

GTAA Living City Project
Etobicoke Creek

*The Aquatic
Ecosystem*



Etobicoke and Mimico
Creeks



THE CONSERVATION
FOUNDATION
OF GREATER TORONTO

 **TORONTO AND REGION
Conservation**
for The Living City

The Aquatic Ecosystem

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Disclaimer

This draft of the Etobicoke Creek Watershed Fisheries Management Plan has been prepared specifically for the Greater Toronto Airports Authority (GTAA) Etobicoke Creek Living City Project (Aquatic Ecosystems Report) and is intended to be used for information purposes only.

This document will be replaced by final Etobicoke Creek Fisheries Management Plan which is currently undergoing review by the Ministry of Natural Resources (MNR) and Toronto and Region Conservation (TRCA).

This Report has been made possible by the generous support from the GTAA and the Region of Peel and has been developed and produced by TRCA with significant input from MNR.

Executive Summary

The Etobicoke Creek Watershed Fisheries Management Plan (FMP) is a provincial resource document developed by Toronto and Region Conservation (TRCA) in partnership with the Ontario Ministry of Natural Resources (OMNR) and the Department of Fisheries and Oceans (DFO). The FMP was developed to protect and enhance the aquatic ecosystem within the watershed and serves as a guide for land use planners, consultants, farmers, private land owners, land developers, anglers and nature enthusiasts. The FMP features the most updated and comprehensive collection of current and historical information relevant to the aquatic ecosystem, as well as resource protection and restoration recommendations meant to provide direction for future fisheries management. This FMP was developed to be consistent with OMNR's Watershed-Based Fisheries Management Plan (WBFMP) guideline (OMNR, 2005).

The Etobicoke Creek watershed is located on the north shore of Lake Ontario and drains an area of approximately 211 square kilometres. It flows through the regional municipality of Peel and the local municipalities of Mississauga, Brampton, Caledon and Toronto. Etobicoke Creek contains 273 kilometres of watercourses from the headwaters to its confluence with Lake Ontario. The FMP divides Etobicoke Creek into four subwatershed basins: Upper Etobicoke, Little Etobicoke, Lower Etobicoke and Spring Creek. Four major physiographic regions underlay the watershed with the headwaters in the southern slope of the Oak Ridges Moraine bounded on the south by the Peel Plain and the lower region, or "Old" South Slope, located between the Iroquois Plain and Lake Ontario. The soils are variable, ranging from clay to sand, however, the impermeable surfaces that dominate the urbanized watershed have impeded infiltration and reduced baseflow discharges. The result is an increase in surface runoff which may cause erosion, flooding, impaired water quality and, ultimately, degraded aquatic habitats. In developing the FMP, the authors uncovered some potential cold-water habitats and tributaries, although the Etobicoke Creek is largely a warm-water system.

Wetlands, and their vital ecosystem functions, have virtually disappeared from Etobicoke Creek watershed and it is estimated that between 80 to 99 per cent of all historic wetlands no longer exist. Many structural barriers to fish passage including drop structures, culverts and channels exist, and it is estimated that there are over 553 such barriers in the watershed. Riparian vegetation, a key component of aquatic ecosystem health, is limited and only 16.5 per cent of the watercourse length (or 45 kilometres out of a total of 273 kilometres) claims woody riparian vegetation zones. The aquatic communities within the watershed are largely impaired. Fish and benthic communities have been degraded since European settlement, particularly in the lower portions of the watershed. Numerous fish species once found in the watershed including Atlantic salmon, slimy sculpin, mottled sculpin and rainbow darter are no longer found. Numerous watercourses only support tolerant species such as white sucker, bluntnose minnow, blacknose dace and creek chub. Forty-three fish species have been found in Etobicoke Creek, nine of which are introduced. Of the species historically found, 28 were captured in 2000 and 2001, and 20 in 2004. The 2004 surveys identified three species not previously documented in the watershed and several species found historically in Etobicoke Creek were not found in 2000, 2001 or 2004.

Analysis of fish and benthic communities indicate that the Upper Etobicoke subwatershed is the least impaired, the Lower Etobicoke and Little Etobicoke are highly degraded, and the Spring Creek subwatershed shows signs of fair to poor habitat quality. The combination of considerable flows and reduced invertebrate diversity and density are likely contributors to the substantial decline in diversity and aquatic community. Poor riparian cover and the presence of in-stream barriers also negatively affect the quality of the habitat, and the potential for access by both fish and invertebrate species. Only the Upper Etobicoke Creek subwatershed stands out as having a relatively healthy aquatic community, with all other subwatersheds showing signs of degradation.

The present state of the ecosystem offers many challenges for restoration and target species for management have been identified. In 2001, TRCA initiated the Regional Watershed Monitoring Program (RWMP) in order to provide a regularly updated picture of the health of the nine watersheds within TRCA's jurisdiction and 14 monitoring stations were initiated in the Etobicoke Creek watershed. The full suite of aquatic data was collected in 2001 and 2004, and will again be surveyed and assembled in 2007.

The FMP provides a range of management recommendations based on the distinct conditions found in the Upper Etobicoke, Lower Etobicoke, Spring Creek and Little Etobicoke Creek subwatersheds. These recommendations are based upon various components and their associated targets including baseflow, water extraction, water quality and nutrients, in-stream barriers and ponds, riparian vegetation, altered watercourses, wetland creation and restoration, Index of Biotic Integrity (IBI) scores, target species and consumptive uses among others. Management recommendations are provided in detail at both the watershed-wide and subwatershed levels in text and map form. Recommendations include the need to increase monitoring stations (at least one per subwatershed) and, furthermore, that a community-based monitoring program be established in order to develop partnerships, constituency, knowledge and ownership for impacts to aquatic habitat in key areas of the watershed.

The FMP recommendations have been further developed within a Habitat Implementation Plan (HIP) and integrated along with Terrestrial Natural Heritage candidate sites to provide several key priority restoration opportunities for immediate implementation. Long-term issues to be addressed include the establishment of institutional frameworks for coordinating partnerships and efforts for collecting data, updating this plan, and monitoring aquatic communities. The final WBFMP guidelines from OMNR should be finalized by 2006 and this will form the template for the process that will need to be followed for community ownership and working together to improve aquatic habitat and ecosystem health within the Etobicoke Creek watershed.



Fisheries Management Plan

1.0 Introduction

The Etobicoke Creek Watershed Fisheries Management Plan (FMP) is a provincial resource document developed by Toronto and Region Conservation (TRCA) in partnership with the Ontario Ministry of Natural Resources (OMNR) and the Department of Fisheries and Oceans (DFO). The FMP was developed to protect and enhance the aquatic ecosystem within the watershed and serves as a guide for land use planners, consultants, farmers, private land owners, land developers, anglers and nature enthusiasts. The FMP offers current and historical information relevant to the aquatic ecosystem, as well as resource protection and restoration recommendations meant to provide direction for future fisheries management. It is anticipated that this document will inspire stakeholders to implement the recommended management actions through an “ecosystem first” approach. This plan is consistent with OMNR’s Watershed Based Fisheries Management Plan (WBFMP) guideline (OMNR, 2005).

FISHERIES MANAGEMENT PLAN

1.1 Background and Purpose

Adaptive resource management is a process whereby new information and practices feedback help refine objectives and targets, and is a critical aspect of fisheries management. Many aspects of land and water use affect fish and fish habitat. The long-term health of aquatic ecosystems is a critical consideration in any land use planning process and the general purpose of Fisheries Management Plans (FMPs) is to incorporate fisheries values and concerns into the municipal, provincial and federal planning and permitting processes. FMPs provide background information on the state of the aquatic ecosystem, as well as management targets and directions. FMPs present biological and physical data, as well as a scientific backdrop to manage the aquatic ecosystem in order to provide measurable benefits to society while maintaining the resource's ecological integrity.

In summary, the purpose of the FMP is to:

- present current and historical fisheries information
- identify critical issues
- outline management objectives
- recommend rehabilitation activities
- provide implementation strategies

1.2 Plan Objectives

The objectives of the FMP are as follows:

1. Establish a benchmark of ecosystem health by describing the existing conditions of the fish community.
2. Protect and enhance the biological integrity of the aquatic ecosystem:
 - i. promote the sustainable utilization of fisheries resources
 - ii. provide a framework for fisheries management at subwatershed, reach and site scales
 - iii. to achieve "net gain" in fisheries habitat
 - iv. to rehabilitate degraded fish communities and fish habitat for self-sustaining native stocks

- v. to promote public awareness, appreciation and understanding of fisheries resources and the aquatic habitats on which they depend
- vi. to involve non-government organizations (NGOs) such as angling associations, environmental interest groups and the general public in fisheries management activities

1.3 Plan Development

1.3.1 Background Information

Development of a background document — Evaluating the Condition of Fish Communities in the Etobicoke Creek Watershed (TRCA, 1998d) — was prepared during the development of the State of the Watersheds Report (TRCA, December 1988) and updated for the subsequent watersheds strategy document, Greening Our Watersheds – Revitalization Strategies for Etobicoke and Mimico Creeks (TRCA, May 2002).

Characteristics such as drainage area, surficial geology, slope and flow are important in order to begin to understand the watershed. Information on historic and present fish communities, as well as impacts on the aquatic ecosystem assist in developing fisheries management priorities.

Background information was collected from published literature, consultant reports and Geographical Information Systems (GIS) data. Historic and current fisheries data was collected from the Ontario Ministry of Natural Resources (OMNR), Toronto and Region Conservation (TRCA) sampling records, as well as other agency documents and consultant reports. Information on the physical features and perturbations/factors currently impacting the aquatic ecosystem (such as barriers, on-line ponds, extent of riparian vegetation, extent of development, etc.) were collected and mapped using GIS. TRCA data and consultant reports provided background information on baseflow and surface flow volumes.

1.3.2 Stakeholder Consultation

The Fisheries Management Plan (FMP) was developed based on comments resulting from two rounds of public meetings, which presented the background document. The first public meeting was held on October 3, 2002 at Professor's Lake Recreation Centre and highlighted three main concerns:

1. that an order of priority be developed for barrier mitigation
2. that all fish stocking should be compatible with existing community makeup
3. that greater emphasis be placed on water quality monitoring, restoration, and enforcement

This information was used to develop "Priority Restoration Strategies" for the Etobicoke Creek watershed. These strategies were then presented to the public at a second meeting, held on December 5, 2002 at Montgomery's Inn, in Toronto. The general issues expressed at the first public meeting were reiterated and a number of new requests were brought forward (Appendix II), and one reflected in section 4.0 Implementation – A Subwatershed Perspective.

1.4 Context of the Plan

Fisheries management falls within the mandates of DFO and OMNR. Other agencies such as the Ontario Ministry of the Environment (OMOE) and conservation authorities are also involved in fisheries management. Table 1 summarizes relevant legislation, agency roles and responsibilities as they relate to fish and fish habitat.

1.4.1 Federal Level

At the federal level, the Fisheries Act defines legal obligations essential to the protection and management of fish habitat. The Policy for the Management of Fish Habitat sets out DFO objectives, goals and strategies for the management of fish habitat. The policy objectives

for this document centre on a "no net loss guiding principle" and an overall policy objective of "net gain of the productive capacity of fish habitats" for Canada's fisheries resources.

Section 2 of the Federal Fisheries Act defines fish to include "parts of fish, shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals."

Section 34(1) of the Federal Fisheries Act defines fish habitat as "spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly to carry out their life processes." The essential components of fish habitat include the following:

- Food
- Cover
- Spawning habitat
- Access for migration

Fish require all four components, in adequate amounts, to survive and reproduce, as well as good water quality (Stoneman et al., DFO, 1997).

The Federal Fisheries Act defines legal obligations essential to the protection and management of fish and fish habitat. Section 35 is the primary section pertaining to the protection of fish habitat and states that "no person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat." Subsection 35(2) qualifies that prohibition by stating that "no person contravenes Subsection 35(1) by causing the harmful alteration, disruption or destruction (HADD) of fish habitat by any means or under any condition unless authorized by the Governor in Council under this Act."

FISHERIES MANAGEMENT PLAN

Table 1: Legislation Relevant to Fisheries Resource Management in Ontario*

Legislation	Agency	Provisions Dealing with Fisheries and Fish Habitat
Fisheries Act	DFO – Habitat Management	Regulates activities affecting fishes and fishable waters, deleterious substances and harmful alterations, disruption or destruction of habitat
Navigable Waters Protection Act	DFO – Coast Guard	Regulates works built on, over, through or across any navigable water
Beds of Navigable Waters Act	OMNR	The beds of most navigable waters are Crown Land
Ontario Fisheries Regulations	OMNR	Fisheries management requirements pursuant to the Federal Fisheries Act
Lake and Rivers Improvement Act	OMNR	Regulates activities affecting lakes and rivers in the province of Ontario
Game and Fish Act	OMNR	Regulates the capture, sale and possession of fish
Beach Protection Act	OMNR	Regulates the removal of sand and gravel from beaches
Public Lands Act	OMNR	Regulates various types of development on public lands
Species at Risk Act	Environment Canada	Protects species at risk and the habitat critical for their survival
Canadian Environmental Assessment Act	Environment Canada	Regulates the process to predict the environmental effects of proposed initiatives before they are carried out
Planning Act	Ontario Ministry of Municipal Affairs and Housing	Provides for preparation and review of development plans
Drainage Act	Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)	Permits individuals and municipalities to initiate and maintain drainage works
Ontario Water Resources Act	OMOE	Regulates discharge into water bodies and withdrawal of water
Environmental Assessment Act	OMOE	Provides for assessment of the effects on the environment of public and private projects
Conservation Authorities Act	Conservation authorities	Provides for regulation dealing with environmental protection.
Municipal Act	Municipalities	Regulates approvals for construction over public shores and waters

* Information presented here was derived from Appendix 4 of Maple District Fisheries Management Plan 1989-2000

1.4.2 Provincial Level

The Strategic Plan for Ontario Fisheries (SPOF II) and the Maple District Fisheries Management Plan 1989 – 2000 currently guides fisheries management in Ontario. SPOF II consists of four parts and provides a basis for actions involving the public and private sectors (Table 2). However, the Watershed Based Fisheries Management Plan (WBFMP) recently developed by the OMNR (OMNR, 2005) is now considered as the new standard for provincial fisheries management plans.

1.4.3 Municipal Level

At the municipal level, fish habitat receives protection indirectly through local Official Plan designation of Green Space or Open Space and through development setbacks. Municipalities also work closely with local conservation authorities, through watershed planning, the development of watershed level fisheries management plans, the plan review process, and through support of conservation authority policies and programs.

Table 2: Outline of Strategic Plan for Ontario Fisheries II (SPOF II)*

Goal for Ontario fisheries	To have "healthy aquatic ecosystems that provide sustainable benefits, contributing to society's present and future requirements for a high-quality environment, wholesome food, employment and income, recreational activity and cultural heritage"
Objectives	To protect healthy aquatic ecosystems
	To rehabilitate degraded aquatic ecosystems
	To improve cultural, social and economic benefits of Ontario's fisheries
Guiding principles	Sustainable development
	Limit to resource
	Natural reproduction
	Knowledge
	Societal benefits
Strategic management actions	Protect and rehabilitate aquatic ecosystems
	Involve the public in decision making
	Ensure resources are appropriately valued
	Improve program management and co-ordination
	Acquire and communicate knowledge
	Enforce firmly and effectively

* Information in this table was derived from SPOF II (OMNR, 1992)

Conservation authorities have indirect responsibility to participate in fisheries management through the Conservation Authorities Act, particularly Ontario Regulation 97/04. The Development, Interference with Wetlands and Alterations to Shorelines and Watercourses, Ontario Regulation 97/04, allows Conservation Authorities to:

- Prohibit, regulate or provide permission for straightening, changing, diverting or interfering in anyway with the existing channel of a river, creek, stream, watercourse or changing or interfering with a wetland.
- Prohibit, regulate or provide permission for development if the control of flooding, erosion, dynamic beaches, pollution or the conservation of land may be affected by development.

Toronto and Region Conservation's (TRCA) Valley and Stream Corridor Management Program (1994) contains another indirect component for fish habitat management. The program identifies valley and stream corridor boundaries in order that they can be appropriately identified in municipal planning documents and zoned in appropriate Open Space categories.

FISHERIES MANAGEMENT PLAN

The fisheries management plan (FMP) is a companion document to the Greening Our Watersheds – Revitalization Strategies for Etobicoke and Mimico Creeks (strategy) and uses seven general principles to guide management directions:

1. The natural cycle of water is one of, if not the main driving force affecting the aquatic community. Where possible, the natural variability of flows should be maintained or where impacted, restored to the historical flows.
2. A continuous band of woody and herbaceous vegetation in the riparian zone and its associated functions should be protected and/or restored.
3. All barriers to the passage of desirable species should be mitigated. If necessary, a sea lamprey barrier is an option to protect native communities.
4. The preferred mitigation technique for on-line ponds is removal. If removal is not an option, bypass or conversion to bottom-draw are the preferred alternatives.

5. The protection and enhancement of native fish communities are of first importance.
6. Where exotic species are present and desirable, they should be managed for but not at the expense of native aquatic communities.
7. Sustainability, not stocking is the priority. Aquatic habitat should be present, accessible and healthy enough to support a self-sustaining population of an appropriate species.

The strategy lists six integral management strategies, and a list of actions to guide protection and restoration initiatives. It is from these strategies that many of the targets, implementation priorities and management actions in this FMP were developed.



2.0 *Biophysical Characteristics*

The Etobicoke Creek watershed is located on the north shore of Lake Ontario, within the western limits of Toronto and Region Conservation's (TRCA) jurisdiction. Etobicoke Creek drains an area of approximately 211 square kilometres and covers the regional municipality of Peel and the local municipalities of Mississauga, Brampton, Caledon and Toronto (Map 1). Etobicoke Creek originates in the south-western portion of the Town of Caledon in the area of Old School Road and Mississauga Road, and contains approximately 273 kilometres of watercourses from the headwaters to the confluence with Lake Ontario. Etobicoke Creek can be divided into four subwatershed basins: Upper Etobicoke, Little Etobicoke, Lower Etobicoke and Spring Creek (Map 1).

2.1 *Physiographic Characteristics*

Four major physiographic regions underlay the watershed (Map 2). The upper sections are found in the southern slope of the Oak Ridges Moraine and are bounded on the south by the Peel Plain, with a predominant surficial geology of young till. This area also contains the Brampton Esker, dominated by coarse glaciofluvial sands and gravels, and capped by a layer of clay till. The middle region is bounded on the north by the Peel Plain and on the south by the Iroquois Plain, with a dominant surficial geology of young till. The clay soils found in the middle sections of the watershed have a much higher runoff potential,

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and as a result stream temperatures and flows, fluctuate throughout the year within this area. The lower region, or “Old” South Slope, is located between the Iroquois Plain and Lake Ontario, with surficial geology primarily made up of older till that were deposited by retreating glaciers. The soils of the plain are variable, ranging from clays to large deposits of sand and gravel associated with the ancient shoreline and beach bars. The deposits are highly permeable and may contribute baseflow to streams flowing through the area. However, the impermeable surfaces, such as asphalt and concrete that dominate the area have likely impeded infiltration and reduced baseflow discharges to the watercourses. The result is an increase in surface runoff to streams, which may then cause erosion, flooding, impaired water quality and, ultimately, degraded aquatic habitats.

The South Slope, Peel Plain and Iroquois Plain all play an important role in the natural heritage system. For example, water falling on the South Slope and Iroquois Plain recharges groundwater and provides baseflow to streams while, historically, the Peel Plain provided wetland habitat (Map 10). The Peel Plain is composed of finer materials, which do not allow for as much infiltration, resulting in intermittent watercourses. Further information on

the physiography and geology of the watershed is available in *Greening Our Watersheds: Revitalization Strategies for Etobicoke and Mimco Creeks* (TRCA, May 2002).

Etobicoke Creek is one of the most urbanized watersheds in the Greater Toronto Area (GTA) and features the following general breakdown in land uses depicted on Map 3 and compared across a 10-year period (1996 and 2005) in Table 3a and 3b.

Common to most watersheds in southern Ontario, urbanization is concentrated within the lower reaches of the watershed. It is anticipated that the watershed will continue to be developed through plans of subdivision, as well as through urban intensification.

Urban and rural land uses impact the quality and quantity of water in the watershed, as well as the physical form of the watercourses and, as such, have a direct impact on the watershed’s aquatic ecosystems. Aquatic ecosystems, therefore, can be an indicator of the condition of the supporting watershed. Aquatic communities and the presence of particular species can act as indicators of habitat quality, and help to focus and direct fisheries management.

Table 3a: 1996–2005 Land Use by Percent in the Etobicoke Creek Watershed

Land Use	1996	2005
Industrial ⁽ⁱ⁾	22	32
Institutional	7	2
Commercial	2	3
Residential	22	23
Open Space ⁽ⁱⁱ⁾	22	15
Agriculture	21	25
Future Development	4	0
Total	100	100

Sources:

1996 data: TRCA, December 1998. State of the Watershed Report: Etobicoke and Mimico Creeks Watersheds.

2005 data: Macaulay Shiomi Howson Ltd., Totten Sims Hubicki Associates. October 2005. Etobicoke – Mimico Creeks Watersheds Land Use Study. Toronto: TRCA.

(i) Industrial land use category for 2005 includes federal lands, highways, industrial lands and railway lands for the purposes of this comparison chart.

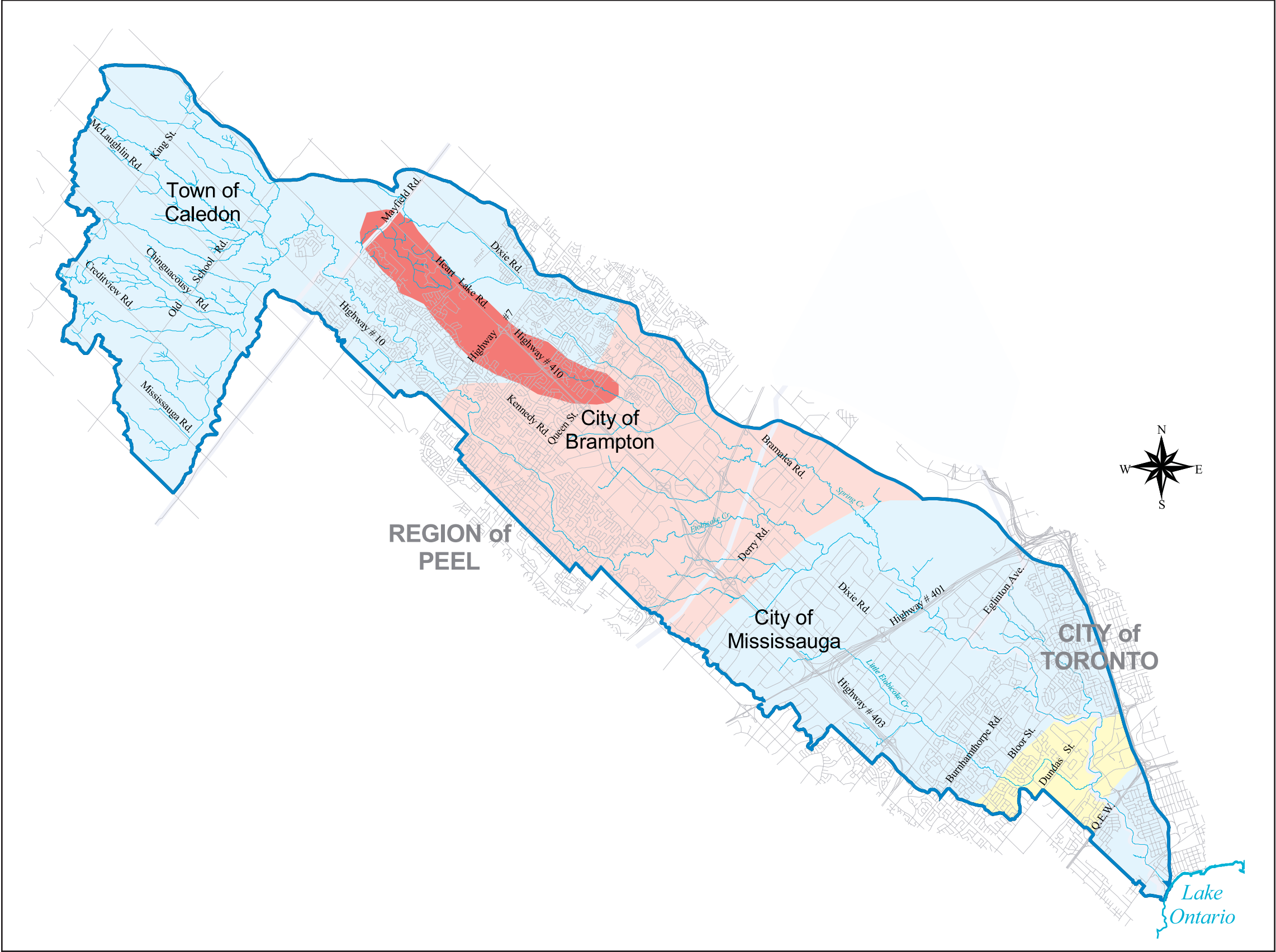
(ii) Open Space land use category for 2005 includes cemetery lands, open space, parkway belt lands, recreational lands and utility lands for the purposes of this comparison chart.



*Etobicoke Creek Watershed
and Subwatersheds*

LEGEND:

- L. Ontario Shoreline
 - Roads
 - Lakes and Ponds
 - Rivers
 - Municipal Boundary
 - Watershed Boundary
- 1 0 1 2 3 4 5 Kilometres



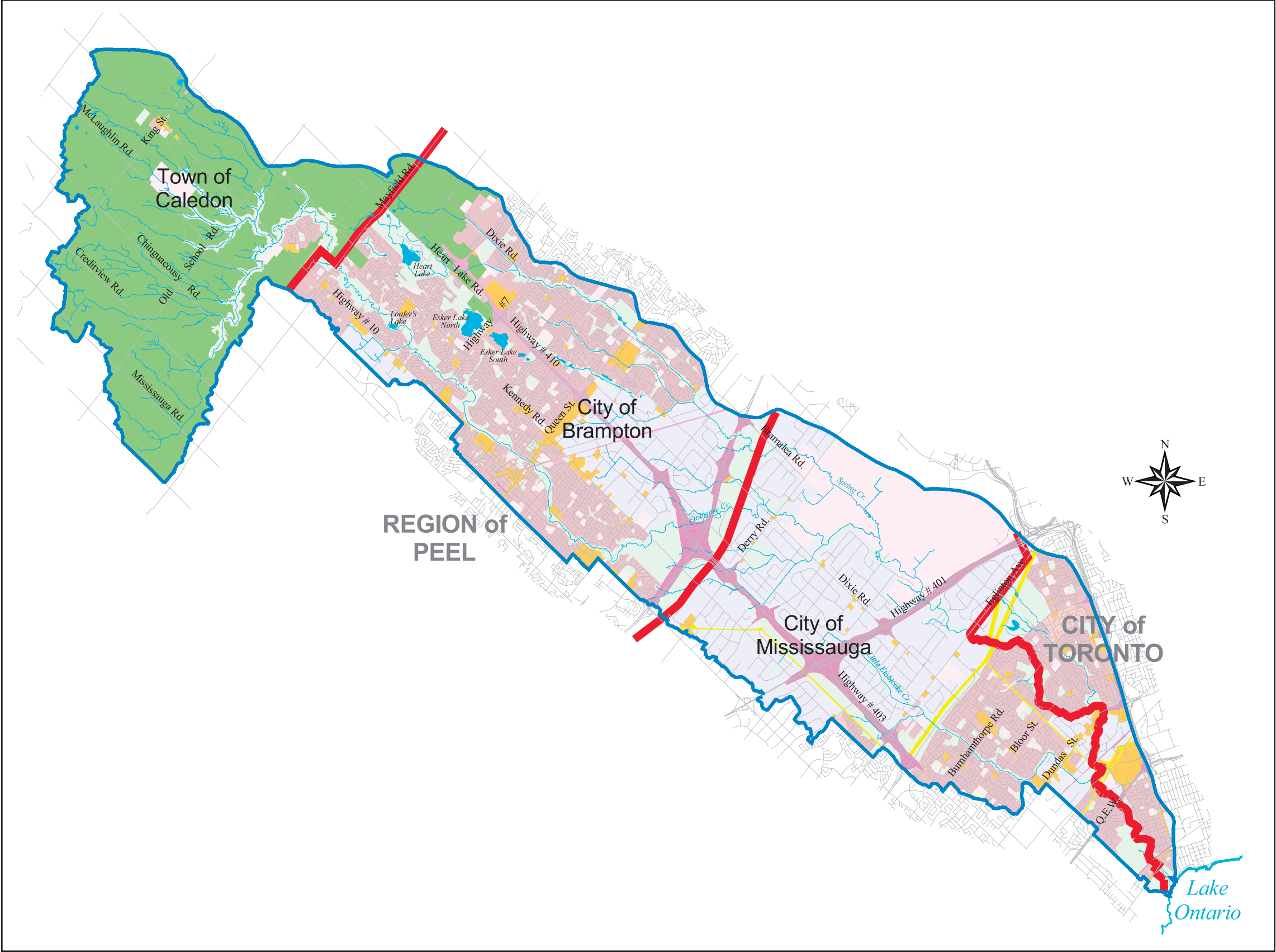
*Physiography of the
Etobicoke Creek Watershed*

LEGEND:

Physiographic Regions

- Iroquois Sand Plain
- Peel Plain
- South Slope
- Brampton Esker
- Municipal Boundary

1 0 1 2 3 4 5 Kilometres



*Etobicoke Creek
Watershed Land Use*

- LEGEND:
- Lakes and ponds
 - Municipal Boundary
 - General Landuse
 - Greenspace
 - Gov't/Educational Institution
 - Agricultural
 - Retail/Commercial
 - Industrial
 - Transportation Corridor
 - Residential Sector
 - Hydro Corridor
 - Watershed Boundary

Table 3b: Land Use by Subwatershed in Etobicoke Creek Watershed

Tributary	Total Area (hectares)	Percent Agricultural	Percent Natural	Percent Urban
Lower Etobicoke Creek	3944.6	0	23.5	76.5
Little Etobicoke Creek	2400	0	23.5	76.5
Upper Etobicoke Creek	9943	40.6	22.3	37.2
Spring Creek	4886	6.3	21.2	72.5

2.2 Aquatic Habitat

Three broad types of aquatic habitat are found within the Etobicoke Creek watershed:

1. **Riverine Habitat** — found in lotic systems (fast-moving water) such as rivers/streams
2. **Lacustrine Habitat** — found in lentic systems (slow-moving water) such as ponds and lakes
3. **Wetland Habitat** — found in marshes, swamps or along watercourse margins

2.2.1 Riverine Habitat

Riverine habitat is the most common habitat type within the Etobicoke Creek watershed. Factors influencing riverine habitat include, but are not limited to, stream order, slope, substrate, stream morphology, flow regime, groundwater and baseflow, water quality, presence of in-stream barriers and extent of riparian vegetation. These characteristics will be discussed in the following sections to characterize the existing conditions of riverine habitat in the Etobicoke Creek watershed.

2.2.1.1 Stream Order

The use of stream order was first proposed by Strahler (1964) and is a common method of dividing a watershed into similar components according to stream size and function. A first-order watercourse is a single, unbranched tributary (e.g., a spring or seep). Where two first-order watercourses meet, they form a second-order stream. When two second-order streams join, they form a third-order watercourse and so on. In general, the higher the

order, the larger the watercourse and the bigger the drainage area. Small headwater streams, generally orders one through three, share many general characteristics.

Aquatic life within these streams is highly dependent upon vegetative cover for stream temperature moderation and the input of organic matter for production. Stream gradient and erosion potential are generally also greater in headwater streams. As stream order increases, productivity increases, transitioning from a stream dominated by terrestrial primary productivity to one dominated by aquatic primary productivity. It is generally understood that both species diversity and habitat diversity increase with drainage area (Vannote et al., 1980).

Small, seemingly insignificant streams play a vital role in aquatic ecosystem health, and connect the aquatic and terrestrial systems. Alterations to these watercourses will change and disrupt the quantity and quality of water available to stream ecosystems. Maintaining low-order or headwater streams is essential to supporting the ecological functions of fish and other aquatic species, as well as maintaining stream form and function.

It is important to examine the percentages of stream order found within the watershed. The mapped first-order streams alone make up approximately 27.5 per cent of the total length of the watercourses. Second-order streams compose approximately 29 per cent of the total length. These calculations do not include “ephemeral” and “intermittent” channels that have not been documented or mapped. Lower order watercourses typically make up the majority of watercourses

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within relatively undisturbed watersheds, perhaps as much as 80 per cent. Historically, these watercourses have been of little concern, as most development occurred towards the lower end of the watershed but now, as development encroaches within headwater areas, impacts to these watercourses become a major concern. Low-order watercourses are easily altered, filled in, channelized or piped. As these streams are very small in size and convey comparatively low flow volumes compared to higher-order watercourses, they are far more vulnerable to impacts from development and alteration. Alterations to these small streams change the ecological function of the aquatic system. Issues relating to water quality and quantity, flood control, pollution, thermal warming, baseflow reduction, groundwater recharge, sediment flow, water quality enhancements, the recycling of nutrients, maintaining biodiversity and aquatic productivity all accumulate as headwater (low-order) streams are lost and/or altered.

Determination of stream order for this report was completed using Toronto and Region Conservation's (TRCA) hydrologically corrected 1999 Digital Elevation Model (DEM). The DEM was produced using Ontario Base Map elevation data (1:10,000) and TRCA watercourse data digitized from 1999 digital ortho-photography. At its confluence with Lake Ontario, Etobicoke Creek is a sixth-order stream (Map 4). The percentage of each order watercourse is shown in Table 4.



Development encroaches within headwater areas.

Table 4: Stream Order Lengths and Percentages in the Etobicoke Creek Watershed

Stream Order	Total Stream Length (km)	Percent of Stream Length (%)
First	75	28
Second	79	29
Third	46	17
Fourth	20	7
Fifth	4	1
Sixth*	49*	18*
TOTAL	273	100

* Some of the length of sixth-order watercourses at the confluence with Lake Ontario is not included in this calculation. The total length of sixth-order watercourse is, therefore, slightly larger than that shown here.

2.2.1.2 Slope, Substrate and Morphology

Stream slope or gradient influences the rate of erosion and deposition of sediment. Watercourses with steep slopes are typically straighter and have a higher ratio of shallow riffles to deeper pools than streams with low slope, and tend to have higher erosion potential due to increased water velocities. Watercourses with steeper slopes typically contain larger materials like cobbles and boulders, whereas lower-sloped streams have lower stream velocities resulting in the accumulation of fine materials like sand and silt. Table 5 outlines general stream characteristics found at a range of stream slopes.

Stream slope is influenced, in part, by the bed material over which the stream flows. The presence of a layer of hard material such as clay or bedrock, or large material such as boulders, can act to hold the stream bed in position both laterally and vertically. Stream reaches with bed material of clay or bedrock do not erode as readily as less cohesive materials such as sand. In transitional areas between hard and soft bed materials, a notable change in gradient



*Stream Order for the
Etobicoke Creek Watershed*

LEGEND:

- Stream Order
- First
 - Second
 - Third
 - Fourth
 - Fifth
 - Sixth
 - Municipal Boundary

1 0 1 2 3 4 5 Kilometres

usually occurs. Groundwater discharge often occurs within these transitional areas, where stream down-cutting intercepts the lateral flow of groundwater. The location of cold-water fish communities have also been correlated with sudden gradient changes (Skinner and Porter, 1987). Figures 1 and 2 depict the slope maps and locations of major roads and municipal boundaries for Spring Creek and the main branch of Etobicoke Creek.

