
- Water Quantity
- Water Quality / Aquatic
- Groundwater
- Aquatic
- Terrestrial
- Municipal Boundary
- Watercourse
- Shoreline
- Pearson Airport
- Greenbelt
- Etobicoke Creek Watershed Boundary

TABLE 11:
Monitoring Program

Monitoring Station	Frequency	What is monitored?	Why do we monitor it?
WATER QUANTITY	Continuous measurement every 15 minutes for stream gauges and every 5 minutes for precipitation gauges	Stream level, discharge, and temperature, and/or rainfall/ snowfall amount	Applicable to overall watershed health and trends to know whether hydrology conditions are improving or not. Water quantity monitoring supports flood plain mapping, flood forecasting and warning, low water response, and infrastructure design. Real-time precipitation and stream monitoring information supports timely flood messaging.
WATER QUALITY	Monthly samples and/or event-based samples (i.e. heavy rainfall)	Water chemistry (e.g. nutrients, metals, bacteria, etc.)	Applicable to overall watershed health and trends to know whether water quality conditions are improving or not. Monitoring water quality helps to understand the impacts of land uses on local water quality that ultimately flows into Lake Ontario.

Monitoring Station	Frequency	What is monitored?	Why do we monitor it?
GROUNDWATER	Hourly groundwater level and temperature, and quarterly manual groundwater level measurements, sampled annually for water quality	Water levels	Applicable to overall watershed health and trends to know whether hydrogeology conditions are improving or not. Groundwater and surface water interactions are essential for a functioning WRS. Understanding groundwater conditions is vital to understanding the nature of these interactions.
AQUATIC HEALTH	Every three years	Fish community, aquatic habitat, and benthic invertebrate community	Applicable to the health of the aquatic ecosystem.
TERRESTRIAL HEALTH	Annually	Vegetation and forest birds	Applicable to the health of the terrestrial ecosystem.

Reporting

As part of the implementation of this watershed plan, TRCA and its partners, will conduct annual reporting on watershed health and plan implementation progress.

Annual reporting will track watershed health trends through the monitoring discussed above and the indicators identified in **Section 5 - Management Framework**.

Some components of the watershed plan may not be reported on annually (e.g. aquatic and terrestrial), since stations are not monitored annually.

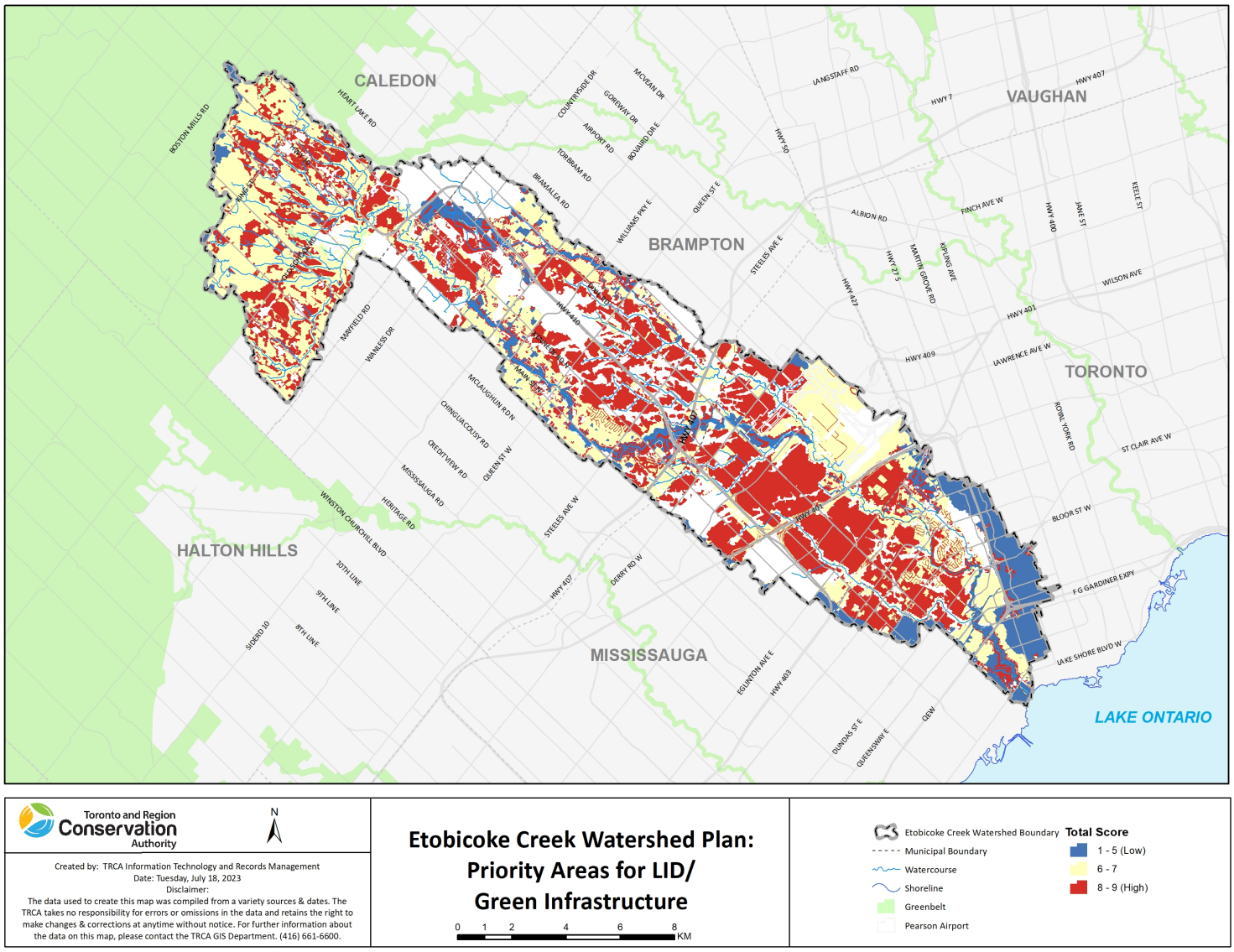
Adaptive Management

Adaptive management is a systematic process for continually improving practices by learning and applying updated knowledge to improve plan implementation (see **Figure 17**). In the context of this watershed plan, adaptive management, in conjunction with the monitoring program, may lead to refinements of the management framework, or the number of monitoring stations, throughout the life of this watershed plan. For example, if water quality continues to deteriorate, management actions may need to be modified to focus on this particular issue.

FIGURE 17:
Adaptive Management Cycle

FIGURE 18:
Before and After, Stream Restoration at Conservation Drive Park (Brampton)

7. Maps

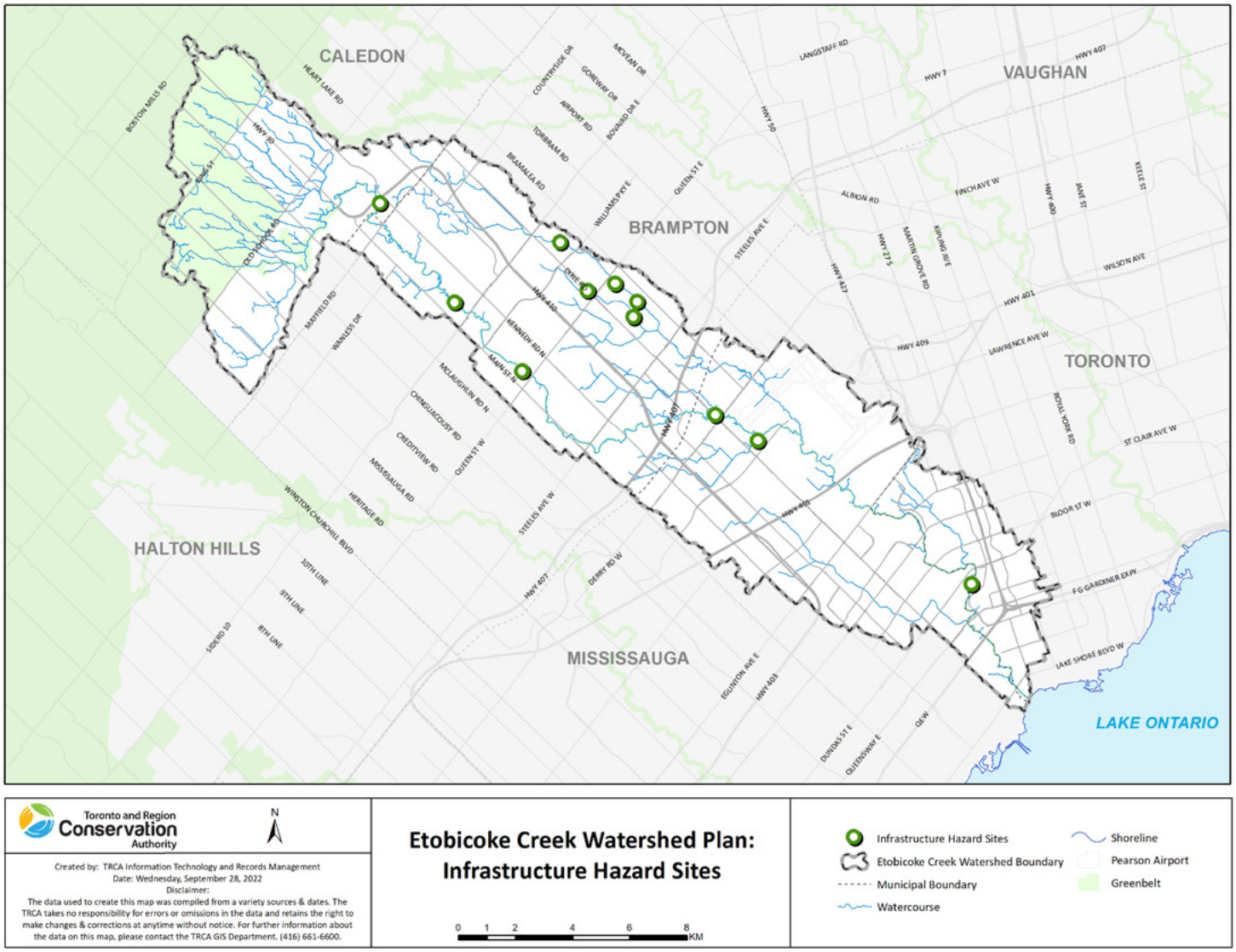


Map 1

This map shows priority areas for LID or green infrastructure, with areas in red being a higher priority.

MANAGEMENT ACTION

1.2.1 refers to this map.

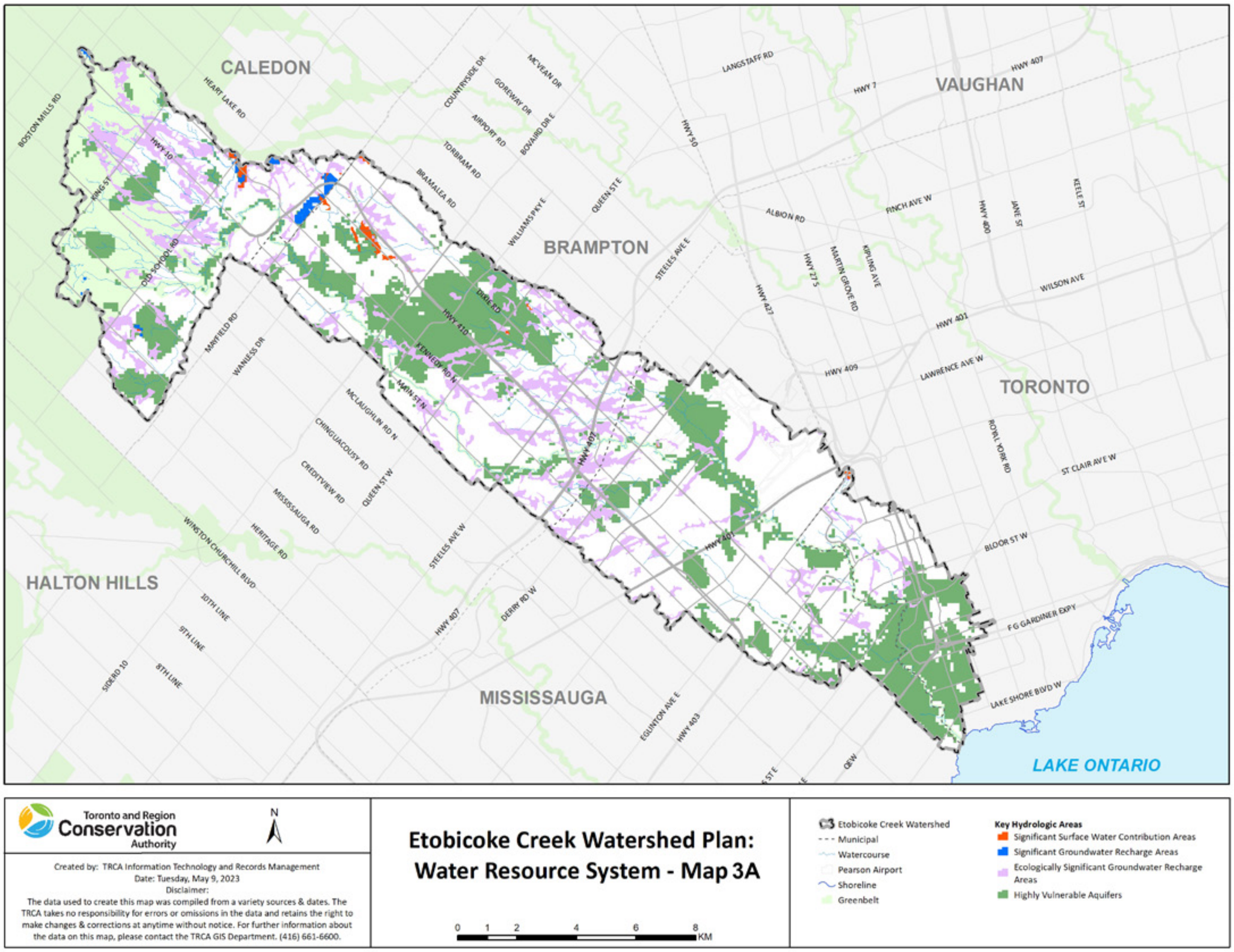


Map 2

This map shows the 11 infrastructure hazard sites forecasted for remediation to reduce erosion risk between 2019 and 2029.

MANAGEMENT ACTION

1.3.6 refers to this map.



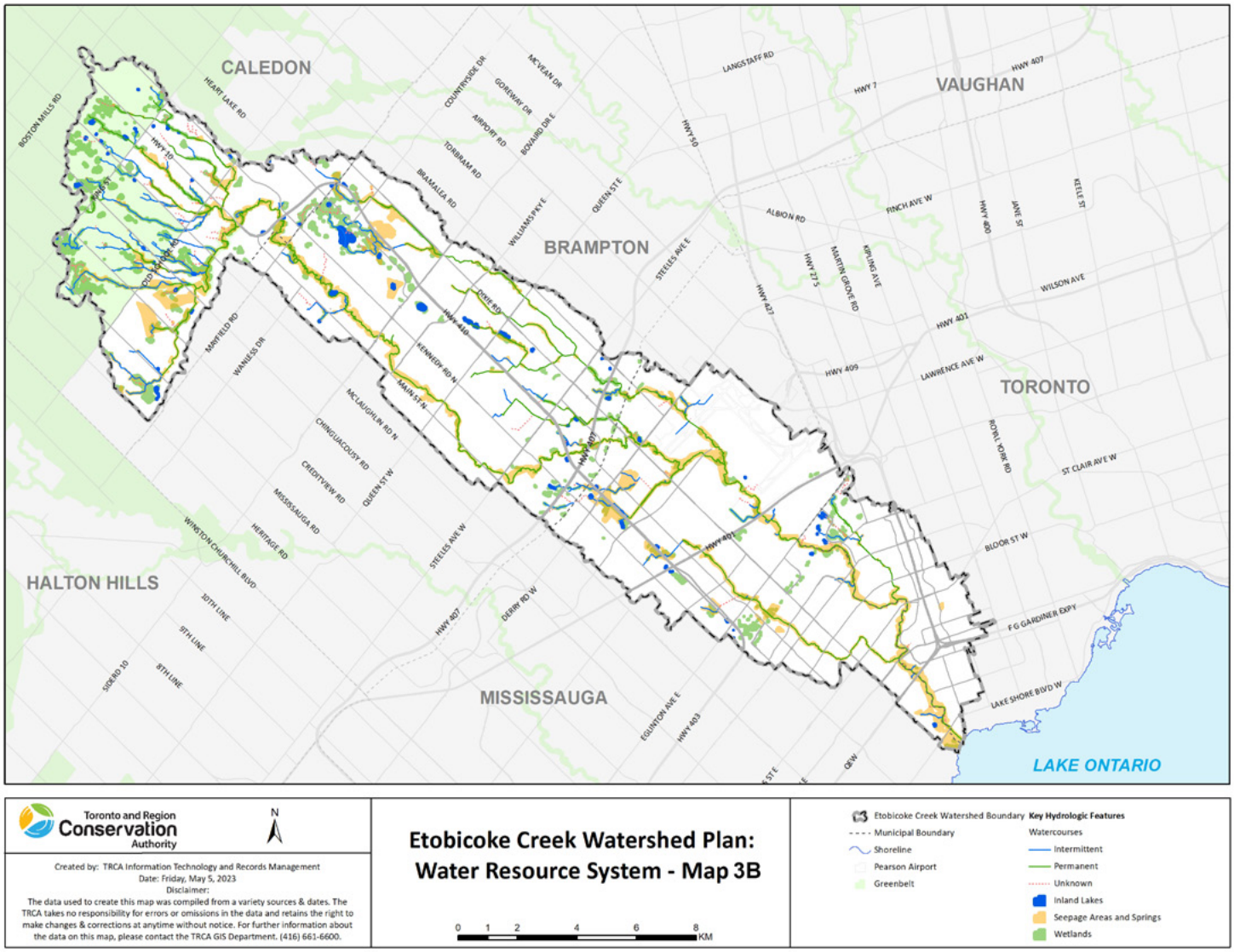
Map 3A

This map shows the Key Hydrologic Areas of the WRS. The WRS is essential for maintaining long-term ecosystem resilience and sustainability.

MANAGEMENT ACTION

2.1.1 refers to this map.

Map 3B shows the Key Hydrologic Features of the WRS.



Toronto and Region Conservation Authority

N

Created by: TRCA Information Technology and Records Management
Date: Friday, May 5, 2023
Disclaimer:
The data used to create this map was compiled from a variety sources & dates. The TRCA takes no responsibility for errors or omissions in the data and retains the right to make changes & corrections at anytime without notice. For further information about the data on this map, please contact the TRCA GIS Department. (416) 661-6600.

Etobicoke Creek Watershed Plan: Water Resource System - Map 3B

0 1 2 4 6 8 KM

Etobicoke Creek Watershed Boundary
Municipal Boundary
Shoreline
Pearson Airport
Greenbelt

Key Hydrologic Features
Watercourses
Intermittent
Permanent
Unknown
Inland Lakes
Seepage Areas and Springs
Wetlands

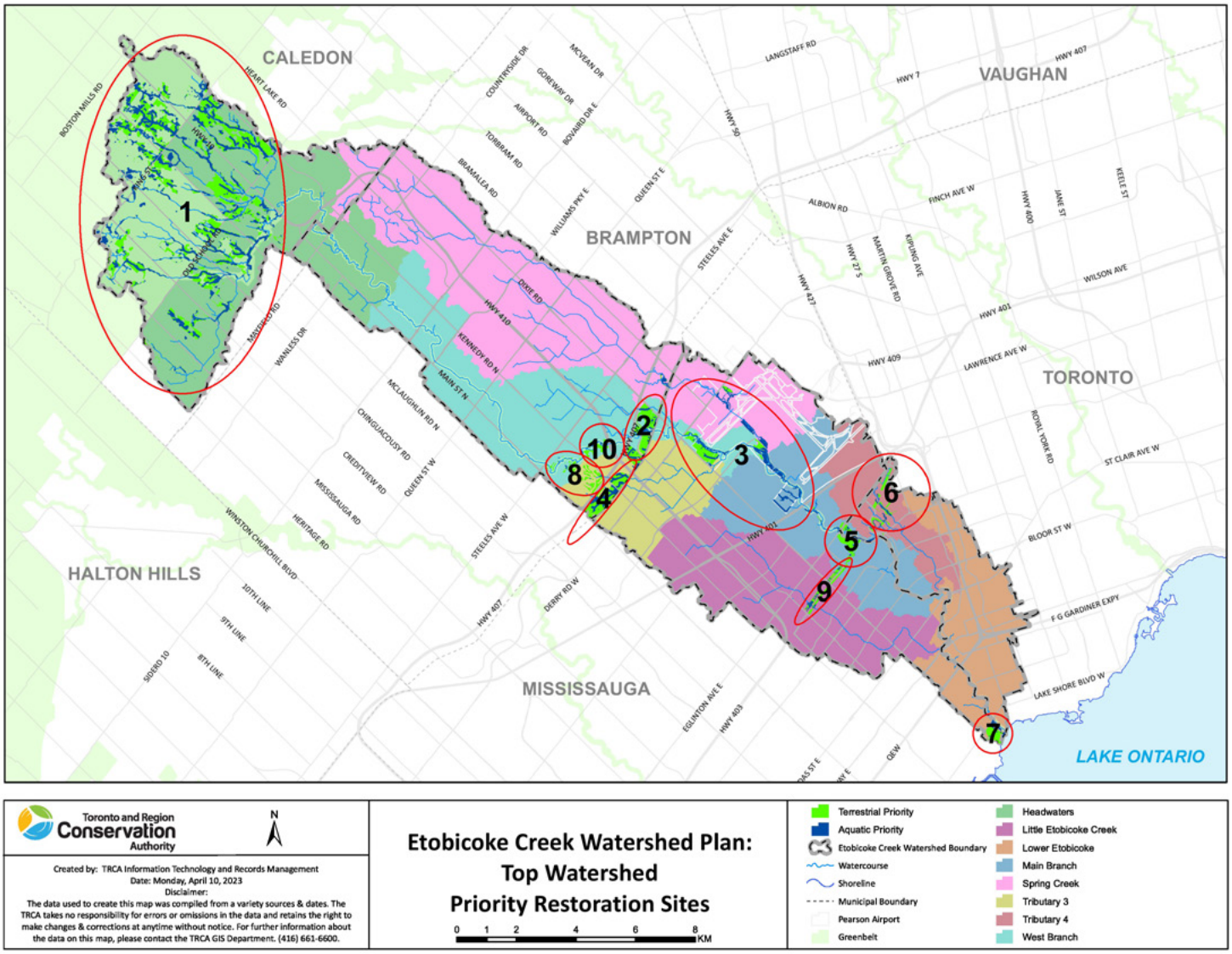
Map 3B

This map shows the Key Hydrologic Features of the WRS. The WRS is essential for maintaining long-term ecosystem resilience and sustainability.

MANAGEMENT ACTION

2.1.1 refers to this map.

Map 3A shows the Key Hydrologic Areas of the WRS.



Map 4A

This map shows the top 10 watershed priority restoration sites based on aquatic and terrestrial criteria and total size.