Table 5: Stream Morphology and Substrate at a Range of Stream Slopes

Slope (%)	Characteristics	Substrate
< 0.3	low gradient; typically sinuous; greater pool-to-riffle ratio	sands and silts
0.31 – 1	relatively sinuous; more or less even pool-to-riffle ratio	gravels and cobbles
1.01 – 5	riffles out-number pools; higher water velocities; less sinuous	large gravels, cobbles and boulders
> 5	riffles predominate; water velocities and erosion forces high; typically straight stream channel	boulders, cobble and sometimes hard clay

Development and the construction of hard surfaces such as dams, roads or concrete channels may create a change in slope, therefore some caution

is required in interpreting slope changes from gradient profiles. Four areas with transitions in stream slope have been identified in the Etobicoke Creek watershed where there is an increased likelihood of groundwater discharge to the stream (Figures 1 and 2):

1. Between Britannia Road and Bramalea Road on Spring Creek.

On the main branch of Etobicoke Creek, three transitions occur:

2. Between Dixie Road and Highway 7.
3. Between Britannia Road and Derry Road.
4. In the area of the Queen Elizabeth Way (QEW).

Stream slope ranges in the Etobicoke Creek are summarized below in Table 6 and are depicted spatially on Map 5.

2.2.1.3 Flow Regime

Once precipitation falls to the ground, it will either evaporate, run off or infiltrate through the soil. The rate and amount of water that follows each pathway depends upon factors such as soil type, topography, land use, soil moisture, and precipitation intensity and duration. Typically, as natural areas becomes developed, the rate and amount of surface runoff to watercourses increases and infiltration decreases. Storm events raise the water level in watercourses more rapidly, more often and to higher levels than

Table 6: Etobicoke Creek Watershed Stream Slopes Summary by Subwatershed

Subwatershed	0-0.3%	0.3-1%	1-5%	>5%	Total (km)
Lower Etobicoke Creek	0.98 km	6.35 km	17.89 km	6.42 km	31.64 km
Little Etobicoke Creek	1.43 km	5.77 km	7.24 km	1.42 km	15.86 km
Upper Etobicoke Creek	26.76 km	76.65 km	54.61 km	14.59 km	172.60 km
Spring Creek	5.63 km	21.36 km	23.48 km	3.25 km	53.74 km

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Figure 1: Slope Map of Spring Creek

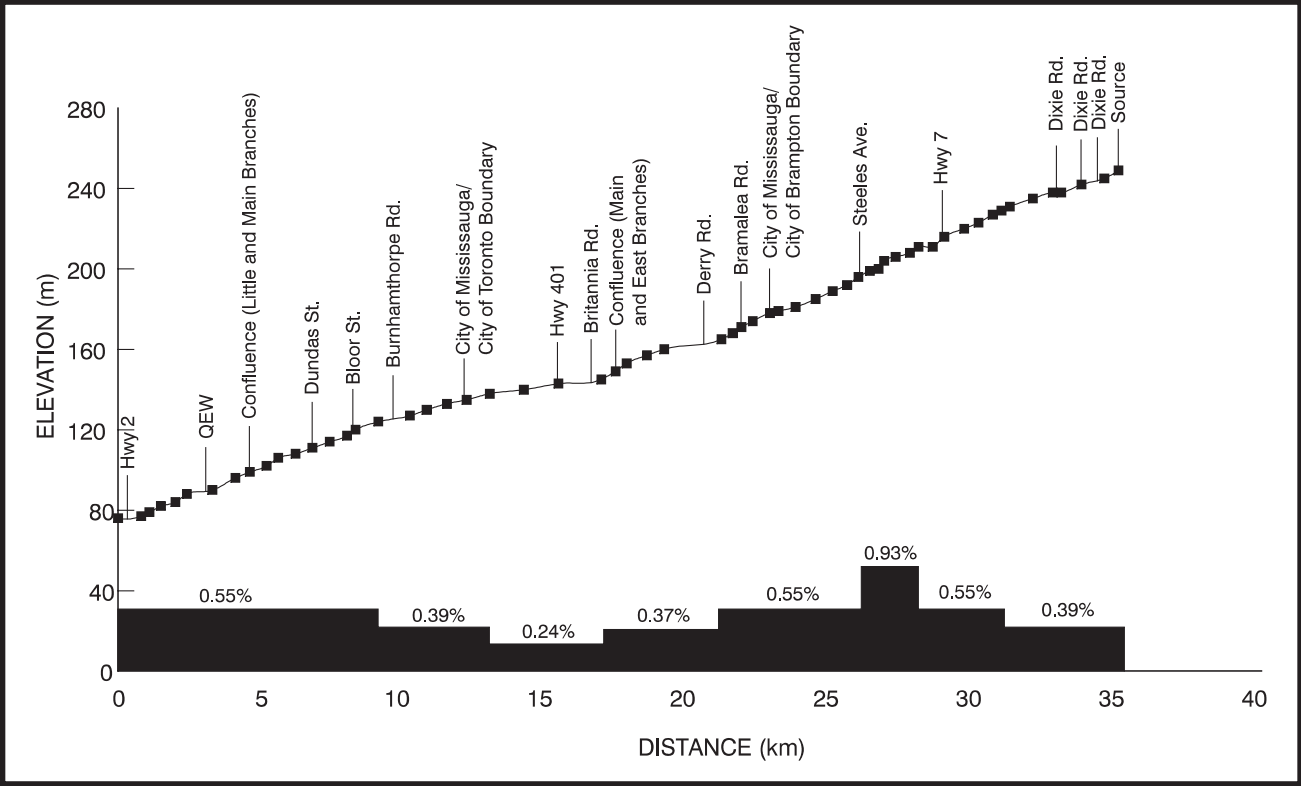
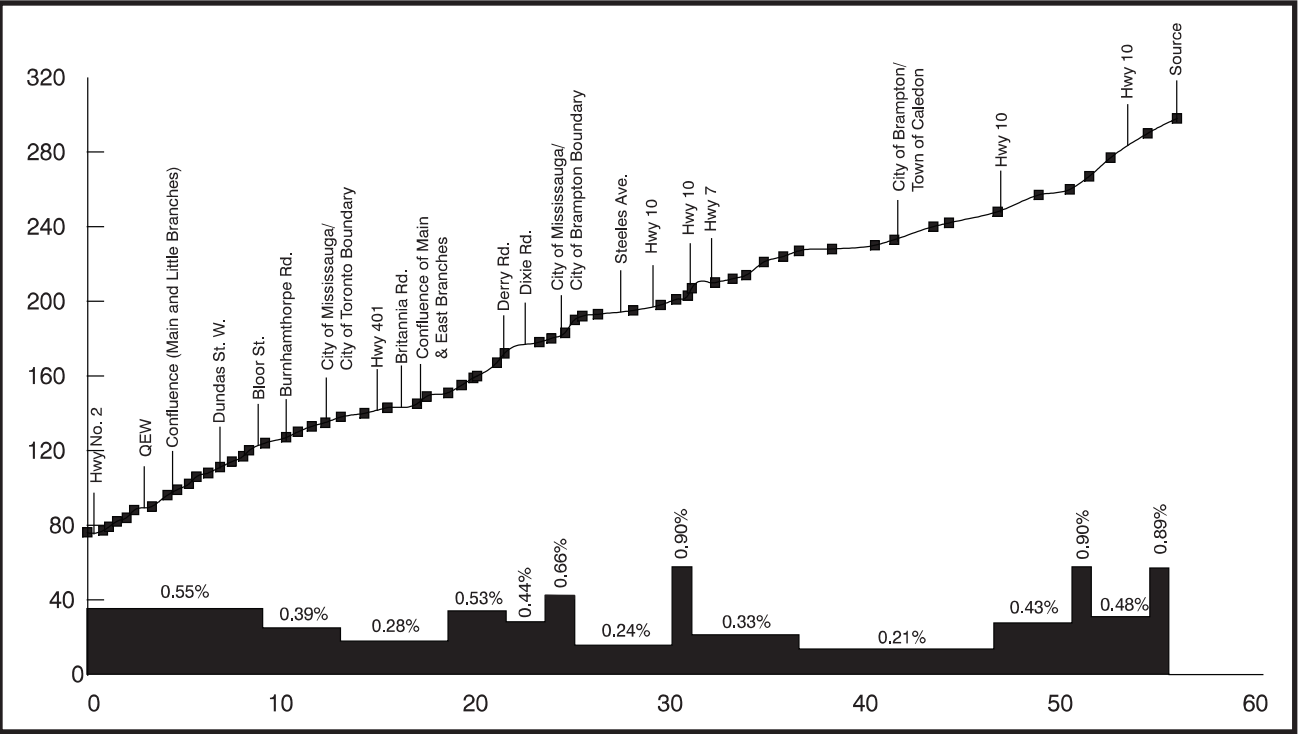
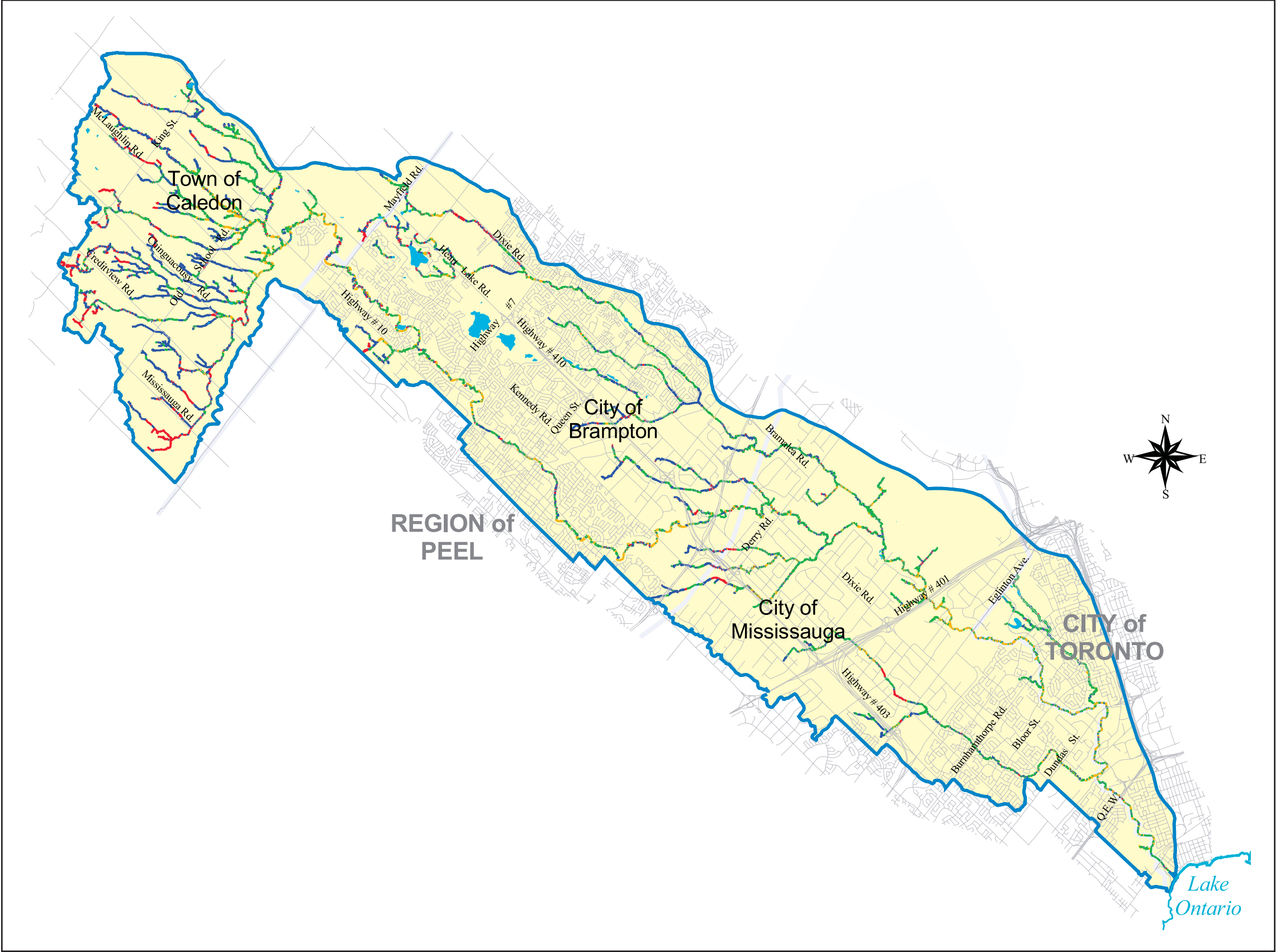


Figure 2: Slope Map of the Main Branch of Etobicoke Creek





*Percent Stream Slope
for the Etobicoke
Creek Watershed*

LEGEND:

Stream Slope

- 0 - 0.3%
- >0.3 - 1%
- >1 - 5%
- >5%

Municipal Boundary

1 0 1 2 3 4 5 Kilometres



under predevelopment conditions (referred to as “peakiness”). As natural areas become developed, watercourses may also experience lower flows during dry periods or dry up completely due to reduced groundwater inputs.

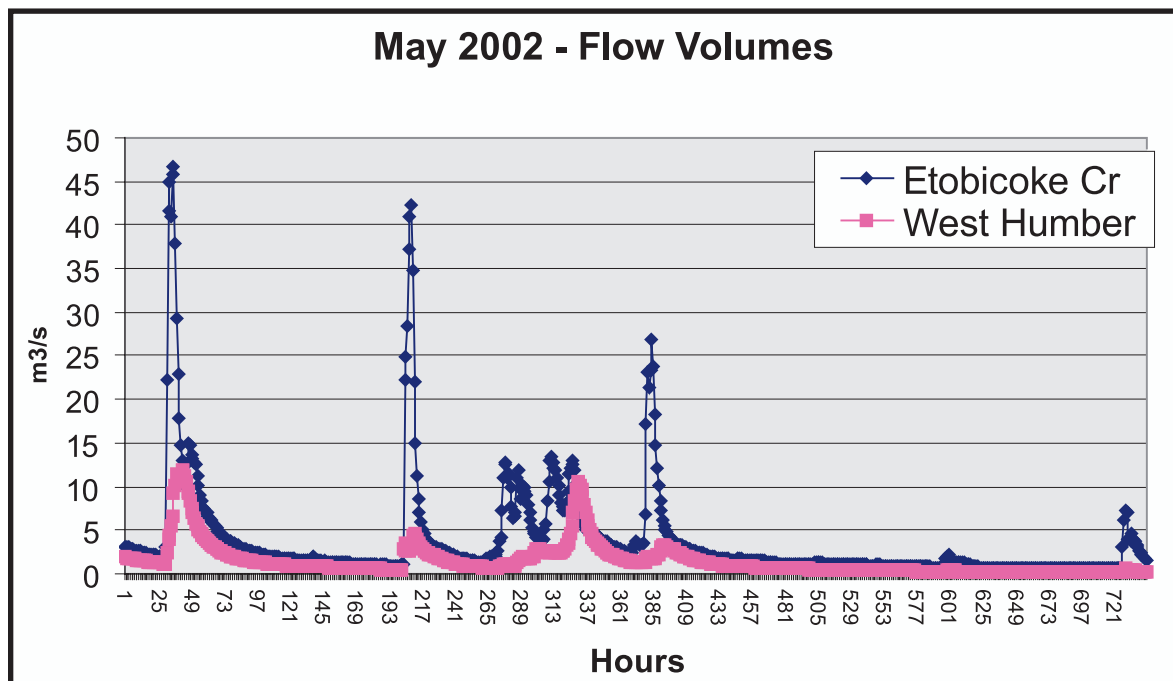
Components of flow (discharge) quantity include timing, duration, magnitude, frequency and rate of change. Together, these components constitute the flow regime or hydrological regime. Water temperature, dissolved oxygen, suspended sediment loads, nutrient availability and physical habitat all vary with hydrological regime (Richter et al., 1997). As such, aquatic communities are vulnerable to changes in the flow regime. Poff refers to flow as the master variable limiting the distribution of riverine species (Poff et al., 1997).

Alteration to the natural flow regime is typically caused by factors such as the creation of dams and weirs, surface water diversions for irrigation, stream channelization, groundwater extraction, deforestation, agriculture and urbanization (Poff et al., 1997). Given that fresh-water systems are defined largely by their hydrology, alteration of flow

regimes by human activities is a significant concern (Saunders et al., 2001).

Only a relatively limited amount of flow data is available from stations in the Etobicoke Creek watershed (Map 6). Data shows that on an annual basis, Etobicoke Creek displays the typical hydrology of a developed watershed, with annual peak flows occurring mainly in the spring. However, there are also very high flows observed in the fall seasons. Throughout the year the watershed demonstrates a typical “peakiness of flows” or “flashy nature” characteristic of urbanized watersheds. This is due to a higher level of imperviousness within the urbanized watershed, which reduces the time period between rainfall reaching the ground and entering the streams. High levels of imperviousness reduce groundwater infiltration and increase overland flow into streams. Figure 3 offers a comparison between the typically “peaky” Etobicoke Creek May 2002 flows, due mainly to storm-water runoff from impervious urbanized areas, and the more stable, groundwater-based flows of the West Humber River.

**Figure 3: A Comparison of Flow Volumes (May 2002)
Between West Humber River and Etobicoke Creek**



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2.2.1.4 Groundwater and Baseflow

Groundwater is defined as subsurface flow that occurs in fully saturated soils and geologic formations (Freeze and Cherry, 1979). Where these saturated soils or geologic formations intersect the surface, groundwater discharge occurs. Groundwater discharge to a stream forms baseflow and is critical for maintaining water flows, especially during the drier summer months. In the Greater Toronto Area (GTA), groundwater temperatures are in the range of eight to 10 degrees Celsius. The more groundwater discharge to a stream, the lower and more stable are water temperatures, which is important to temperature-sensitive species such as sculpin. Bowlby and Roff found that groundwater discharge is one of the major characteristics determining the presence of cold-water fish communities (Bowlby and Roff, 1986).

Habitat Suitability Indices developed in the United States utilize annual baseflow as a percent of average annual daily flow to determine habitat suitability for certain trout species (Raleigh, 1982; Raleigh et al., 1984; Raleigh et al., 1986). This ratio is useful in determining flow fluctuations and provides an indication of flow stability, and suggests that the higher the ratio, the more stable the flow, the more likely the habitat is suitable for sensitive cold-water species. In terms of trout production, ratios greater than 50 per cent are excellent, those between 25 to 50 per cent are good and ratios less than 25 per cent are poor. Data from the flow gauging station in Etobicoke Creek indicate that the baseflow ratio is below that required by trout and is more suitable for warm-water species that are tolerant of higher water temperatures and less stable flows. However, the headwater ecosystem in the Upper Etobicoke Creek subwatershed is composed of a sensitive, cool-water community (e.g., blacknose and blackchin shiners, and central mudminnows). The cool-water status of this ecosystem is supported by continuous water temperature data collected over the summer months from 2002–2004. Areas of high baseflow discharge may be very localized in the subwatershed and may support a significant amount of overall flow volume in this system. It is

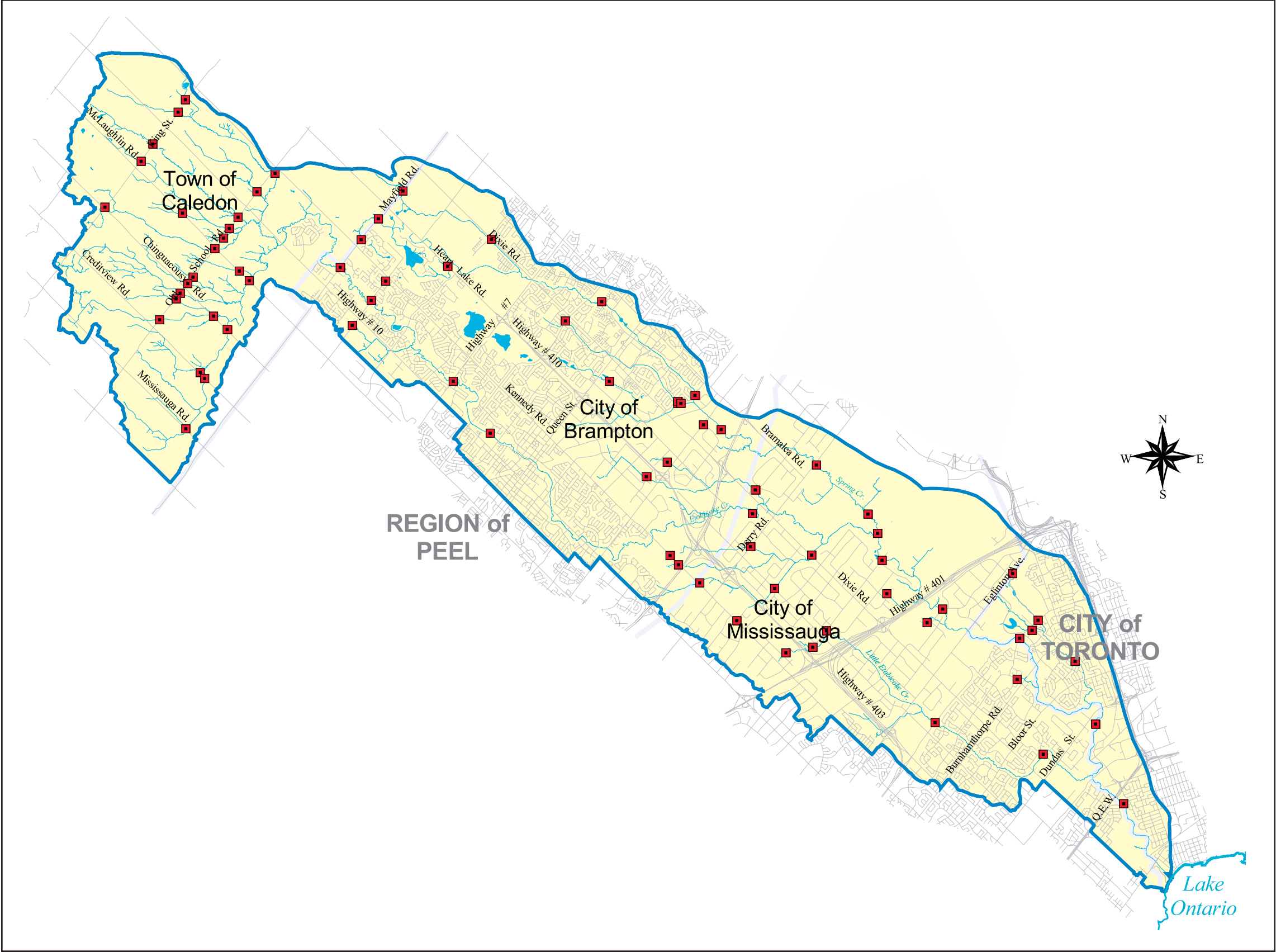
very important to maintain this baseflow discharge condition in order to protect the cool-water species that exist in the associated reaches.

In 2000, Toronto and Region Conservation (TRCA) initiated a work plan to develop a Low Flow Management Program. This program is aimed at gaining an improved understanding of the connections between surface and groundwater systems through the measurement and mapping of the quantity and distribution of baseflows within each of the watersheds found in TRCA's jurisdiction. The program allows TRCA to manage more effectively and to protect baseflow systems through an integrated approach with other TRCA initiatives and through the Ministry of the Environment's (MOE) Permit to Take Water (PTTW) program. The data collected are being used to develop groundwater and water budget models which include information related to land use, surficial soils, and the underlying geology to delineate aquifer systems and recharge/discharge areas. This information is then used to adopt more comprehensive strategies for watershed management, based upon a better understanding of the distribution of baseflows and their associated influence on the aquatic ecosystem. More detailed work was conducted in 2002 in the Upper Etobicoke subwatershed. Insufficient data were available to base any definitive conclusions upon at the time of developing this Fisheries Management Plan (FMP).

2.2.1.5 Water Quality

The quality of surface water is influenced by land use activities, which have the potential to increase pollutants and/or generate new pathways for pollutants to enter watercourses.

Pollutants typically reach receiving waters via one of three routes: overland runoff, atmospheric deposition or direct discharge (e.g., through storm-water outfalls, drainage ditches or agricultural tile drains). The first two methods are non-point sources of pollution, while the latter is an example of point source pollution. In urban areas, the primary sources of water quality problems include runoff from impervious surfaces, sewer and storm-



*Baseflow Monitoring
Stations in the Etobicoke
Creek Watershed*

LEGEND:

■ Baseflow Monitoring Stations

— Municipal Boundary

1 0 1 2 3 4 5 Kilometres

water outfalls, landfill leachate, snow dump runoff, excessive stream bank erosion and atmospheric fallout. In rural and agricultural areas, sources may include excessive erosion of cultivated soils and stream banks, livestock access to streams, and fertilizers and pesticides.

The Etobicoke Creek watershed has been monitored by the City of Toronto at three stream-water quality monitoring stations, but lacks Provincial Water Quality Monitoring sites for the period between 1996 and 2001. Two of the City of Toronto monitoring stations were decommissioned in 1998, with water quality data being collected at the remaining station near Evans Avenue between 1999 and 2002. Provincial water quality data for the time period 1985–1995 and 1998–2002 were examined with reference to guidelines or targets, and summary statistics were calculated for the following key water quality parameters: phosphorus, suspended sediment, phenols, chlorides and faecal coliforms. In addition, a review of City of Toronto stream sampling data was undertaken in relation to the provincial data. Summary statistics were generated for Biological Oxygen Demand (BOD), total suspended sediment and faecal coliforms (TRCA, 1998c). In 2002, two additional stations, one located at Highway 10 and one located at Derry Road were installed, and form part of the next phase of water quality monitoring. Toronto and Region Conservation (TRCA) has prepared a number of detailed reports on water quality for the Etobicoke Creek watershed (TRCA, 2002; TRCA, 1998e; Meek et al, 1998; Scanlon and Meek, 2001; TRCA 2003).

Additional water quality-monitoring initiatives are being developed as a component of TRCA's Regional Watershed Monitoring Network (RMN). This program includes a project by the University of Toronto to explore the use of periphytic diatoms as biomonitors. Diatoms are algae that are particularly sensitive to basic water chemistry, and are amongst the first group of organisms to be affected by changes in physical and chemical conditions in a water body. This project was initiated in 2002 and completed in 2004.

The percentage of exceedences of Provincial Water Quality Objectives (PWQO) and other guidelines were calculated for the key parameters to obtain an understanding of present conditions in the Upper and Lower Etobicoke Creek subwatersheds. Without additional testing, it would be difficult to identify separate water quality contributions from the Little Etobicoke and Spring Creek subwatersheds.

Since Etobicoke Creek is highly urbanized, the impacts on the water quality within the stream can be traced to primary residential and industrial sources. The watershed also has a substantial rural component in the Upper Etobicoke Creek subwatershed and can be expected to be influenced by primary rural sources of contamination (TAWMS, 1986).

Lester B. Pearson International Airport (LBPIA) covers approximately 1,900 hectares, with 1,700 hectares situated within the Spring Creek/Upper Etobicoke subwatersheds. Storm-water runoff associated with airport operations can negatively impact water quality of receiving tributaries. Recognizing this issue, the Greater Toronto Airports Authority (GTAA) has been working to reduce the generation of waste materials and to treat storm-water runoff. Specific measures implemented within the past decade include the following:

- Site-level stormwater management including quantity and quality control (e.g., all major outfalls have fuel separators, on-line pollution analyzers and a diversion to the sanitary sewer for contaminated water; central de-icing facility to contain glycol-based de-icing fluid; addition of a subsurface wetland to aid in the treatment of stormwater)
- All PCB-filled transformers have been removed and all known contaminated sites have been remediated
- High-performance standards (green buildings) are being developed, with water-efficient and other energy saving devices being incorporated into the design of these buildings

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- Restoration of the valley lands through riparian plantings
- Natural channel design techniques have been applied to Spring Creek
- One barrier-to-fish passage was mitigated in 2001 on Spring Creek

Substantial reductions in the on- and off-site impacts from LBPIA have been documented (McGill, 2002).

Generally, water quality decreases from headwaters to Lake Ontario, with the majority of the Provincial Water Quality Objectives and other guidelines exceeded for various key parameters. The Etobicoke Creek has shown high concentrations of chloride above the target guideline of 250 milligrams per litre and should be considered for further investigation.

2.2.1.6 Sport Fish Consumption

The Ontario Ministry of the Environment (OMOE) regularly monitors the level of contaminants found in sport fish and publishes consumption guidelines annually in the Guide to Eating Ontario Sport Fish. For the Etobicoke Creek however, some species are not listed in the guide and are listed under the Toronto Offshore area (OMOE, 2004). For specific consumption restrictions, please refer to the most recent version of the guide.

2.2.1.7 In-stream Barriers

In-stream barriers can take many forms such as logs, low water levels, beaver dams, low head weirs, pollution, water temperature and road crossings. Naturally occurring structures like log jams or beaver dams are relatively short-term in nature when compared to human-constructed structures such as dams and weirs. Log jams and beaver dams also provide a source of woody material for habitat and food for many aquatic organisms. Permanent human-constructed structures are a primary fisheries concern. Over the years, dams

and weirs have been constructed on the Etobicoke Creek system for a variety of purposes including energy dissipation, flood control, irrigation, recreation and aesthetics. Impacts to fish and fish habitat associated with barriers include restriction of passage for both migratory and non-migratory species, preventing access to spawning, nursery or feeding habitats, and temperature refuges.

Many barriers, such as drop structures, have created on-line ponds, which can adversely affect water temperature and aquatic habitat. The ponding of water causes suspended particles to settle out due to lower water velocities. Over time, the pond fills in with sediment, potentially starving downstream reaches of natural bedload and ultimately creating the need to dredge the pond. If the sediment is released downstream, the material can smother downstream aquatic habitats and communities. In addition, ponds likely receive little shade and may warm up considerably during the summer months. The warmer water may reach temperatures above limits tolerated by downstream aquatic communities and gradually change downstream cold-water aquatic habitats to warm-water systems.

In-stream barriers can have some limited or specific positive impacts such as preventing the spread of undesirable fish upstream. For example, the Toronto Golf Club dam prevents the parasitic sea lamprey and gobies from reaching spawning habitat upstream. In other cases, such as in the Duffins Creek watershed, dams are maintained as a management tool and species partition between native fish and migratory exotic populations.

Recent air photo interpretation using 1999 imagery, along with limited field verification, has identified 553 confirmed and potential barriers within the watershed (Table 7 and Map 7). Barriers not positively identified by this method include those caused by perched culverts, bridges, and those obscured by overhead woody vegetation. There may still be unrecorded barriers particularly at road and railway crossings, in areas of forest cover, on smaller tributaries and on private land. In some places, the gabion bottom has heaved and buckled, effectively reducing the depth of water, and

thereby hindering fish movement within any of the channelized sections.

Table 7: Number of Potential In-stream Barriers to Fish Passage in the Etobicoke Creek Watershed by Subwatershed

Subwatershed	Number of Barriers
Upper Etobicoke Creek	287
Spring Creek	139
Little Etobicoke Creek	45
Lower Etobicoke Creek	82
Watershed Total	553

2.2.1.8 Riparian Vegetation

Riparian vegetation is defined as the combination of different plant communities found within the transitional area between the aquatic and the adjacent terrestrial ecosystem. The vegetation found in this area provides a number of critical functions (Table 8). The riparian zone is also an important habitat area for many flora and fauna species, and acts as a movement corridor for both. Table 8 provides a description of the five main functions provided by the riparian zone and the criteria commonly used to delineate the zone (City of Toronto, 2001).

The riparian vegetation of the Etobicoke Creek watershed was mapped, measured and categorized based on interpretation of 1999 ortho-photography (Map 9). Riparian communities were divided into five categories and include forest, successional, meadow, wetland and urban. Table 9 lists the characteristics used to define each riparian category.

Table 8: Five Categories of Riparian Functions and their Delineation Criteria

Function	Method	Commonly Used Delineation Criteria
Water Quality and Quantity Improvement	Filtering, polishing, evaporating and attenuating surface waters	• 30 m measured on both sides of the stream (EC, 1998)
Watercourse Structure	Provision of in-stream cover, channel structure and erosion resistance	• 30 m for watercourses located on the Oak Ridges Moraine (ORMCP, 2002)
Shade	Moderation of water temperature	• 15 m for warm-water watercourses and 30 m for cold-water watercourses (OMNR, 1994)
Food Supply	Organic material as food supply for the aquatic food chain	• 30 m measured on both sides of the stream (EC, 1998)
		• 30 m for watercourses located on the Oak Ridges Moraine (ORMCP, 2002)
		• 15 m for warm-water watercourses and 30 m for cold-water watercourses (OMNR, 1994)
		• The 25-year storm floodplain and all plant communities associated with mesic soils (City of Toronto, 2001)
Watercourse Movement	Long-term movement of watercourses and other geomorphic functions	• The watercourse meander belt, the maximum lateral extent of meandering in a defined reach

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Table 9: Riparian Category Definitions

Category	Definition
Forest	Areas with a woody component of less than 25 per cent and at least three trees deep
Successional	Sparsely vegetated areas having a small woody component (10 to 25 per cent woody vegetation)
Meadow	Dominated by uncultivated grasses, not including grazing/fallow fields or manicured grasses
Wetland	Areas dominated by wetland: marsh, bog (swamp difficult to distinguish due to canopy cover)
Urban	Areas lacking riparian vegetation where it is either dominated by cropped grasses or was devoid of any vegetation at the time of the air photo

Each category type was measured along both stream banks and quantified in kilometres, and as a percentage of total stream length (Table 10). In total, 16.5 per cent of the watercourse length in the Etobicoke Creek watershed has woody riparian vegetation.