MANAGEMENT ACTIONS

2.1.4 and 3.1.3 refer to this map. See **Table 12** for more details on each priority site.

Appendix B contains information on how the priority restoration areas were determined.

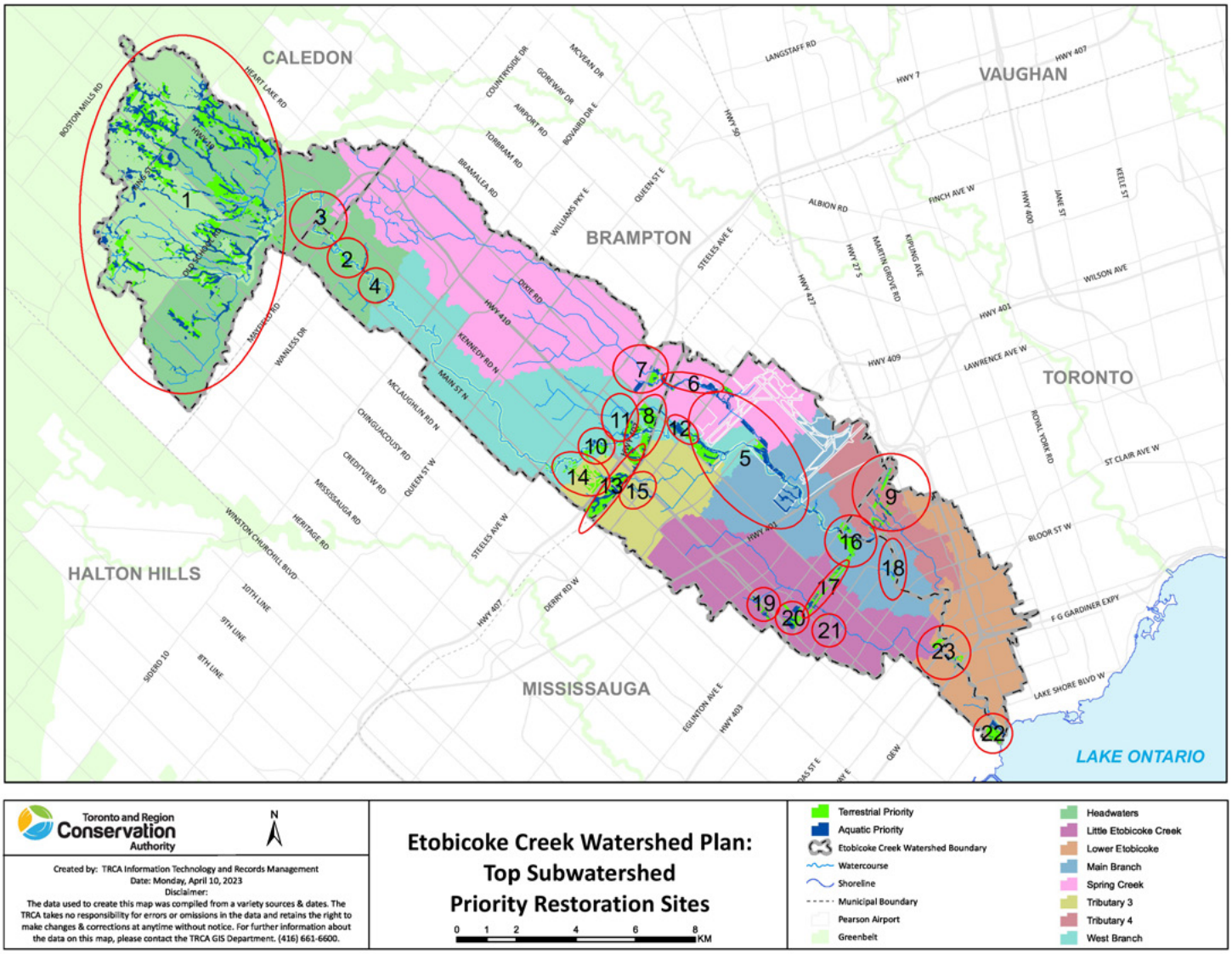
TABLE 12:
Top 10 Watershed Priority Restoration Sites

Name of Site (Subwatershed)	**Existing Natural Cover to Enhance** (in hectares)	**Potential Natural Cover to Restore** (in hectares)	**Total Size** (in hectares)	**By Habitat Type** (in hectares)
1. Headwaters 1* (Headwaters) Town of Caledon	130.2	550.4	680.6	Forest (357.2), Riparian (159.4), Wetland (164 ha)
2. Hwy 407 Hydro (East of 410) (Tributary 3 / West Branch / Spring Creek) City of Brampton	30.3	50.1	80.3	Forest (25.5), Meadow (34.1), Riparian (12.4), Wetland (8.3)
3. Pearson 1 (West Branch / Spring Creek / Main Branch) City of Mississauga	52.2	14.8	67.3	Forest (11.4), Riparian (50.8), Wetland 5.1)
4.Hwy 407 Hydro (West of 410) (Tributary 3) City of Brampton	9.2	57.0	66.1	Forest (10.0), Meadow (30.8), Riparian (20.0), Wetland (5.3)
5. Wood Creek (Main Branch) City of Mississauga	11.4	25.2	36.6	Forest (22.4), Meadow (5.9), Riparian (6.4), Wetland (1.8)
6. Centennial Park Etobicoke (Tributary 4) City of Toronto	2.3	22.7	25.1	Forest (8.2), Meadow (8.6), Riparian (3.8), Wetland (3.5)

Name of Site (Subwatershed)	**Existing Natural Cover to Enhance** (in hectares)	**Potential Natural Cover to Restore** (in hectares)	**Total Size** (in hectares)	**By Habitat Type** (in hectares)
7. Marie Curtis / Arsenal **(Lower Etobicoke)** City of Toronto and City of Mississauga	7.3	15.9	23.2	Forest (17), Riparian (5.3), Wetland (0.6), Shoreline (0.3)
8. Brampton Golf Club / Peel Village Golf Club **(Tributary 3 / West Branch)** City of Brampton	5.5	22.1	27.6	Forest (24.2), Meadow (1.1), Riparian (2.0), Wetland (0.3)
9. Eastgate Transitway **(Little Etobicoke Creek / Main Branch)** City of Mississauga	12.1	13.3	25.4	Forest (10.1), Meadow (9.6), Riparian (2.5), Wetland (3.3)
10. CAA Centre **(West Branch / Tributary 3)** City of Brampton	7.8	9.2	17.0	Forest (10.6), Meadow (3.0), Riparian (2.9), Wetland (0.4)
TOTALS	**268.3**	**780.7**	**1,049.2**	**Forest (496.6), Meadow (93.1), Riparian (265.5), Wetland (192.6), Shoreline (0.3)**

Notes:
*If there is urban expansion in the headwaters, most of the restoration opportunities will be through stewardship, and areas with high ecological function should be included in the NHS.

There may be some minor discrepancies between total size, existing + potential, and by habitat type due to rounding, overlap of restoration opportunities, and the exclusion of restoration opportunities like green infrastructure.



Map 4B

This map shows the top five priority restoration sites per subwatershed based on aquatic and terrestrial criteria and total size.

MANAGEMENT ACTIONS

2.1.4 and 3.1.3 refer to this map. See **Table 13** for more details on each priority site.

Appendix B contains information on how the priority restoration areas were determined.

TABLE 13:
Top 5 Priority Restoration Sites Per Subwatershed

Name of Site (Subwatershed)	**Existing Natural Cover to Enhance** (in hectares)	**Potential Natural Cover to Restore** (in hectares)	**Total Size** (in hectares)	**By Habitat Type** (in hectares)
1. Headwaters 1* (Headwaters) Town of Caledon	**130.2**	**550.4**	**680.6**	**Forest (357.2), Riparian (159.4), Wetland (164 ha)**
2. Conservation Drive Park (Headwaters) City of Brampton	8.4	3.2	11.6	Forest (5.5), Riparian (1.4), Wetland (1.2)
3. Summer Valley (Headwaters) Town of Caledon	2.8	2.2	5.0	Forest (1.4), Riparian (0.8), Wetland (0.8)
4. Loafers Lake (Headwaters) City of Brampton	2.9	0.1	3.0	Riparian / Wetland (3.0)
5. Pearson 1 (Spring Creek Portion) City of Mississauga	**19.0**	**8.8**	**27.8**	**Forest (0.4), Riparian (21.1), Wetland (1.6)**
5. Pearson 1 (West Branch Portion) City of Mississauga	**13.2**	**2.9**	**16.2**	**Forest (5.1), Riparian (10.3), Wetland (0.8)**
5. Pearson 1 (Main Branch Portion) City of Mississauga	**19.0**	**8.8**	**27.8**	**Forest (0.4), Riparian (21.1), Wetland (1.6)**

***Note:**
If there is urban expansion in the headwaters, most of the restoration opportunities will be through stewardship, and areas with high ecological function should be included in the NHS.

Name of Site (Subwatershed)	**Existing Natural Cover to Enhance** (in hectares)	**Potential Natural Cover to Restore** (in hectares)	**Total Size** (in hectares)	**By Habitat Type** (in hectares)
6. Wildfield Park (Spring Creek) City of Mississauga	8.6	5.1	13.7	Forest (0.8), Riparian (11.6), Wetland (1.3)
7. Hwy 407 Median (Spring Creek) City of Brampton and City of Mississauga	13.0	0.5	13.5	Forest (8.6), Riparian (2.2), Wetland (2.7)
8. Hwy 407 Hydro (East of 410) (Spring Creek Portion) City of Brampton	**4.9**	**0.1**	**5.0**	**Forest (0.7), Riparian (1.4), Wetland (2.6)**
8. Hwy 407 Hydro (East of 410) (West Branch Portion) City of Brampton	**22.9**	**27.1**	**50.0**	**Forest (22.5), Meadow (16.7), Riparian (5.4), Wetland (5.5)**
8. Hwy 407 Hydro (East of 410) (Tributary 3 Portion) City of Brampton	**2.4**	**22.8**	**25.2**	**Forest (2.4), Meadow (17.0), Riparian (5.6), Wetland (0.3)**
9. Centennial Park Etobicoke (Tributary 4) City of Toronto	2.3	22.7	25.1	Forest (8.2), Meadow (8.6), Riparian (3.8), Wetland (3.5)
10. CAA Centre (West Branch) City of Brampton	**7.6**	**9.1**	**16.7**	**Forest (10.3), Meadow (3.0), Riparian (2.9), Wetland (0.4)**
11. Westcreek Trailhead (West Branch) City of Brampton	7.5	7.6	15.1	Forest (10.0), Riparian (4.5), Wetland (0.6)

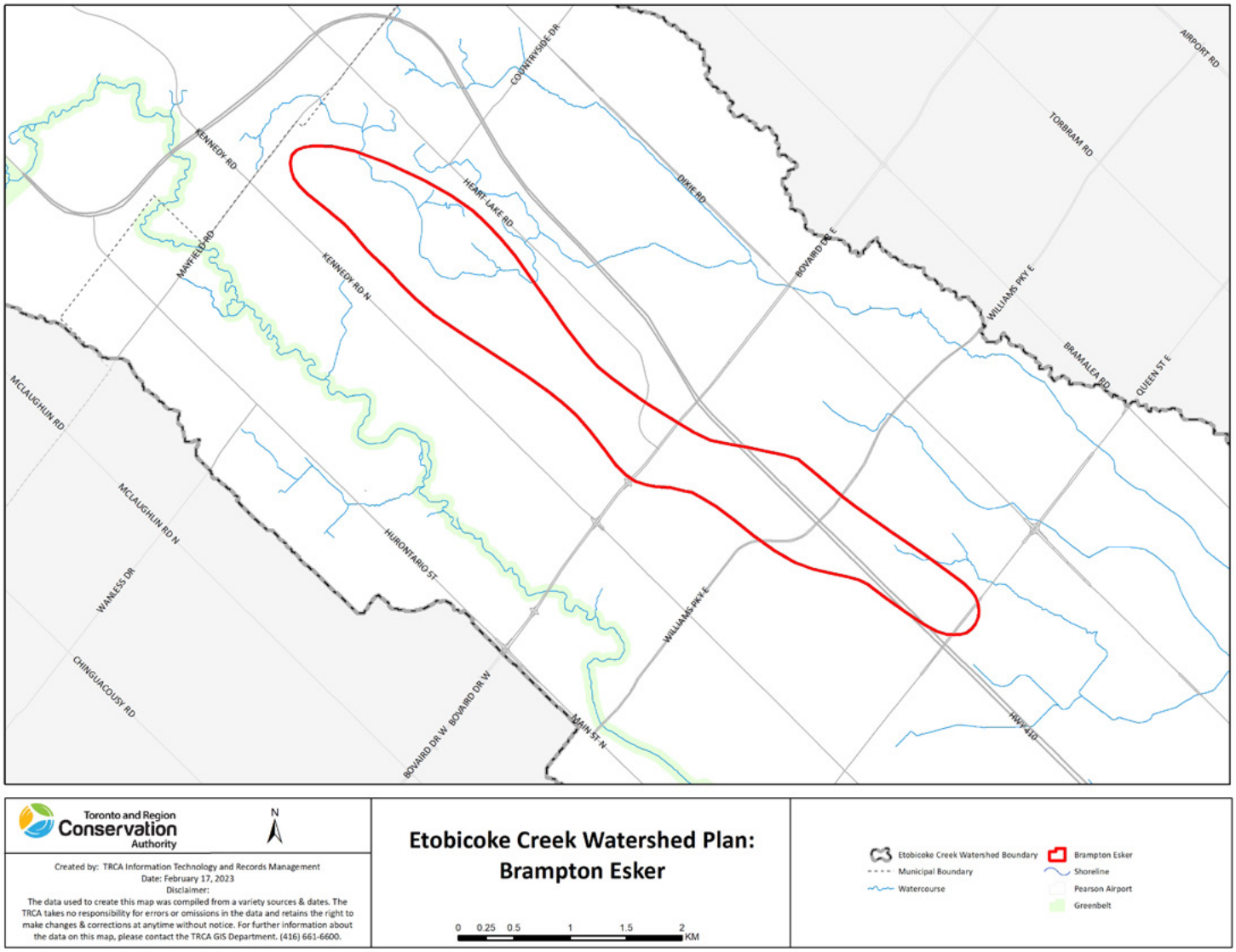
Name of Site (Subwatershed)	**Existing Natural Cover to Enhance** (in hectares)	**Potential Natural Cover to Restore** (in hectares)	**Total Size** (in hectares)	**By Habitat Type** (in hectares)
12. King's Park (West Branch) City of Mississauga	3.2	0.4	3.6	Forest (1.4), Riparian (2.2)
13. Hwy 407 Hydro (West of 410) (Tributary 3) City of Brampton	**9.2**	**57.0**	**66.1**	**Forest (10), Meadow (30.8), Riparian (20), Wetland (5.3)**
14. Brampton Golf Club / Peel Village Golf Club (Tributary 3) City of Brampton	**3.4**	**16.5**	**19.9**	**Forest (19), Riparian (0.9)**
15. SWMP Derry Road (Tributary 3) City of Mississauga	2.4	0.3	2.7	Riparian (2.7)
16. Wood Creek (Main Branch) City of Mississauga	11.4	25.2	36.6	Forest (22.4), Meadow (5.9), Riparian (6.4), Wetland (1.8)
17. Eastgate Transitway (Main Branch) City of Mississauga	2.7	4.1	6.8	Forest (2.6), Meadow (3.1), Wetland (1.1)
17. Eastgate Transitway (Little Etobicoke Creek) City of Mississauga	**9.4**	**9.3**	**18.7**	**Forest (7.5), Meadow (6.5), Riparian (2.5), Wetland (2.2)**
18. Fleetwood Park (Main Branch) City of Mississauga	0.7	1.7	2.4	Forest (1.5), Riparian (0.4), Wetland (0.4)

Name of Site (Subwatershed)	**Existing Natural Cover to Enhance** (in hectares)	**Potential Natural Cover to Restore** (in hectares)	**Total Size** (in hectares)	**By Habitat Type** (in hectares)
19. Iceland Forest (Little Etobicoke Creek) City of Mississauga	3.0	6.0	9.0	Forest (4.8), Riparian (1.6), Wetland (2.6)
20. Hwy 403 Eglinton (Little Etobicoke Creek) City of Mississauga	1.3	2.2	3.5	Forest (3.0), Wetland (0.5)
21. Rathwood Park 1 (Little Etobicoke Creek) City of Mississauga	0.8	0.8	1.6	Forest (0.7), Riparian (0.5), Wetland (0.3)
22. Marie Curtis / Arsenal (Lower Etobicoke) City of Toronto and City of Mississauga	**7.3**	**15.9**	**23.2**	**Forest (17), Riparian (5.3), Wetland (0.6), Shoreline (0.3)**
23. Etobicoke Creek Valley Park North (Lower Etobicoke) City of Toronto	4.4	4.5	9.0	Forest (7.6)

Notes:
There may be some minor discrepancies between total size, existing + potential, and by habitat type due to rounding, overlap of restoration opportunities, and the exclusion of restoration opportunities like green infrastructure and invasives management.

There is intentional overlap between the Top 10 watershed sites and Top 5 by subwatershed, since the Top 10 by watershed are the largest sites by amount of restoration opportunity, which would also be the top sites for the relevant subwatershed. Sites that are also Top 10 watershed sites are in **bold**.

Not all subwatersheds have five sites with restoration opportunities.

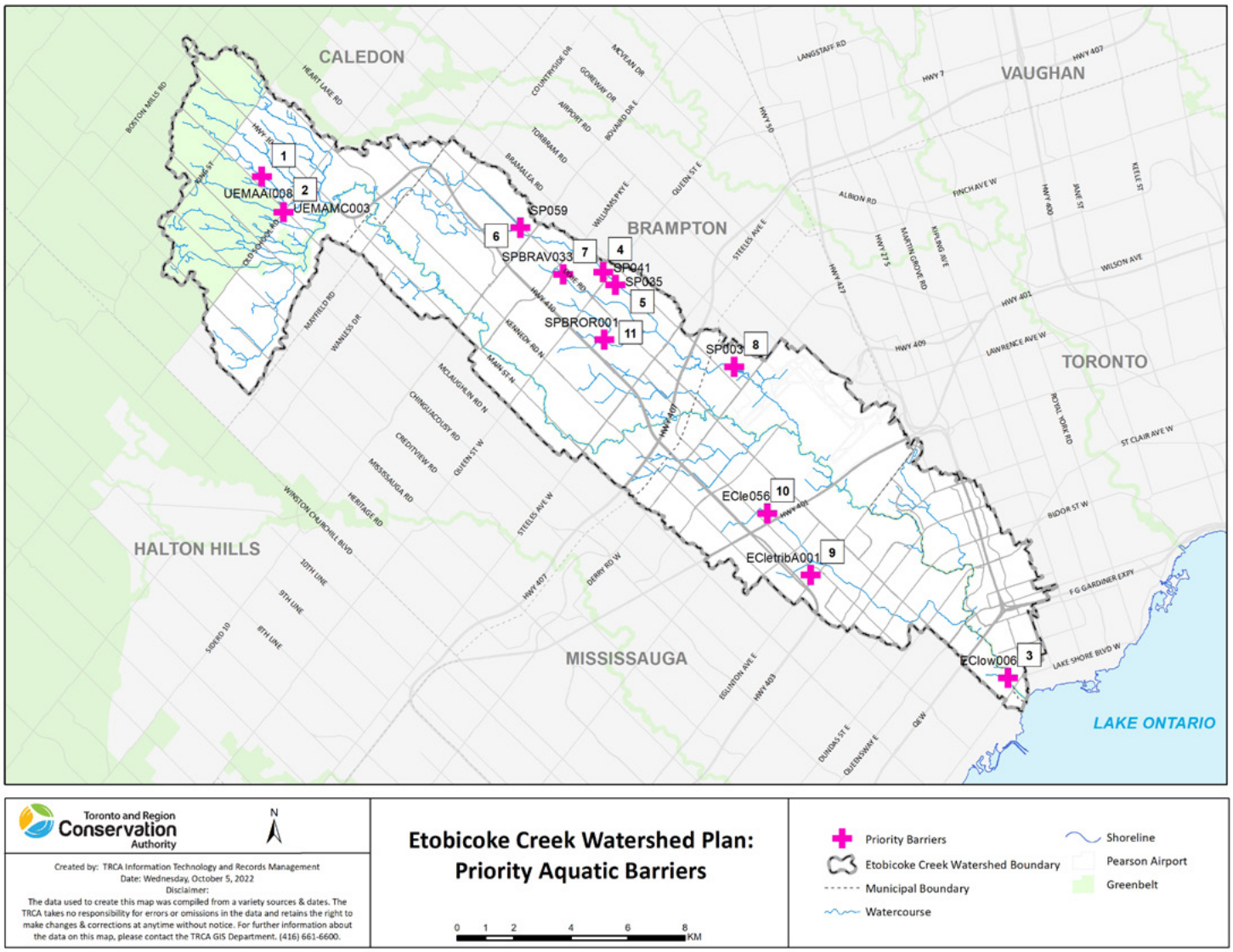


Map 5

This map shows the location of the Brampton Esker.

MANAGEMENT ACTION

2.1.5 refers to this map.