2.2.1.9 Riverine Habitat Categories

Based on the information presented in the previous sections, watercourse reaches within the Etobicoke Creek watershed can be classified into one of seven habitat categories, originally developed in the Draft Don Watershed Fish Community and Habitat Management Plan (MTRCA, 1997). These seven habitat categories form two parts, including:

Part 1

- small riverine cold water
- small riverine warm water
- intermediate riverine cold water
- intermediate riverine warm water
- large riverine

Part 2

- lacustrine
- estuarine

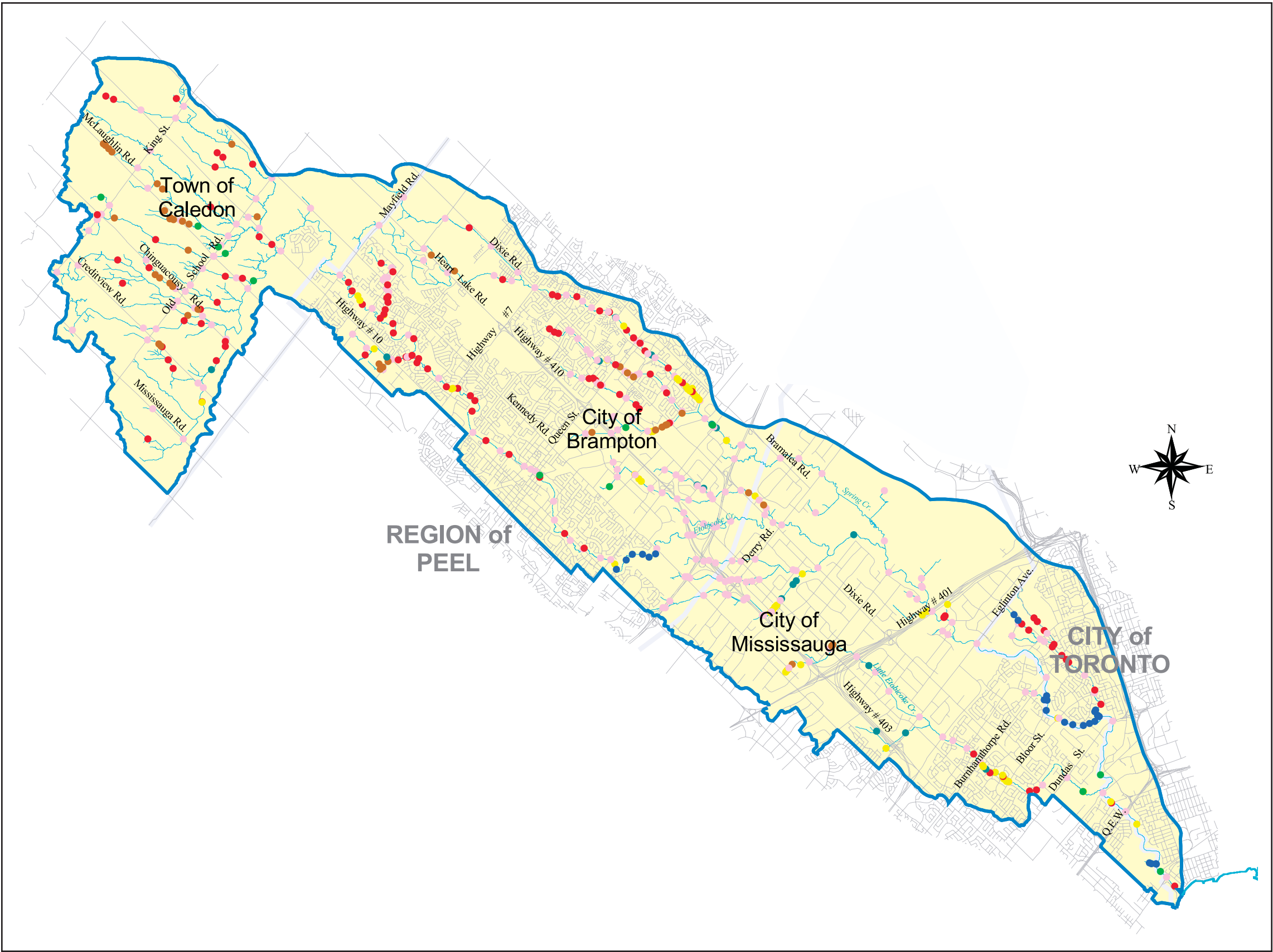
Separating watercourses into small, intermediate or large is based upon stream size or drainage area. The river continuum concept (Vannote et al., 1980) finds that as a watercourse becomes larger, the complexity of habitat increases and the watercourse is able to support a greater number of species. Data from Steedman showed that species richness initially rises dramatically in streams with drainage

Table 10: Assessment of Riparian Vegetation for the Etobicoke Creek Watershed

Vegetation Type	Length of Watercourse with Vegetation (km)	Percent of Total Stream Length with Vegetation
Forest	41.8	15.4
Successional	3.2	1.2
Meadow	35.6	13
Wetland	10.8	4
Urban	180.1	66.4
Total Woody Vegetation*	45	16.5
Total Naturally Vegetated	91.3	33.6
Total Length of Stream	273	150.1

* Woody vegetation includes forest and successional vegetation categories.

Existing and Potential
In-stream Barriers



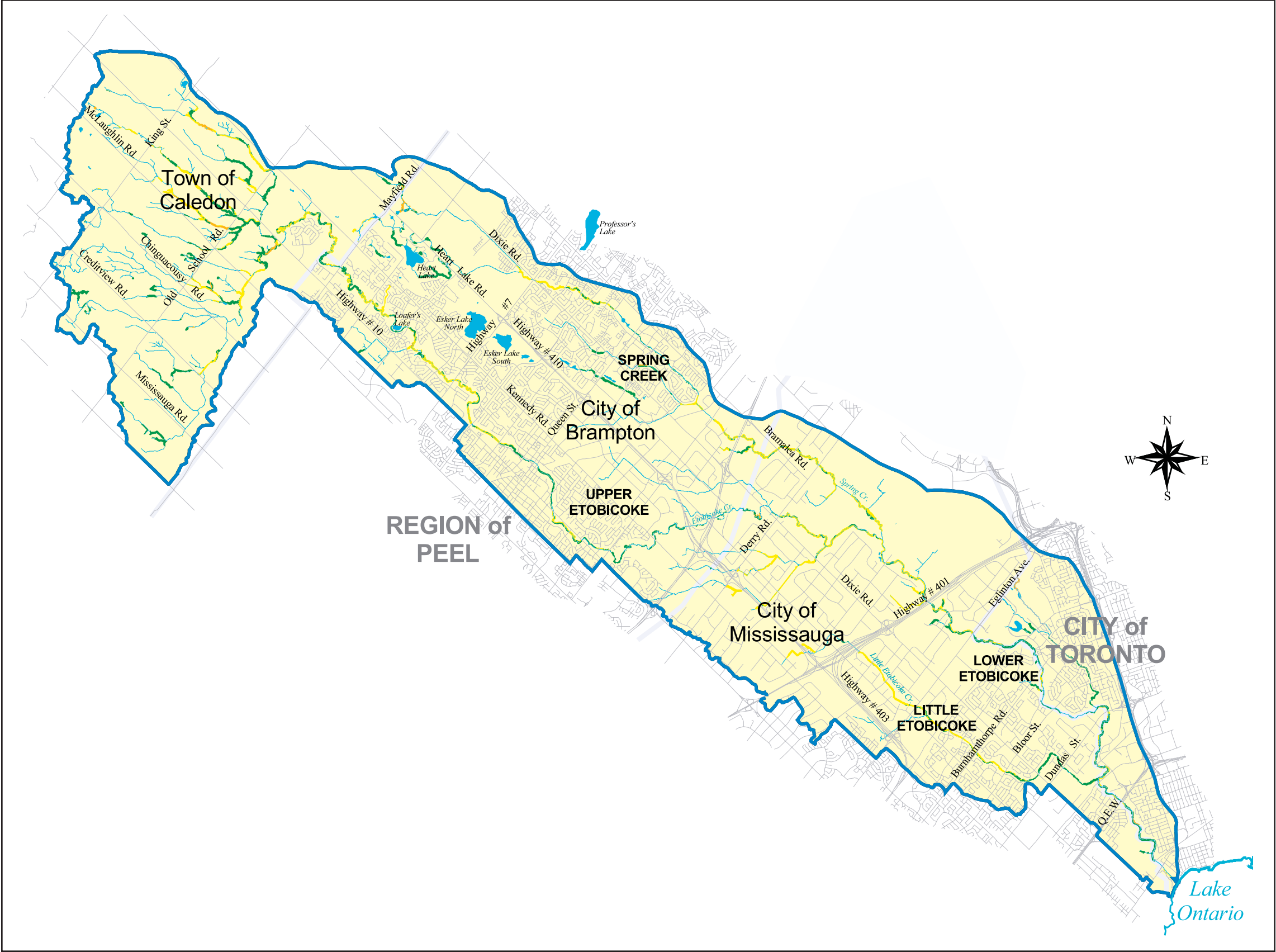
LEGEND:

Potential In-stream Barriers

- Driveway
- Golf course crossing
- RR Crossing
- Road Crossing
- Sanitary sewer protection
- Trail Crossing
- Weir
- Unknown

Municipal Boundary





*Riparian Habitat
in the Etobicoke
Creek Watershed*

LEGEND:

Riparian Habitat

- Forest
- Successional
- Meadow
- Wetland
- Beach/Bluff

Municipal Boundary

1 0 1 2 3 4 5 Kilometres



areas up to 10 square kilometres, increases more slowly in streams with drainage areas between 10 and 200 square kilometres and then levels off as drainage area increases beyond 200 square kilometres (Table 11) (Steedman, 1987). It is on this basis that small, intermediate and large riverine habitats were defined.

The distinction between the two parts is as follows:

Part 1: Are actively flowing (lotic) systems

Part 2: Are still or non-flowing waters (lentic) lakes and ponds

Physical and biological attributes were used to define a watercourse as either cold or warm water. Flow regime, surficial geology, the ratio of baseflow to average annual flow, stream slope and observed temperatures were used to gauge whether a watercourse would have the cold, stable flows necessary to classify it as cold-water habitat. The historic presence or absence of cold-water fish species was also used to identify cold- or warm-water tributaries. Map 9 and tables 12 and 13 show the location and extent of each habitat category.

Table 11: General Riverine Habitat Category Definitions (adapted from Clayton et al., 2004)

Habitat Category	Physical Characteristics				Biological Characteristics
	Mean Baseflow (m ³ /s/km ²)	Drainage Area (km ²)	Stream Order	Temperature	
Small riverine cold water	High	Less than 10	First and second order (sometimes third)	Stable	Sculpin historically present
Small riverine warm water	Low	Less than 10	First and second order	Fluctuates	Cyprinids, Johnny and fantail darters
Intermediate riverine warm water	Low	10–200	Third, fourth and fifth order	Fluctuates	Cyprinids, Johnny and fantail darters
Large riverine	Low to moderate	Less than 200	Sixth order and higher	Fluctuates	Cyprinids, darter species and smallmouth bass

* Classes are based on physical characteristics, with biological considerations.

Table 12: Extent of Each Habitat Category in the Etobicoke Creek Watershed

Habitat Category	Extent of Habitat
Small riverine cold water	10.3 km or 3.8%
Small riverine warm water	174.5 km or 64%
Intermediate riverine warm water	87.6 km or 32%
Estuarine	.5 km or 0.2%

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Table 13: Extent of Each Habitat Category in Etobicoke Creek by Subwatershed

Tributary/Habitat Category	Total Stream Length (km)	Percentage of Overall Stream Length (%)
Lower Etobicoke Creek		
Intermediate river warm water (IRW)	16.7	52.8
Small riverine warm water (SRW)	14.4	45.6
Estuarine (E)	0.5	1.6
Little Etobicoke Creek		
Small riverine warm water (SRW)	16	100.0
Upper Etobicoke Creek		
Intermediate river warm water (IRW)	37.6	21.9
Small riverine warm water (SRW)	128.8	75.1
Small riverine cold water (SRC)	5.2	3.0
Spring Creek		
Intermediate river warm water (IRW)	33.3	61.9
Small riverine warm water (SRW)	15.4	28.6
Small riverine cold water (SRC)	5.1	9.5

2.2.1.10 Thermal Conditions

Temperature data loggers were set up at all of Toronto and Region Conservation's (TRCA) Regional Watershed Monitoring Network Stations over the course of three field seasons. These temperature loggers were installed in 2001, 2002 and 2004. Additional temperature loggers were deployed in the Upper Etobicoke subwatershed at various locations in 2003. Using a method outlined in the Ontario Stream Assessment Protocol (MNR, 2003), the thermal stability of each location was determined and is summarized in the tables below for three of the subwatersheds (tables 14, 15 and 16). The temperature of the stream is logged for the warmest months of the summer (e.g., the period between July 1 and September 10). The temperatures selected for thermal analysis were based on the following points:

- taken after 12 p.m. and as close as possible to 4 – 5 p.m
- taken between July 1 and September 10
- taken on days when maximum daily air temperature exceeds 24.5 degrees Celsius

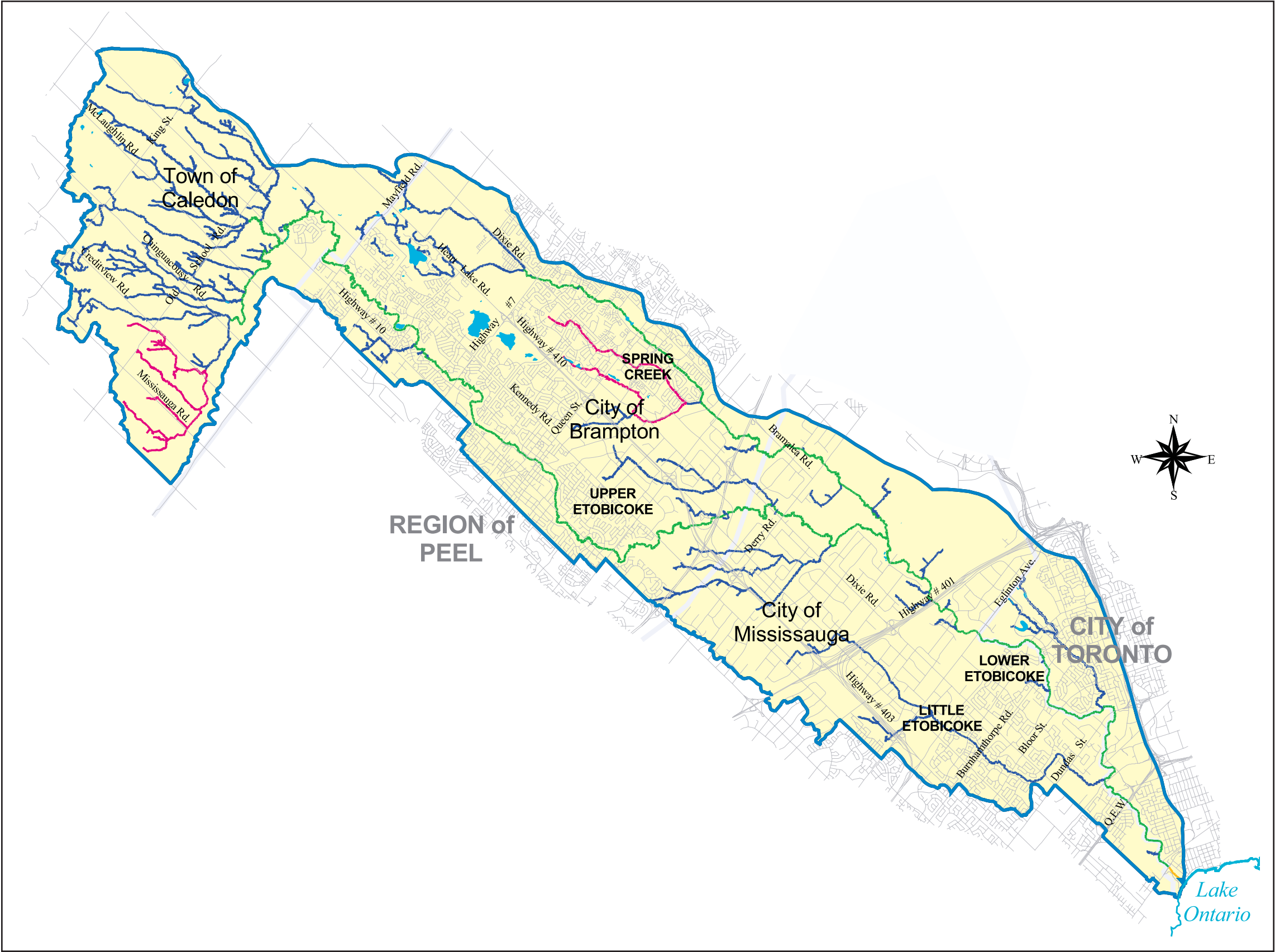
- during a heat wave (less than two days) and no rainfall to affect baseflow

The stream temperatures are then compared to the maximum air temperature recorded on a data logger that has been set up within the watershed. Both temperatures are compared to a regression line that has been developed by the Department of Fisheries and Oceans (DFO) and the Ministry of Natural Resources (MNR) to determine the site's thermal stability.

2.2.1.10.1 Lower Etobicoke Creek Thermal Condition

All of the stations in the Lower Etobicoke Creek subwatershed are thermal unstable condition (Table 14). One station (EC001WM) shows other thermal issues. This station exhibits inconsistent five degrees Celsius increases over 20-minute periods. This occurred late in the season (August–September) and early in the morning (8–10 a.m.), when water temperatures should be close to the daily minimum. The anomaly may be linked to a

Habitat Categories for the
Etobicoke Creek Watershed



nearby sewer outfall, servicing nearby commercial/ industrial users. The temperature and water quality impacts on the aquatic resources are unknown, and warrant further detailed investigations.

Table 14: Ontario Stream Assessment Protocol (OSAP) Thermal Summary for the Lower Etobicoke Creek Subwatershed

Station	2001	2002	2003	2004
EC001WM	-	Unstable	-	-
EC002WM	-	Unstable	-	Unstable
EC003WM	Unstable	-	-	-
EC004WM	-	-	-	-
EC005WM	-	Unstable	-	Unstable

2.2.1.10.2 Little Etobicoke Creek Thermal Condition

To date there have been no thermal investigations conducted within this subwatershed. Future monitoring within the subwatershed will include a thermal component.

2.2.1.10.3 Upper Etobicoke Creek Thermal Condition

As was anticipated, the lower sections of the Upper Etobicoke Creek subwatershed in the urban portion of Brampton and below the Brampton diversion channel indicate a thermally unstable, and a warm-water condition. The upper three stations located above the urban envelope indicate a moderately stable and a cool-water condition that is reflective of the fish community found within these reaches (Table 15). The challenge will be to maintain the moderately stable condition of the watercourses as the upper sections of this subwatershed begin to urbanize.

Table 15: Ontario Stream Assessment Protocol (OSAP) Thermal Summary for the Upper Etobicoke Creek Subwatershed

Station	2001	2002	2003	2004
EC006WM	Unstable	-	-	-
EC007WM	-	Unstable	-	Unstable
EC008WM	Unstable	-	-	-
EC011WM	Unstable	-	-	Unstable
EC012WM	-	Moderately Stable	-	Unstable
EC013WM	-	Moderately Stable	-	Unstable
EC014WM	-	-	-	Moderately Stable

Previously, this study area was thought to contain only one cold-water stream but recent, continuous thermal data seems to indicate that there may be a second cold-water stream in the headwaters. There may be other small tributaries that are cold-water systems but as of yet they have not been identified in the field. It is very likely that there are small upwellings of groundwater within this headwater area that may significantly impact overall thermal conditions. Just to the east of the Etobicoke headwaters, in Campbell's Cross within the Humber watershed, there is enough groundwater flow to support a small, local brook trout population. Although there are no brook trout found within the Etobicoke Creek watershed, and perhaps no mottled sculpin, the importance of the groundwater additions to the watercourses cannot be over-emphasized.

There is very little upstream drainage for a majority of these small watercourses and, again, anecdotal evidence tells us that many of them dry up in the summer months. Although there are no cold-water species that have been documented with the study area, the effect of these localized groundwater inputs support the cool-water communities found here. Thermal data also suggests that the streams feel the impacts of thermal warming late in the

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summer season and likely have very reduced baseflow levels. It is likely that during these very low flow conditions that the watercourses are highly susceptible to negative impacts by small point-in-time events and environmental conditions. It would appear that rain events late in the season, for instance, may act to heat up the watercourses very quickly. This is likely caused in part by the proximity of the roadways to the watercourse, having little to no buffer between them. Also, short, intense rain events during hot, sunny days may super-heat the water coming off the roadways. Additional investigations of these conditions will be undertaken in subsequent years to further define impacts.

Further, baseflow data has been analyzed and has identified a large groundwater discharge zone near Mayfield Road. Although downstream thermal conditions do not suggest this condition is present, the potential alteration of this condition for future urban development will negatively impact both the quality of water in the watercourse and its thermal condition. More investigations will need to be undertaken to determine what significance this discharge area has to the local watercourse and to downstream ecosystems.

2.2.1.10.4 Spring Creek Thermal Condition

All of Toronto and Region Conservation's (TRCA) Regional Watershed Monitoring Network stations in the Spring Creek subwatershed show a thermally unstable condition and are presently warm-water ecosystems. Continuous thermal data only exists for the 2004 sampling event and was taken at station EC009WM, and the additional station that was surveyed south of EC010WM (Table 16). An examination of the data would seem to illustrate that the stream condition for this section of the watercourse is more reflective of cool-water habitat; however, it was a cooler summer than the 2001 sampling event. The 2004 results would indicate that the watercourse is generally that of a cool-water system which warms up during the hottest days into the warm-water range.

Table 16: Ontario Stream Assessment Protocol (OSAP) Thermal Summary for the Spring Creek Subwatershed

Station	2001	2002	2003	2004
EC009WM	Unstable	-	-	Unstable
EC010WM	Unstable	-	-	-

When detailed groundwater discharge and baseflow data is available, and when additional monitoring of the thermal conditions of the stream has been completed, there will likely be key areas identified on which restoration efforts should be focused. Concentrated work on key ecological areas will likely be able to augment baseflows, and improve thermal and hydrologic conditions of selected portions of the watercourse. Likely, portions of the Spring Creek subwatershed already have high levels of baseflow discharge, as there is currently one cold-water habitat category that exists within the subwatershed. There may be an opportunity to pinpoint areas where stream restoration work could significantly enhance the aquatic habitat available to species and potentially allow for reintroductions of other species from other parts of the watershed. Further thermal work shall continue in the subwatershed in subsequent years and further integration work will need to continue with other groups working on groundwater, baseflow, flood conveyance and implementation.

2.2.2 Lacustrine Habitat

Lacustrine habitat is characterized by low slope and the presence of slow-moving or standing water. In general, there are two types of lacustrine habitat in the Etobicoke Creek watershed: on-line and off-line ponds. On-line ponds, including reservoirs, are directly connected to a stream or river, and are created when an obstruction such as a dam, weir, beaver dam or other blockage backs up water in

a stream or contained basin. They are built for a number of purposes including recreation, aesthetic, fisheries management, flood control, erosion reduction, water supply or water power. They are depositional areas that accumulate sediments over time.

Off-line ponds are completely isolated with no connection to a watercourse or indirectly connected where a surface channel or pipe directs some flow from the watercourse to the pond. Off-line ponds may also have subsurface flow of groundwater, which can influence nearby ponds or rivers. This is often the case in gravel pits, where extraction activities have intercepted the water table.

Limited air photo interpretation has been performed on the Etobicoke Creek watershed to assess the number of on-line and off-line ponds. However, seven on-line and five off-line ponds are known (Table 17). There are many smaller on-line and off-line ponds within the watershed that have yet to be formally investigated, and are too numerous to discuss individually.

2.2.3 Wetland Habitat

Wetlands are areas that are seasonally or permanently covered by shallow water, and are typically less than one metre in depth, or where the water table is close to or at the surface (OMNR/OMMA, 1992). Lands under active agricultural

Table 17: Major Water Bodies in the Etobicoke Creek Watershed

Water Body	Municipality	Subwatershed	Function	Size (ha)	Ownership
Centennial Park Pond	Toronto	Lower Etobicoke Creek	Recreational pond	n/a	Public
Loafers Lake*	Brampton	Upper Etobicoke Creek	Lake/recreational	2.7	Public
Chinguacousy Pond	Brampton	Spring Creek	Recreational pond	n/a	Public
Esker Lake North*	Brampton	Spring Creek	Lake/recreational	26–31	Private
Esker Lake South*	Brampton	Spring Creek	Lake/recreational	13.5	Private
Heart Lake	Brampton	Spring Creek	Kettle lake/recreational	14.5	Public
Major Oaks Lake	Brampton	Spring Creek	Lake/recreational	0.4	Public
Cashel Lake*	Brampton	Spring Creek	Lake/recreational	1.87	Public
Parr Lake North	Brampton	Spring Creek	Recreational pond	n/a	Public
Parr Lake South	Brampton	Spring Creek	Recreational pond	n/a	Public
Teapot Lake*	Brampton	Spring Creek	Kettle lake/recreational	0.5	Public
Mayfield West Pond	Caledon	Spring Creek	Recreational pond	0.7	Private

* Off-line

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production that are periodically flooded, soaked, or wet are not considered to be wetlands by definition (OMNR, 1994). Temporary wetlands may occur as a result of beaver dams, which flood the surrounding area. Wetlands maintain and improve water quality, protect shorelines from erosion, aid in flood control, provide fish and wildlife habitat, and contribute substantial social and economic benefits including resource products, outdoor recreation and tourism-related activities (OMNR, 1994). An evaluation based on biological, social and hydrological components determines whether a wetland is provincially significant (OMNR, 1994). However, all wetlands have a value to society, both intrinsically and instrumentally.

Wetland types are determined on the basis of major plant associations, physical and hydrological characteristics, and the immediate surroundings. The four types of wetlands are:

- Swamps
- Marshes
- Bogs
- Fens

The physiographic position of a wetland in the landscape defines its characteristics:

- **Estuarine** — river mouth
- **Lacustrine** — lake
- **Riverine** — river (permanent inflow and outflow)
- **Palustrine** — streams with absent or intermittent inflow and intermittent or permanent outflow; otherwise isolated — no surface outflow (OMNR/OMMA, 1992; OMNR, 1994)

Many areas contain closely-spaced wetlands that, as a group, have similar or complementary biological, social and/or hydrological functions. The group is referred to as a “wetland complex” and the area between the individual wetlands as “adjacent upland habitat” (OMNR, 1994).

Over 80 per cent of the pre-settlement wetlands in the Toronto area have been lost (Snell, 1988). In the

Etobicoke Creek watershed, wetlands historically covered more than 1,500 hectares, approximately 15 times more than today’s coverage (Snell, 1987). The extent of historical wetlands was approximated by mapping all naturally wet soils, which were assumed to have originally supported wetland vegetation. Losses were identified as those areas of originally wet soil no longer supporting natural vegetation (Snell, 1988). Since 1987, additional losses have occurred and former agricultural lands may have reverted to wetlands in isolated locations. Map 10 shows the locations of historic and present wetlands. Where streams and rivers entered the waterfront, erosion and sediment deposition contributed to the formation of wetlands. It has been estimated that more than 90 per cent of fish production occurs within the shallow water zone of lakes (Royal Commission on the Future of the Toronto Waterfront, 1991). Some of the most significant losses have been in the original marsh area across the Toronto waterfront, which, by the 1950s, had been reduced from approximately 835 hectares to 92 hectares (Whillans, 1980). Despite their relatively small size, estuarine wetlands collectively form a critical component in the maintenance of local fisheries resources and healthy ecosystems (Stephenson, 1988). Estuaries create aquatic habitat sheltered from the open lake conditions and tend to favour warm-water fish species such as largemouth and smallmouth bass, and northern pike (OMNR, 1995). However, the estuarine communities represent some of the most depleted aquatic habitats along the shores of Lake Ontario (Whillans, 1982) and their loss represents a significant impairment in the ability of the area to support aquatic life (OMNR/RAP, 1995).

Historically (from at least 1848 to 1907), Etobicoke Creek had five hectares of wetlands in its estuary (Whillans, 1980). The extent to which this habitat formerly existed within the watershed is not well documented. Estuarine habitat is characterized by low gradient (0.03 per cent or less), slow-moving, turbid water and is directly influenced by the water level in Lake Ontario. This area of high sediment deposition typically contains emergent and submergent vegetation. Lake-dwelling fish

species are attracted to the foraging, rearing and breeding potential of coastal wetlands, and provide a source of species and genetic diversity to the riverine environment.

Map 10 and the calculations within Table 18 represent the best estimation of historical wetland area within Etobicoke Creek, and consist of the Ontario Ministry of Natural Resources (OMNR) classified wetlands GIS layer, and the most updated Toronto and Region Conservation (TRCA) Terrestrial Natural Heritage wetlands layer. These are wetlands that have been surveyed and ranked by OMNR, or other qualified individuals, or that have been identified in the field by TRCA botanists. It is acknowledged that there are many small upland, ephemeral, riparian, floodplain and riverine wetlands within the watershed that have not yet been formally identified and/or mapped. Most of these wetlands are either too small to have been surveyed and ranked using the Southern Ontario Wetland Evaluation scoring system, or have not yet been identified in the field by TRCA botanists. As such, no mapping is available for these aquatic ecosystem features and they have not been used within Map 10, Table 18 or the Fisheries Management Plan (FMP) for wetland area calculations and spatial interpretation.

Table 18: Historic Wetland Area by Subwatershed in Etobicoke Creek Watershed

Subwatershed	Historic Total Estimated Wetland Area (ha)	Mapped Wetland Area (ha)	Estimated Historic Wetland Loss (%)
Lower Etobicoke Creek	590	2.9	99.5
Little Etobicoke Creek	82.7	3.3	96.0
Upper Etobicoke Creek	364.9	54	85.2
Spring Creek	571.4	111.7	80.4

Aquatic Communities

This section provides information on the historic and present conditions of the fish and benthic invertebrate communities in the Etobicoke Creek watershed. A good understanding of the present and historic aquatic ecology is critical when setting management targets and rehabilitation goals. This section offers an overall evaluation of the health of the aquatic community through the exploration of the following topics: historic and present fish community; introduced species; vulnerable, threatened and endangered species; species richness; index of biotic integrity; community composition and the benthic invertebrate community.

Fish Community — Historic and Present

Historic fish collection data provides an important record of the past distribution of fish species and aquatic communities in a watershed. The historic context provides a reference point against which to compare the present condition of the aquatic resource. Without this type of reference point, management decisions would be made relative to an existing condition that may already be impacted. Comparison of the present fish community with the historic species composition and distribution allows for the development of a potential expectation for the fish community if conditions currently limiting their presence were eliminated.

Very little anecdotal information on fish species historically present in Etobicoke Creek was found in the literature. Dymond (1965) reported that there are few references to Atlantic salmon (*Salmo salar*). Due to the limited abundance and distribution of groundwater discharge areas resulting from the Peel Plain, which form the headwaters of the watershed, large numbers of salmon would have historically been unlikely. With respect to other species, the coastal marsh at the river’s mouth likely meant that many lake-resident fish species utilized the lower portion of the watershed on a seasonal basis. The loss of this wetland has exerted

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a significant negative impact on the ability of the watershed, particularly at the mouth, to support a range of species.

The first record of a scientific fish survey for Etobicoke Creek is dated 1927. Another was found for 1933 and two more for 1935. A watershed-wide survey of 24 stations was done in 1946 by A.H. Richardson. Additional surveys were done in the mid-1960s, the early 1980s and 1990s. In 1996/1997, and 2001, 26 and 16 stations, respectively, were sampled by Toronto and Region Conservation (TRCA) as part of a watershed-wide inventory. An additional three stations were surveyed by TRCA in 2000 for the Toronto Wet Weather Flow Management Master Plan (WWFMMP) studies.

In 2001 and 2004, TRCA conducted fisheries surveys at 14 stations in the Etobicoke Creek watershed

using a single-pass electrofishing method as detailed in the Ontario Stream Assessment Protocol (OMNR, 1998). The Lake Ontario coastal wetlands of the watershed were surveyed in 2002 using a variety of methods (OMNR, 1998; DFO 1996). Map 11 shows the location of the historic, 2001 and 2004 surveys sites.

Forty-three fish species have been found in Etobicoke Creek, nine of which are introduced. Of the species historically found within the watershed, 28 were captured in 2000 and 2001, and 20 in 2004. The 2004 sampling identified three species not previously documented in the watershed (Table 19). Several species found historically in Etobicoke Creek were not identified in 2000, 2001 or 2004.

Due to the number of stations and timing of the 2000, 2001 and 2004 assessments, the true number of species currently inhabiting the watershed may

Table 19: Fish Species Historically Found in the Etobicoke Creek Watershed

Common Name	Pre-1950	1951-1970	1971-1995	1996-1997	2000	2001**	2004
Herring Family							
alewife ¹	X		X	X	X	X	
gizzard shad			X				
Salmon Family							
coho salmon ¹			X				
chinook salmon ¹				X			
rainbow trout ¹				X		X	
brown trout ¹			X				
Smelt Family							
rainbow smelt ¹			X				
Mudminnow Family							
central mudminnow				X		X	X
Sucker Family							
white sucker	X	X	X	X	X	X	X
northern hog sucker	X					X	
shorthead redhorse			X				
Minnow Family							
goldfish ¹			X				
northern redbelly dace ⁴	X			X		X	X
redside dace ^{3,6}	X						
lake chub				X			
common carp ¹			X		X	X	

Table 19: Fish Species Historically Found in the Etobicoke Creek Watershed (cont.)

Common Name	Pre-1950	1951–1970	1971–1995	1996–1997	2000	2001**	2004
river chub	X						
golden shiner	X		X	X		X	X
emerald shiner	X		X	X	X	X	
common shiner	X	X	X	X		X	X
blackchin shiner				X			
blacknose shiner		X	X	X		X	
spottail shiner	X		X	X	X	X	
rosyface shiner	X						
spotfin shiner	X					X	
bluntnose minnow	X	X	X	X	X	X	X
fathead minnow	X	X	X	X		X	X
blacknose dace	X	X	X	X	X	X	X
longnose dace	X	X	X	X	X	X	X
creek chub	X	X	X	X	X	X	X
pearl dace	X		X	X		X	X
central stoneroller							X
Catfish Family							
brown bullhead	X		X	X	X	X	X
stonecat ⁵	X						
Freshwater Eel Family							
american eel ⁴			X		X		
Stickleback Family							
brook stickleback	X	X	X	X		X	X
Trout-Perch Family							
three-spine stickleback	X		X	X			
Temperate Bass Family							
white perch ¹			X		X		
white bass		X	X				
Sunfish Family							
rock bass	X	X	X	X		X	X
green sunfish							X
pumpkinseed	X		X	X	X	X	X
smallmouth bass			X				
largemouth bass			X	X		X	

** Due to the limited number of stations, and timing of the surveys, the number of species may be higher.

¹ Introduced species

² Extirpated species

³ Species at Risk Act (SARA) Schedule 3 – Special Concern Species

⁴ COSEWIC – Group 2, Intermediate Priority

⁵ COSEWIC – Group 3, Lower Priority

⁶ COSSARO – Threatened

⁷ Likely misidentified

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Table 19: Fish Species Historically Found in the Etobicoke Creek Watershed (cont.)

Common Name	Pre-1950	1951–1970	1971–1995	1996–1997	2000	2001**	2004
Perch Family							
logperch						X	
rainbow darter ⁴	X	X					
fantail darter	X	X	X	X		X	X
johnny darter	X	X	X	X	X	X	X
tessellated darter							X
Drum Family							
freshwater drum			X		X	X	
Sculpin Family							
mottled sculpin	X		X				
slimy sculpin	X						
Total Species	29	14	34	27	15	28	20

** Due to the limited number of stations, and timing of the surveys, the number of species may be higher.

¹ Introduced species

² Extirpated species

³ Species at Risk Act (SARA) Schedule 3 – Special Concern Species

⁴ COSEWIC – Group 2, Intermediate Priority

⁵ COSEWIC – Group 3, Lower Priority

⁶ COSSARO – Threatened

⁷ Likely misidentified

be slightly higher than that shown in Table 19. However, it is expected that this current species list is quite complete, barring the anthropogenic introductions. There are an additional 14 species that may have been found historically within the watershed but for which there have been no confirmed records. Most of these species were found historically in nearby watersheds or anecdotal evidence of their presence was found for the Etobicoke watershed. These species include sea lamprey, longnose gar, bowfin, atlantic salmon, northern pike, finescale dace, brassy minnow, hornyhead chub, sand shiner, trout-perch, bluegill, black crappie, yellow perch and Iowa darter.