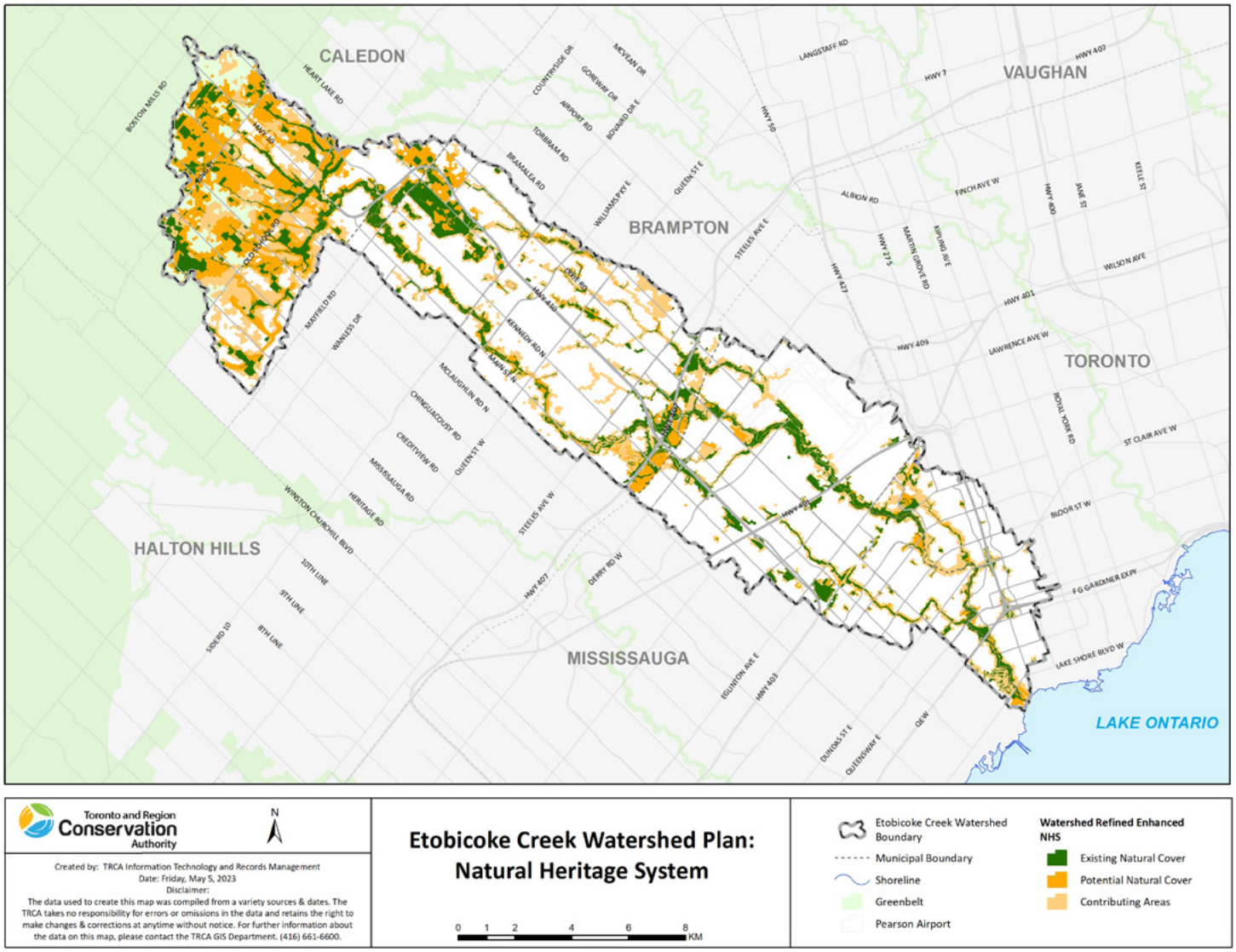


Map 6

This map shows the priority aquatic barriers for removal to restore in-stream habitat connectivity.

MANAGEMENT ACTION
2.2.1 refers to this map.

Barrier #	Type of Barrier
1	Weir
2	Road crossing
3	Weir
4	Dam
5	Weir
6	Stormwater weir
7	Weir
8	Stormwater culvert
9	Weir
10	Natural erosion step
11	Weir



Map 7

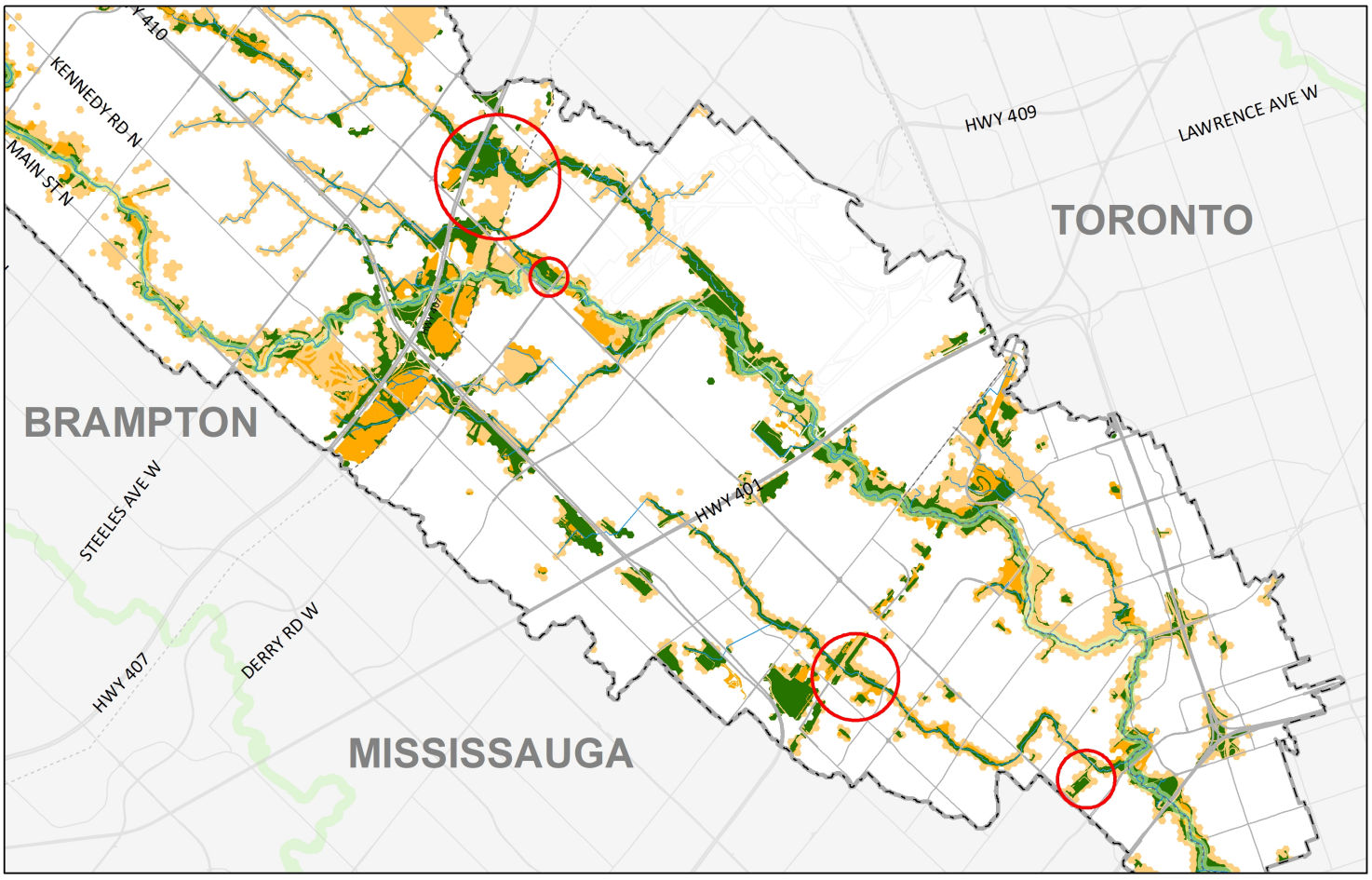
This map shows the watershed refined enhanced NHS, consisting of existing natural cover, potential natural cover, and contributing areas.

Potential natural cover are areas that could be restored to provide ecosystem and habitat benefits.

Contributing areas are built or unbuilt areas that can provide additional habitat and connectivity benefits through the use of green infrastructure.

MANAGEMENT ACTION

3.1.2 refers to this map.



Toronto and Region Conservation Authority

N

Created by: TRCA Information Technology and Records Management
Date: Tuesday, July 18, 2023
Disclaimer:
The data used to create this map was compiled from a variety sources & dates. The TRCA takes no responsibility for errors or omissions in the data and retains the right to make changes & corrections at anytime without notice. For further information about the data on this map, please contact the TRCA GIS Department. (416) 661-6600.

Etobicoke Creek Watershed Plan: Priority Securement Areas

0 0.5 1 2 3 4 KM

- Priority Securement Areas
- Etobicoke Creek Watershed Boundary
- Municipal Boundary
- Watercourse
- Pearson Airport
- Greenbelt

Watershed Refined Enhanced NHS

- Existing Natural Cover
- Potential Natural Cover
- Contributing Areas

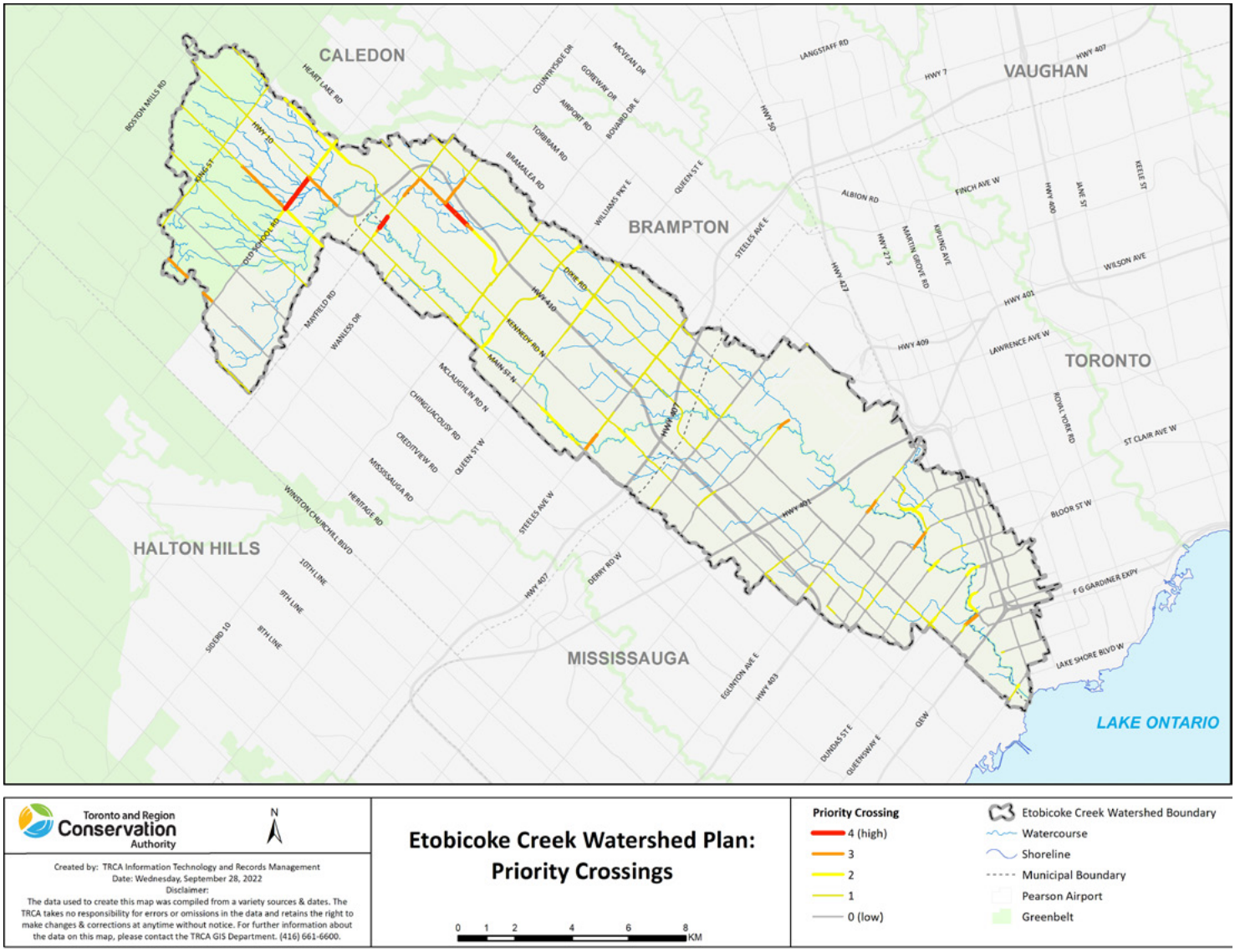
Map 8

This map shows priority areas for land securement based on lands where restoration priorities intersect with Flood Vulnerable Clusters (on both private land and some public land such as Hydro ROWs not in municipal or TRCA ownership). These areas are priorities to use nature-based solutions as part of flood risk mitigation. For land already in public ownership, the focus would be on conservation efforts (i.e. meadow habitat restoration) when opportunities arise.

Other lands outside these areas may be secured by municipalities or TRCA to increase public land ownership to achieve habitat objectives associated with this watershed plan.

MANAGEMENT ACTION

3.1.4 refers to this map.