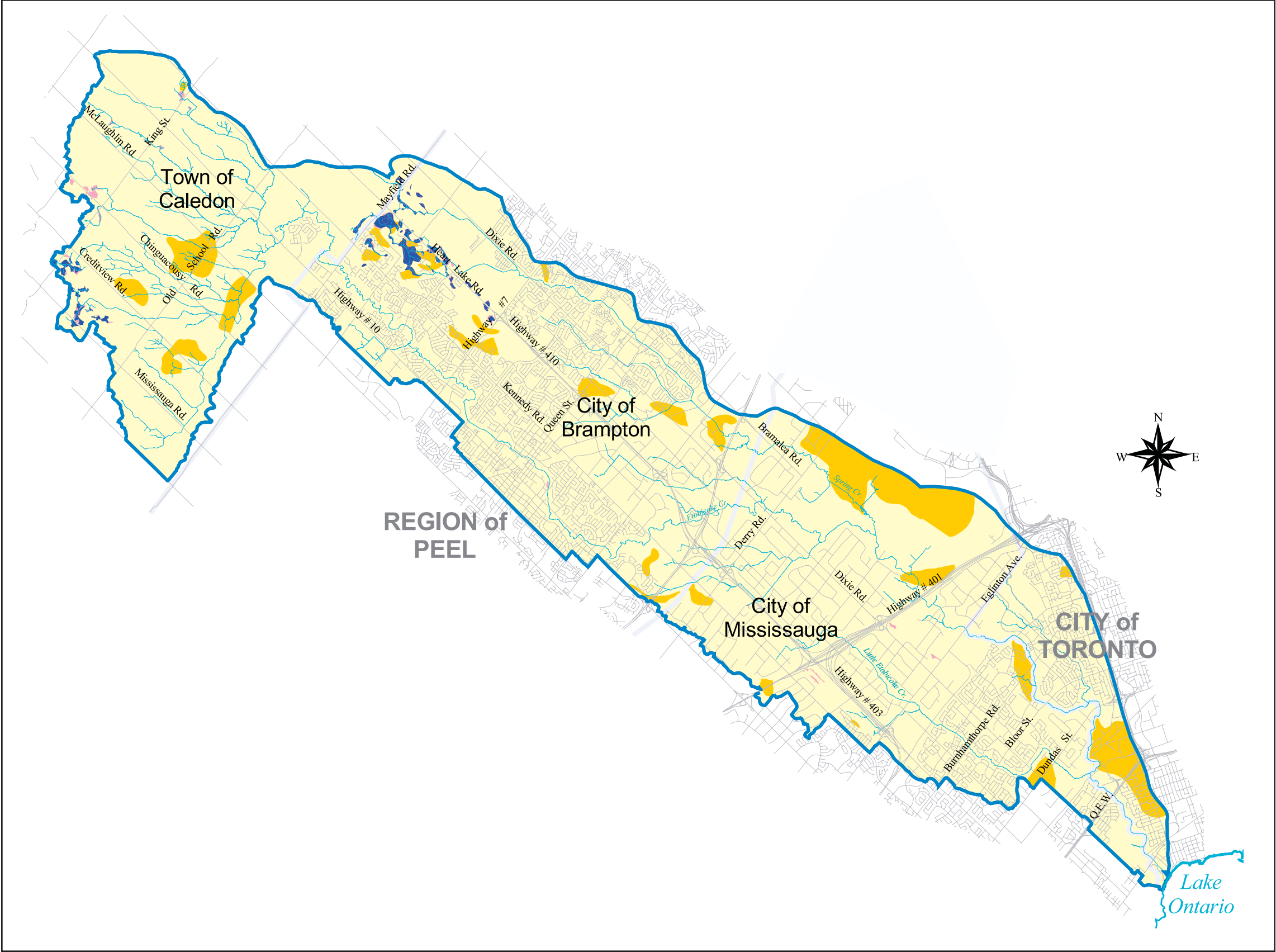
2.3.1.1 Lower Etobicoke Creek Subwatershed

Forty-one fish species have historically been found in the Lower Etobicoke Creek subwatershed including chinook salmon, populations of redbreasted dace, as well as a mix of minnow species. Two

species, chinook salmon and common carp, are introduced to Ontario, as well as the subwatershed. In 2001, 17 fish species were found in the Lower Etobicoke Creek subwatershed. Twenty-eight species once found in the Lower Etobicoke Creek subwatershed were not found in 2001, including sensitive species such as redbreasted dace and rainbow darter. In 2004, the watershed survey found very similar species to the 2001 survey, but positively identified a new species for the watershed, that of tessellated darter.

Of the 41 fish species historically surveyed, only 17 were found in 2001 and 10 were found in 2004. The species listed in the 2002–2003 surveys (six and 11 species respectively) were found along the waterfront area of the mouth of the creek. A list of fish species found in the lower Etobicoke Creek subwatershed are shown in Table 20.

The Lower Etobicoke is currently an aquatic system that is composed of a tolerant, warm-water fish community. It is largely dominated by minnow



*Current and Historic
Wetlands in the Etobicoke
Creek Watershed*

LEGEND:

- Current Wetland (evaluated)
- Current Wetland (unevaluated)
- Historic Wetland
- Municipal Boundary

1 0 1 2 3 4 5 Kilometres

Fish Monitoring Stations
in the Etobicoke
Creek Watershed

LEGEND:

- 2001/2004 Fish Sampling Stations
- Historic Fish Sampling Stations
- ▬ Municipal Boundary

1 0 1 2 3 4 5 Kilometres



Table 20: Fish Species Found in the Lower Etobicoke Creek Subwatershed

Common Name	Historic	2001*	2002 ⁸	2003 ⁸	2004*
Herring Family					
alewife ¹	X	X		X	
gizzard shad	X		X		
Salmon Family					
coho salmon ¹	X		X		
chinook salmon ¹	X			X	
rainbow trout ¹					
brown trout ¹	X				
Smelt Family					
rainbow smelt ¹	X				
Mudminnow Family					
central mudminnow				X	
Sucker Family					
white sucker	X	X	X	X	X
northern hog sucker	X				
shorthead redhorse	X				
Minnow Family					
goldfish ¹	X				
northern redbelly dace ⁴					
redside dace ^{3,6}	X				
lake chub	X				
common carp ¹	X	X		X	
river chub	X				
golden shiner	X	X			
emerald shiner	X	X	X	X	
common shiner	X	X			X
blackchin shiner	X				
blacknose shiner	X				
spottail shiner	X	X	X	X	
rosyface shiner	X				
spotfin shiner		X			
bluntnose minnow	X	X			X
fathead minnow	X				X
blacknose dace	X	X			X
longnose dace	X	X			X
creek chub	X	X			X
pearl dace	X				
central stoneroller					
Catfish Family					

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Table 20: Fish Species Found in the Lower Etobicoke Creek Subwatershed (cont.)

Common Name	Historic	2001*	2002 ⁸	2003 ⁸	2004*
brown bullhead	X			X	
stonecat ⁵	X				
Freshwater Eel Family					
american eel ⁴	X				
Stickleback Family					
brook stickleback	X				
Trout-Perch Family					
three-spine stickleback	X				
Temperate Bass Family					
white perch ¹	X				
white bass	X				
Sunfish Family					
rock bass	X	X			
green sunfish					
pumpkinseed	X	X		X	X
smallmouth bass	X		X	X	
largemouth bass	X				
Perch Family					
logperch		X			
rainbow darter ⁴	X				
fantail darter	X				
johnny darter	X	X			X
tessellated darter					X
Drum Family					
freshwater drum	X	X		X	
Sculpin Family					
mottled sculpin	X				
slimy sculpin					

* Due to the limited number of stations, and timing of the surveys, the number of species may be higher.

¹ Introduced species

² Extirpated species

³ SARA Schedule 3 – Special Concern Species

⁴ COSEWIC – Group 2, Intermediate Priority

⁵ COSEWIC – Group 3, Lower Priority

⁶ COSSARO – Threatened

⁷ Likely misidentified

⁸ Lakefront Sampling Only

species that can tolerate high nutrient and sediment loads, and which can survive high thermal variation events. During the 2004 surveys, tessellated darter was identified at station EC001WM, a new species record for the watershed. This species is typically hard to sample for and their presence warrants further investigation. It is important to determine whether there is an active breeding population using this habitat or if the fish simply come in from the lake environment occasionally to feed. This species is very uncommon in sampling records but they are also very hard to positively identify in the field. They are also a species that would be at risk should round goby become established in the mouth of the Etobicoke Creek.

Historically, the in-stream habitat would have been more diverse but the historic and remaining attending riparian habitat, in the lowest portion of the watershed, is mature and of good quality, and has likely not changed to a large degree. In addition to the lack of quality in-stream habitat throughout this portion of the watershed, the mouth, or estuarine, habitat is virtually non-existent. Historic sampling shows a diverse population with ecologically-sensitive species, which are largely absent at present. An important aspect of restoring the ecological integrity of the aquatic system will be the recreation of wetland habitat in the mouth of the watercourse. The wetland habitat will serve as a source habitat for many lake species, as well as those riverine species able to persist in the lower reaches. This habitat type offers diverse structure and array of physical features for aquatic species to take advantage of to spawn, rear young, feed and mature. This area will then act as a source habitat from which species can travel upstream to establish new populations as physical barriers are removed. Limiting factors that restrict this habitat type from becoming established must be addressed before any attempt is made to restore a wetland ecosystem here. Attention must be paid, but not limited to, water quantity, timing, magnitudes, and frequencies of inundations and winter ice.

Although not sampled as often as some of its neighbouring watersheds, Etobicoke Creek has shown evidence of decline in the lower

subwatershed. Likely a major difference between historic sampling and current sampling events is a lack of overall in-stream habitat quality in this subwatershed, differences in the hydrologic condition and overall water quality. Before improved fish habitat can be created or enhanced in the main channel, the overall hydrology of the system must be improved. This will likely happen through larger initiatives such as the City of Toronto's WWFMMP and through the creation of new stormwater ponds, stormwater retrofits and through the use of green infrastructure. Stream hydrology will need to be addressed through development applications and through larger city storm-water control initiatives.

2.3.1.2 Little Etobicoke Creek Subwatershed

Redside dace, a nationally ranked species of special concern as defined by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and provincially threatened species as defined by the Committee on the Status of Species at Risk in Ontario (COSSARO), was historically found in the tributaries of the Etobicoke Creek watershed, such as Little Etobicoke Creek but has not been found since 1946 and is considered extirpated. The most recent sampling in the Little Etobicoke Creek subwatershed was in 1991 and six species were captured: white sucker, common shiner, fathead minnow, blacknose dace, longnose dace and creek chub. No surveys of Little Etobicoke Creek have been conducted since 1991. A historic list of 12 species was identified and is presented in Table 21.

Although much of the riparian habitat is very mature and intact, especially towards the lower end of the subwatershed, much of the in-stream habitat is degraded in this system, particularly below the CN rail line south of Dundas Street. The CN rail line has a very large drop structure that prevents upstream movement of fish in this subwatershed. However, there are also several other natural, shale rock drop structures that prevent fish from even getting to the CN rail line. From the rail line to the confluence of the main channel of the

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Table 21: Fish Species Found in the Little Etobicoke Creek Subwatershed

Common Name	Historic	2001*	2004*
Herring Family			
alewife ¹			
gizzard shad			
Salmon Family			
coho salmon ¹			
chinook salmon ¹			
rainbow trout ¹			
brown trout ¹			
Smelt Family			
rainbow smelt ¹			
Mudminnow Family			
central mudminnow			
Sucker Family			
white sucker	X		
northern hog sucker			
shorthead redhorse			
Minnow Family			
goldfish ¹			
northern redbelly dace ⁴			
redside dace ^{3,6}	X		
lake chub			
common carp ¹			
river chub			
golden shiner			
emerald shiner			
common shiner	X		
blackchin shiner			
blacknose shiner			
spottail shiner			
rosyface shiner			
spotfin shiner			
bluntnose minnow	X		
fathead minnow	X		
blacknose dace	X		
longnose dace	X		
creek chub	X		
pearl dace			
central stoneroller			
Catfish Family			

Table 21: Fish Species Found in the Little Etobicoke Creek Subwatershed (cont.)

Common Name	Historic	2001*	2004*
brown bullhead			
stonecat ⁵			
Freshwater Eel Family			
american eel ⁴			
Stickleback Family			
brook stickleback	X		
Trout-Perch Family			
three-spine stickleback			
Temperate Bass Family			
white perch ¹			
white bass			
Sunfish Family			
rock bass	X		
green sunfish			
pumpkinseed			
smallmouth bass			
largemouth bass			
Perch Family			
logperch			
rainbow darter ⁴	X		
fantail darter			
johnny darter	X		
tessellated darter			
Drum Family			
freshwater drum			
Sculpin Family			
mottled sculpin			
slimy sculpin			
Total Species	12	na	na

* Due to the limited number of stations, and timing of the surveys, the number of species may be higher.

¹ Introduced species

² Extirpated species

³ SARA Schedule 3 – Special Concern Species

⁴ COSEWIC – Group 2, Intermediate Priority

⁵ COSEWIC – Group 3, Lower Priority

⁶ COSSARO – Threatened

⁷ Likely misidentified

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Lower Etobicoke Creek, much of the stream bed is composed of shale, affording almost no substrate for aquatic species. It will take considerable effort to address hydrological issues and habitat restoration concerns before this subwatershed could support a healthy aquatic community in its lower reach. This watercourse was once home to redbreasted dace and now has a complete absence of fish in large parts of this subwatershed. It is a testament to this Little Etobicoke Creek subwatershed's decline in ecological integrity. A considerable level of effort will be needed in order to restore the system to its previous ecological integrity.

2.3.1.3. Upper Etobicoke Creek Subwatershed

Many of the twenty-one fish species historically found are considered to be tolerant, warm-water species, although some species, such as fantail darter, are more sensitive. Other species found exist only in the headwater areas and are noted as being cool-water species, such as the pearl dace and blacknose shiner. The total species found in 2004 was four fewer than what has been found historically and this includes the potential redbreasted dace cross. Historically, 21 species were identified within the Upper Etobicoke Creek subwatershed, and this number dropped in subsequent surveys in 2001 and 2004 to 19 and 18 species respectively. Of note is the identification of the central stoneroller in the subwatershed for the first time in 2004. A list of fish species found in the Upper Etobicoke Creek subwatershed are presented in Table 22.

The Upper Etobicoke Creek subwatershed is the most diverse subwatershed in terms of fish communities. The middle to lower portions of the subwatershed are composed largely of tolerant, warm-water species, consisting of those species found in the lower Etobicoke Creek. Species composition and diversity begin to shift (towards greater diversity) above the urbanized portions of Brampton and the diversion channel located approximately at Queen Street. From the diversion channel down to the confluence with the Spring Creek subwatershed, the aquatic system has been, for the most part, largely degraded. The

subwatershed is bolstered by the fact that the headwaters area is largely still agricultural and not yet urbanized.

Particular attention should be paid to the upper portions of this subwatershed, as it is one of the few remaining source areas for many aquatic species in the entire watershed. Specific attention will have to be paid to infrastructure and servicing impacts, as well as overall landscape change as this area urbanizes, if the remaining species found in the subwatershed are to persist into the future.

The Peel Plain serves as the headwaters for Etobicoke Creek tributaries, where groundwater discharges are generally thought to be low due to the high imperviousness of the clay soils, although there have now been several significant localized groundwater source areas identified. Many of the first and second order streams are thought to dry up during the warm summer months, allowing for only seasonal use of these watercourses by aquatic species. There may in fact be very limited habitat available to fish species during the summer months above Old School Road. The extent to which aquatic species use these watercourses may be largely defined by the amount of annual rainfall. In 1946, two sampling events in July found brook stickleback almost at the very top of the eastern watercourses, just south of King Street. Currently these watercourses are generally thought to be dry during the summer months. This suggests aquatic species use these habitats during wet years, or alternatively, landscape changes over the years have reduced the baseflows to these streams to the extent that they don't flow for most of the summer. A third possibility may be that a significant number of isolated standing pools exist that species exploit as refugia during the summer low-flow period. A lack of baseflow during the summer months will greatly reduce habitat use by aquatic species. This again needs further study to make positive determinations about the total flow of water in these watercourses during the course of the year and to determine if these habitats are used seasonally by aquatic species.

Slow-moving watercourses and standing pools with emergent vegetation, often quite dense,

Table 22: Fish Species Found in the Upper Etobicoke Creek Subwatershed

Common Name	Historic	2001*	2004*
Herring Family			
alewife ¹			
gizzard shad			
Salmon Family			
coho salmon ¹			
chinook salmon ¹			
rainbow trout ¹			
brown trout ¹			
Smelt Family			
rainbow smelt ¹			
Mudminnow Family			
central mudminnow		X	X
Sucker Family			
white sucker	X	X	X
northern hog sucker		X	
shorthead redhorse			
Minnow Family			
goldfish ¹			
northern redbelly dace ⁴	X	X	X
redside dace ^{3,6}			
(potential) redside dace/creek chub cross	X		
lake chub			
common carp ¹			
river chub			
golden shiner	X	X	X
emerald shiner			
common shiner	X		X
blackchin shiner	X		
blacknose shiner	X	X	
spottail shiner		X	
rosyface shiner			
spotfin shiner		X	
bluntnose minnow	X	X	X
fathead minnow	X	X	X
blacknose dace	X	X	X

* Due to the limited number of stations, and timing of the surveys, the number of species may be higher.

¹ Introduced species

² Extirpated species

³ SARA Schedule 3 – Special Concern Species

⁴ COSEWIC – Group 2, Intermediate Priority

⁵ COSEWIC – Group 3, Lower Priority

⁶ COSSARO – Threatened

⁷ Likely misidentified

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Table 22: Fish Species Found in the Upper Etobicoke Creek Subwatershed (cont.)

Common Name	Historic	2001*	2004*
longnose dace	X	X	X
creek chub	X	X	X
pearl dace	X	X	X
central stoneroller			X
Catfish Family			
brown bullhead	X		X
stonecat ⁵			
Freshwater Eel Family			
american eel ⁴			
Stickleback Family			
brook stickleback	X	X	X
Trout-Perch Family			
three-spine stickleback			
Temperate Bass Family			
white perch ¹			
white bass			
Sunfish Family			
rock bass	X	X	X
green sunfish			
pumpkinseed	X	X	X
smallmouth bass			
largemouth bass	X		
Perch Family			
logperch			
rainbow darter ⁴	X		
fantail darter	X	X	X
johnny darter	X	X	X
tessellated darter			
Drum Family			
freshwater drum			
Sculpin Family			
mottled sculpin			
slimy sculpin			
Total Species	21	19	18

* Due to the limited number of stations, and timing of the surveys, the number of species may be higher.

¹ Introduced species

² Extirpated species

³ SARA Schedule 3 – Special Concern Species

⁴ COSEWIC – Group 2, Intermediate Priority

⁵ COSEWIC – Group 3, Lower Priority

⁶ COSSARO – Threatened

⁷ Likely misidentified

dominate the aquatic habitat located above of the urbanized portion of the City of Brampton and into Caledon. Much of the riverine habitat is composed of riparian wetland edges and the watercourses themselves have very low slope gradients. The fish that inhabit these waters reflect this physical condition. Many of the fish species that inhabit this section of the watershed prefer slow-moving and silt-free waters, and are wetland fish species. Blacknose and blackchin shiners have been noted as suffering population decline due to the impacts of siltation and have been extirpated in many areas around Lake Erie (Smith, 1985, Pflieger, 1971). The species found in this section of the subwatershed prefer cool temperatures and some species are habitat specialists that can tolerate low oxygen conditions. These species' ability to survive low oxygen conditions offers certain ecological advantages if stranded in one of the many standing pools that form over the summer months. Many of these species also rely on aquatic macrophytes that would be eliminated in higher flow and higher velocity waters. The key species to focus specific attention on within these headwaters habitats are the following: blacknose shiner, blackchin shiner, fantail darter, rainbow darter, pearl dace, central mudminnow and redbreasted dace.

These species are of concern locally because they are only found in this portion of the subwatershed and their elimination will extirpate them from the entire watershed. Rainbow darter and redbreasted dace are likely already extirpated from the watershed. If healthy aquatic ecosystems that exhibit high levels of ecological integrity are to be achieved in the watershed, then the extirpation of species cannot be permitted. Species loss is a strong indication that aquatic ecosystem integrity is being impacted in a negative manner and must be corrected before additional species are lost.

The stream located north of Conservation Drive is the only known area to support freshwater mussels in the watershed. One of the identified host fish species for one of the mussel species is the mottled sculpin, a cold-water fish, and a species not seen in many years in the watershed. The mussels currently identified in the subwatershed are listed in Table 23.

Table 23: Freshwater Mussels of the Upper Etobicoke Creek Subwatershed

Species Name	Common Name	Status	Host Species
Anodontoides ferussacianus	cylindrical floater	S4	spotfin shiner, largemouth bass, black crappie, mottled sculpin and sea lamprey
Lasmigona compressa	creek heelsplitter	S5	slimy sculpin, spotfin shiner, guppy, yellow perch, black crappie
Pyganodon grandis	common floater	S5	gar species, catfish species, sunfish species, freshwater drum
Strophitus undulatus	creeper	S5	rock bass, yellow bullhead, spotfin shiner, fantail darter, bluegill, largemouth bass, river chub, sand shiner, bluntnose minnow, fathead minnow, white crappie, longnose dace, walleye, green sunfish, yellow perch

2.3.1.4 Spring Creek Subwatershed

Twenty species have been found in the Spring Creek subwatershed, 19 of which are native. In the 2001 sampling event, there were 10 species identified and seven species identified in 2004 surveys. Of note is the historic presence of redbreasted dace, a national species of special concern as designated by the Canadian Committee on the Status of Endangered Wildlife in Canada (COSEWIC), and provincially threatened species as designated by the Committee of the Status of Species at Risk in Ontario (COSSARO). This is a sensitive species, suggesting that water quality and habitat in Spring Creek were once much better. Furthermore, the historic presence of fantail darters and slimy sculpin is additional evidence of the previous health of this subwatershed and cold-water habitat. Also of note in 2004 is a new species record for the watershed, that of the green sunfish. A complete list of fish species found in the Spring Creek subwatershed are presented in Table 24.

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Table 24: Fish Species Found in the Spring Creek Subwatershed

Common Name	Historic	2001*	2004*
Herring Family			
alewife ¹			
gizzard shad			
Salmon Family			
coho salmon ¹			
chinook salmon ¹			
rainbow trout ¹	X		
brown trout ¹			
Smelt Family			
rainbow smelt ¹			
Mudminnow Family			
central mudminnow	X		
Sucker Family			
white sucker	X	X	X
northern hog sucker			
shorthead redhorse			
Minnow Family			
goldfish ¹			
northern redbelly dace ⁴			
redside dace ^{3,6}	X		
lake chub			
common carp ¹			
river chub			
golden shiner	X	X	
emerald shiner			
common shiner	X	X	X
blackchin shiner			
blacknose shiner			
spottail shiner	X	X	
rosyface shiner			
spotfin shiner			
bluntnose minnow			
fathead minnow	X	X	X
blacknose dace		X	X
longnose dace	X	X	
creek chub	X	X	X
pearl dace			
central stoneroller			

Table 24: Fish Species Found in the Spring Creek Subwatershed (cont.)

Common Name	Historic	2001*	2004*
Catfish Family			
brown bullhead	X		
stonecat ⁵			
Freshwater Eel Family			
american eel ⁴			
Stickleback Family			
brook stickleback		X	
Trout-Perch Family			
three-spine stickleback			
Temperate Bass Family			
white perch ¹			
white bass			
Sunfish Family			
rock bass	X		
green sunfish			X
pumpkinseed	X	X	X
smallmouth bass			
largemouth bass	X		
Perch Family			
logperch			
rainbow darter ⁴			
fantail darter	X		
Johnny darter	X		
tessellated darter			
Drum Family			
freshwater drum			
Sculpin Family			
mottled sculpin	X		
slimy sculpin	X		
Total Species	18	10	7

* Due to the limited number of stations, and timing of the surveys, the number of species may be higher.

¹ Introduced species

² Extirpated species

³ SARA Schedule 3 – Special Concern Species

⁴ COSEWIC – Group 2, Intermediate Priority

⁵ COSEWIC – Group 3, Lower Priority

⁶ COSSARO – Threatened

⁷ Likely misidentified

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There is generally a lack of species diversity in the Spring Creek subwatershed, which is a good indication that the aquatic system has already been degraded. The continued absence of sensitive species such as sculpin, darters and redbreasted sunfish may mean that these species have been extirpated from the subwatershed. However, a new species has been found in this subwatershed, that of the green sunfish. Although a good candidate for the habitat in which it has been found, its method of entry to the watershed is of concern. Although it is possible for the species to have entered the watershed via eggs on birds or mammals, the more likely method is a human introduction. This species has also recently been found in the neighbouring Humber River watershed, well outside of its historic range. It is impossible for this species to have arrived at its present location through the riverine system, as there are numerous fish barriers that are currently impassable. Future unplanned anthropogenic introductions must be prevented, to protect the aquatic ecosystem from aquatic invasive species, as well as native species that may negatively impact the ecosystem.

2.3.2 Introduced and Invasive Species

Introduced species are defined as non-native fish species, either regionally or nationally, that have either been purposefully or accidentally introduced into a water body. The establishment of exotic species is often to the detriment of native species (Saunders et. al, 2002). Introduced species compete for food, territory and spawning sites, or they may prey upon desirable native species as a predator or as a parasite, often resulting in their displacement and/or extirpation.

Ten introduced species have been found in Etobicoke Creek, of which alewife, rainbow trout, common carp and white perch were encountered in the 2000/2001 surveys. Of note is that no invasive species were found in the 2004 sampling. Table 25 provides a summary of the introduced species found within the watershed and those for which introduction is a major concern due to the negative impacts they have on aquatic ecosystems.

Sea lamprey feed on the body fluids of other fish, clinging to its victim with a suction-cup mouth and rasping through the scales and skin with a sharp tongue. Sea lamprey prey on all large Great Lakes fish species and are so destructive that only one in seven fish attacked will survive (Environment Canada, Green Lane website). Sea lamprey spend most of their adult life in lacustrine environments and return to streams to spawn.

Common carp are aggressive omnivores that inhabit lacustrine habitats such as those found in embayments and wetland areas. They feed on molluscs, insects, worms, crustaceans, algae, and aquatic plants and seeds. During feeding, they suck in and expel water, mud and debris. In doing so, aquatic plants become uprooted, nutrients and sediments are released and resuspended, causing an increase in water turbidity. High turbidity can reduce aquatic plant growth by limiting light penetration and reduces the ability of sight-feeding predatory fish to catch their prey. Common carp are prolific in suitable habitats and as they increase in numbers, they compete for food and space with other more desirable fish species (GLFC, 1985).

2.3.3 Species at Risk

At a federal level, the designation of species of national significance is governed by the COSEWIC. A species of special concern is defined as "any indigenous species of fauna or flora that is particularly at risk because of low or declining numbers, occurrence at the fringe of its range or in restricted areas, or for some other reason, but is not a threatened species" (Ontario Ministry of Natural Resources [OMNR], 1993). In 2002, Royal Assent was given to the federal Species at Risk Act (SARA). The Act was implemented in phases, beginning in 2003 and is now in full effect. The purposes of this Act are to prevent wildlife species from becoming extirpated or extinct, to provide for the recovery of wildlife species that are extirpated, endangered or threatened as a result of human activity, and to manage species of special concern in order to prevent them from becoming at risk. At a provincial level, the OMNR designates species of significance under the COSSARO.

Table 25: Status of Introduced and Invasive Fish Species in the Etobicoke Creek Watershed

Fish Species	Date of Introduction to the Great Lakes	Method of Introduction	Location of Discovery Within the Etobicoke Creek Watershed
sea lamprey* <i>Petromyzon marinus</i>	Between 1819 and 1900	Ballast water or migrated through the Erie Canal	Found only south of Lakeshore Blvd. in spring
alewife <i>Alosa pseudoharengus</i>	1819	Stocked inadvertently or migrated through the Erie Canal	Found only south of Lakeshore Blvd.
coho salmon <i>Oncorhynchus kisutch</i>	1873	Intentional stocking	Found in the fall downstream of Lakeshore Blvd.
chinook salmon <i>Oncorhynchus tshawytscha</i>	1874	Intentional stocking	Found in the fall downstream of the QEW
rainbow trout <i>Oncorhynchus mykiss</i>	1876	Intentional stocking	Found in the spring and fall downstream of first barrier and stocked in Heart Lake
brown trout <i>Salmo trutta</i>	1883	Intentional stocking	Found in fall downstream of first barrier
rainbow smelt <i>Osmerus mordax</i>	1931	Intentional stocking	Found only south of Lakeshore Blvd.
goldfish <i>Carassius auratus</i>	Early 1900s	Introduced by release of aquarium stock	Found only south of Lakeshore Blvd.
common carp <i>Cyprinus carpio</i>	1880	Likely an intentional introduction	Found below the Queensway
white perch <i>Morone americana</i>	1950(?)	Believed to have gained access via the Oswego River	Found only south of Lakeshore Blvd.
rudd* <i>Scardinius erythrophthalmus</i>	1880s in U.S	Unknown	Not currently found in the watershed
ruffe* <i>Gymnocephalus cernuus</i>	1986	Believed to have been introduced through ship ballast	Not currently found in the watershed
round goby* <i>Neogobius melanostomus</i>	1990	Believed to have been introduced through ship ballast	Not currently found in the watershed
grass carp* <i>Ctenopharyngodon idella</i>	1999 (unconfirmed)	Believed to have been introduced accidentally, unknown source	Not currently found in the watershed
rusty crayfish* <i>Crconectes rusticus</i>	1984 (unconfirmed)	Believed to have been introduced by fishermen	Not currently found in the watershed

Information presented in this table was derived primarily from the Great Lakes Fishery Commission, 1985.

Invasive species are those that have a negative effect upon the ecology of the aquatic ecosystem and provide no value to watershed residents. *These species have not yet been identified within the watershed but have been found in neighbouring watersheds and are of great concern due to their propensity to inflict negative impacts on native species and habitat.

Historic records indicate that two fish species, Atlantic salmon and redbreasted dace, both designated as nationally and provincially significant, were historically found within the watershed. There are currently no species found within the watershed that have been listed under COSEWIC or SARA that are considered at risk. There are also currently no species found in the watershed that are listed as being at risk by COSSARO. Table 26 lists those

species that have been found in the watershed that have been identified as being at risk or could potentially be at risk.

Once locally abundant throughout the Ontario range, redbreasted dace populations have experienced a substantial decline over the last 50 years (OMNR and OSCIA, 2002). Habitat degradation has caused local extinction within several watersheds (McKee

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Table 26: Species at Risk and their Status in the Etobicoke Creek Watershed

Species	Risk Category	Presence within the Etobicoke Creek Watershed
northern redbelly dace	COSEWIC – Group 2 Intermediate Priority Candidate List	Found currently in the watershed
redside dace	SARA Schedule 3 – Special Concern Species COSSARO – Threatened	Found historically (pre-1950s) in the watershed
stonecat	COSEWIC – Group 2 Lower Priority Candidate List	Found historically (pre-1950s) in the watershed
American eel	COSEWIC – Group 1 High Priority Candidate List	Found historically (1971–95 and recently in 2000) in the watershed

and Parker, 1981). Healthy populations still exist in the Rouge and Humber rivers, as well as Morrison, Fourteen Mile, Bronte and Spencer creeks. The last documented observation of redside dace in the Etobicoke Creek watershed occurred in fish surveys from the period predating 1950. In 1997, a potential redside dace and creek chub cross was found and identified by the Royal Ontario Museum (Holm, 1997), suggesting that redside dace may still exist in the watershed. The species has been listed as having been probably extirpated from the watershed, as identified in the draft Redside Dace Recovery Strategy, January 31, 2005. If the species were to still be present in the watershed, its distribution would be very limited and in decline.

Redside dace is a sensitive species requiring cool, clear water with gravel substrate for reproduction, and overhanging bushes and trees for cover and for a food resource of terrestrial insects. Redside dace leap out of the water as they feed on insects that swarm over the water's surface, and need clear water in order to see their prey (OMNR and OSCIA, 2002). Although sensitive to turbidity, redside dace have been found in some streams of moderate turbidity (Holm and Crossman, 1986). Preferred habitat includes slow-moving sections of small headwater streams, which have mixtures of stream-side shade, pool and riffle habitat (Holm and Crossman, 1986). Redside dace prefer temperatures less than 20°C and dissolved oxygen concentrations at least seven milligrams per litre (McKee and Parker, 1981).

Redside dace can be a useful indicator of the health of the aquatic ecosystem. When its habitat starts to deteriorate, redside dace is one of the first to suffer (OMNR and OSCIA, 2002). Changes to channel form and structure, changes to hydrology and the degradation of habitat through the removal of riparian area and increases in siltation are some of the likely causes that impacted the redside dace population in Etobicoke Creek. Additional concerns include, but are not limited to, channelization, agricultural runoff and pollution in urban areas. Once widespread, this species is now restricted to the headwaters of many streams (Redside Dace Recovery Team, 2005). Atlantic salmon also historically spawned in Etobicoke Creek in small numbers but were extirpated from Lake Ontario approximately 100 years ago due to pollution, barriers and overfishing. Efforts are presently being expanded by the Lake Ontario Management Unit of the OMNR to reintroduce Atlantic salmon to several watersheds (e.g., Credit and Humber rivers).

Toronto and Region Conservation is beginning to monitor and track species that are ecologically sensitive and that may become extirpated from the Etobicoke Creek watershed due to landscape changes, urbanization and climate change. Although a formalized ranking process has not yet been developed, the following species have been identified as species of local concern due to their

limited frequency of occurrence and distribution during sampling:

- Blacknose shiner, *Notropis heterolepis*
- Blackchin shiner, *Notropis heterodon*
- Fantail darter, *Etheostoma flabellare*
- Central mudminnow, *Umbra limi*
- Northern redbelly dace, *Phoxinus eos*
- Pearl dace, *Margariscus margarita*
- *Mottled sculpin, *Cottus bairdii*
- *Slimy sculpin, *Cottus cognatus*
- *Rainbow darter, *Etheostoma caeruleum*

* Likely already extirpated from the watershed

Some species above are wetland habitat specialists, a diminishing habitat type in the watershed, and many are sensitive to turbidity, siltation, high flow velocities, and/or chemical pollution.

2.3.4 Species Richness

Species richness, or diversity, is defined as the total number of species present and is used to provide a general indication of the health of the fish community. Generally, the more degraded a watercourse, the lower the species richness. However, smaller streams, even healthy ones, typically have lower species richness than larger watercourses. The river continuum concept (Vannote et al., 1980) postulates that as a watercourse becomes larger, habitat complexity increases, which allows for higher species diversity. Furthermore, it is recognized that the larger the watershed, the greater the habitat heterogeneity and, hence, the greater number of niches, and a greater potential for a higher number of species (Steedman, 1987).

Data collected in the summers of 2001 and 2004 were analyzed and compared to Steedman's correlation (Steedman, 1987). Median species richness in the Etobicoke Creek watershed was eight, and ranged between one and 11 in 2001. In 2004, the median species richness was seven, with a range between one and 13. Data collected in Etobicoke Creek reflects a trend of increasing discrepancy between the expected and actual

number of species from the headwaters to the river mouth. This trend is coincident with the distribution of urbanization within the watershed. Fish communities in Etobicoke Creek, particularly those in subwatersheds with larger drainage areas, have been impacted as a result of landscape change. The number of actual species was less than that predicted by Steedman's methodology for the vast majority of sampling stations.

2.3.4.1 Small Riverine Cold-water Habitat

The small riverine cold-water habitat type was surveyed at two stations in the Etobicoke Creek watershed in 1997 but not during the 2001 and 2004 surveys. All of the stations sampled exhibited a species richness value that was lower than expected. Species that have been sampled in this habitat type include common shiner, blacknose dace, creek chub, pearl dace and brook stickleback. Representative and sensitive species historically found in this habitat type include slimy sculpin, mottled sculpin and redbelly dace. If these species are still present, they would likely have an extremely small population within this habitat category. However, as noted previously, their current status is unclear. Mottled sculpin and slimy sculpin are likely extirpated from their respective habitats within the watershed.