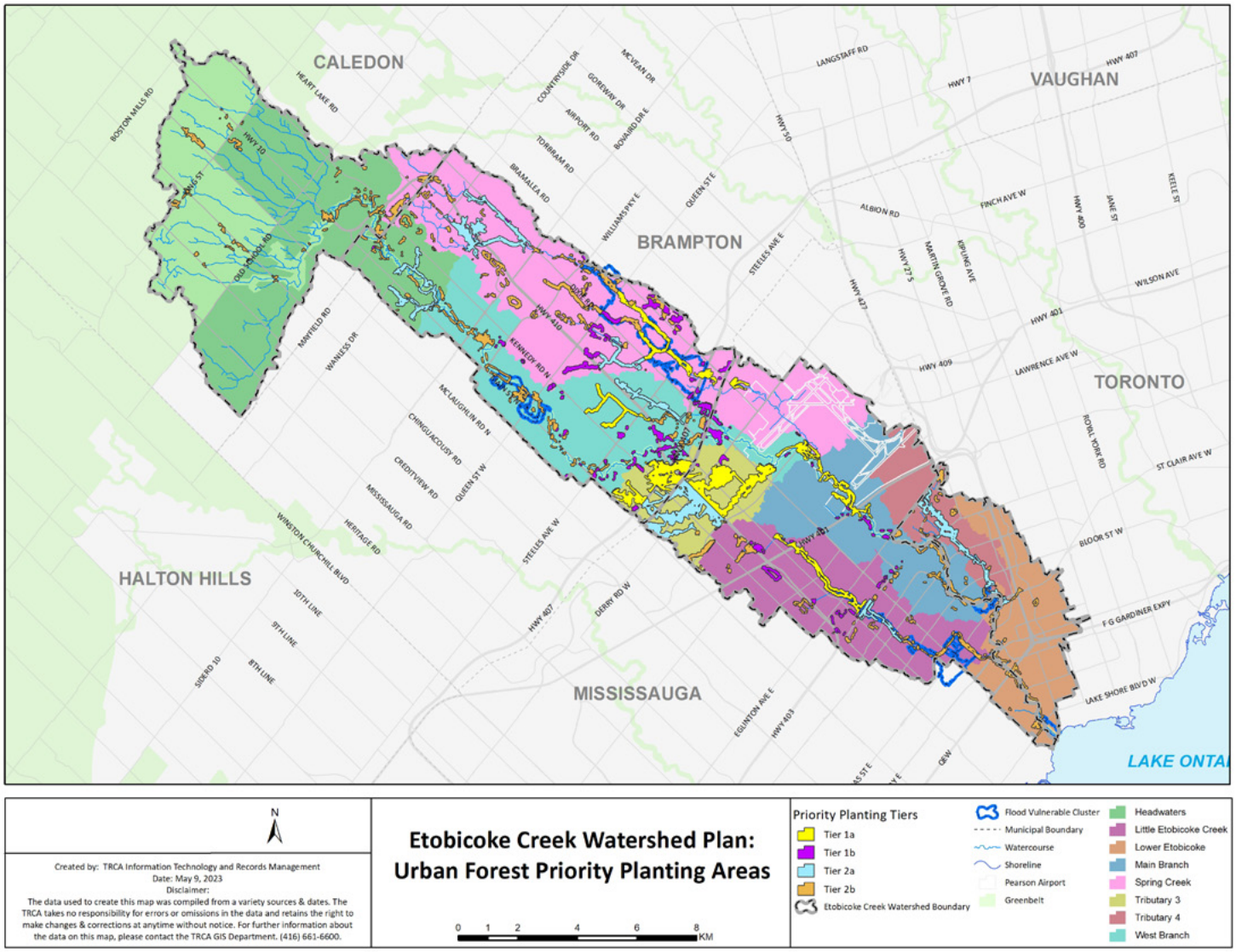


Map 9

This map shows priority road crossings to enhance connectivity for wildlife to pass safely.

MANAGEMENT ACTION

3.1.6 refers to this map.



Map 10

This map shows the priority planting areas to increase tree canopy cover (i.e. urban forest) within the watershed.

See **Appendix B** for more information on each tier and how the priority areas were determined.

MANAGEMENT ACTIONS

3.2.1 and 3.2.3 refer to this map.

8. Glossary

Biodiversity
The variability among organisms from all sources including terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species and ecosystems.

Detention
The temporary storage of stormwater to control discharge rates and allow for sedimentation.

Ecological Function
The natural processes, products, or services that living and non-living environments provide or perform within or between species, ecosystems, and landscapes, including hydrologic functions and biological, physical, chemical, and socio-economic interactions.

Green Infrastructure
Natural and human-made elements that provide ecological and hydrologic functions and processes. Green infrastructure can include components such as natural heritage features and systems, parklands, stormwater management systems, street trees, urban forests, natural channels, permeable surfaces, and green roofs.

Headwater Drainage Features
Ill-defined, non-permanently flowing drainage features that may not have defined beds and banks.

Highly Vulnerable Aquifer
Aquifers, including lands above the aquifers, on which external sources have, or are likely to have, a significant adverse effect.

Hydrologic Function
The functions of the hydrologic cycle that include the occurrence, circulation, distribution, and chemical and physical properties of water on the surface of the land, in the soil and underlying rocks, and in the atmosphere, and water's interaction with the environment including its relation to living things.

Impervious Cover

EFFECTIVE IMPERVIOUS AREA/COVER

Represents a portion of the total impervious area that sheds stormwater directly into a water body or a storm drain system without being treated (e.g. by low impact development, green infrastructure, filtration, sedimentation, or other conventional techniques).

TOTAL IMPERVIOUS AREA/COVER

A measure of all the hard impermeable surfaces in the landscape that prevent precipitation from penetrating the ground in a catchment.

UNTREATED IMPERVIOUS COVER

Areas where runoff from impervious surfaces is conveyed directly to waterbodies without being treated (e.g., by low impact development, green infrastructure, filtration, sedimentation, or other conventional techniques).

Infiltration

The entry of water into site soils or material.

Key Hydrologic Areas

Significant groundwater recharge areas, highly vulnerable aquifers, significant surface water contribution areas, and ecologically significant groundwater recharge areas, that are necessary for the ecological and hydrologic integrity of a watershed.

Key Hydrologic Features

Permanent streams, intermittent streams, inland lakes and their littoral zones, seepage areas and springs, and wetlands.

Low Impact Development

An approach to stormwater management that seeks to manage rain and other precipitation as close as possible to where it falls to mitigate the impacts of increased runoff and stormwater pollution. It typically includes a set of site design strategies and distributed, small-scale structural practices to mimic the natural hydrology to the greatest extent possible through infiltration, evapotranspiration, harvesting, filtration, and detention of stormwater. Low impact development can include, for example: bio-swales, vegetated areas at the edge of paved surfaces, permeable pavement, rain gardens, green roofs, and exfiltration systems. Low impact development often employs vegetation and soil in its design, however, that does not always have to be the case and the specific form may vary considering local conditions and community character.

Natural Hazards *(Consisting of Erosion Hazard and Flooding Hazard)*

EROSION HAZARD

Means the loss of land, due to human or natural processes, that poses a threat to life and property.

FLOODING HAZARD

Means the inundation of areas adjacent to a shoreline or a river or stream system not ordinarily covered by water.

Natural Heritage System

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 system can include key natural heritage features, key hydrologic features, federal and provincial parks and conservation reserves, other natural heritage features and areas, lands that have been restored or have the potential to be restored to a natural state, associated areas that support hydrologic functions, and working landscapes that enable ecological functions to continue.

Predevelopment

Is defined as follows for the various development conditions:

NEW DEVELOPMENT (I.E. GREENFIELD DEVELOPMENT AND/OR AGRICULTURAL CONVERSION TO URBAN)

The predevelopment impervious condition shall correspond to the current conditions present in the field at the project onset or to an undisturbed forested condition.

REDEVELOPMENT (I.E. EXISTING URBAN AREAS)

The predevelopment impervious condition shall correspond to the current conditions present in the field at the project onset, or the least urbanized conditions (i.e. lowest total impervious percentage for the site) prior to the project onset.

LINEAR DEVELOPMENT AND RETROFITS

The predevelopment impervious condition for the right-of-way shall correspond to the current conditions present at the project onset.

Riparian

The areas adjacent to water bodies such as streams, wetlands, and shorelines. Riparian areas form transitional zones between aquatic and terrestrial ecosystems.

Sustainable Community Retrofits

Focus on public and private land actions in older, urban neighbourhoods by retrofitting buildings and infrastructure, regenerating habitats and urban ecology, and revitalizing a community's social fabric. TRCA's Sustainable Neighbourhood Action Program provides examples of sustainable community retrofits.

Urban Forest

All trees, shrubs, and understory plants, as well as the soils that sustain them, occurring on public and private property in natural, urban, and rural areas.

Water Balance

The accounting of inflow and outflow of water in a system according to the components of the hydrologic cycle.

Water Resource System

A system consisting of ground water features and areas and surface water features (including shoreline areas), and hydrologic functions, which provide the water resources necessary to sustain healthy aquatic and terrestrial ecosystems and human water consumption. The water resource system is comprised of key hydrologic features and key hydrologic areas.

Whitebelt

Refers to lands between the built boundary of urban settlement areas and the boundary of the Greenbelt Plan Area.

9. References

ECWP Technical Reports

Toronto and Region Conservation Authority, 2022. *Etobicoke Creek Watershed Future Management Scenario Analysis Report.*

Toronto and Region Conservation Authority, 2021. *Etobicoke Creek Watershed Characterization Report.*

ECWP Engagement Summaries

Toronto and Region Conservation Authority, 2022. *ECWP: Engagement Summary 2 – July 2021 – July 2022.*

Toronto and Region Conservation Authority, 2021. ECWP: *Engagement Summary 1 – July 2020 – June 2021.*

Provincial / Federal Policies / Plans / Guidelines

Canadian Council of Ministers of the Environment, no date. *Water Quality Guidelines for the Protection of Aquatic Life.*

CTC Source Protection Committee, 2019. *Approved Source Protection Plan: CTC Source Protection Region.* Amendment (Version 2.0) effective March 25, 2019.

Environment Canada, 2013. *How Much Habitat is Enough?* Third Edition.

Ontario, 2020. *A Place to Grow: Growth Plan for the Greater Golden Horseshoe.*

Ontario, 2020. *Provincial Policy Statement.*

Ontario, 2017. *Greenbelt Plan.*

Ontario, 2016. *Water Management: Policies, Guidelines, Provincial Water Quality Objectives.*

Schueler, T, 1994. *The Importance of Imperviousness.* Watershed Protection Techniques 2: 100-111.

Great Lakes Agreement and Policies

Government of Canada and Government of Ontario, 2021. *Canada-Ontario Agreement on Great Lakes Water Quality and Ecosystem Health*.

Government of Canada and Government of the United States of America, 2012. *Great Lakes Water Quality Agreement*.

Ontario, 2016. *Ontario's Great Lakes Strategy*.

TRCA Guidelines

Credit Valley Conservation and Toronto and Region Conservation Authority, 2014. *Evaluation, Classification and Management of Headwater Drainage Features Guidelines*.

Toronto and Region Conservation Authority, 2018. *Guideline for Determining Ecosystem Compensation (after the decision to compensate has been made)*.

Toronto and Region Conservation Authority, 2017. *Wetland Water Balance Risk Evaluation*.

Toronto and Region Conservation Authority, 2016. *Wetland Water Balance Monitoring Protocol*.

Toronto and Region Conservation Authority, 2015. *Crossings Guideline for Valley and Stream Corridors*.

Toronto and Region Conservation Authority, 2012. *Stormwater Management Criteria*.