2.3.4.2 Small Riverine Warm-water Habitat

This habitat type was surveyed at two stations in 2001 and 2004, with four species having been captured. Surveys in 1997 resulted in a total of 12 species being identified. Both stations in 2001 and 2004 exhibited a species richness that was lower than expected. However, with only two stations having been sampled, the results are not representative of the entire watershed. Only at three out of 12 stations sampled in 1997 (all located in the Upper Etobicoke Creek subwatershed), was species richness higher than expected. No fish were found at five stations in 1997, at two stations in the

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Spring Creek subwatershed, and at three stations within the Little Etobicoke Creek subwatershed. Species found in small riverine warm-water habitat included white sucker, common shiner, blacknose shiner, bluntnose minnow, northern redbelly dace, blacknose dace, longnose dace, creek chub, pearl dace, brook stickleback, fantail darter and Johnny darter.

2.3.4.3 Intermediate Riverine Warm-water Habitat

This habitat type was surveyed at 12 stations in 2001 and 2004, with 21 species having been captured. At individual stations, the actual number of species found was significantly less than expected, with one exception in the Upper Etobicoke Creek subwatershed in 2004, where more species were captured than expected. The species found in this habitat type included white sucker, northern hog sucker, northern redbelly dace, golden shiner, common shiner, fathead minnow, blacknose dace, longnose dace, creek chub, pearl dace, brook stickleback, rock bass, green sunfish, pumpkinseed, fantail darter, Johnny darter and bluntnose minnow. Of note was the capture of a potential redbelly dace/creek chub cross in 1997. Green sunfish and central stoneroller were captured in 2004, and was the first time these species have been surveyed in the watershed.

2.3.4.4 Estuarine/Lacustrine Habitat

Due to different sampling techniques, it is not possible to calculate or compare the actual and expected species richness values for stations in these habitats. However, in 2001 and 2004 the one station sampled found nine species including blacknose dace, longnose dace, rock bass, pumpkinseed, Johnny darter, tessellated darter, spotfin shiner, bluntnose minnow, fathead minnow and white sucker. Of note in the 2004 sampling was the first time tessellated darter has been captured in the watershed.

2.3.5 Index of Biotic Integrity

The Index of Biotic Integrity (IBI) is a measure of fish community associations that is used to identify the general health of the broader stream ecosystem. It was first developed to assess small- to moderate-sized, warm-water rivers in the United States (Karr, 1981). Steedman adapted this measure and developed a methodology for streams in southern Ontario (Steedman, 1987). He used four categories made up of 10 measures of fish community composition to determine an IBI score for a particular study area:

- 1. Species Richness**
 - Number of native species
 - Number of darter and/or sculpin species
 - Number of sunfish and/or trout species
 - Number of sucker and/or catfish species
- 2. Local Indicator Species**
 - Presence or absence of brook trout (only in streams designated as cold water)
 - Per cent of sample as Rhinichthys species
- 3. Trophic Composition**
 - Per cent of sample as omnivorous species
 - Per cent of sample as piscivorous species
- 4. Fish Abundance**
 - Catch per minute of sampling

Summary of Index of Biotic Integrity (IBI) Scores and Rating of the Aquatic Community

Score	Rating
0–20	“Poor”
21–27	“Fair”
28–37	“Good”
38–45	“Very good”

Two modifications of Steedman’s methodology were necessary for the calculation of IBI in the Etobicoke Creek watershed. The presence or absence of blackspot was removed from the IBI

methodology since the presence of blackspot does not necessarily reflect unhealthy habitat conditions. The second modification relates to the presence or absence of brook trout, which Steedman assumed should be present at all stations. While brook trout were more widespread historically, they were not found in all streams and their absence does not necessarily reflect unhealthy conditions. Brook trout sub-indices were only calculated for stations that showed the potential for, or real, cold-water habitat conditions. IBI scores for stations located in warm-water habitat were calculated based on eight rather than nine sub-indices and were transformed for comparison with scores from cold-water habitat.

The modified IBI scores ranged from extremely “poor” to “very good.” IBI scores have been calculated to reflect stream quality for the watershed based on subwatershed stations. A detailed review of each subwatershed, and its associated sampling stations and IBI summaries is presented in the next section. Table 27 shows the

number of stations in each subwatershed and their respective IBI score and rating.

2.3.5.1 2001 Sampling

Sixteen stations were sampled in Etobicoke Creek in 2001; however, none were located in cold-water streams. Two stations were sampled using an electrofishing boat, making the calculation of an IBI using this methodology impractical. For the remaining 14 sampling stations, IBI scores were calculated. Ten of the 14 stations in 2001 had “poor” IBI scores. Three of four stations with a “good” rating were located in the Upper Etobicoke Creek subwatershed, indicating that the Etobicoke Creek headwaters is in better condition than the lower sections of the watershed. The median IBI score for the Etobicoke Creek watershed was 18 (IBI score range 14 to 34), which translates to a “poor” stream quality IBI rating. Table 28 provides a summary of the 2001 subwatersheds regional monitoring network sampling station IBI scores and ratings.

Table 27: 2001 and 2004 Index of Biotic Integrity (IBI) Ratings and Scores for the Etobicoke Creek Watershed

IBI Rating	IBI Score	Number of Stations in Each Subwatershed			
		Lower Etobicoke Creek	Little Etobicoke Creek*	Spring Creek	Upper Etobicoke Creek
2001					
Poor	0–20	5 (100%)	N/A	1 (50%)	4 (57%)
Fair	21–27	0	N/A	0	0
Good	28–37	0	N/A	1 (50%)	3 (43%)
Very good	38–45	0	N/A	0	0
2004					
Poor	0–20	5 (100%)	N/A	2 (100%)	2 (28.5%)
Fair	21–27	0	N/A	0	3 (43%)
Good	28–37	0	N/A	0	2 (28.5%)
Very good	38–45	0	N/A	0	0

Numbers in brackets indicate per cent of stations within each subwatershed. Little Etobicoke Creek subwatershed was not sampled in 2001 or 2004.

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2.3.5.1.1 Lower Etobicoke Creek Subwatershed Sampling Stations in 2001

The stations sampled for fish in 2001 in the Lower Etobicoke Creek subwatershed had a median IBI score of 16, or a rating of “poor,” with the individual stations demonstrating scores from 14 to 20. All of the individual stations reflect “poor” stream quality. In 2000, stations in the Lower Etobicoke Creek subwatershed had IBI scores ranging from 14 to 18, with a median of 14. Conditions appear to be fairly constant in this subwatershed in comparison to other data years. This subwatershed is much more impaired than the Upper Etobicoke Creek subwatershed, and appears to lack piscivores, resulting in an unhealthy trophic structure. There is also a general lack of abundance of fish, and in the diversity of fish species found, due in part to the poor water quality in this highly urbanized subwatershed. All of the stations found in the Lower Etobicoke Creek subwatershed had lower species richness levels than they should have, according to Steedman’s predictive methodology (Steedman, 1987).

2.3.5.1.2 Little Etobicoke Creek Subwatershed Sampling Stations in 2001

No sampling was undertaken for the Little Etobicoke Creek subwatershed in the 2001 sampling event.

2.3.5.1.3 Upper Etobicoke Creek Subwatershed Sampling Stations in 2001

In the 2001 sampling event, three stations with a “good” rating were located in the headwaters of the Upper Etobicoke Creek subwatershed, while the four stations that were identified as being “poor” were located in urbanized portions of the subwatershed. The three stations reflecting a “good” condition are located in the headwater

habitats of the subwatershed where urbanization has not yet taken place. The Upper Etobicoke Creek subwatershed had a range of IBI scores from 14 to 34 (median 20), and featured both the highest and lowest IBI ratings for the watershed. The subwatershed featured a score of 34 at one station, the highest overall IBI score for the watershed. In addition, this subwatershed had one of the lowest IBI scores for the watershed in its lower portions. This suggests the subwatershed contains healthy aquatic habitats in most headwater areas but has also been impacted by landscape change in its lower portions. The rural areas of the Upper Etobicoke Creek subwatershed currently support more fish species and a more diverse community than anywhere else in the watershed.

2.3.5.1.4 Spring Creek Subwatershed Sampling Stations in 2001

In the Spring Creek subwatershed, species richness is generally lower than Steedman’s predictive methodology (Steedman, 1987). Scores in Spring Creek varied from 14 in the upper portions to 29 in the lower portions, with a median score of 22 or “fair” quality. Station EC010WM reflects “poor” stream quality and did not have a diverse fish community. However, Station EC009WM had a relatively diverse community, with a species richness that almost matched the Maximum Species Richness line. The station had good ecological structure although there was an absence of piscivorous fish species. EC009WM actually scored within the “good” range of ecological health. The result is somewhat surprising as the channel above the monitoring site has been concrete-lined and the attending riparian area is not well developed.

The discrepancy between the two sites can likely be attributed to the amount of channelization that occurs upstream from site EC009WM, and the number of barriers to fish passage, thereby limiting species diversity upstream. It should be noted that there has been a barrier to fish passage that has been identified immediately upstream of EC009WM, however its status still requires field confirmation.

There are numerous potential barriers between station EC009WM and EC010WM that require field verification. The City of Brampton has previously considered habitat enhancement through natural channel design of the reach immediately to the north of the Chinguacousy Park within these sections of the creek. It is strongly recommended that these measures include efforts to re-establish fish passage in this section of the watercourse through barrier mitigation. Ideally, consideration should be given to taking the Chinguacousy Park ponds off-line or creating a low-flow bypass channel.

Table 28: Etobicoke Creek Watershed 2001 Index of Biotic Integrity (IBI) Summary

Lower Etobicoke Creek Subwatershed		
Regional Monitoring Network Sampling Station	IBI Score	IBI Rating
EC001WM	16	poor
EC002WM	14	poor
EC003WM	18	poor
EC004WM	16	poor
EC005WM	20	poor
Median	16	poor
Little Etobicoke Creek Subwatershed		
No monitoring conducted in 2001.		
Upper Etobicoke Creek Subwatershed		
EC006WM	14	poor
EC007WM	20	poor
EC008WM	18	poor
EC011WM	18	poor
EC012WM	29	good
EC013WM	34	good
EC014WM	29	good
Median	20	poor
Spring Creek Subwatershed		
EC009WM	29	good
EC010WM	14	poor
Median	21.5	poor

2.3.5.2 2004 Sampling

Nine of 14 Regional Monitoring Network stations had IBI scores of “poor” habitat quality in 2004, reflecting only a slight increase from the 2001 sampling results. The two stations with a rating of “good” stream quality were located in the Upper Etobicoke Creek subwatershed. The aquatic habitat in the headwaters of Etobicoke Creek continues to maintain better ecological integrity than the lower sections of the watershed.

2.3.5.2.1 Lower Etobicoke Creek Subwatershed Sampling Stations in 2004

In 2004, the Regional Monitoring Network stations in the Lower Etobicoke Creek subwatershed were re-sampled and had a median IBI score of 16, or “poor”, stream quality, which remains unchanged from the 2001 survey results. The individual stations ranged in scoring from 14 to 18, which illustrates a slightly negative change from the 2001 sampling events. Although there was a small decline in quality at the sites, there was also an entirely new species found for this watershed. Although it is unknown whether the species is using the habitat year round or seasonally, the fact that it was identified indicates that potential opportunities exist for future gains in species diversity in the lower watershed. This potential gain in species diversity is contingent on the re-establishment of suitable aquatic habitat and the mitigation of lower barriers.

2.3.5.2.2 Little Etobicoke Creek Subwatershed Sampling Stations in 2004

No sampling was conducted for Little Etobicoke Creek subwatershed in 2004. The degraded conditions of the watercourse and habitat quality were confirmed during the research for the Fisheries Management Plan for the lower portion of the subwatershed, from the CN rail line to its

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confluence with the main branch. Additionally, in-stream barriers to fish movement were confirmed. There are several natural shale bedrock structures at the lower end of the subwatershed that prevent aquatic species from moving upstream, and a large concrete weir at the CN rail line.

2.3.5.2.3 Upper Etobicoke Creek Subwatershed Sampling Stations in 2004

The same Regional Monitoring Network (RMN) stations that were sampled in 2001 were re-sampled in the 2004 surveys. Only two stations scored a “good” rating in the subwatershed, while three stations were identified as being “fair” and two stations were identified as having “poor” conditions of stream quality. The two stations that reflected “good” sampling results in 2004 remained unchanged from the 2001 sampling event and are located in the headwater habitats of the subwatershed where urbanization has not yet taken place. The Upper Etobicoke Creek subwatershed had a range of IBI scores, 16 to 34 (median 23), and still recorded the highest overall IBI score for the watershed (headwater tributary sampling stations EC013WM and EC014WM). Further, the subwatershed continues to show lower IBI scores at those sampling stations below the headwater habitats.

2.3.5.2.4 Spring Creek Subwatershed Sampling Stations in 2004

In 2004, the regional monitoring stations were re-sampled and had a median IBI score of 20, or a “poor” condition of stream biotic integrity, which reflected a change towards a more impaired ecological condition from the 2001 results. An additional sampling station (ECNP1: see Table 29) was surveyed in this subwatershed in 2004 and it had an IBI score of 18, or “poor” ecological integrity. This station was located just south of EC010WM.

Both stations returned an identical score of 20 in 2004. All three stations ranged in scoring from 18 to 20, which illustrates a slight negative change overall from the 2001 sampling events. Of concern is the decline in quality that was seen at EC009WM; the species richness dropped, as well as the abundance of fish present. Further, the overall ecological structure of the site appears to exhibit less integrity. However, further work will be conducted on this station in subsequent years. It is anticipated that a more obvious trend shall appear as future sampling is conducted. Station EC010WM appears relatively unchanged and continues to exhibit characteristics of a degraded ecological condition.

Although there was a small decline in the quality of the sites, there was an entirely new species found for this subwatershed. The green sunfish is has not been previously surveyed in the watershed and provides some evidence that the species may be able to survive in this habitat type. However, the presence of the species is likely due to an unplanned introduction. Further work will need to be undertaken to determine the status of this species in the watershed, and to monitor species and habitat conditions.

2.3.5.2.5 2004 Subwatershed Sampling Summary

There is a significant range in IBI scores for stations within the smallest drainage areas, indicating high variability in habitat conditions. However, small drainage areas offer the highest potential for improvement. Stations with large drainage areas (greater than 100 square kilometres) had poor IBI scores, indicating that aquatic habitats in the lower portions of the watershed are quite degraded. These habitats should be the most diverse (Vannote et al., 1980), however, the smaller headwater communities are providing the large majority of the diversity in the system. Table 29 provides a summary of the 2004 subwatershed RMN sampling station IBI scores and ratings.

Table 29: Etobicoke Creek Watershed 2004 Index of Biotic Integrity (IBI) Summary

Lower Etobicoke Creek Subwatershed		
Regional Monitoring Network Sampling Station	IBI Score	IBI Rating
EC001WM	18	poor
EC002WM	14	poor
EC003WM	18	poor
EC004WM	16	poor
EC005WM	14	poor
Median	16	poor
Little Etobicoke Creek Subwatershed		
No monitoring conducted in 2004		
Upper Etobicoke Creek Subwatershed		
EC006WM	20	poor
EC007WM	16	poor
EC008WM	23	fair
EC011WM	23	fair
EC012WM	27	fair
EC013WM	32	good
EC014WM	34	good
Median	23	fair
Spring Creek Subwatershed		
EC009WM	20	poor
EC010WM	20	poor
ECNP1	18	poor
Median	20	poor

2.3.6 Benthic Invertebrates

Benthic invertebrates (bottom-dwelling aquatic animals without backbones) such as insects, mussels and crustaceans live within the substrate during all, or part, of their lifecycle. They play a critical role in aquatic ecosystems by serving as a link between fish and other vertebrates, bacteria and allochthonous nutrients (nutrients originating outside of the watercourse such as woody debris, twigs and leaves). They function both as processors of primary production and secondary production,

and as a food source for many species of fish. Birds, turtles and amphibians also feed on benthic invertebrates during different life stages.

Invertebrates can be grouped into one of four categories depending on forage strategies: collectors, shredders, scrapers and predators. Shredders break up coarse organic matter such as leaves, while collectors filter fine organic matter and/or living drifting organisms. Scrapers or grazers remove algae and bacteria from stream substrates, and predators capture living prey (Merrit and Cummins, 1996).

The river continuum concept suggests benthic invertebrates are distributed throughout the stream in an organized manner (Vannote et al., 1980). In headwater streams where vegetative cover is generally high, collectors and shredders dominate. As the stream widens, shaded areas are confined to shorelines and sunlight exposure increases, primary production then occurs within the stream and significant populations of scrapers are found as a result. In the larger sections of a stream where turbidity is likely higher, collectors dominate. Predator species remain relatively constant throughout the continuum, comprising a small portion of the total population.

Benthic invertebrates are useful indicators of ecosystem health and of water quality. Invertebrates have ranges of tolerance to environmental change. When water quality changes (e.g., increases in sediment or other pollutants), benthic communities change, responding to impacts to water quality with a change in species, numbers and diversity. As sensitive species are eliminated, tolerant-generalist species flourish. Clean water is usually associated with high diversity, while polluted water produces lower diversity.

Advantages to using benthic invertebrates as indicators of stream health include the following:

- They are good indicators of localized conditions.
- They integrate the effects of short-term environmental variations.
- Their distribution is ubiquitous.

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- They are abundant and easy to collect.
- They are a food source for many fish (Plafkin et al., 1990).

Several methodologies can be used for assessing benthic communities (Appendix III). Most indices have limitations and biases. For example, the number of taxa (taxa diversity) is the basic component of most evaluation systems, and generally increases with improved water quality, habitat diversity and habitat suitability. The absence of pollution-sensitive benthic groups such as mayflies (Ephemeroptera), stoneflies (Plecoptera) and caddisflies (Trichoptera), or EPT, indicates impairment. The absence of permanent stream dwellers such as mussels and clams, snails, crustaceans or annelids may indicate repetitive disturbance. Overall low diversity may suggest degradation, but must take into context the site's location within the watershed. Some high-quality headwater streams may be naturally unproductive, supporting few taxa. The relative abundance or per cent contribution of each taxa provides a rapid indication of the relative health of a site. Greatly skewed abundances indicate faunal imbalances. Appendix (III) lists the 10 criteria used by Toronto and Region Conservation's (TRCA's) RMN to collect and analyze the benthic invertebrate data for the watershed.

Analysis of 2001–2003 benthic invertebrate data and comparison of indices were completed to generate the following qualitative description of diversity and habitat quality:

POTENTIALLY IMPAIRED

If five or more indices were calculated outside the limits of the unimpaired criteria, the site condition is reported as "potentially impaired."

UNIMPAIRED

Alternatively, if four or less indices were shown to be outside the limits of the unimpaired criteria, the site is declared "unimpaired."

Additional diagnostic information can be derived from observed abundance or absence of characteristic species/taxa. Examples of taxa with defined habitat requirements are listed in Table 30.

Table 30: Common Benthic Indicator Taxa and their Implications for Stream Health

Sensitive Taxa	General Stream Health Implication
Beetles (Coleoptera)	Diverse community indicative of cooler, faster-flowing streams, with limited sediment.
	Promerisa sp – sensitive to degraded water quality.
	Require cool, well oxygenated flowing water.
Mayflies (Ephemeroptera)	Heptageniidae – indicator of healthy cool-water environment.
Caddisflies (Trichoptera)	Glossosoma – typical of high gradient cold-water streams with enclosed riparian canopy.
Stoneflies (Plecoptera)	Found in flowing waters, with high oxygen content in cool- or cold-water environments.
Blood worms (Chironomidae)	Some species found in cool, flowing water and are sensitive to eutrophication (Brillia, Natarsia, Parametrioconemus).
Tolerant Taxa	General Stream Health Implication
Pill bugs (Isopoda)	High abundances reflect high organic material.
Tubifex worms (Tubificidae)	Typical of depositional zones, organically enriched, warm water, low dissolved oxygen.
Blood worms (Chironomidae)	Generally tolerant to sedimentation, organically enriched, slower, warmer water. (Chironomus sp, Cladotanytarsus sp, Procladius)

The earliest known benthic invertebrate study on Etobicoke Creek was conducted by the Ontario Department of Planning and Development as part of a habitat assessment in 1946 for the Etobicoke Valley Report (Ontario Department of Planning and Development, 1947). It was reported that over a hundred species were identified, with the majority being distributed evenly throughout the stations. Other species, due to their scarcity, occurred irregularly throughout the watershed sampling stations. The distribution abundances in particular parts of the stream were used as indicators to help determine habitat categories, e.g., cold water, warm water and intermittent. Unfortunately, neither the original raw data nor a summary appears to have survived. However, due to the sampling methods

used at the time, the value of the historic records would be limited to a species distribution list (if the identifications were correct).

Two other historic surveys were conducted across the Etobicoke Creek watershed. The first was a 1962–64 study by the Biology Branch of the Ontario Water Resources Commission. Nine stations were sampled in the three-year study. The 1962–63 surveys were qualitative collections of all habitats, using a Needham scraper and hand sieve, and by picking. The 1964 collection involved quantitative sampling with an Eckman dredge for soft sediments and a Surber sampler for riffle sections. The second survey was conducted by the Ontario Ministry of Natural Resources (OMNR) in 1978. Six stations were surveyed by Surber sampler, hand sieve and picking. Additional surveys using Surber samplers have been conducted by consultants, including two in the vicinity of Lester B. Pearson International Airport in 1993 and in 1996–97.

Benthic surveys were conducted at 14 stations throughout the Etobicoke Creek watershed between mid-July and mid-August 2001–2004 using a modified kick-and-sweep technique (TRCA, 2002). The 2004 benthic invertebrate results were not available at the time that the Fisheries Management Plan was completed. Each station sample was assessed against the criteria listed in Appendix III.

The 14 samples collected in 2001–2003 contained an array of taxa, however, conspicuously absent from all of the samples for the entire watershed, including the headwaters, were stoneflies (Order Plecoptera). The absence of one entire Order that is sensitive to pollution is an indicator the ecosystem is in decline. All of the taxa present in the samples are considered as having some tolerance to organic pollution (Hilsenhoff, 1987 and Griffiths, 1995). The most abundant and widespread taxa in the watershed have considerable tolerance (Frana, 1997).

Table 31: Benthic Assessment Summary for Etobicoke Creek Watershed (2001–2003)

Regional Monitoring Network Sampling Station	2001	2002	2003
Lower Etobicoke Creek Subwatershed			
EC001WM	Potentially impaired	Potentially impaired	Potentially impaired
EC002WM	Unimpaired	Potentially impaired	Potentially impaired
EC003WM	Potentially impaired	Potentially impaired	Potentially impaired
EC004WM	Potentially impaired	Potentially impaired	Potentially impaired
EC005WM	Potentially impaired	Potentially impaired	Potentially impaired
Upper Etobicoke Creek Subwatershed			
EC006WM	Unimpaired	Unimpaired	Potentially impaired
EC007WM	Potentially impaired	Unimpaired	Unimpaired
EC008WM	Unimpaired	Unimpaired	Unimpaired
EC011WM	Potentially impaired	Unimpaired	Unimpaired
EC012WM	Potentially impaired	Potentially impaired	Potentially impaired
EC013WM	Potentially impaired	Potentially impaired	Potentially impaired
EC014WM	Potentially impaired	Unimpaired	Unimpaired
Spring Creek Subwatershed			
EC009WM	N/A	Potentially impaired	Potentially impaired
EC010WM	N/A	Unimpaired	Potentially impaired

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2.3.6.1 Lower Etobicoke Creek Subwatershed

There has been an obvious impairment to the invertebrate community within the Lower Etobicoke Creek subwatershed that is illustrated by the benthic aggregate assessments outline in Table 31 above. There are likely several causes to consider. The causal factors are again the same issues that impact the fish community, which include, but are not limited to, water quantity, timing, magnitudes and frequencies of inundations, and winter ice. There is very little diversity in the substrate within the subwatershed and the substrate shows signs of imbrication that reflects problems with overall hydrology within the system. Water quality is another part of the problem, with periodic releases of chemicals and other contaminants to the watercourse.

One issue that can be addressed immediately is the reduction of chemical and other contaminants to the watercourse. This will have to be addressed through education, stewardship activities and spills prevention planning, and will have to be targeted towards those areas, industries and commercial operations that are likely to impact the aquatic system. Targeting those industries and commercial operations, or particular sewersheds, that are of concern given known releases documented by the Ministry of Environment and Regional Spills Action Centres would represent a starting point.

2.3.6.2 Upper Etobicoke Creek Subwatershed

The invertebrate information still requires further analysis to make positive determinations about the quality of habitat and potential impacts to the watercourses. Interestingly, the only station within the entire Etobicoke Creek watershed that has shown an unimpaired condition for all sampling events is EC008WM. It is likely that this location is being buffered by a relatively large groundwater seepage area located just upstream that may improve the water quality. However, the volume of water is being added to watercourse

from the seepage area is unknown, so it is difficult to definitively determine if this is the cause of the improved ratings. Further, EC012WM and EC013WM have demonstrated a potentially impaired condition for all of the sampling events. This potentially impaired condition may not relate to water quality or flow volume, but to habitat type. As stated earlier, the habitat type in this section of the subwatershed is dominated by riparian wetlands and standing pools. The condition being displayed at the site may be related to the high organic content and nutrient enrichment captured by the wetland habitat, and not by poor water quality or flow conditions.

One invertebrate species that has been identified in the headwaters is that of the chimney crayfish. Although they live primarily in terrestrial wet environments, they require nearby watercourses in which to breed and migrate. This species is also connected to the level of the groundwater table and their presence indicates groundwater near the surface of the landscape. This species' presence may indicate important areas where further environmental and ecological protection may be required in order to preserve aquatic habitat. As well, this species may have implications for development proposals and the harmful alteration, disruption or destruction of fish habitat, as crayfish are defined as a fish species under the federal Fisheries Act. These crayfish are found in the upper sections of the subwatershed in and around the



Etobicoke Creek.

seasonally flowing streams mentioned above. More detailed invertebrate surveys are being conducted to enhance the understanding of the aquatic ecosystems and shall be available in subsequent Fisheries Management Plans and Etobicoke and Mimico creeks watersheds report card updates and revisions.

2.3.6.3 Spring Creek Subwatershed

The invertebrate information from the Spring Creek subwatershed still requires further analysis to make positive determinations about the quality of habitat and potential impacts to the watercourses. The only station to have indicated an unimpaired result was EC010WM in 2002. All of the other sampling events at the two stations in the subwatershed indicated that there was a potential ecological problem that is impacting the stations in a negative manner.

The potentially impaired condition may not relate to water quality but is likely linked to flow

volume and to habitat type. This section of the subwatershed has witnessed substantial alteration, it generally lacks a riparian ecological unit and it lacks diversity in channel structure. The watercourse has been straightened in some sections and armoured in others, reducing the available habitat for invertebrate species. The condition being displayed at the sites may be related to a number of factors that likely work synergistically to degrade the habitat quality.

As there have only been two analyzed sampling events to date, there will need to be additional surveys to offer more details about the condition of the sampling stations and their condition over time. These future results will help guide management actions and return the subwatershed to an improved state of ecological integrity. More detailed invertebrate surveys are being conducted to enhance the understanding of the aquatic ecosystems, and shall be available in subsequent Fisheries Management Plans and Etobicoke and Mimico creeks watersheds report card updates and revisions.



Spring Creek.



Riley Park.

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2.3.7 Aquatic Communities Conclusions

Fish and benthic communities have been degraded since European settlement in Etobicoke Creek, particularly in the lower portions of the watershed. Numerous fish species once found in the watershed including Atlantic salmon, slimy sculpin, mottled sculpin and rainbow darter are no longer found. Numerous watercourses do not support a fish community, while others only support tolerant species such as white sucker, bluntnose minnow, blacknose dace and creek chub. Analysis of fish and benthic communities indicate that the Upper Etobicoke Creek subwatershed is the least impaired, with the Lower Etobicoke Creek being quite highly degraded and Spring Creek showing signs of fair to poor habitat quality. Data from 1997 indicates that the Little Etobicoke Creek is also significantly degraded.

The poor representation of epibenthic organisms (species that are typically non-burrowing and inhabit the sediment surface) such as EPT taxa in Etobicoke Creek is of interest since EPT are considered the preferred food for insectivorous fish (Waters, 1999). The complete absence of Plecoptera from all sampling stations monitored from 2001 to 2003 is of concern. The combination of considerable flows and reduced invertebrate diversity and density are likely contributors to the substantial decline in diversity. Poor riparian cover and the presence of in-stream barriers also negatively affect the quality of the habitat, and the potential for access by both fish and invertebrate species. Only the Upper Etobicoke Creek subwatershed stands out as having a relatively healthy aquatic community, with the three other subwatersheds showing signs of degradation.



Rainbow trout (*Oncorhynchus mykiss*)

The rainbow trout is widely stocked in Ontario and is primarily a lake fish. It is a highly regarded game fish. They generally feed close to the bottom on aquatic and terrestrial insects, mollusks, crustaceans, fish eggs, minnows and other small fish.



Natural watercourse under bridge.



3.0 *Aquatic Ecosystem Management*

Effective aquatic ecosystem management requires considerable understanding of ecosystem functions, as well as present and future human pressures. Integrated resource management is critical to successfully identify relevant and realistic management targets, and suggest recommendations. Aquatic ecosystem management should include the elements of good science, cost effectiveness, management practicality and public input (Ontario Ministry of Natural Resources, 1989). It must also address the major issues related to the resource and its users.

In the development of the Fisheries Management Plan, a variety of issues were identified through analysis, knowledge of the watersheds, management needs and topics raised by the public. They were summarized as the following topics for discussion:

- Aquatic Habitat
- Aquatic Community
- Consumptive Uses
- Public Access
- Education
- Planning Input and Development Review
- Broader Issues

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3.1 Aquatic Habitat

The following sections discuss issues, goals and recommended management actions related to aquatic habitat improvement.

3.1.1 Water Budget

The protection of groundwater, stormwater management and water use are three critical water quantity issues, and are related to urbanization within the Etobicoke Creek watershed. Ensuring groundwater recharge and discharge areas are protected from development is an important first step in maintaining or improving water quantity. Creating wetlands or other ecological restoration efforts are methods of increasing groundwater recharge and slowing runoff from storm and snowmelt events.

Water-taking is the process of removal of water from either the surface or sub-surface of the earth and subsequently used for irrigation, watering of livestock, golf courses and/or municipal drinking water. The removal of too much groundwater can impact watercourses by reducing or eliminating groundwater discharge. Unfortunately, the time that human users require water is usually the time when it should not be removed from the aquatic system. The Ontario Ministry of the Environment (OMOE) manages the permit process for water-taking and has set withdrawal limits. A permit is required when the amount to be withdrawn is greater than 50,000 litres per day (50 m³/day). Recently, the OMOE and Toronto and Region Conservation (TRCA) have been setting the invert elevation of intake pipes to be at the 60 per cent duration flow (e.g., baseflow).

Water-taking issues are currently not a significant concern in most of the Etobicoke Creek watershed due to the level of urbanization and municipally supplied water. However, there still may be concerns in the upper portions of the watershed as it is largely rural, has a relatively intact aquatic ecosystem and a large majority of the streams seem to flow only seasonally.

Management recommendations for the water budget in Etobicoke Creek include the following:

1. Ensure that any development or resource use proceeds only if it can be demonstrated that the existing water balance will be maintained (e.g., maintain existing groundwater infiltration volumes and distribution).
2. Ensure sustainable volume and timing of water-taking activities.
3. Protect and enhance recharge functions and features (e.g. preservation and creation of wetlands).
4. Apply the Valley and Stream Corridor Management Program (TRCA, 1994).
5. Implement the retrofits outlined in the City of Toronto's Wet Weather Flow Management Master Plan (WWFMMP) where applicable.

3.1.2 Water Quality

Ensuring water quality is one of the most important tasks in managing the aquatic system. Excess sediment, nutrients, bacteria, fertilizers, oils, grease, chlorides and heavy metals are the most common substances that impact water quality and aquatic ecosystems.

There are many regulatory methods, technologies and programs for mitigating potential impacts to water quality. These include Provincial Water Quality Objectives (PWQO), Best Management Practices (BMP), municipal stormwater management, sewage treatment, chemical management programs and inventories, hazardous waste days, sediment management and vegetative buffers.

The primary sources of water quality problems are sewer and stormwater outfalls, spills, landfill leachate, snow dump sites, stream bank erosion and atmospheric fallout. Overland sediment, bank erosion, livestock access to streams, animal wastes and point sources are major sources of water quality impacts in rural areas found in the Upper Etobicoke Creek subwatershed. Data from water quality monitoring stations reflect overall poor water quality conditions within the watershed, as

the average concentrations of all the parameters measured frequently exceeded the provincial guidelines (TRCA, 1998c; TRCA, 1998e; TRCA, 2002; Meek et al, 1998; Scanlon and Meek, 2001).

Stormwater runoff associated with airport operations used to result in negative impacts to the water quality of receiving tributaries through a number of point sources. Recognizing this issue, the Greater Toronto Airports Authority (GTAA) has been working to reduce the generation of waste materials to enhance aquatic and terrestrial habitat features, and to treat stormwater runoff on-site through state-of-the-art ponds, treatment facilities, collection and conveyance enhancements and operations best practices, as well as ISO 14000 designation and recertification.

Future analysis should include a review of spills in the Etobicoke Creek watershed to evaluate any trends in the distributions and the nature of accidental discharges into the creek. Spill detection relies heavily on the public to report suspected spills. Spills should be reported immediately to OMOE and to the municipality. The Spills Action Centre, staffed on a 24-hour basis, receives and records province-wide reports of spills and coordinates appropriate responses. A spills prevention plan that highlights historical impact areas and sewersheds, as well as including a risk assessment of future events based on land use would ultimately lead to improvements in aquatic ecosystems.

Management recommendations for improvements to water quality in Etobicoke Creek include the following:

1. Reduce the use of chemicals and contaminants that have the potential to reach watercourses.
2. Golf courses, cemeteries and agricultural industries should develop integrated pesticide and nutrient management programs.
3. All stormwater should be treated to the "enhanced" level prior to discharge into streams and should meet the ecological

requirements for aquatic species to fulfill their lifecycle functions.

4. All municipal and industrial effluent reaching a watercourse must comply with current PWQO at a minimum.
5. Apply agricultural, industrial and residential BMP.
6. Protect and plant riparian buffers that protect the riparian zone.
7. Apply the Valley and Stream Corridor Management Program (TRCA, 1994) to new developments.
8. Implement the retrofits outlined in the City of Toronto's WWFMMP where applicable.

3.1.3 In-stream Barriers and On-line Ponds

The impacts of in-stream barriers and on-line ponds have been dealt with in detail above and include alteration of channel hydraulics, the deposition of sediment, warming of water and restricting upstream access of aquatic organisms. In-stream barrier mitigation and/or removal is critical to rehabilitating stream functions in the watershed.

Taking a pond off-line, or entirely removing a barrier, are the preferred alternatives to mitigation. Where it is not feasible to take a pond off-line or remove a barrier, or drop structure, conversion of the outlet to a bottom draw, or providing fish passage, should be considered. A bottom draw configuration allows cooler water from the on-line pond bottom to be drawn into the watercourse. Downstream aquatic communities benefit from the higher oxygen content and lower relative temperature of the cooler water. This method, however, still precludes fish passage.

Fish passages including rocky ramps, step-pool, vertical slot and Denil fishways can be constructed to provide unobstructed fish passage. In some cases sections of a dam (e.g., stop logs or boards) can be removed to lower the height of the outlet.

Barriers can be beneficial, particularly when used to harness the water's energy or for controlling

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access of undesirable fish species, such as sea lamprey, to upstream habitat. Sea lamprey have had devastating effects on large Great Lakes fish, therefore limiting lamprey access to spawning grounds is a key management tool. Unfortunately, maintaining barriers precludes the passage of non-jumping species.

Management recommendations for the Etobicoke Creek watershed include increasing the species present and reducing habitat fragmentation through barrier mitigation or removal. The environmental implications must be considered when mitigating barriers, as well as human heritage concerns to ensure that the cultural significance of the feature is not overlooked. From a management perspective, the focus should be on the removal or mitigation of barriers starting from the lower-most barrier and then working upstream. It is acknowledged, however, that the mitigation of the lower-most barrier is not always possible for various reasons including land ownership, financial and technical constraints, and invasive species partitioning. In these cases, the focus should be on the mitigation of the lower-most barrier within a subwatershed, where the greatest gain in upstream access can be made or the lower-most barrier within a given project site or subwatershed reach.

Management recommendations for in-stream barriers and on-line ponds in the Etobicoke Creek watershed include the following:

1. Barriers and on-line ponds should be removed or by-passes created (and other mitigation measures) where feasible. Where not possible, fish passage should be considered and/or pond outlets converted to bottom-draw structures.
2. Removal of the lower-most barrier on the Etobicoke Creek watershed (the Toronto Golf Club Dam) should be carefully and quickly studied given its current structural integrity (e.g., engineering studies have determined it has a limited lifespan). Additional research is required to evaluate alternative sea lamprey barriers that would allow for the passage of non-jumping fish

species, thereby allowing for fish passage, while at the same time limiting destructive invasive species.

3. Implement barrier removal projects identified in the City of Toronto's WWFMMP for the Etobicoke Creek.
4. Make barrier removal and mitigation of on-line ponds a priority objective in any large-scale environmental restoration, channel naturalization, or other TRCA enhancement project, Habitat Implementation Plan or municipal projects.

3.1.4 Riparian Vegetation

The benefits of riparian vegetation are outlined in more detail in the previous sections and include bank stabilization, stream shading, sources of debris for in-stream cover and inputs of organic materials. Indirect benefits include attracting insects, reptiles, birds and mammals to the watercourse, which then serve as important ecological components to the aquatic ecosystem. Historically, most of the watercourses in the watershed had dense riparian vegetation and forests covering much of the tablelands. Currently, urban and rural land uses have removed much of this vegetation. Planting stream-side vegetation is an effective and inexpensive method of rehabilitation.

The relationship between the percentage of riparian vegetation by stream length and stream health was developed by Steedman (Steedman,1987). His work suggested that at zero per cent urbanization within the watershed, a stream would require approximately 80 per cent of its bank by length in a naturally vegetated state to be considered unimpaired. Further, as a watershed becomes urbanized, it would require an increasingly higher percentage of riparian vegetation to remain in this unimpaired state. Beyond 15 per cent urbanization, his analysis suggested that a stream would require more than 100 per cent of its stream bank length vegetated. In addition, his work indicated that at least 75 per cent of total riparian vegetation should have a woody component (e.g., trees) to maintain the integrity of the biological system. Environment Canada recommends that all streams

should be naturally vegetated along 100 per cent of stream bank length, with 75 per cent of this as woody vegetation according to Steedman's analysis (Environment Canada, 1998).

Much research continues regarding the delineation of riparian widths and how they contribute to aquatic ecological integrity. Upon review of the scientific literature, a 30 m vegetated buffer applied to both sides of the active stream channel has been accepted by the TRCA as the best minimum criterion to be applied to protect aquatic functions of all watercourses. Similar methodologies are presently being utilized by various other Conservation Authorities (LGL 2003), and the underlying principles are also generally endorsed by the federal government (Environment Canada, 2004) and other jurisdictions (Desbonnet, et al., 1994; U.S. EPA, 1993). The 30 m width ensures that natural nutrient inputs, in-stream and overhanging cover and shading are optimized, and that sediment and anthropogenic nutrient loadings are minimized, and is an appropriate buffer to apply for target setting and restoration site identification through the Watershed Plan and Fisheries Management Plan processes.

TRCA currently analyzes the quantity of riparian habitat in its jurisdiction through GIS analysis. This process involves determining the average stream width (active channel) for watercourses situated within the same Strahler stream order within an individual watershed. Once the average width has been determined for each individual Strahler order, then a secondary width of 30 m is applied to delineate the outer edge of the riparian zone. The area of riparian zone delineated by this method is considered to be an ecological unit within the landscape. TRCA is currently developing an assessment tool in conjunction with MNR to help refine the delineation of riparian widths, and to assess how these widths are linked to water temperature and other stream characteristics, such as meander belt width, soil type, and valley characteristics (Stanfield et. al., 2005).

The 30 m is a guideline to define a riparian zone as an ecological unit within the landscape. Buffers to protect the functional riparian zone may be required in addition to this 30 m width. These buffers may need to be applied in floodplain areas for example. Where this 30 m riparian zone guideline cannot be implemented it is recommended that riparian zone/buffer width delineation should follow protocols outlined in the Oak Ridges Moraine Protection Act (2001), Generic Regulation and the Valley and Stream Corridor Management Program (TRCA, 1994).

Management recommendations for riparian vegetation enhancement within the Etobicoke Creek watershed include the following:

1. One hundred per cent of stream bank length should be naturally vegetated and 75 per cent of stream bank vegetation should have a woody component.
2. Riparian vegetation must not be mowed or cropped to the stream's edge.
3. Delineation of riparian buffer widths should be applied following the Oak Ridges Moraine Protection Act (2001) and the Valley and Stream Corridor Management Program (TRCA 1994).
4. Restoration plantings are required on both private and public lands.
5. Toronto and Region Conservation's Terrestrial Natural Heritage Strategy to be applied where applicable.
6. Toronto and Region Conservation's Habitat Implementation Plan to be applied where applicable.
7. The City of Toronto's WWFMMP implementation projects regarding stream revegetation should be implemented for Etobicoke Creek.

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3.1.5 Habitat Rehabilitation

There are a wide variety of techniques used to restore aquatic habitat features and functions, requiring varying levels of effort and intervention. In all cases, a clear understanding of subwatershed, reach and site-specific conditions, and channel characteristics is needed to ensure that the proposed technique is appropriate. In general, it is preferable to employ techniques and constructions that mimic natural processes. Traditionally, stream alterations have involved the use of concrete channels, sheet piling or other “hard” techniques. More recently, the use of “natural channel design” has been viewed as the best way to improve habitat in an altered watercourse. It is an attempt to mimic the natural form and function of a stream channel by applying geomorphological and physical relationships (Gerdes, 1994; Newbury and Gaboury, 1993) to restoration design.

In-water and riparian habitat rehabilitation techniques include bioengineering (e.g., live staking, fascines, brush layers, brush mattresses, live crib walls, willow posts, native material revetments and live rock revetments), in-stream habitat improvements (e.g., boulder placement, log covers, and log jams) and riparian plantings. More detailed approaches to in-water and riparian habitat rehabilitation measures can be found in various sources including the Ontario Stream Rehabilitation Manual (Heaton et al., 2002) or Stream Corridor Restoration: Principles, Processes and Practices (Federal Interagency Stream Restoration Working Group, 1998).

Wetland restoration and protection is a key factor to improving aquatic ecosystem health for the recharge, flow attenuation and habitat functions they provide. Similar to the restoration of natural channels, restoring wetland features and functions is a multi-disciplinary endeavour.

Before work begins on any rehabilitation project, it is important to consult with TRCA and OMNR regarding past studies, implemented projects within the reach and permits, among other issues. This is particularly important in the case of in-

stream and wetland works where extensive channel alterations are proposed or fill (e.g., boulders, rip rap, logs, etc.) is proposed in floodplains or valley slopes. These agencies may also be able to recommend rehabilitation locations, offer advice or link the project with other local initiatives.

Management recommendations for habitat rehabilitation within the Etobicoke Creek watershed include the following:

1. A good understanding of the existing aquatic system (including the geomorphology and hydrology) at a site and reach level is necessary prior to undertaking any in-stream works.
2. Rehabilitation works should be appropriately scaled for the watercourse in which they are situated.
3. Natural channel design should guide stream restoration.
4. Appropriate agencies should be consulted prior to initiating in-water, wetland and stream works.
5. A wetland protection and rehabilitation plan should be developed for each sub-watershed.
6. Toronto and Region Conservation's Terrestrial Natural Heritage Strategy to be applied and potential sites captured within the Habitat Implementation Plan Priority sites database.



Habitat rehabilitation, Heart Lake Conservation Area.

3.2 Aquatic Community

3.2.1 Target Species for Management

Previous sections have identified the physical and biological characteristics of the watershed, allowing for the assessment of “aquatic potential” and designation of streams into cold- and warm-water habitat categories. This designation did not take into account limitations imposed by land use change, planned development, in-stream barriers, or human wants and needs. A second level of designation regarding the specific fish communities is necessary and is based upon these human ecological issues.

Based on the habitat categories, target species were identified throughout the watershed. The term “target species” is interchangeable with the term “indicator species,” a species whose habitat needs encompass those of the entire community. Target species were selected to represent native fish that are at the top of the food web for a given habitat type (e.g., smallmouth bass) or an ecologically sensitive species (e.g., slimy sculpin). Target species have been assigned to each of the habitat categories and summarized in Table 32 below and Map 12 gives a spatial interpretation of the target species management zones.

3.2.2 Species at Risk

Habitat destruction and degradation have been major factors in reducing the distribution of redbside dace, a Species of Special Concern as listed under Species at Risk Act (SARA). Siltation, removal of riparian cover, channelization and agricultural pollution, and direct disturbance by people and domestic animals in urban areas have significantly reduced suitable habitat and food sources. In 2000, a meeting of the Ontario Ministry of Natural Resources (OMNR), Toronto and Region Conservation (TRCA), CVC, Ontario Streams, Federation of Ontario Naturalists and the Royal Ontario Museum (ROM) identified a need to develop a recovery plan for redbside dace. In 2002, Ontario Streams began implementing the recovery plan to restore redbside dace in a significant portion of their historic range in Canada. The recovery plan is currently being formally approved as an official Provincial document. Protection and rehabilitation of riparian habitats and water quality are key to restoring and potentially re-introducing the population.

Species of High and Intermediate Priority as listed under SARA include American eel, brassy minnow, stonecat and northern redbelly dace. Barriers, overfishing, pollution and ecological change are all considered factors in the apparent decline of the American eel, to the point where the Great Lakes

Table 32: Habitat Categories and Target Species for Management in the Etobicoke Creek Watershed

Habitat Category	Target Species for Management
small riverine cold-water habitat	slimy sculpin/*blacknose and blackchin shiner, and central mudminnow
small riverine warm-water habitat	fantail and rainbow darter/*blacknose and blackchin shiner, and central mudminnow
intermediate warm-water habitat	smallmouth bass and darter species
lacustrine	largemouth bass
estuarine	smallmouth bass, largemouth bass, pike

* Upper Etobicoke Creek subwatershed only.

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Fisheries Commission – Lake Ontario has stated that “without management intervention, extirpation of the American eel in the Great Lakes Basin is likely” (GLFC, 2002). Northern redbelly dace has recently been found (2004) in the Etobicoke Creek watershed, while the stonecat has been absent in surveys since it was found at Highway 2 (Lakeshore Blvd.) in 1933. Stonecat is still found in nearby watersheds such as the Humber River but is likely extirpated from the Etobicoke Creek watershed.

The larval lampricide TFM (3-trifluoromethyl-4-nitrophenol) has been linked to the near extirpation of stonecat (Dahl and McDonald, 1980). The larval lampricide TFM is generally applied on a three to five-year cycle within a watershed. The amount of TFM currently used is 50 per cent less than what was used in the 1980s since it is recognized that TFM impacts non-target organisms (U.S. Fish and Wildlife Service, Fisheries and Oceans Canada, 2000). It is also lethal to mudpuppies and other amphibians. Currently there is no TFM application schedule for the Etobicoke Creek watershed.

Potential Species at Risk in the watershed also include native mussels and crayfish, which could be impacted due to habitat degradation and competition with introduced species.

Management recommendations for Species at Risk in Etobicoke Creek include the following:

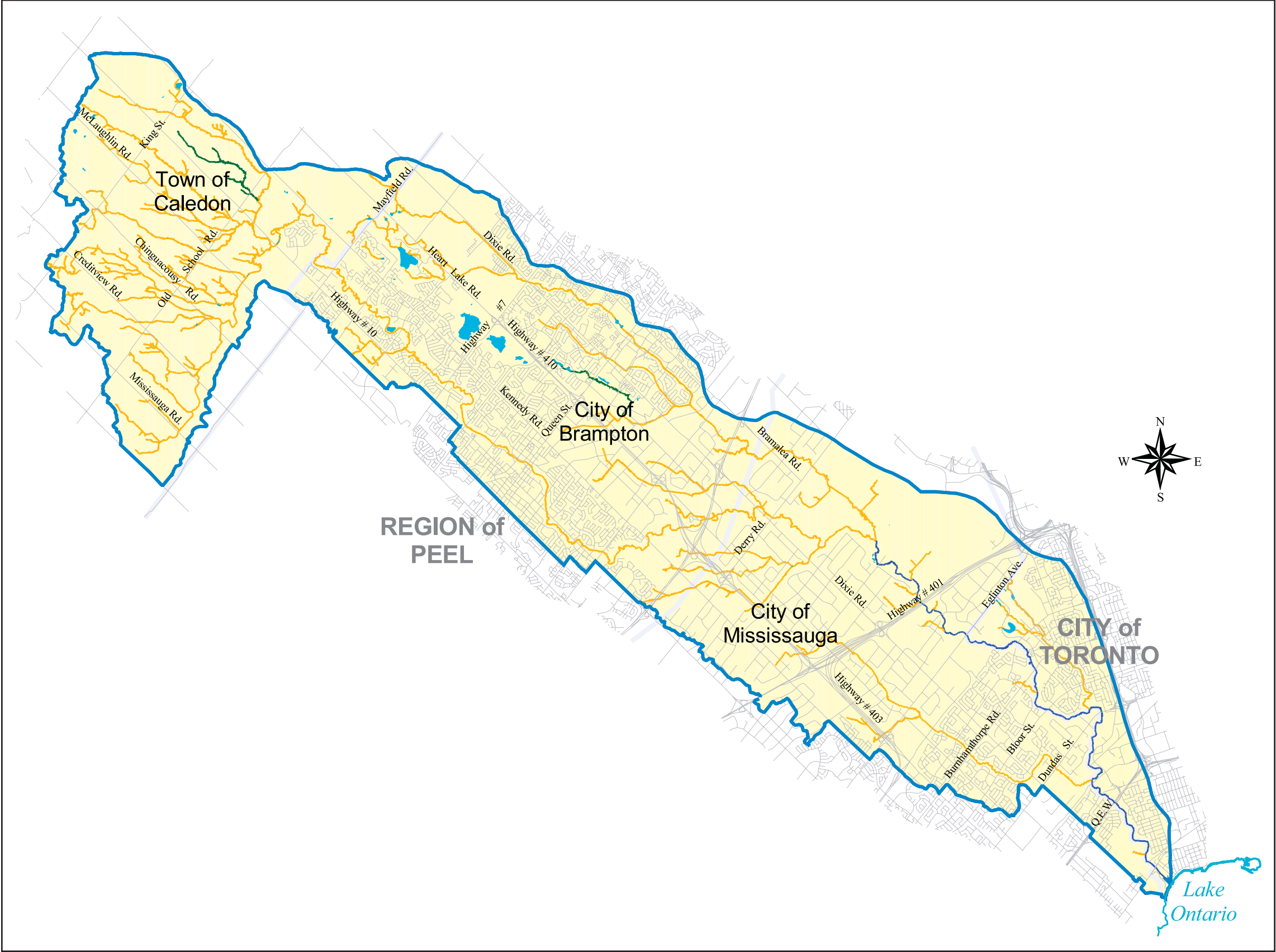
1. Confirm the presence/absence or extirpation of redbelly dace within the watershed and establish redbelly dace management zones if identified.
2. Protect and restore riparian habitat. Restoration plantings should include a high proportion of grass and shrub material at the river bank in redbelly dace management zones should they be identified
3. Apply the Valley and Stream Corridor Management Program (TRCA, 1994)
4. Investigate the status of native and other sensitive fish species in decline locally including: mottled sculpin, slimy sculpin, rainbow darter, blacknose and blackchin shiners, mussels and crayfish

3.2.3 Introduced and Invasive Species

Ten introduced species have been found in the Etobicoke Creek watershed including sea lamprey, alewife, coho salmon, chinook salmon, rainbow trout, brown trout, rainbow smelt, goldfish, common carp and white perch. Rusty crayfish, an invasive crustacean species, has yet to be confirmed in the Etobicoke Creek watershed, but is strongly suspected to be present. It is currently found in the neighbouring Humber River watershed.

Sea lamprey control measures include the construction of low head barriers on streams to block access to spawning grounds, larval lampricide applications and adult sterilization. Lamprey barriers allow passage for jumping fish species such as salmonids, but block access to non-jumping fish such as minnows, smallmouth bass and darters. No lamprey barrier currently exists at the mouth of Etobicoke Creek, however, the Toronto Golf Club Dam currently blocks the migration of sea lamprey. An agreement reached between TRCA and the Toronto Golf Club to mitigate this dam will allow fish passage by 2007 and a draft plan has been developed. If this barrier is mitigated, the next most upstream barrier will become the sea lamprey barrier. However, this will need to be discussed in conjunction with the Department of Fisheries and Oceans (DFO) and OMNR.

Carp were brought to Ontario from Asia in 1880 and released in a pond near Markham (Environment Canada Factsheet, 1996). They have dramatically increased their distribution across Ontario. Carp have only been captured below The Queensway and at the mouth of Etobicoke Creek. Their numbers in the watershed are low but greater densities can cause great damage to wetland plants and substantially increase water turbidity, particularly during spawning periods (Scott and Crossman, 1973; Hagen, 1996). They are considered naturalized in the watershed and there is currently no active management or controls in place except that they are humanely euthanized during fisheries surveys.



Target Species
Management Zones

LEGEND:

- Target Species
- Management Zones
- Zone 1: Smallmouth Bass
 - Zone 2: Darter spp.
 - Zone 3: Mottled Sculpin
 - Municipal Boundary

1 0 1 2 3 4 5 Kilometres

Rusty crayfish is a recent invasive species to many of TRCA's watersheds, although it has not yet been confirmed within the Etobicoke Creek watershed. As a first step, the presence and potential impact of the crayfish must be identified.

Other introduced species such as chinook salmon and migratory rainbow trout are found only in the lower reaches of the Etobicoke Creek, in isolated locations. There is no natural reproduction of either species that is known to occur within the watershed. These species are very popular in the angling community and are annually stocked into Lake Ontario by the OMNR.

Management recommendations for introduced and invasive species within the Etobicoke Creek watershed include the following:

1. Additional research is required to evaluate alternative sea lamprey barriers that allow the passage of non-jumping fish species (e.g., inflatable barriers).
2. Investigate barriers that limit access of introduced and invasive species to the watershed by maintaining barriers that act as species partitions.
3. Investigate active management controls for Aquatic Invasive Species (AIS) and apply proactively.

3.2.4 Stocking

Stocking is a fisheries management tool whose purposes include providing for recreational fisheries, species rehabilitation or research. Recreational stocking includes put-and-take stocking where catchable-sized fish are released for public or private angling benefits. Put,-grow-and-take stocking is similar but the fish are released at a small size, with the intention of having them grow to a catchable size, with the expected benefit to the public occurring years later (e.g., Lake Ontario chinook salmon fishery).

Stocking by the OMNR has historically included rainbow and brown trout and is typically done on

public waters. The most recent stocking events in the Etobicoke Creek watershed were brown trout in 2001 and the annual stocking of rainbow trout at Heart Lake. Approximately 5,000 rainbow trout are stocked in Heart Lake annually by TRCA, with 4,675 being stocked in 2000, 5,024 in 2001, 5,406 in 2002 and approximately 5,000 in 2003–2005.

In addition to stocking of public-owned areas, some stocking of private ponds likely takes place. The amount of private stocking into ponds by various groups is unknown. Some of the more common species used for the stocking of private ponds include brook and rainbow trout, and largemouth bass. Permits from OMNR are required for the sale, transfer and stocking of fish and spawn in Ontario.

A final type of stocking is for rehabilitative purposes and is typically done when an existing population is extirpated or has diminished beyond the point of recovery. Fish are stocked at various life stages (e.g., fry, fingerling or yearling), with the intention of having them grow to maturity and become self-sustaining after a number of years of stocking effort.

Management recommendations for recreational and rehabilitative stocking in Etobicoke Creek include the following:

1. Fish species to be stocked on either public or private land must be consistent with the management zones defined in this plan, the stocking of non-native species is not recommended and, where proposed, is subject to review by the appropriate agency.
2. Investigate the stocking of salmonids in the middle portions of the Lower Etobicoke Creek subwatershed (limit to be determined). No additional stocking of non-native salmonid species into the tributaries of the Upper Etobicoke and Spring creeks subwatersheds is recommended.
3. Investigate the stocking of other native species that are currently extirpated or experience greatly reduced populations within the watershed.

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3.3 Consumptive Uses

Consumptive uses include any method of using the resource such as angling, baitfish harvesting or water removal. It is critical that consumptive use opportunities be provided while, at the same time, protecting the integrity of the natural resource.

3.3.1 Angling

Recreational angling is popular in Etobicoke Creek. Rainbow trout, particularly in the spring, draw many anglers from southern Ontario. Popular locations in the watershed for angling include the Toronto Golf Club Dam, Heart Lake and Loafers Lake. The pressure these anglers place on sportfish and the ecosystem in both watersheds is currently unknown but is important to understand in order to better manage the fishery.

Recommendations regarding angling in Etobicoke Creek include the following:

1. The OMNR should co-ordinate a creel survey during all seasons to better understand angler use.



3.3.2 Enforcement and Regulations

Fishing seasons, sanctuaries, methods and limits are set and administered by the OMNR under the Ontario Fisheries Regulations, which fall under the Fish and Wildlife Conservation Act. Further information is detailed in the Ontario Sport Fishing Regulations published annually by the OMNR.

Enforcement of the fishing regulations is administered by OMNR conservation officers (COs), with some limited assistance from local police and the public. It is the responsibility of COs to control illegal activities such as poaching, overfishing, angling without a licence and other infractions under the regulations. Anglers who observe illegal activities are encouraged to contact the OMNR, Crimestoppers or the local police detachment.

To reduce illegal activities, the Fish and Wildlife Guardian Program could be initiated within the watershed. Fish and Wildlife Guardians are volunteers who assist OMNR's compliance efforts. The primary roles of a Guardian are:

- To provide the public with local knowledge and awareness about fishing and hunting rules and regulations.
- To act as the "eyes and ears" for the OMNR, noting any observed non-compliance activities and reporting information to district enforcement staff.

Each volunteer accepted into the Guardian program will be trained in the following:

- Introduction to the various statutes
- Note-taking and observational skills
- Conflict avoidance and conflict resolution
- Cross-cultural awareness.

The Etobicoke Creek watershed is found in OMNR Division 4 and any angler between the ages of 18 and 64 inclusive must have a valid licence to fish. The open season for bass (either smallmouth or largemouth) extends from the last Saturday in June

until November 30. The regular trout season runs from the last Saturday in April until September 30.

A number of angling regulations could be developed for the Etobicoke Creek, including reduced trout and salmon catch and possession limits. Due to an anticipated Lake Ontario-wide review of trout and salmon regulations, these changes have not gone forward at this time. However, opportunities to apply stricter rules on TRCA properties exist and are listed below.

Recommended changes to enforcement of angling regulations in the Etobicoke Creek watershed include the following:

1. Catch and possession limits for trout and salmon be reduced to two with a sportfishing licence and one with a conservation licence.
2. Assessment of the need for fish sanctuaries within the watershed (protection of biodiversity).
3. Ministry of Natural Resources to assess the angling regulations for salmonoids in the Lower Etobicoke watershed.

3.3.3 Baitfish Harvesting

Ontario's bait resource industry is comprised of approximately 1,100 baitfish harvesters and 800 dealers engaged in the retail, wholesale and export of live bait for angler use. Businesses engaged in the collection and sale of bait are required to have a valid baitfish harvester and/or dealer licence issued by the OMNR. Commercial harvesters must also report their catches on a regular basis. The baitfish resource in much of the province is allocated to harvesters through the exclusive use block system (which tends to follow watershed boundaries), with one harvester per Bait Harvest Area (BHA). The industry is conservatively estimated to contribute \$40–\$60 million to the Ontario economy. On a smaller scale, recreational anglers are permitted, as part of their regular sportfish licence, to catch baitfish as defined in the Ontario Sport Fishing Regulations.

Baitfish include suckers, sticklebacks, darters, sculpins and minnows (e.g., dace, shiners, chub). The most common baitfish are emerald shiner, spottail shiner, common shiner, creek chub, white sucker and northern redbelly dace. The captured fish are sorted by species and any game fish, such as trout, salmon, pike and bass, are returned to the stream. Shiners, suckers and minnows are then graded by size and transported to holding tanks in local retail stores.

The Etobicoke Creek watershed has been a location for the commercial harvest of baitfish for many years and is a double Bait Harvest Area (two watersheds) including the Mimico Creek watershed (which is identified as BHAAU06). There is only one person licensed to harvest bait in this BHA. Recent returns indicate that approximately 234.5 gallons, 45 gallons and 74.5 gallons of baitfish were harvested from the combined Bait Harvest Area of the Etobicoke and Mimico creeks in 2000, 2001 and 2002 respectively.

Management recommendations for baitfish harvesting in Etobicoke Creek include the following:

1. Commercial harvesters should be aware of areas that support Species of Concern, such as redbelly dace.
2. Commercial harvesters should reduce the risk of accidental harvest of significant and game species through appropriate timing, location and collection techniques.
3. Commercial harvesters should be capable of identifying all species found in Etobicoke Creek, and have attended a recognized and accredited fish identification course.
4. Minimize or eliminate the harvesting of crayfish to prevent the accidental spread of the rusty crayfish.
5. All species of concern, and game species, should be released, as well as those species in decline locally and/or those at risk of extirpation from the watershed.
6. Complete and accurate records should be sent to OMNR and TRCA on an annual basis, including data on volumes, species harvested and collection locations.

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7. The Ontario Ministry of Natural Resources and TRCA explore opportunities to use baitfish harvest records as additional data in assessing fish community trends in the watersheds and to support the baitfish harvest industry.

3.3.4 Water-taking

Water-taking is the removal of water from either surface or sub-surface sources, and is used for irrigation of agricultural fields and golf courses, watering of livestock, and municipal and domestic drinking water. The removal of too much groundwater can impact watercourses by reducing or eliminating groundwater discharge. Unfortunately, the demand on water resources typically coincides with the low baseflow and surface water periods (e.g., draught conditions).

There is currently no detailed information available for low-flow management for the Etobicoke Creek watershed. In Etobicoke Creek, there are an estimated 13 Permits to Take Water (PTTW), of which seven are active/valid permits. One location is situated on the Lower Etobicoke Creek and the remaining six are on Spring Creek (Duncan, 2003).

There has been no assessment within the watershed as to where active PTTW may be having an impact on the aquatic system. It is likely that unpermitted water withdrawals occur throughout the watershed. A great challenge exists in estimating the overall amount of water being withdrawn from the various watercourses and subwatersheds.

Management recommendations for water-taking in Etobicoke Creek include the following:

1. Precise volume limits and timing of water extraction must be determined for each habitat category within each sub-basin to ensure minimum baseflow requirements for fish and benthic invertebrates.
2. Water-taking must be conducted on an “environment first” basis.

3.4 Public Access

Public lands owned by the federal government, the Province of Ontario, Toronto and Region Conservation (TRCA), local and regional municipalities and public educational institutions provide access to various sections of the river for angling, walking, wildlife viewing and educational opportunities.

3.4.1 Toronto and Region Conservation and Municipal Lands

Toronto and Region Conservation has acquired 413.32 hectares (1,021.3 acres) of land in the watershed including the Heart Lake Conservation Area and the Snelgrove Resource Management Tract, as well as numerous properties leased to the City of Toronto (e.g., Marie Curtis Park and the Arsenal Lands at the mouth of the creek). Toronto and Region Conservation owns 153.58 hectares in the Upper Etobicoke Creek, 172.08 hectares in Spring Creek, 2.46 hectares in Little Etobicoke Creek and 85.2 hectares in the Lower Etobicoke Creek subwatersheds. The city-owned municipal parks account for approximately 1,303.1 hectares within the watershed. While the majority of public land is considered publicly accessible, some lands require additional permission to enter.

Recommendations for TRCA- and municipal-owned lands in the Etobicoke Creek watershed include the following:

1. Create specific access areas/nodes for anglers in the Lower Etobicoke Creek sub-watershed and at Heart Lake.
2. Promote catch-and-release angling and the use of barbless hooks within identified reaches.
3. Improve angling opportunities and stewardship practices by exploring the possibility of establishing angling clubs within Heart Lake Conservation Area.
4. Additional conservation lands should be secured in the Etobicoke Creek watershed,

with a focus on the Upper Etobicoke Creek subwatershed's lower order tributaries.

5. Continue to reduce the amount of mowed areas adjacent to streams on public lands.

3.4.2 Federal and Provincial Lands

Lester B. Pearson International Airport (LBPIA) occupies a substantial amount of land within the Spring Creek/Upper Etobicoke Creek subwatersheds, with 1,700 hectares falling within the Etobicoke Creek watershed or approximately four per cent of the watershed's total area. Access to the natural areas within federal airport lands is highly restricted and they are not accessible to the general public.

Management recommendations for federal and provincial lands within the Etobicoke Creek watershed include the following:

1. All development should be conducted on an "environment first" basis and should include a setback of at least 30 metres from top of bank.
2. All existing wetlands, ephemeral, intermittent and permanent streams must be identified and receive the full extent of regulated protection.

3.5 Education

Education is an integral part of healthy habitat and clean water for people and the aquatic system. It also increases awareness and appreciation of the resource. The educational experience may occur through Toronto and Region Conservation (TRCA) programs such as Yellow Fish Road, Adopt-a-Pond, or the Aquatic Plants Program, or through a local interest or community group.

Fish viewing can also be an educational experience. Spawning runs of trout and white sucker in the spring, and salmon in the fall provide an excellent opportunity. Presently, many people are attracted to the area below the Toronto Golf Club Dam

to watch the trout, salmon and white suckers move upstream.

Opportunities exist to expand fish viewing within the watershed. A concern is that when fish are most easily seen it coincides with critical spawning periods. These fish may be easily disturbed, especially if people enter the water. Care must be taken when viewing fish so that disturbance is minimized. In many cases, interpretive signs could inform and guide people. However, more popular areas would benefit from the construction of boardwalks and platforms to reduce the impacts of increased public access.

Management recommendations for education and fisheries management include the following:

1. Viewing opportunities and ecological understanding should be expanded and/or formalized on appropriate TRCA lands.
2. Signs at road crossings be posted to indicate presence of sensitive species and watercourse names.
3. Members from the community should be actively involved in the monitoring of the aquatic ecosystem.

3.6 Plan Input and Review

The long-term health of aquatic ecosystems, including the protection of fish habitat, is an essential consideration in any land use planning process. Discussion at the early stages of project design should occur between proponents, Department of Fisheries and Oceans (DFO), Ontario Ministry of Natural Resources (OMNR), Ontario Ministry of Environment (OMOE) and Toronto and Region Conservation (TRCA) to ensure that appropriate fish habitat protection measures are considered at the proper planning stage. The Department of Fisheries and Oceans, OMNR, OMOE and TRCA use opportunities in the planning process defined under the Planning Act and the Environmental Assessment Act to ensure that future activities resulting from development will be consistent with the provisions of the Fisheries Act. Approval under the Planning Act does not absolve

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a proponent from meeting the requirements of any other statutes (required after the Planning Act approvals have been received), such as a work permit under the Public Lands Act, the Lakes and Rivers Improvement Act, the Ontario Water Resources Act and the Conservation Authorities Act. In many cases, consideration of fish habitat protection for the proposed development under the Planning Act may address the concerns that are commonly raised when applications are received for approvals.

Habitat Typing is another method that allows for management agencies to set the level of protection that individual watercourses will receive from adjacent landscape development. This method is only being recommended for zoning exercises that



occur on a broad scale that can be later refined at a site level. Typical Habitat Typing includes the categorization of streams into one of three habitat types:

Type 1 – Highest Priority Habitat (often referred to as Critical)

Type 2 – Intermediate Priority Habitat (often referred to as Important)

Type 3 – Lower Priority Habitat (often referred to as Marginal)

Types 1–3 habitat is being defined in terms of direct impact to fish at an adult life stage. It must be made clear that all habitat types offer different functional services to the aquatic ecosystem in different seasons. In many cases, Type 3 habitat may be the most significant habitat in terms of sediment transport, and nutrient and contaminant removal. The maintenance of all ecological functions in all habitat types is required to maintain healthy fish populations in a defined Type 1 habitat. The Habitat Typing process may be undertaken in the headwaters of the Etobicoke Creek within the Town of Caledon. The process is still in development for the Etobicoke Creek and does not address the other various pieces of legislation that may need to be taken into consideration including the Conservation Authorities Act and Source Water Protection initiatives.

From an implementation standpoint, the Fisheries Management Plan provides construction timing windows (Table 33). These guidelines are based on the management direction established within this plan. It should be noted that the OMNR is responsible for establishing construction timing windows.

It should be emphasized that the Fisheries Management Plan is a resource document and not a policy document, and several areas of the plan do not provide enough information to satisfy planning and permitting decisions. In the permitting process for applications to alter a watercourse, staff at TRCA and OMNR require proponents to provide detailed information to evaluate fisheries, habitat, flooding

Table 33: Construction Timing Windows in the Etobicoke Creek Watershed

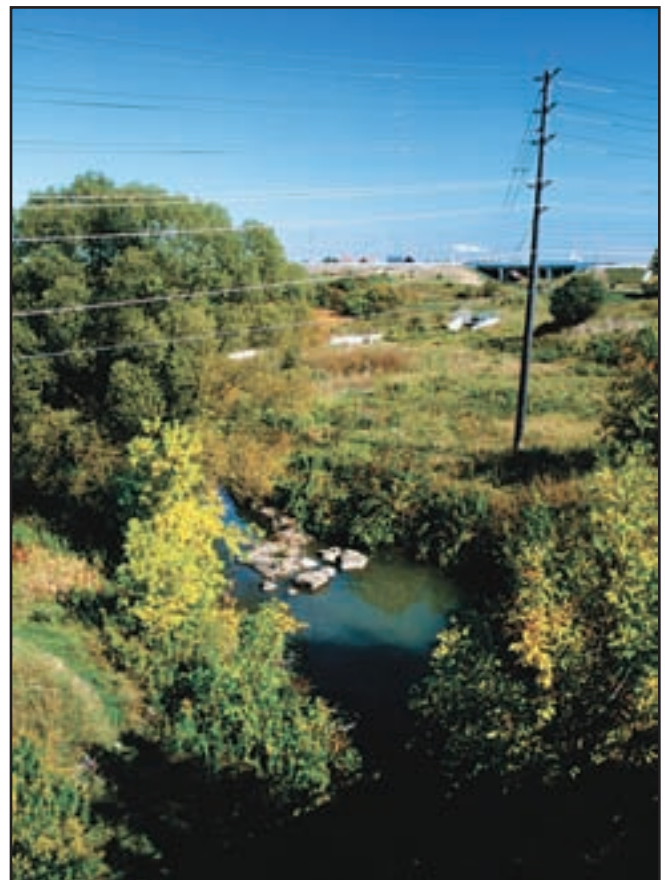
Habitat Category	Construction Period	Comments
small riverine cold water	June 15 to September 15	The presence of redbreasted sunfish may require a modification of the construction timing period to start July 1
small riverine warm water	July 1 to March 31	Where migratory species are present, passage must be maintained
intermediate riverine warm water		
estuarine		
lacustrine		

and erosion concerns. In order to evaluate projects against objectives of the Fisheries Management Plan and the Federal Fisheries Act, staff may require details of any proposed channel alterations. The scope of the study and level of detail required will depend on the size of the project, the location and the extent of the proposed alteration.