Relevant Municipal Plans / Strategies / Guidelines

Note: *this is not an exhaustive list of potentially relevant municipal plans, strategies, or policies with relevance to this watershed plan. It does not include Official Plans, Secondary Plans, Master Plans, or Bylaws, which may need to be updated as part of implementation of this watershed plan.*

Instead, the list below includes complementary Strategies, Plans, or Guidelines related to water management, biodiversity, environmental protection, etc.

CITY OF TORONTO

Biodiversity Strategy. October 2019.

Parkland Strategy. Adopted November 2019.

Ravine Strategy. Adopted October 2017.

Toronto Green Standard, Version 4. Adopted July 2021.

TransformTO: Net Zero Strategy, A Climate Action Pathway to 2030 and Beyond. November 2021.

Toronto's Strategic Forest Management Plan. Adopted February 2012.

REGION OF PEEL

Climate Change Master Plan, 2020 – 2030. Adopted 2019.

CITY OF MISSISSAUGA

City of Mississauga Climate Change Action Plan. Adopted November 2021.

Living Green Master Plan. Adopted January 2012.

Natural Heritage and Urban Forest Strategy. Adopted January 2014.

Parks and Forestry Master Plan. Adopted February 2019.

CITY OF BRAMPTON

Brampton Eco Park Strategy. Adopted in 2019.

Brampton Grow Green Environmental Master Plan. Adopted in 2014.

Brampton One Million Trees Program. Adopted in 2019.

Lake Enhancement Strategy. Adopted in 2021.

Natural Heritage and Environmental Management Strategy. Adopted December 2015.

Our 2040 Energy Transition: Community Energy and Emissions Reduction Plan. Adopted in 2020.

TOWN OF CALEDON

Community Climate Change Action Plan. Adopted January 2020.

APPENDIX A

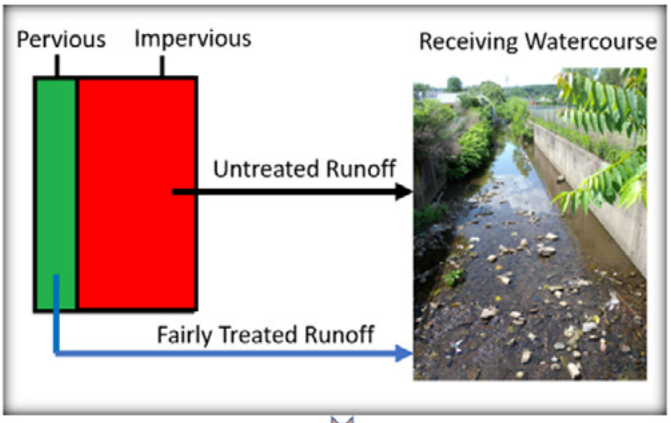
As outlined in **Section 3.3 - Current State of the Watershed**, aquatic habitat quality is expected to decrease as impervious cover increases. Environment Canada provides recommendations on impervious cover percentages and has defined the quality of aquatic habitat based on the amount of impervious cover in a catchment area where 'sensitive' quality habitat occurs when there is 0-10% impervious cover, and declines in aquatic habitat quality are demonstrated when impervious cover is between 11-25% (impacted/urbanizing), greater than 25% (non-supporting), and greater than 60% (urban drainage). Therefore, to minimize impacts to aquatic habitat health, it is recommended that the impervious cover percentage (effective impervious cover) for the Headwaters subwatershed (and the watershed in general) remains below 25%. This is reflected in management actions 1.2.2 (c) and 2.1.3.

The following provides additional details about total impervious cover and effective impervious cover (see **Section 8 - Glossary** for definitions), the need for a 25% effective impervious cover target, and various stormwater management control measures in existing urbanized and urban expansion areas.

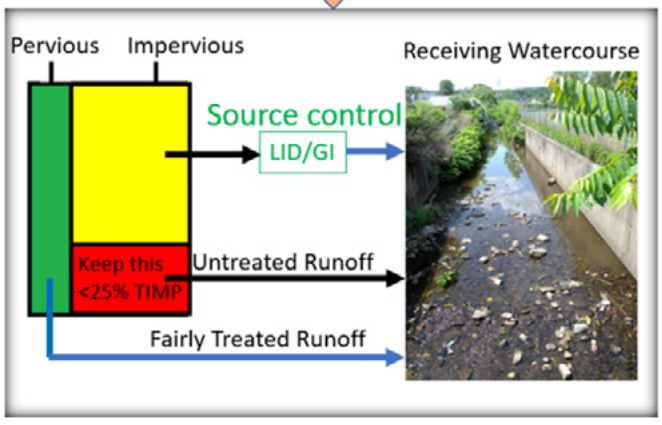
1 Existing urbanized area without any control measures:

Decreasing the impervious area that is directly connected to the storm sewer network to 25% of the total impervious area (TIMP) by connecting the remaining impervious area back to the ground via implementation of green infrastructure is crucial to reverse impacts of uncontrolled runoff generated from impervious cover. By doing so, we can mitigate the impacts of impervious cover on the watershed's hydrological cycle (the amount of runoff, peak discharge rates, and baseflow are altered), stream morphology, stream temperature, stream water quality (nutrient and pollutant loads increase), and stream biodiversity.

Existing urbanized area without any SWM control measures



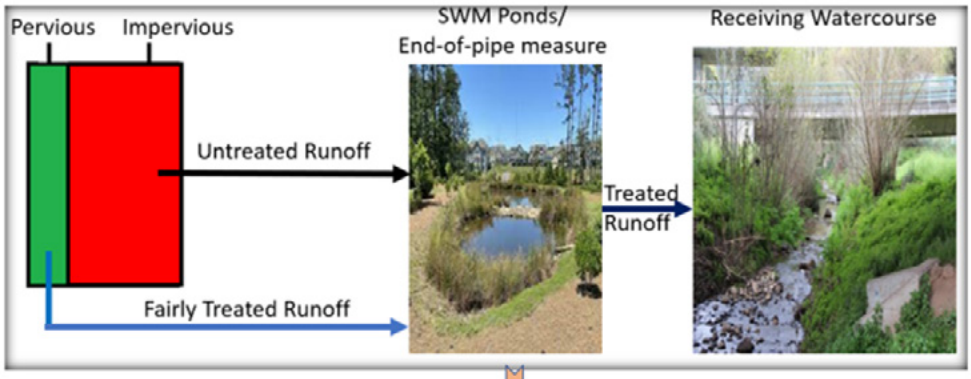
Retrofitted existing urbanized area with LID/GI to achieve <25% effective impervious cover



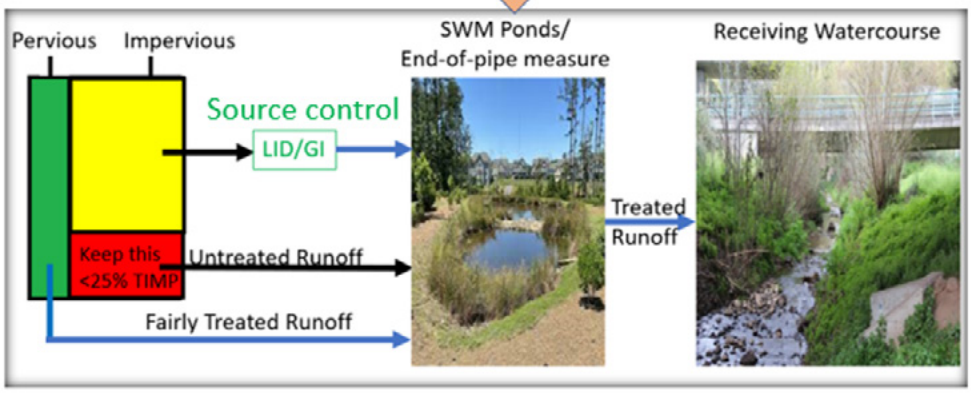
2 Existing urbanized area with some end-of-pipe control measures:

Managing stormwater at the source (source controls) is widely effective for limiting the negative hydrological effects of urbanization. Decreasing the impervious area directly connected to the storm sewer network to 25% of total impervious area by connecting the remaining impervious area back to the ground via implementation of green infrastructure is recommended to further enhance the health of the watershed. This illustrates a recommendation/ opportunity to go beyond the minimum requirements of stormwater management treatment criteria to help minimize impacts to the health of the receiving watercourse.

Existing urbanized area with stormwater management pond (SWM pond) or end-of-pipe control measures



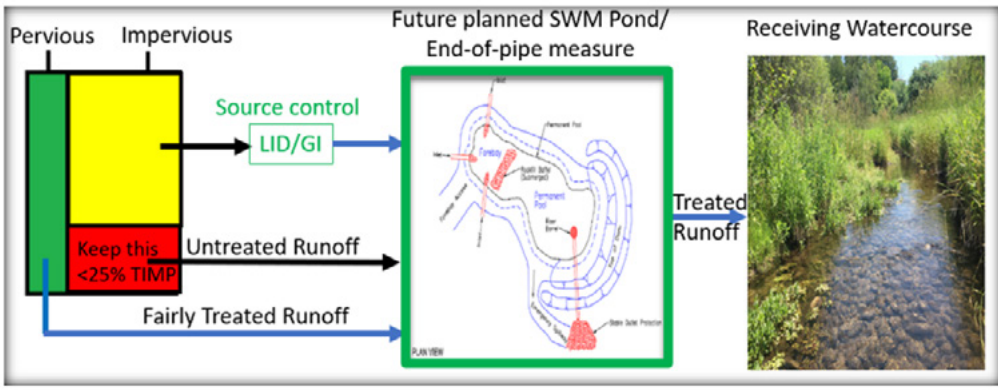
Implementing source control measures (LID/ GI) in existing urbanized area with SWM pond to achieve <25% effective impervious cover



3 Future urban expansion areas within the Town of Caledon that apply current stormwater management criteria:

These future urban expansion areas have the opportunity to achieve the current stormwater management criteria and benefit the receiving waterbodies by implementing green infrastructure to target stormwater at the source and limit the effective impervious cover to less than 25%, effectively augmenting the end-of-pipe conventional stormwater management. This illustrates a recommendation/opportunity to go beyond the minimum requirements of stormwater management treatment criteria to help minimize impacts to the health of the receiving watercourse.

Implementing source control measures (LID/GI) along with proposed SWM pond to achieve <25% effective impervious cover in the future urban expansion



APPENDIX B

This appendix contains more details on prioritization exercises for LID, restoration, and urban forest that form a key part of the management framework.

LID Implementation Case Study

Map 1 shows priority catchments for on-site control through the use of LID. A case study of the cost and benefits of particular LIDs is presented to demonstrate how watershed enhancements such as this can address issues related to flooding, water quality, and erosion in developed portions of the watershed.

The LID implementation case study uses the **Treatment Train Tool** to assess the costs/benefits of LID implementation at the southeast corner of Bovaird Drive and Hurontario Street (West Branch subwatershed). This case study assumed three bioretention sites (two at the Walmart, and one at the row houses), one vegetated strip near the school, and two infiltration trenches by the Walmart.

The focus of this case study was a return to pre-development water balance.

The modelled LIDs were designed with a rainfall depth control target of 25 mm and a volume control target of 3,142.5 m^2.

For the chosen site, the results are shown in Table 14.

TABLE 14:
LID Modelling Results Pre and Post Retrofit

Site	Total (mm)
Site Rainfall	753
Infiltration Pre-retrofit	318
Infiltration Post-retrofit	463
External Outflow Pre-retrofit	263
External Outflow Post-retrofit	92
Rainfall Retention On-site Pre-retrofit	490 (65%)
Rainfall Retention On-site Post-retrofit	662 (88%)

The modelling results demonstrate that widespread LIDs designed to retain 25 mm of rainfall would prevent 90% of annual rainfall events from generating runoff.