3.7 Broader Issues

There are a number of broader issues that, while important, are beyond the scope of this document and are suggested for further study, including the following:

- Monitoring of the potential impacts of climate change
- Monitoring of the potential impacts of air quality
- Assessment of the socio-economic benefits of the fisheries of the watershed
- Include the Etobicoke Creek in the sportfish contaminant sampling program and expand the number of locations and species in the sampling



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4.0 *Implementation — a Subwatershed Perspective*

This section focuses on the current conditions and issues affecting each subwatershed. This section also identifies subwatershed restoration and protection needs based on the management recommendations outlined in the previous section.

4.1 **Toronto and Region Conservation's Terrestrial Natural Heritage System Strategy**

The Terrestrial Natural Heritage System Strategy (TNHSS) is a tool that can play a key role in identifying the lands that should be protected and restored to natural cover in order to enhance biodiversity and improve natural system functions. It uses a science-based analytical tool, based on sound ecological criteria, to identify an expanded and targeted land base for inclusion in a terrestrial natural heritage system.

The terrestrial natural system was designed for the entire Toronto and Region Conservation (TRCA) jurisdiction because terrestrial systems and their interactions span watershed boundaries. The target system relates to the terrestrial component of the

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natural heritage system. Although increases in natural cover would benefit many other system components, such as promoting a more natural water budget, the target terrestrial natural heritage system was designed using terrestrial ecological criteria.

The watershed planning process will serve as the main vehicle for developing a more comprehensive approach to natural heritage system design and management. At the watershed or subwatershed level, integration of other natural heritage elements, including aquatic and hydrologic components, can be addressed. The target terrestrial natural heritage system can best be refined at the watershed and subwatershed planning scale by identifying areas beyond the terrestrial focus where protection and restoration would benefit comprehensive and sustainable watershed management.

The modeling carried out in the integrated watershed planning process allows TRCA to develop alternative land use scenarios and recommend a preferred scenario based on a range of environmental indicators. The models (such as the water budget models) can estimate the benefits of natural cover, in terms of providing hydrological functions, preventing erosion, improving water quality, and enhancing recreation and quality of life, as well as enhancing biodiversity. For example, predictions can be made on how increases in terrestrial natural cover may change groundwater levels and stream baseflow, which in turn may benefit the aquatic community composition within certain stream reaches.

The TNHSS considers all the natural cover in a region (all forest, wetland and native meadow) as one “organism” functioning in the landscape rather than as a collection of individual sites, some of which may be “significant” or otherwise designated.

The TNHSS uses three main factors in its consideration of the target terrestrial system:

1. Quantity – the per cent of natural cover in a region
2. Quality – the average habitat patch size, shape and matrix influence (impacts of surrounding land use)
3. Distribution – the distribution of the quantity and quality of natural cover

The most important characteristic of a habitat patch for biodiversity is its size, which relates to the amount of space required for a species to find resources and remain in viable populations. The second factor is matrix influence, which is a measure of the positive or negative influence that a patch receives from its surrounding land uses.

The TNHSS has set a goal of at least 12 per cent natural cover in the Etobicoke Creek watershed (Draft TRCA, 2004).

4.2 Etobicoke Creek Watershed Habitat Implementation Plan (HIP)

In 2003, Habitat Implementation Plans (HIP) were developed by Toronto and Region Conservation (TRCA) for the Etobicoke and Mimico creeks watersheds. The Habitat Implementation Plans identify important habitat restoration projects throughout the watershed. The Etobicoke Creek watershed HIP includes an inventory, concept plan, recommended restoration communities, preliminary feasibility and database of high priority habitat projects for immediate implementation. The highest priority projects have been selected and preliminary site prescriptions have been completed.

The HIP reflects the goals and objectives of the Toronto Area of Concern Remedial Action Plan (RAP), the Etobicoke-Mimico Creeks Watersheds Strategy, the Fisheries Management Plan and the Terrestrial Natural Heritage Strategy at the site level. The HIP identifies important habitat areas and prioritizes the most feasible projects. The aim is implementation of practical habitat projects that will give the most benefit to the ecosystem health of the watersheds. The HIP methodology utilizes site-level information collected through field

assessments and priority scoring which is inputted into a database of potential projects. Thus, the HIP can have two purposes:

1. To present a list of high priority habitat implementation sites that represent the general principles of the various strategies and management plans, while working to meet the overall RAP targets and restore watershed integrity.
2. To create a workable database that contains a prioritized list of sites that may be recommended for implementation by interested stakeholder groups/partners as funding opportunities arise. The database has been designed to adapt specifically to new requests, by facilitating project queries, which are linked to GIS queries.

Restoration recommendations are focused on habitat creation or enhancement, naturalization and community involvement. Habitat implementation work is determined on a site-by-site basis and will include one or more of the following:

- Wetland creation/enhancement
- Riparian corridor enhancement
- Upland and lowland forest regeneration/woodlot expansion
- Meadow/prairie creation/enhancement
- Installation of critical habitat structures (bird boxes, brush piles, snake hibernacula, etc.)
- Fish barrier removal/mitigation
- Vegetation buffers and corridors

Using the Habitat Implementation Program project database and GIS, project deliverables and total areas can be quantified in order to calculate the HIP's contribution to the overall goals, objectives and targets outlined in the various applicable strategies and plans described above. The second phase of the completed HIP plans will be to assess lands outside of TRCA ownership to create a full and comprehensive list of potential habitat projects.

4.3 City of Toronto Wet Weather Flow Management Master Plan (WWFMMP Study Area 2) Etobicoke and Mimico Creeks

Historical approaches to servicing development within the Greater Toronto Area lead, in some uncontrolled cases, to environmental and flood problems. A need was identified to develop a comprehensive and focused master planning process to develop a cost-effective approach to managing municipal stormwater services. The City of Toronto's Wet Weather Flow Management Master Plan (WWFMMP) is to be managed on a watershed basis that recognizes rainwater as a potential resource that can be utilized to improve the health of Toronto's watercourses and the near-shore zones of Lake Ontario, and to protect and enhance the natural environment. The goal is to reduce and eventually eliminate the adverse impacts of wet weather flow on the built and natural environment, and to achieve measurable improvements in watershed ecosystem health (TSH Consultants Ltd., 2003).

The development of the WWFMMP documents followed the Municipal Class Environmental Assessment (Class EA) process. The process involved extensive public and stakeholder involvement throughout the Master Plan's development (TSH Consultants Ltd., 2003). This process involved many public agency organizations, municipalities and their related departments, local residents and environmental organizations, including Toronto and Region Conservation (TRCA).

Through the Class EA process, the preferred alternative that was selected for the Master Plan, was that of "Strategy Number 5," or the "enhanced level of control." The preferred alternative consists of source control measures, conveyance control works, end-of-pipe facilities, enhanced municipal operations, public education programs, environmental monitoring and plan review, stream restoration and waterfront management

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works (TSH Consultants Ltd., 2003). The source control measures are to be considered first in the hierarchy (source control, conveyance, end-of-pipe) in a manner that is balanced with the other two measures in terms of environmental, social and economic impacts, and benefits (TSH Consultants Ltd., 2003).

The implementation of the WWFMMP will:

1. Contribute to achieving healthy aquatic communities, including warm or cold fisheries as appropriate.
2. Contribute to reducing fish consumption advisories due to local wet weather sources.
3. Manage wet weather flows to reduce erosion impacts on streams and riparian habitats, public and private properties, and open spaces.
4. Contribute to the re-establishment of a more natural hydrologic process, based on maximizing permeability and minimizing runoff at source.
5. Contribute to the protection, re-establishment and rehabilitation of natural features such as wetlands and ecological corridors.
6. Contribute to the virtual elimination of toxic contaminants in the ground and surface waters utilizing the principle of pollution prevention at source.
7. Contribute to achieving federal, provincial and municipal water and sediment quality objectives and guidelines in area watercourses and along the waterfront.
8. Eliminate discharges of sanitary sewage including those associated with combined sewer overflows (CSOs), sanitary sewer overflows (SSOs), treatment plant by-passes, illegal cross-connections and spills.
9. Improve water quality for body contact recreation in rivers and recreational areas, and reduce posting of beaches by the Medical Officer of Health.
10. Contribute to eliminating objectionable deposits, nuisance algae growth, unnatural colour, turbidity and odour in order to improve the aesthetics of area surface waters.

11. Manage wet weather flow to reduce basement flooding and other adverse impacts.
12. Reduce sanitary sewer infiltration and inflows to city design standards.
13. Eliminate or minimize threat to life and property from flooding.
(TSH Consultants Ltd., 2003)

The key control measures outlined in the 25-year (and 100-year) plan for all of the watersheds within the City of Toronto include the following:

- Eighteen thousand roof downspouts to be disconnected
- Nine thousand rain barrels to be installed
- Twelve kilometres of filtration/exfiltration systems to be constructed under public roadways as road and sewer infrastructure is replaced
- Forty-eight stormwater management facilities to be constructed
- Twenty-six underground tanks are to be constructed along the waterfront
- Twenty fish barriers to be removed
- Five exposed trunk sewers and/or water mains to be protected
- Eight kilometres of streams to be restored
- Basement flooding in four cluster areas to be eliminated (TSH Consultants Ltd., 2003)



In stream barrier.

The preferred strategy has been designed to have a phased implementation schedule. The first phase focuses on the next 25-year period, but the preferred strategy will be implemented over a 100-year time frame. The 25-year implementation plan has program and project costs that have been assigned to the one-to-five-years, six-to-10-years, 11-to-15-years, 16-to-20-years and 21-to-25-years time frames. This implementation plan also addresses each of the 13 WWFMMMP objectives.

The 25-year plan for the Etobicoke Creek watershed identifies the following objectives and projects:

- Six barriers that shall be removed or modified
- Twenty-five hundred metres of stream restoration completed
- Four stormwater pond enhancements at an approximate cost of \$3.25 million

4.4 Lower Etobicoke Creek Subwatershed

4.4.1 Aquatic Ecosystem Health

The Lower Etobicoke Creek subwatershed is urbanized, with just over three quarters of its area consisting of commercial, industrial and residential land uses. The remaining area consists of parkland, valleylands and open green space. There is no longer any agricultural land found in this subwatershed. The Lower Etobicoke Creek subwatershed has small sections of mature riparian cover that offer the watercourse good, but limited, buffering from surrounding land use impacts. In 2005, the rediscovery of northern watersnake in this subwatershed seems to support this observation, as this species requires a healthy and mature riparian ecosystem.

The actual watercourse continues to show a degraded ecological condition. The fisheries community is exhibiting very limited species diversity, an indication of poor ecological integrity, as well as low Index of Biotic Integrity (IBI) scores. The benthic communities found within the Lower Etobicoke subwatershed are mainly comprised of

those species that typically live in slow-flowing, organically-enriched, warmer sections of streams. The stations all have a low diversity of species, likely an indicator of severe organic pollution impacting the sites. The poor IBI scores at all of the monitoring stations support this conclusion. All of the Regional Monitoring Network (RMN) stations illustrate a “potentially impaired” condition for the invertebrate assessments and a “poor” condition of stream health for the fisheries component.

The Lower Etobicoke Creek subwatershed shows signs of imbrication, evidence that flow magnitudes and velocities are too high, and are degrading the physical structure of the watercourse. The watercourse continues to be “peaky,” with fast-rising and receding waters after rain events owing to the smaller tributaries having been piped and/or channelized, and the many stormwater outlets along its banks. As well, in the main branch of the subwatershed, some banks have been hardened, several in-stream barriers block upstream movement of aquatic species and numerous storm sewer outfalls are potential impairments to the fish community. Additionally, winter ice and road salt are having an (extent unknown) impact upon the aquatic ecosystem. All of the stations in this subwatershed exhibit a definite level of impairment.

4.4.2 Management Targets

Table 34 summarizes the targets and aquatic management components for the Lower Etobicoke Creek subwatershed.

4.4.3 Implementation Strategies for Management Activities and Targets

To attain and/or maintain the management objectives and targets, conservation and restoration efforts are required. Recommended management activities required to protect and enhance the aquatic community are listed below in Table 35 and illustrated in Map 13.

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Table 34: Aquatic Management Components and Targets for the Lower Etobicoke Creek Subwatershed

Management Component	Management Target	Existing Conditions by Habitat Category		
		Small Riverine Warm Water	Intermediate Riverine Warm Water	Estuarine
Baseflow	Protect existing baseflow. As a minimum, maintain baseflow to average annual flow ratio of at least 25 per cent.	Data indicates that the baseflow ratio is below that required by trout and is more suitable for warm water species that are more tolerant of higher water temperatures and less stable flows.		
Water extraction	Allocate such that there are no conflicts with fish habitat (environment-first approach)	Preliminary data on water extraction has been collected in 2002 but no data analysis had been performed at the time that this plan was finalized.		
Water quality and nutrients	Provincial Water Quality Objectives (PWQO) or better.	Nutrient levels are generally high. Invertebrate data indicates a fairly substantial level of organic pollution, with EC005WM showing the least amount of impairment. Anecdotal information points to chemical discharge through sewer outfalls.		
Potential in-stream barriers and on-line ponds	Remove or mitigate barriers and on-line ponds except where they are integral to fisheries management (e.g., Toronto Golf Club Dam).	Dams – 1; golf course crossings – 20; ponds – 6; railroad crossings – 2; road crossings – 29; runway crossings – 1; trail crossings – 17; weirs – 6 Total = 82		
Riparian vegetation	a) Stream length vegetated: 100 per cent b) Stream length with woody vegetation: 75 per cent	c) Naturally vegetated: 24.8 per cent d) Stream length with woody vegetation: 18.2 per cent		
Altered watercourses	Natural channel principles used when alterations are necessary or improvements proposed.	Renforth Creek at Markland Wood Golf Club has sediment and flooding issues related to on-line ponds. Various portions of the subwatershed have been channelized/altered and lined with gabion baskets or concrete and should be removed.		
Wetland creation and restoration	Historic wetland cover of 540 hectares or similar quantity of functional service through artificial means.	Currently there exists zero hectares or zero per cent wetland cover within the subwatershed.		
Target fish species	Small riverine warm water = darter species Intermediate riverine warm water = smallmouth bass Estuarine = smallmouth bass, largemouth bass and pike	In the 2001–2004 sampling events, no darter species were found. In the 2001–2004 sampling events, there were no smallmouth bass caught. In the 2001–2004 sampling events, no smallmouth bass, largemouth bass or pike were caught.		
Fish IBI	Minimum of “good”	2001 “poor,” 2004 “poor”		

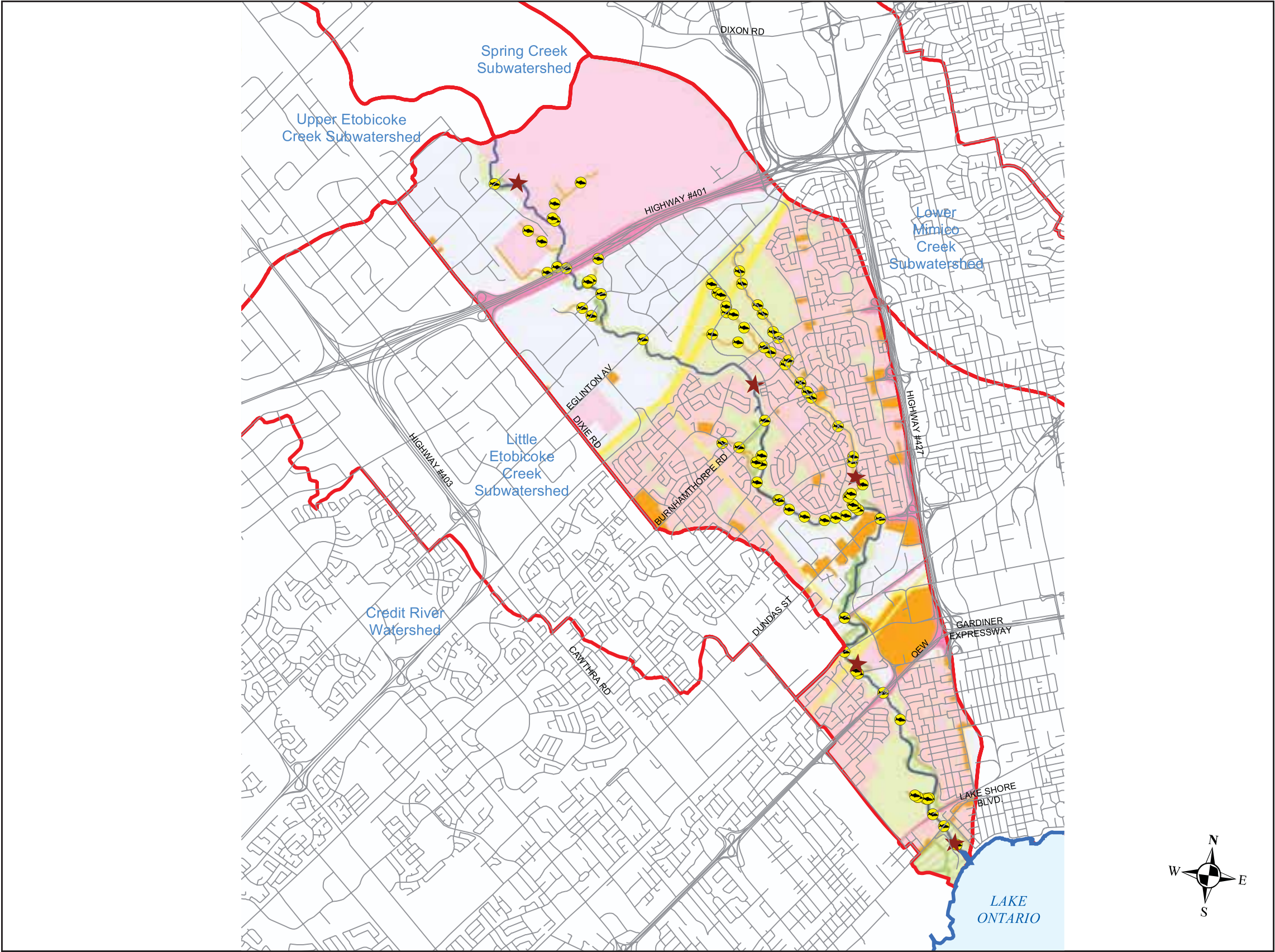
Table 35: Management Recommendations for the Lower Etobicoke Creek Subwatershed

Management Component	Management Recommendations
High Priority – Lower Etobicoke Creek Subwatershed	
Water balance	• Ensure existing water balance is maintained in new development areas.
Monitoring	• Expand monitoring to determine presence and absence of mussel species, rusty crayfish and other aquatic invasive species. Focus above and below Toronto Golf Club Dam in advance of its mitigation. • Expand monitoring to include the presence/absence of rare and/or sensitive species (e.g., redbreasted sunfish, tessellated darter). • Assess water use and baseflow data.
Public land	• Additional aquatic surveys including electrofishing and spawning surveys should be conducted. • Selected Toronto and Region Conservation (TRCA)-owned lands should provide specific areas/nodes for angling access with a focus on Marie Curtis Park. • Promote catch-and-release angling. • Purchase/secure additional conservation lands within the subwatershed to fill in missing floodplain and valley land linkages.
Riparian vegetation	• Maintain and protect existing riparian vegetation. • Woody riparian vegetation should be planted along Summerville Court and the Trillium Heath Care Centre as identified in TRCA's Habitat Implementation Plan (HIP). A major focus should be extensive plantings at Marie Curtis Park that should be integrated with the Toronto Waterfront Aquatic Habitat Restoration Strategy (TWAHRS). • A minimum stream setback of 30 metres should be maintained. Feasibility should be examined and recorded through the HIP process and database. • Planting should be concentrated in the upper reach of the subwatershed. • Hydro corridors should be revegetated with appropriate species. • Golf courses and agricultural operations should be encouraged to allow woody vegetation to grow adjacent to watercourses through TRCA Private Lands programs and other incentives for implementation. • Implement Terrestrial Natural Heritage Strategy (TNHS) through the HIP process. • Incorporate the City of Toronto's Wet Weather Flow Management Master Plan (WWFMMP) target sites where feasible.
Wetland creation and restoration	• Existing wetlands must receive full protection. • Opportunities to create additional wetlands should be explored. A total of 540 hectares of wetlands are required to meet the target of 100 per cent of the subwatershed's historic wetland area. Where natural wetlands are not possible, artificial systems that replace the lost functional services should be employed. Where possible, historic wetlands should be recreated. Utilize the information from the York/Peel Wetland Identification Project 2004 to focus on sites for protection, creation or enhancement. • Implement the Toronto Waterfront Aquatic Habitat Restoration Strategy (TWAHRS) plan for wetland creation within the mouth of Etobicoke Creek.
Potential in-stream barriers and ponds	• Mitigate the Toronto Golf Club Dam by 2007. Begin consultation, project design, funding and obtain necessary regulatory approvals. • The barrier above the sea lamprey barrier should be formally identified and the feasibility of its removal should be investigated. Where removal is not an option, other options should be explored, such as a by-pass channel. • A prioritized list of barriers for removal should be developed. • Apply the City of Toronto's barrier removal projects in the WWFMMP.
Altered watercourses	• Natural channel principles to be used when alterations are necessary or improvements proposed, and must reflect target fish species requirements. • Low order watercourses should be daylighted and/or restored. • Apply the City of Toronto's WWFMMP where possible.

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Table 35: Management Recommendations for the Lower Etobicoke Creek Subwatershed (cont.)

Management Component	Management Recommendations
In-stream habitat	- Assessments required to evaluate the need for in-stream habitat works. - Focus on the implementation of TWAHRS for the mouth of Etobicoke Creek. - Investigate opportunities upstream of the mouth where flow velocity and volumes may be suitable for the creation of aquatic habitat.
Medium Priority – Lower Etobicoke Creek Subwatershed	
Water-taking	- Compile an extensive analysis of the amounts of water being taken. - Precise volume limits and timing of water extraction need to be determined to ensure minimum baseflow requirements for aquatic community.
Water quality	- Investigate locations where contaminants impact the watercourse. Utilize the Etobicoke Creek Spills Mapping Study as a basis to address spills and their impacts upon the aquatic community. - Investigate discharge source at EC001WM. - Pollution prevention, lot level and conveyance controls, and end-of-pipe controls should be used where appropriate throughout the watershed. - Apply the City of Toronto's WWFMMP in suitable areas of Toronto.
Stocking	- Consider the feasibility/benefit of stocking of non-native trout and salmon species for put-and-take (or delayed take) fishery in riverine systems. - Consider stocking of other natives species where it would improve trophic structure/ecosystem function.
Stormwater retrofits	- Implement the City of Toronto's WWFMMP and City of Mississauga's Stormwater Quality Control Study where appropriate. - Investigate other opportunities not yet identified in retrofit plans.
Angling regulations	- Consider implementing a year-round season for brown and rainbow trout at the mouth of Etobicoke Creek to the Toronto Golf Club Dam. - Conduct creel surveys to determine angling pressures. - Ontario Ministry of Natural Resources (OMNR)/TRCA to construct fishing nodes at Marie Curtis Park.
Baitfish Harvest	- Licensed baitfish collectors certified in fish identification (OMNR or Royal Ontario Museum). - Identify locations where baitfish are being collected and manage database.



*Recommended
Implementation Strategies
in the Lower Etobicoke
Creek Subwatershed*

LEGEND:

- Subwatershed Boundary
- 2001 Fish Sampling Stations
- Instream Barriers (refer to Map7 for barrier type)
- TRCA Property
- Fisheries Management Zones
 - Zone 1: Smallmouth Bass
 - Zone 2: Darter spp.
 - Zone 3: Mottled Sculpin
- Landuse
 - Greenspace
 - Gov't/Educational Institution
 - Agricultural
 - Retail/Commercial
 - Residential Sector
 - Industrial
 - Transportation Corridor
 - Utility

1:60,000
0 250 500 1,000 1,500 2,000 2,500 Metres



4.5 Little Etobicoke Creek Subwatershed

4.5.1 Aquatic Ecosystem Health

The Little Etobicoke Creek subwatershed has a high level of urbanization similar to the Lower Etobicoke Creek subwatershed. However, the Little Etobicoke Creek subwatershed has a high level of woody riparian vegetation, relatively intact and mature, and is found along approximately 22 per cent of the length of the subwatershed, but this is still well below the targeted 75 per cent cover targets (Environment Canada, 1998). The lower sections of the watercourse support aquatic species but the channel is highly degraded.

This watershed has been substantially degraded from its reported condition in the 1948 ODPD survey when reddsides were identified. There will need to be additional monitoring undertaken in this subwatershed to determine what aquatic species remain and what habitat is available to them above the CN rail line. In the fall of 2005, the subwatershed was surveyed for in-stream barriers and preliminary information indicates that the watercourse consists of highly fragmented habitat, with very few locations where aquatic species remain.

For the purposes of the Fisheries Management Plan (FMP), an assumption is being made that the subwatershed has been highly degraded and is continuing to decline incrementally. Index of Biotic Integrity (IBI) ratings, and differences between actual and expected species richness, have not been calculated for this subwatershed as no data has been collected. Further, there have been no invertebrate collections or analysis.

4.5.2 Management Objectives and Targets

Table 36 summarizes the aquatic management components and targets for the Little Etobicoke Creek subwatershed based upon limited monitoring and field assessments of in-stream barriers conducted to date.

4.5.3 Implementation Strategies for Management Activities and Targets

In order to achieve and/or maintain the management objectives and targets, conservation and restoration efforts are required. Table 37 lists the recommended management activities required to protect and enhance the aquatic community within the Little Etobicoke Creek subwatershed, while Map 14 spatially interprets the recommended activities.

4.6 Upper Etobicoke Creek Subwatershed

4.6.1 Aquatic Ecosystem Health

Land use in the Upper Etobicoke Creek subwatershed is comprised of agricultural, followed closely by urban land use and only 23.3 per cent remains as natural cover, including forest, meadow and/or wetland. This subwatershed is currently under development pressure. The riparian zone in this subwatershed is sparse in many areas and many tributaries are at risk from development because of their low flow or seasonal nature. The watercourses in the upper portions of the subwatershed are slow-moving and are dominated by shrub and herbaceous riparian wetland habitat. The lack of woody vegetation has further intensified the low infiltration capacity of the clay soils that dominate the area, likely increasing the number and length of the intermittent streams that dry-up during the summer.

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Table 36: Aquatic Management Components and Targets for the Little Etobicoke Creek Subwatershed

Management Component	Management Target	Existing Conditions by Habitat Category
		Small Riverine Warm Water
Baseflow	Protect existing baseflow. Maintain baseflow to average annual flow ratio of at least 25 per cent.	Although there is currently no information regarding baseflow for this subwatershed, it is assumed to be in a similar state as in the monitored urbanized portions of the watershed. Data from the flow gauging stations in Etobicoke Creek indicate that the baseflow ratio is below that required by trout and is more suitable for warm-water species that are more tolerant of higher water temperatures, and less stable flows.
Water extraction	Resource allocation such that there are no conflicts with fish habitat (environment-first approach).	Preliminary data on water extraction has been collected in 2002 but no data analysis had been performed as of the time that this report was finalized.
Water quality and nutrients	Provincial Water Quality Objectives (PWQO) or better.	Water quality in terms of nutrients is unknown as no historical stations existed and no data was collected at the time of compiling the Fisheries Management Plan (FMP). The 2003/04 Guide to Eating Ontario Sport Fish does not list the Little Etobicoke Creek.
Potential in-stream barriers and ponds	Remove or, at minimum, mitigate barriers except where they are integral to fisheries management.	Driveways – 3; railroad crossings – 1; road crossings – 14; trail crossings – 5; unknown – 4; weirs – 18 Total = 45
Riparian vegetation	a) Stream length naturally vegetated: 100 per cent b) Stream length with woody vegetation: 75 per cent	a) Naturally vegetated: 68 per cent b) Stream length with woody vegetation: 22 per cent
Altered watercourses	Natural channel principles used when alterations are necessary or improvements proposed.	Various portions of the subwatershed have been channelized/altered and lined with gabion baskets or concrete. Sites to be restored.
Wetland creation and restoration	Historic wetland cover 82.7 hectares.	Currently there are currently 3.3 hectares or 0.13 per cent wetland cover within this subwatershed.
Fish Index of Biotic Integrity (IBI)	Minimum of “good.”	Not yet sampled.
Target fish species	Small riverine warm water = darter species	Although this subwatershed was not surveyed, darter species are expected to be present in the lower end of the subwatershed when barriers are removed and flow conditions improve. Limited previous sampling found species such as white sucker, common shiner, creek chub, blacknose dace, as well as other generalist species.

Table 37: Management Recommendations for the Little Etobicoke Creek Subwatershed

Management Component	Recommended Activity
High Priority	
Monitoring	- Assess water use and baseflow data. - Expand monitoring to include a station(s) in this subwatershed, and to determine the presence and absence of fish, mussel species, rusty crayfish, thermal and flow conditions.
Altered watercourses	- Rehabilitate channelized sections of the upper subwatershed. - Natural channel design principles to be used when alterations are necessary or proposed, and to reflect habitat requirements of target fish species. - Focus on re-naturalizing the stream from Highway 401 to Eglinton Ave.
Riparian vegetation	- Maintain and protect existing riparian vegetation. - Woody riparian vegetation should be planted in the headwater areas of the subwatershed, focusing on the reach from Highway 401 to Eglinton Ave. - A minimum setback of 30 metres should be maintained as a protective riparian zone. Buffers to this zone should also be considered to minimize matrix influences. - Parks are encouraged to allow woody vegetation to grow adjacent to watercourses and to change operational practices to allow for no-mow zones. - Implement Terrestrial Natural Heritage Strategy (TNHS). - Community involvement in riparian plantings should be encouraged.
Potential in-stream barriers and ponds	- Barriers and on-line ponds should be removed and/or mitigated. - Fish passage assessments for barriers was conducted in 2005. The development of a prioritized list of in-stream barriers for removal and management should be developed through the Habitat Implementation Plan (HIP) process and partners. - Formally assess the feasibility of fish passage at the bottom end of the subwatershed at the railroad crossing.
Wetland creation and restoration	- Existing wetlands must receive full protection. - Opportunities to create additional wetlands should be explored. A total of 82.7 hectares of wetland creation is required to meet the target of 100 per cent of the historic amount within the subwatershed area. This could include the creation of mid-reach wetlands. The goal is to replace lost functional services and, therefore, artificial wetlands and/or technologies are acceptable. Utilize the information from the York/Peel Wetland Identification Project 2004 to focus on sites for protection, creation or enhancement.
Stormwater retrofits	Advocate adherence to retrofit schedule for pond 96.3 and 96.4, and implement the City of Mississauga's Stormwater Quality Control Study.
In-stream habitat	Assessments are required to evaluate the need for in-stream habitat works, and to assess the volumes, velocities, magnitude and timing of flows.
Medium Priority	
Water quality	Investigate locations where contaminants impact the watercourse. Utilize the Etobicoke Creek Spills Mapping Study as a basis to address spills and their impacts upon the aquatic community.
Water balance	- Ensure existing water balance is maintained in new development areas. - Protect areas of significant recharge and discharge functions. Post signage as appropriate to educate the public.
Baitfish harvest	- Licensed baitfish collectors be certified in fish identification (Ontario Ministry of Natural Resources [OMNR] or Royal Ontario Museum [ROM]). - Identify locations where baitfish are being collected (if any).
Public land	- Although there appears to be a minimal amount of public land within the subwatershed, development should be conducted on an "environment-first" basis and should include a setback of at least 30 metres from top of bank. - Toronto and Region Conservation (TRCA) and other organizations should consider securement of additional conservation lands within the subwatershed to improve/increase floodplain and valley land linkages.
Water-taking	Water-taking databases are not up-to-date and it is assumed that the majority of potential users are on municipal water. It is assumed that there is little to no water-taking within this subwatershed.
Angling regulations	No changes suggested at this time, but it is recommended that OMNR conduct creel surveys to determine angling pressure.
Stocking	No stocking recommended at this time.

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The headwaters aquatic habitat north of Mayfield Road continues to support a diverse assemblage of fish species that are both ecologically sensitive and habitat dependent. These watercourses continue to show high species diversity and high ecological integrity, along with the highest Index of Biotic Integrity (IBI) scores for the watershed. The available headwater habitat is relatively restricted in the low-flow summer months and is likely very susceptible to stochastic impacts due to the contraction, and the seasonal nature, of many of the watercourses. A key focus for maintaining habitat and ecological integrity should be the protection of these low order watercourses through the Ontario Planning Act processes, the Generic Regulation through the Conservation Authorities Act, the Mayfield West subwatershed study (currently underway), and through the restoration of riparian areas and their upland drainage systems through the implementation of the Terrestrial Natural Heritage System (TNHS).

The middle to lower reaches of the subwatershed demonstrate a different ecological condition, indicating that these watercourses have been impacted by landscape changes. The fish found at the respective sampling stations are pollution- and disturbance-tolerant species. The fisheries community is exhibiting very limited species diversity, an indication of poor ecological integrity. The resulting IBI scores for this section of the subwatershed have a “poor” stream quality assessment rating. It should be noted that many channels through this section of the watershed have been altered and armoured, and generally provide poor habitat for aquatic species. It is also known that there are flow quantity and quality concerns within a section of this subwatershed, from the Brampton by-pass channel to the Greater Toronto Airports Authority (GTAA) lands downstream.

From the benthic aggregate scores, the Upper Etobicoke Creek subwatershed reflects a less impaired condition than the Lower Etobicoke Creek, and less impaired than the Spring Creek subwatershed. As well, the Upper Etobicoke Creek subwatershed had the only station reporting an

“unimpaired” condition for all three years that it was sampled. Further assessments are being conducted on the invertebrate data and will be available in subsequent years. Further examination at the species level of detail will provide more information about the habitat conditions of the sampling sites. It should be noted that the sampling occurred during the summer, the period of greatest environmental stress with low flows and high temperatures. An assessment during this time may result in higher biotic index scores (Hilsenhoff, 1987). This is why it is important to use multiple variables in the analysis. A comparison of the relative scores across the watershed is valid but a comparison with historic surveys may not be. The current information should only be used as an initial flag to identify potential problematic areas in the subwatershed. Further analysis will be completed to more fully understand the current system and its status over time.