Table 15 identifies the construction and maintenance costs associated with the modelled LIDs. The total life-cycle costs consist of the construction and 25-year maintenance costs for each LID.

TABLE 15:
LID Implementation Case Study Costing

LID Type	Construction Cost	25-year Maintenance Cost	Total Lifecycle Cost
Bioretention	$794,124.80	$554,288.30	$1,348,413.10
Vegetated Strips	$122,455.00	$176,890.00	$299,345.00
Infiltration Trenches	$726,926.70	$372,727.50	$1,099,654.20
TOTALS	**$1,643,506.50**	**$1,103,905.80**	**$2,747,412.30**

FOR CONSIDERATION:

It is important to note that extreme events greater than 25 mm cannot be retained. Existing stormwater infrastructure is built to a standard of conveying and controlling the 100-year or Regional storm (current rainfall volume of 88.5 mm). With climate change, this rainfall volume is projected to increase to 107 mm, resulting in a need for additional storage of 18.9 mm. It will be necessary to factor climate change into stormwater asset management planning, including the implementation of LIDs as a volume control form of infrastructure.

ADDITIONAL RESOURCES:

The **Sustainable Technologies Evaluation Program** has guidance and resources on Low Impact Development that can inform municipal and development planning.

Terrestrial and Aquatic Restoration Priorities

Priority areas for ecological restoration (as shown in **Maps 4A** and **4B**) were determined through a multiple hit analysis of various terrestrial and aquatic criteria overlayed with the NHS. This exercise accounted for existing policy designations and future plans, while trying to ensure geographic distribution across the watershed. The purpose of this prioritization exercise was to increase habitat quality and quantity, address biodiversity needs, and improve climate resiliency.

In terms of the criteria identified in **Table 16**, terrestrial and aquatic criteria were equally weighted to determine the highest scoring areas based on ecological function that should be targeted for further restoration to improve both the NHS and WRS.

TABLE 16:
Criteria for Restoration Priorities

Category	Aquatic Criteria	Terrestrial Criteria
Habitat Quantity	ESGRA HDF Riparian Corridor	Natural Cover Habitat Patch (L-rank)
Habitat Quality and Biodiversity	Benthic Species Diversity Fish Species Diversity	Vegetation Communities of Concern (ELC) Species Abundance (avian L1-L4) Species Richness (avian L1-L4) Habitat Suitability (avian and amphibians)
Habitat Connectivity	Stream Connectivity	Regional Connectivity (Top 50%) Watershed Connectivity (Top 50%) Local Connectivity (Forest-Wetland) Local Connectivity (Forest-Forest)
Climate Change Vulnerability	Thermal Regime – Max Temperature Thermal Regime – Stability	Climate Change Vulnerability

Typical costing for restoration by habitat type / hectare for 2021 is as follows:

- Forest = $131,951.57
- Riparian = $141,215.20
- Meadow = $143,407.84
- Wetland = $186,256.75
- Shoreline (per 100 m) = $157,726.05

Table 17 identifies the anticipated cost (rounded to two decimal places) of restoring the top 10 watershed priority restoration sites based on 2021 typical restoration costing for each habitat type. The Headwaters is not included since it is such a large area that will be better addressed through targeted enhancements, protection, and stewardship.

TABLE 17:
Restoration Costing for Top 10 Watershed Sites

Site Name	Habitat Type	Cost
Hwy 407 Hydro (East of 410)	Forest	$3,364,765.04
	Meadow	$4,890,207.34
	Riparian	$1,751,068.48
	Wetland	$1,545,931.03
	TOTAL	**$11,551,971.88**
Pearson 1	Forest	$1,504,247.90
	Riparian	$7,173,732.16
	Wetland	$949,909.43
	TOTAL	**$9,627,889.48**
Hwy 407 Hydro (West of 410)	Forest	$1,319,515.70
	Meadow	$4,416,961.47
	Riparian	$2,824,304.00
	Wetland	$987,160.78
	TOTAL	**$9,547,941.95**
Wood Creek	Forest	$2,955,715.17
	Meadow	$846,106.26
	Riparian	$903,777.28
	Wetland	$335,262.15
	TOTAL	**$5,040,860.85**
Centennial Park Etobicoke	Forest	$1,082,002.87
	Meadow	$1,233,307.42
	Riparian	$536,617.76
	Wetland	$651,898.63
	TOTAL	**$3,503,826.68**

Site Name	Habitat Type	Cost
Marie Curtis / Arsenal	Forest	$2,243,176.69
	Riparian	$748,440.56
	Wetland	$111,754.05
	Shoreline	$47,317.82
	TOTAL	**$3,150,689.12**
Brampton Golf Club / Peel Village Golf Club	Forest	$3,193,227.99
	Meadow	$157,748.62
	Riparian	$282,430.40
	Wetland	$55,877.03
	TOTAL	**$3,689,284.04**
Eastgate Transitway	Forest	$1,332,710.86
	Meadow	$1,376,715.26
	Riparian	$353,038.00
	Wetland	$614,647.28
	TOTAL	**$3,677,111.40**
CAA Centre	Forest	$1,398,686.64
	Meadow	$430,223.52
	Riparian	$409,524.08
	Wetland	$74,502.70
	TOTAL	**$2,312,936.94**

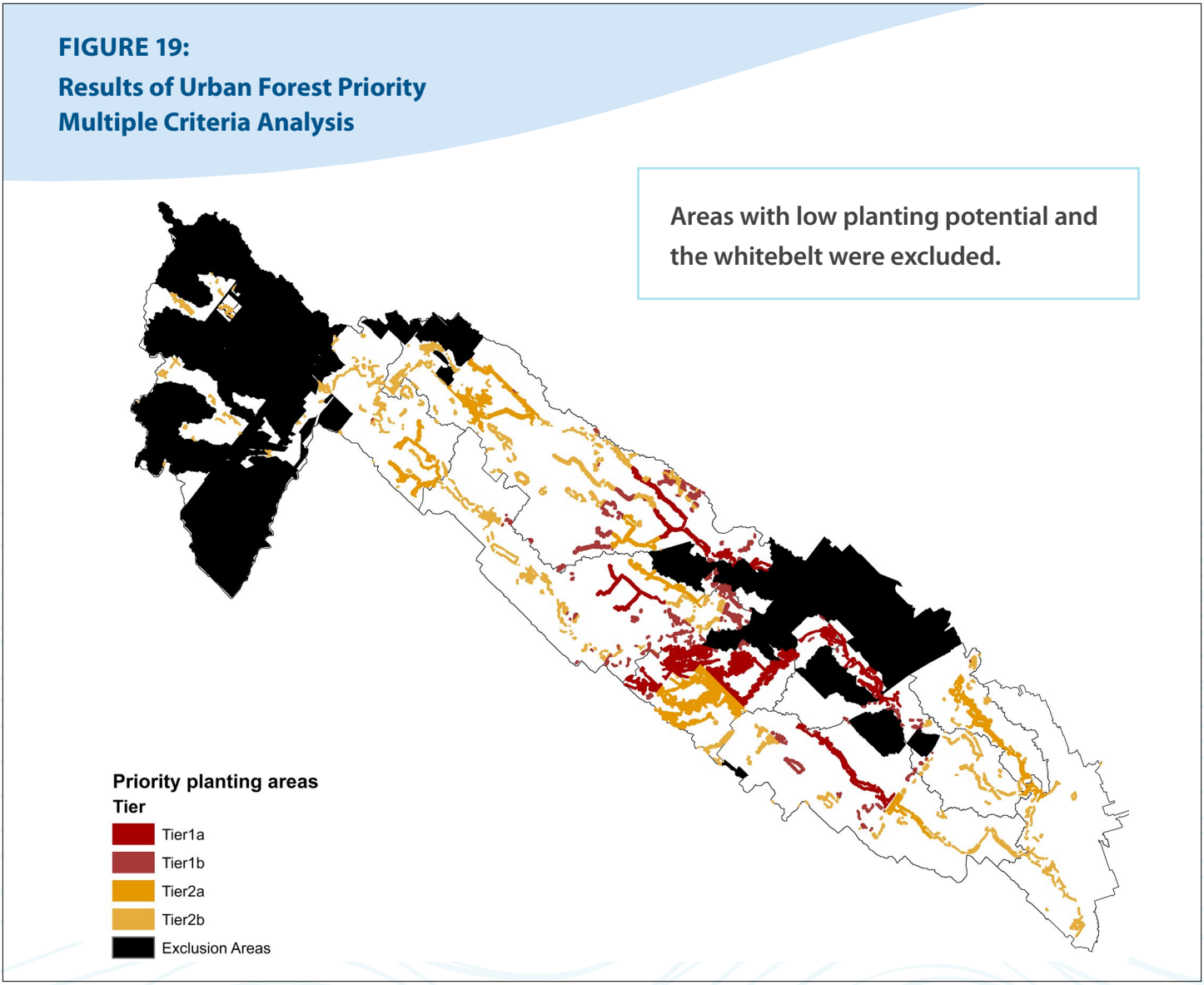
Urban Forest Priorities

Priority areas for planting to enhance the urban forest canopy used a multiple criteria analysis with equally weighted scoring. **Figure 19** shows the results of the multiple criteria analysis.

The first set of criteria were ecological / hydrological, which consisted of:

1. Within the contributing areas of the NHS (i.e. to improve buffers)
2. Proximity to the Water Resource System (i.e. the closer to the system the higher the score)
3. Lower canopy cover of the subwatershed (i.e. needs more trees)
4. Within ESGRAs (i.e. to improve infiltration)

FIGURE 19:
Results of Urban Forest Priority Multiple Criteria Analysis



The social / municipal criteria consisted of the heat vulnerable mapping from Peel Region and known municipal priorities like Brampton no-mow areas and Peel climate change priority areas. The whitebelt was excluded from the analysis because of potential urbanization there. Additionally, areas with low planting potential based on land use (e.g. airport), and land cover (e.g. industrial) were excluded. Assumptions were made for each land use type on the amount of trees planted with impervious areas being more limited.

A tiered approach was chosen to represent priority canopy cover enhancement (see **Map 10** and the results in **Table 18**). Tier 1 represents priority areas based on ecological, hydrological, social, and municipal criteria. Tier 1a represents the top 10 areas by number of trees planted. Tier 2 represents priority areas based on ecological and hydrological criteria. Tier 2a represents the top 10 areas by number of trees planted. Tier 1b and 2b represent the remainder of plantable areas meeting the specified criteria.

A total of 288.6 hectares of additional canopy cover can be added based on this tiered approach.

TABLE 18:
Canopy Cover Enhancements by Tier

Subwatershed	Current Canopy Cover	Tier 1 and 2 Canopy Cover	Tier 1 (Number of Trees)	Tier 2 (Number of Trees)
Headwaters	12.9%	13.3%	16	3,808
Little Etobicoke	14.0%	15.1%	1,779	5,337
Lower Etobicoke	22.9%	23.3%	–	2,809
Main Branch	14.2%	15.0%	2,924	2,741
Spring Creek	14.5%	16.0%	5,326	6,822
Tributary 3	6.5%	12.2%	6,864	3,395
Tributary 4	13.3%	14.7%	10	2,222
West Branch	17.9%	19.6%	10,288	3,757
TOTALS	**14.6% (watershed)**	**15.9% (watershed)**	**27,208**	**30,891**
COST (Estimated at $743 per tree)			**$20,215,544.00**	**$22,952,013.00**


TORONTO


Region of Peel
working with you


MISSISSAUGA


brampton.ca
BRAMPTON
Flower City


TOWN OF CALEDON


MISSISSAUGAS OF THE CREDIT
FIRST NATION


Toronto Pearson


Toronto and Region
Conservation
Authority