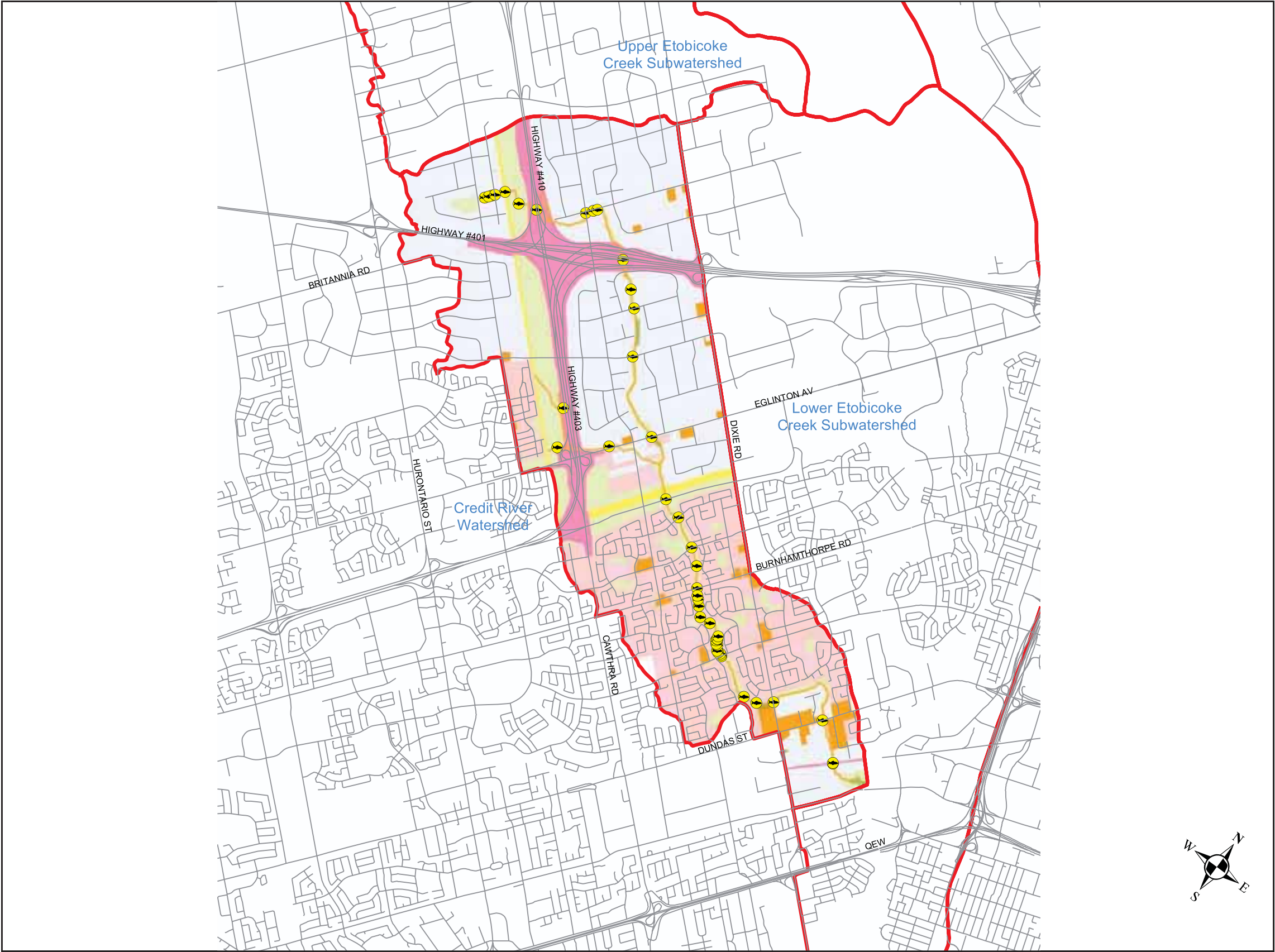
It is important to note that nearly all of the remaining high-quality habitat and species diversity is contained within the headwaters area of this subwatershed. Once the headwater habitat becomes degraded, there are many species that will be put at risk of extirpation from the subwatershed and the watershed as a system.

4.6.2 Management Objectives and Targets

Table 38 summarizes the aquatic management components and targets for the Upper Etobicoke Creek subwatershed.

4.6.3 Implementation Strategies for Management Activities and Targets

Table 39 lists the recommended management activities required to protect and enhance the aquatic habitat and species, while Map 15 shows the location of recommended activities.



*Recommended
Implementation Strategies
in the Little Etobicoke
Creek Subwatershed*

- LEGEND:**
- Subwatershed Boundary
 - 2001 Fish Sampling Stations
 - Instream Barriers (refer to Map7 for barrier type)
 - TRCA Property
- Fisheries Management Zones**
- Zone 1: Smallmouth Bass
 - Zone 2: Darter spp.
 - Zone 3: Mottled Sculpin
- Landuse**
- Greenspace
 - Gov't/Educational Institution
 - Agricultural
 - Retail/Commercial
 - Residential Sector
 - Industrial
 - Transportation Corridor
 - Utility

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0 250 500 1,000 1,500 2,000 Metres



Table 38: Aquatic Management Components and Targets for the Upper Etobicoke Creek Subwatershed

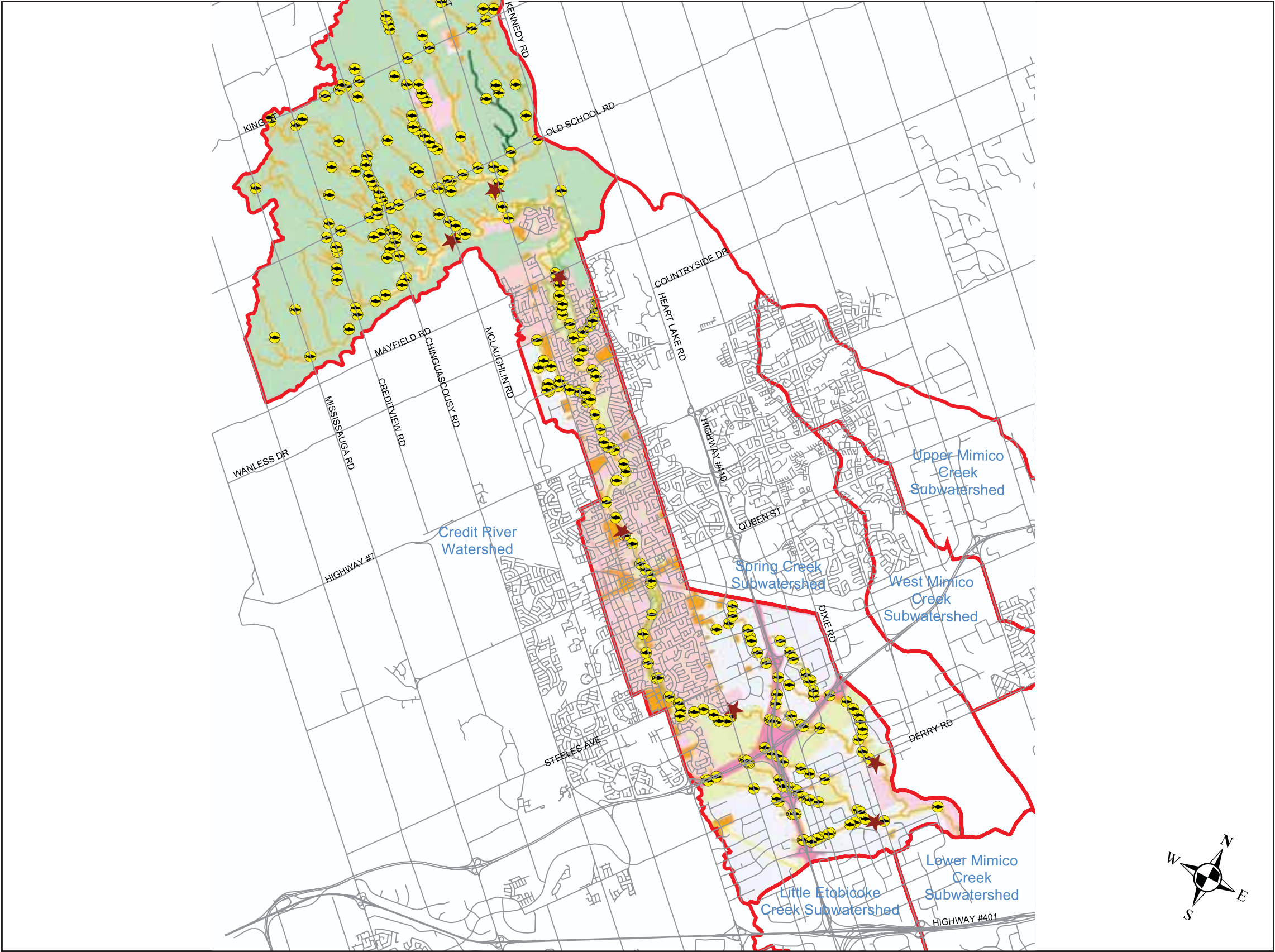
Management Component	Management Target	Existing Conditions by Habitat Category			
		Small Riverine Cold-water Habitat	Small Riverine Warm-water Habitat	Intermediate Riverine Warm-water Habitat	Lacustrine Habitat
Baseflow	Protect existing baseflow. Maintain a baseflow to average annual flow ratio of at least 25 per cent.	Adequate baseflow to support a cold-water community in isolated locations. Preliminary data shows that there are locations where baseflow is increasing during the late summer months.	Data from the flow gauging stations indicate that the baseflow ratio is below that required by trout and is more suitable for species tolerant of higher water temperatures and less stable flows.		
Water extraction	Resource allocation should not interfere/conflict with fish habitat ("environment-first" approach).	Preliminary data on water extraction has been collected but no data analysis had been performed as of the time that this report was finalized.			
Water quality and nutrients	Provincial Water Quality Objectives (PWQO) or better.	The Upper Etobicoke Creek subwatershed can be expected to be influenced by primary rural sources of contamination: overland sediment, stream bank erosion, livestock access to streams and point sources such as storm sewers (TAWMS 1986).			
Potential in-stream barriers and ponds	Mitigate or remove barriers. Conversion of structures to bottom-draw for on-line ponds.	Dams – 1; driveways – 30; golf course crossings – 6; ponds – 14; railroad crossings – 7; road crossings – 141; runway crossings – 2; trail crossings – 60; unknown – 8; weirs – 18 Total = 287			
Riparian vegetation	a) Stream length naturally vegetated: 100 per cent b) Stream length with woody vegetation: 75 per cent	a) Naturally vegetated: 30.9 per cent b) Stream length with woody vegetation: 15.5 per cent			
Altered watercourses	Natural channel principles used when alterations are necessary or improvements proposed.	Many sections of this subwatershed have been channelized or altered, the most notable, or well known, is the Brampton by-pass channel. Much of the subwatershed's remaining low-order streams exist in a minimally altered state, or are natural.			
Wetland creation and restoration	Historic wetland cover = 364.9 hectares	Currently there are 54 hectares or 0.54 per cent wetland cover within this subwatershed.			
Index of Biotic Integrity (IBI)	Minimum of "good."	Not sampled.	2001 "poor" 2004 "poor"	2001 "fair" 2004 "fair"	Not sampled.
Target species	Small riverine cold-water habitat: manage for baseflow and cool-water communities. Small and intermediate warm-water habitats: blacknose shiner, blackcin shiners and central mudminnow in the headwaters area and darter species elsewhere.	N/A	In the 2001–2004 sampling no darters were found.	In the 2001 sampling, two darter species were found — fantail darter and Johnny darter. Blacknose shiner and central mudminnow were found in the headwaters. In the 2004 sampling, two darter species were found, fantail and Johnny darter, and only central mudminnow was found in the headwaters.	N/A

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Table 39: Management Recommendations for the Upper Etobicoke Creek Subwatershed

Management Component	Recommended Activity
High Priority	
Water balance	- Ensure existing water balance is maintained in sensitive areas (e.g., tributaries east of Highway 10 and north of Old School Road). - Protect areas of significant recharge and discharge by limiting landscape imperviousness.
Monitoring	- Expand monitoring to include one Ontario Stream Assessment Protocol (OSAP) station within the cold-water habitat or conduct fisheries sampling in areas of high baseflow discharge. - Assess water use and baseflow data. Also, conduct further investigations into the large baseflow input identified at Mayfield Road. - Verify cold-water discharge areas and seasonal nature of headwater watercourses. - Additional fisheries sampling should be conducted to determine seasonal use of habitats and the presence of rare local species in the subwatershed. - Expand monitoring to determine the presence/absence of mussel species, rusty crayfish and native crayfish species.
Public land	Toronto and Region Conservation (TRCA) and other organizations should consider securing additional conservation lands within the subwatershed to improve/increase floodplain and valley land linkages.
Riparian vegetation	- Maintain and protect existing riparian vegetation. - Future construction and extension of Highway 410 and the Mayfield Road expansion should minimize impacts to the riparian corridor. - Implement recommendations for riparian plantings in TRCA's Habitat Implementation Plan (HIP) for Snelgrove Reach and Valleybrook Park. - Plant along low-order streams, particularly west of Chinguacousy Road and north of Old School Road in order to create a riparian ecological unit. - Implement the Terrestrial Natural Heritage Strategy (TNHS). - Involve the local community in riparian plantings.
Potential in-stream barriers and ponds	- Conduct fish passage assessment for each known and potential barrier. - Mitigate identified barriers. Mitigate and retrofit on-line ponds through the installation of bottom-draw structures.
Wetland creation and restoration	- Existing wetlands must receive full protection, particularly in headwater areas. There also exists a need to create additional wetlands. A total of 310.9 hectares of wetland creation is required to meet the target of 100 per cent of the historic amount within the subwatershed area. However, the goal is to replace lost functional services, and this can utilize artificial wetlands and/or technologies. - Utilize the information from the York/Peel Wetland Identification Project 2004 to focus on sites for protection, creation or enhancement. - Implement the recommendations for wetland pockets in TRCA's HIP for Snelgrove Reach and Valleybrook Park.
Stormwater retrofits	Implement the City of Brampton's Stormwater Retrofit Study and City of Mississauga's Stormwater Quality Control Study where appropriate.
Medium Priority	
Water quality	- Investigate locations where contaminants impact the watercourse. Utilize the Etobicoke Creek Spills Mapping Study as a basis to address spills and their impacts upon the aquatic community. - Any new development must include stormwater management controls. - Assess rural impacts to the watercourse. - Investigate the presence of cattle at EC014WM and work with landowner to restrict cattle access to the stream.
Stocking	Identify candidate habitat in the subwatershed for redbreasted dace stocking.
Water-taking	Precise volume limits and timing of water extraction need to be determined by subcatchment area to ensure minimum baseflow requirements for aquatic community.
Altered watercourses	- Assessments are required and formalized processes should be established for municipal drains between the city, TRCA and Department of Fisheries and Oceans (DFO). - Natural channel design must reflect the habitat requirements of target fish species.
Angling regulations	No changes recommended at this time.
Baitfish harvest	- All licensed baitfish collectors certified in fish identification (Ontario Ministry of Natural Resources [OMNR] or Royal Ontario Museum [ROM]). - Baitfish harvest locations to be identified.
In-stream habitat	- Field assessments are required to evaluate the need for in-stream habitat restoration. - TRCA is working with the City of Brampton to investigate in-stream habitat improvements at Loafer's Lake. - Implement the stream restoration proposal outline in TRCA's HIP for Snelgrove Reach.

Etobicoke Creek Watershed



Recommended Implementation Strategies in the Upper Etobicoke Creek Subwatershed

LEGEND:

- Subwatershed Boundary
- 2001 Fish Sampling Stations
- Instream Barriers (refer to Map7 for barrier type)
- TRCA Property
- Fisheries Management Zones
 - Zone 1: Smallmouth Bass
 - Zone 2: Darter spp.
 - Zone 3: Mottled Sculpin
- Landuse
 - Greenspace
 - Gov't/Educational Institution
 - Agricultural
 - Retail/Commercial
 - Residential Sector
 - Industrial
 - Transportation Corridor
 - Utility

1:100,000
0 5001,000 2,000 3,000 4,000 5,000 Metres



4.7 Spring Creek Subwatershed

4.7.1 Aquatic Ecosystem Health

The Spring Creek subwatershed is heavily urbanized in the lower reaches, with over 50 per cent of the subwatershed currently in some form of urban land use. There are still remnant agricultural lands, and nearly a quarter of the subwatershed maintains some form of natural habitat. This intense urban use has changed the drainage network and hydrologic patterns in the subwatershed so that the tributaries are quickly affected by storm events. The northern portion of the subwatershed is expected to experience future urban growth. Currently 13.8 per cent of the natural and agricultural portions of the subwatershed are committed for development.

This subwatershed is underlain primarily by soils with low infiltration rates, although there are areas associated with the Brampton Esker that receive groundwater inputs. The Brampton Esker provides a source of groundwater for a chain of lakes extending from Teapot and Heart lakes in the north, to Cashel Lake in Norton Place Park in the south. The system of lakes forms the headwaters of Spring Creek (Dillon, 1991). This indicates that overall groundwater discharge to Spring Creek would be expected to be low and not likely to support cold-water aquatic communities, with the exception of the tributary originating in Nuffield Park, southeast of Bovaird Drive and Highway 410 that receives discharges from the Brampton Esker. Finally, new mapping indicates that there are likely localized discharge zones from the Oak Ridges Moraine aquifer.

The actual watercourses of Spring Creek continue to show a degraded ecological condition. The fisheries community exhibits very limited species diversity, an indication of poor ecological integrity, as well as low Index of Biotic Integrity (IBI) scoring. The degraded stream condition relates primarily to the historic loss of habitat quality and the elimination of specific habitat types. Spring Creek used to support both reddsides and slimy sculpin. The watercourses now appear to have flow quantity and quality problems, issues with continued channel

alteration and armouring, and there are many in-stream barriers along its length that fragment the aquatic habitat.

While both density and diversity of invertebrates found within the subwatershed are relatively low, this can be considered as typical of urbanized streams. The potentially impaired condition of the two Regional Monitoring Network (RMN) stations within the subwatershed is likely a consequence of the synergistic effects of poor habitat structure, resulting from poor hydrological conditions and poor water quality. There are some preliminary findings at stations EC009WM and EC010WM that should be noted including the near absence of major groups of invertebrates from the subwatershed (such as beetles). These stations warrant more detailed consideration in subsequent monitoring studies and the area of focus should be expanded beyond the RMN site boundaries.

4.7.2 Management Objectives and Targets

Table 40 summarizes the aquatic management components and targets for the Spring Creek subwatershed.

4.7.3 Implementation Strategies for Management Activities and Targets

Table 41 lists recommended management activities required to protect and enhance the aquatic community, and Map 16 features a spatial interpretation of the recommendations.

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Table 40: Aquatic Management Components and Targets for the Spring Creek Subwatershed

Management Component	Management Target	Existing Conditions by Habitat Category			
		Small Riverine Cold-water Habitat	Small Riverine Warm-water Habitat	Intermediate Riverine Warm-water Habitat	Lacustrine Habitat
Baseflow	Protect existing baseflow. Maintain a baseflow to average annual flow ratio of at least 25 per cent.	Baseflow from the Brampton Esker may be able to support a cold-water community. The precautionary principle should be used when analyzing current development projects.	Data from the flow gauging stations in Etobicoke Creek indicate that the baseflow ratio is below that required by trout and is more suitable for warm-water species that are more tolerant of higher water temperatures and less stable flows.		
Water extraction	Resource allocation such that there is no interference/ conflict with fish habitat ("environment-first" approach).	Preliminary data on water extraction has been collected in 2002 but no data analysis had been performed as of the time that this report was finalized.			
Water quality and nutrients	Provincial Water Quality Objectives (PWQO) or better.	Unfortunately, all of the water quality monitoring stations are in the Upper and Lower Etobicoke Creek subwatersheds. Without additional testing, it would be impossible to identify the separate contributions to the chemical composition of the stream from the Spring Creek subwatershed. Thus, the analysis of the subwatershed can only be of a general nature. In addition, the Heart Lake lake lung seems to have improved oxygen levels in the lake.			
Potential in-stream barriers and ponds	Mitigate or remove barriers. Mitigate ponds through conversion of structures to bottom-draw.	Driveways – 11; ponds – 4; railroad crossings – 2; road crossings – 67; runway crossings – 2; trail crossings – 30; unknown – 5; weirs – 18 Total=139			
Riparian vegetation	a) Stream length naturally vegetated: 100 per cent b) Stream length with woody vegetation: 75 per cent	a) Naturally vegetated: 36.6 per cent b) Stream length with woody vegetation: 16.8 per cent			
Altered watercourses	Natural channel principles used when alterations are necessary or improvements proposed.	Various portions of the subwatershed have been channelized/ altered and lined with gabion baskets or concrete, and should be removed and the sites restored.			
Wetland creation and restoration	Historic wetland cover: 571.4 hectares, 100 per cent	Currently there are 111.7 hectares or 2.3 per cent wetland cover within this subwatershed.			
Index of Biotic Integrity (IBI)	Minimum of "good."	Not sampled	Not sampled	"Fair" 2001, "Poor" 2004	Not sampled
Target species	Small riverine cold-water habitat: slimy sculpin Warm-water habitats: darter species, largemouth bass	N/A	N/A	Darter species were expected but were not found in the 2001 sampling.	N/A

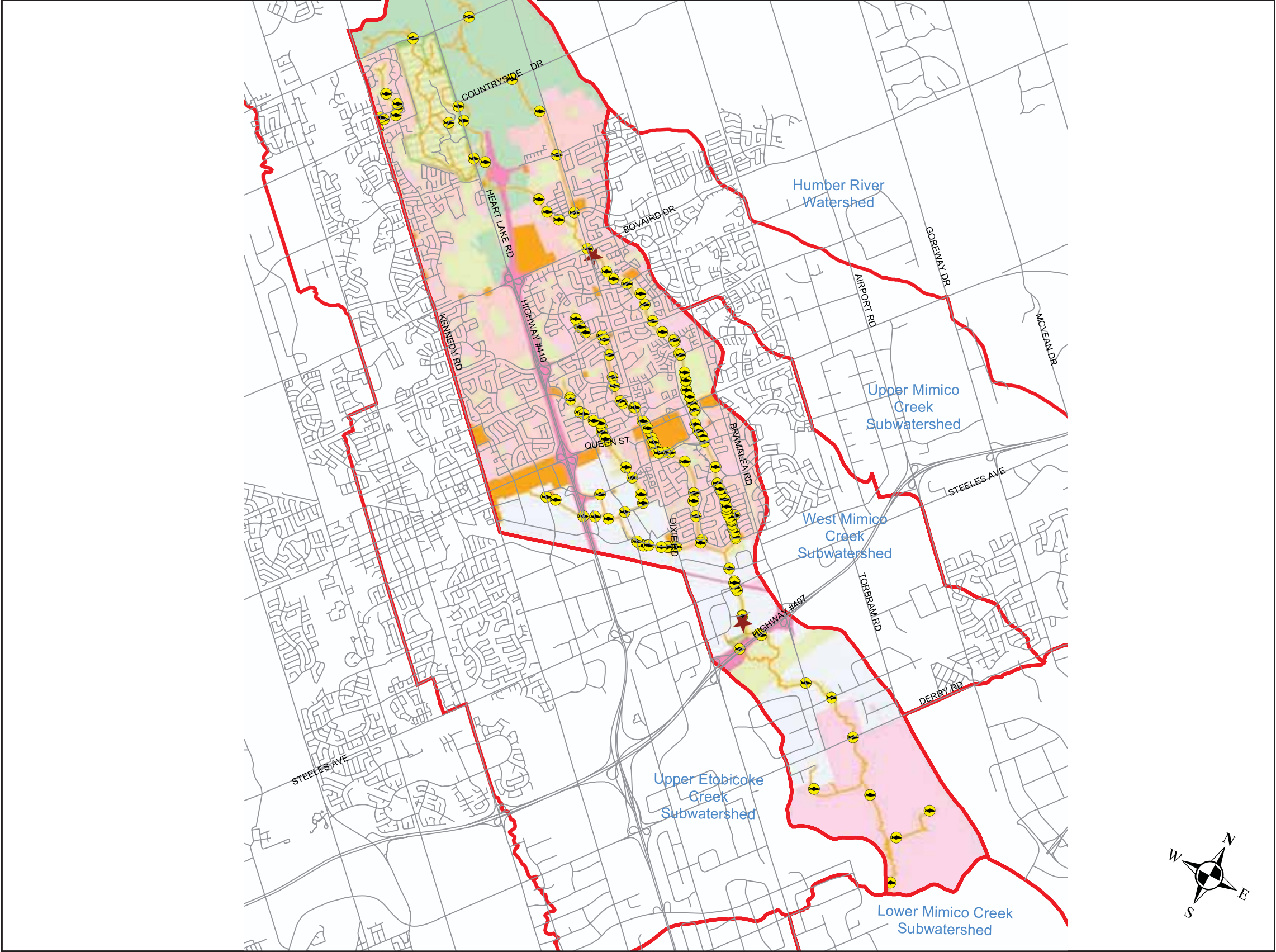
Table 41: Management Recommendations for the Spring Creek Subwatershed

Management Component	Recommended Activity
High Priority	
Water balance	• Ensure existing water balance is maintained in sensitive future development areas (e.g., Brampton Esker). • Protect areas of significant recharge and discharge functions from additional dewatering, groundwater withdrawals and increased levels of landscape imperviousness.
Monitoring	• Expand monitoring to include an Ontario Stream Assessment Protocol (OSAP) monitoring station in cold-water habitat. • Establish additional OSAP monitoring sites in the subwatershed to collect information regarding species distribution, extirpated species and aquatic ecosystem health. • Assess water use and baseflow data. • Determine the presence/absence of mussel species and rusty crayfish through future expanded monitoring activities and surveys.
Public land	• Development of Greater Toronto Airports Authority (GTAA) lands must be done with an “environment-first” approach and should include a setback of at least 30 metres from top of bank. • Toronto and Region Conservation (TRCA) lands should promote catch-and-release angling, no live bait and the use of barbless hooks within identified reaches. • Promote public education of aquatic ecosystems and their ecological processes.
Altered watercourses	• Natural channel principles to be used when alterations are necessary or improvements proposed, and design must reflect the habitat requirements of target fish species. • Opportunities exist to restore Spring Creek north of Chinguacousy Park through Hilldale and Maitland parks using natural channel design over the next five to 10 years.
Potential in-stream barriers and ponds	• Conduct fish passage assessment for each known and potential barrier. • Mitigate identified barriers and/or conversion of pond structures to bottom-draw. • Chinguacousy Park has two on-line ponds. It is strongly recommended that fish passage be re-established in this section of the watercourse. Ideally, consideration should be given to taking the ponds off-line or creating a low-flow by-pass channel. • Mitigation of barriers upstream of the Chinguacousy Park ponds should include the lower-most barrier above the ponds to reconnect the watercourse and allow for fish passage upstream from the ponds themselves.
Riparian vegetation	• Maintain and protect existing riparian vegetation. • Plant riparian vegetation along low-order streams and on the Brampton Esker and, where feasible, on GTAA lands. Also focus attention on re-establishing dense vegetation for the area south of Mayfield Road, downstream to Queen Street and around Sandalwood Parkway. • Maintain/create a riparian zone of at least 30 metres on each side of the creek. • Implement Terrestrial Natural Heritage Strategy (TNHS). • Conduct riparian plantings with the local community.
Wetland creation and restoration	• Existing wetlands must receive full protection, particularly in headwater areas. • Opportunities to create additional wetlands should be explored. A total of 459.7 hectares of wetland creation is required to meet the target of 100 per cent of this subwatershed’s historic wetland area. However, the goal is to replace lost functional services, and artificial wetlands and/or technologies may be used to meet the goal. Utilize the information from the York/Peel Wetland Identification Project 2004 to focus on sites for protection, creation or enhancement.
Stormwater retrofits	• Implement the City of Brampton’s Stormwater Retrofit Study and City of Mississauga’s Stormwater Quality Control Study

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Table 41: Management Recommendations for the Spring Creek Subwatershed (cont.)

Management Component	Recommended Activity
Medium Priority	
Water quality	• Protection of source areas will help to protect and improve water quality. • Investigate locations where contaminants impact the watercourse. Utilize the Etobicoke Creek Spills Mapping Study as a basis to address spills and their impacts upon the aquatic community. • Pollution prevention, lot level and conveyance controls, end-of-pipe controls should be implemented. • Any new development must include stormwater management control measures for quality and quantity, and should employ green technologies to achieve net gains.
In-stream habitat	• Future work will be required to assess the need for in-stream habitat restoration projects. • Expand the bioengineering work at Heart Lake to restore the south shore 2005–2007.
Public land	• Development of GTAA lands should be done with an “environment-first” approach and should include a setback of at least 30 metres from top of bank. • Toronto and Region Conservation lands should promote catch-and-release angling and the use of barbless hooks within identified reaches. • Promote public education of aquatic ecosystems and their ecological processes.
Stocking	• The stocking program at Heart Lake should investigate the possibility of stocking native game fish species (largemouth bass) in conjunction with the stocking of rainbow trout.
Water-taking	• Although water-taking databases are not currently up-to-date, there does not appear to be any concerns at this time. • Precise volume limits and timing of water extraction need to be determined by subcatchment area to ensure minimum baseflow requirements for aquatic community.
Angling regulations	• No changes recommended at this time.
Baitfish harvest	• Licensed baitfish collectors be certified in fish identification (Ontario Ministry of Natural Resources [OMNR] or Royal Ontario Museum [ROM]). • Identify locations where baitfish are being collected.



*Recommended
Implementation Strategies
in the Spring Creek
Subwatershed*

- LEGEND:**
- Subwatershed Boundary
 - 2001 Fish Sampling Stations
 - Instream Barriers (refer to Map7 for barrier type)
 - TRCA Property
- Fisheries Management Zones**
- Zone 1: Smallmouth Bass
 - Zone 2: Darter spp.
 - Zone 3: Mottled Sculpin
- Landuse**
- Greenspace
 - Gov't/Educational Institution
 - Agricultural
 - Retail/Commercial
 - Residential Sector
 - Industrial
 - Transportation Corridor
 - Utility

1:70,000
0 500 1,000 2,000 3,000
Metres





5.0 *Monitoring*

Periodic watershed-wide inventories of Etobicoke Creek have been conducted in the past. However, the inventories were not systematic, were often many years apart and only examined either the fish and/or benthic invertebrate communities. In 2001, Toronto and Region Conservation (TRCA) initiated the Regional Watershed Monitoring Program (RWMP) and Regional Monitoring Network stations (RMN) to provide a regular picture of the health of the nine watersheds within TRCA's jurisdiction. A total of 150 stations were located and developed, with 14 located within the Etobicoke Creek watershed. Each of these stations is sampled annually for benthic invertebrates, while every three years, the suite of data collected is expanded to include fish community, aquatic habitat, algae and stream temperature information following the Ontario Stream Assessment Protocol (OSAP). The full suite of data was collected in 2001 and 2004 for the Etobicoke Creek watershed.

While the RMN provides a comprehensive summary of regional conditions, it is focused on larger stream reaches and does not provide the level of detail required for a complete watershed-wide aquatic

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ecosystem inventory. It is recommended that when the next full suite of data is collected (2007), additional OSAP stations be added in the following locations:

- Establish at least one monitoring station in the Little Etobicoke Creek subwatershed.
- Establish one monitoring station in the small riverine cold-water habitat in the Upper Etobicoke Creek subwatershed.
- Establish one monitoring station along the Brampton Esker to monitor changes as development occurs with the Highway 410 extension.

The additional stations should address important data gaps, answer questions about the presence/absence of species and confirm the physical conditions of the stream ecosystem at a site level. It is also recommended that a complementary community monitoring program be initiated. Initial projects being examined by TRCA include benthic invertebrate and aesthetic monitoring. Other projects could include creel, migratory fish or fish spawning surveys in conjunction with the Ontario Ministry of Natural Resources (OMNR). Local rod and gun clubs, schools or non-government organizations would be potential implementation groups.





6.0 *Next Steps*

The Etobicoke Creek Watershed Fisheries Management Plan (FMP) is meant to be a living document. It is anticipated that the FMP will provide guidance to those looking to implement stream restoration projects. The FMP will need regular updating to stay current and provide the best management directions. It will also require a method for the incorporation of new data and research.

It is recommended that upon completion of this plan and approval by the Ontario Ministry of Natural Resources (OMNR), a process should be initiated to establish the framework that will conform to the new OMNR Watershed-based Fisheries Management Plan (WBFMP) Guidelines. It is anticipated that the guidelines will be completed in 2006.

The barrier identification and mapping program that was initiated in the Little Etobicoke and Lower Etobicoke subwatersheds in 2005 should be expanded to the entire watershed. This will allow for more informed decisions on prioritization of barrier mitigation projects and for interpreting the Regional Watershed Monitoring Program (RWMP) site data, as well as other related fisheries data. Through the barrier mapping and identification program, we shall gain a better understanding of how the aquatic ecosystem operates, how species distributions are impacted by an

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urbanizing watershed, and for the identification species partitioning and invasive species control opportunities. This, in turn, will lead to more informed management decisions that will more accurately address the ecological needs of the aquatic ecosystem and fisheries resource.

Implementation of the FMP will require the help of federal, provincial and municipal governments, non-governmental organizations, rod and gun clubs, industry, agriculture, golf courses and private citizens.



Shoreline planting at Heart Lake Conservation Area as part of the Peel Children's Water Festival.



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Appendix

Appendix I: Summary of 2002 Public Meetings

The first public meeting was held on October 3, 2002 at Professor's Lake Recreational Centre in the City of Brampton. Representatives from the Baitfish Association of Ontario and the general public were in attendance.

Information on the Provincial documents — Strategic Plan for Ontario Fisheries (SPOF II) and the Maple District Fisheries Management Plan — was presented by the Ontario Ministry of Natural Resources (OMNR) Aurora District Area biologist to outline a context for provincial fisheries management.

The purpose of the Etobicoke Creek Fisheries Management Plan (FMP) is to set priorities to guide restoration strategies at a reach, subwatershed and watershed level, to assist in implementing Community Action Sites as outlined in the May 2002 Greening Our Watersheds – Revitalization Strategies for Etobicoke and Mimico Creeks, and to provide input to the plan review and permit process.

The presentation on the Etobicoke Creek Fisheries Management Plan provided an overview of the status of the plan and included a discussion of the biological, physical and chemical conditions in the watershed used to determine the habitat potential of each of the watercourses.

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Three main issues were highlighted by participants:

1. That restoration priorities focus on barrier mitigation.
2. That any consideration of stocking be carefully evaluated to ensure compatibility with existing community makeup.
3. That greater emphasis be placed on water quality monitoring, restoration and enforcement.

These three factors were incorporated into the final draft of the Etobicoke Creek Fisheries Management Plan.

A second public meeting was held on December 5, 2002 at Montgomery's Inn in the City of Toronto. In addition to the three main issues brought forward

in the first public meeting, the following concerns were expressed:

1. Walleye should be stocked at the mouth of Etobicoke Creek.
2. A contact list of key agencies involved in regulating watercourses and aquatic habitat should be included within the FMP.
3. Consideration should be given to the establishment of a "creek watch" program, similar to OMNR's River Guardian program, where volunteers from the general public act in educating others about the Etobicoke Creek watershed and restoration efforts. In addition, the volunteers, although not acting in any official capacity, would notify appropriate agencies of any potential violations of relevant policies and legislations.

Appendix II: Reporting Potential Violations of Legislations Related to Aquatic Habitat Management in the Etobicoke Creek Watershed

Agency	Spills	Fish Kills	Physical Alteration to Watercourse	Changes to the Valley and Stream Corridor	Removal of Woody Riparian Vegetation ¹	Telephone Number
Fisheries and Oceans Canada – Fish Habitat Management						905-639-1835
Ministry of the Environment – Spills Action Centre						1-800-268-6060 or 416-325-3000
Ontario Ministry of Natural Resources – Aurora District						905-713-7400
Toronto and Region Conservation						416-661-6600
Town of Caledon						905-584-2272
City of Brampton						905-874-2000
Region of Peel						905-791-7800
City of Mississauga						905-896-5000
City of Toronto						416-338-0338

¹ Only those cities with Tree/Woodland Preservation by-laws have been included in the contact list.

Appendix III: Benthic Analysis Criteria and Calculations

Benthic Analysis Criteria and Calculations					
Index	Explanation/Formula	Impaired	Potentially Impaired	Unimpaired	Source(s)
Per cent worm	$= 100 \times \frac{(O + \text{Nem} + \text{Tur})}{N}$ where, O = number of Oligochaeta Nem = number of Nematoda Tur = number of Turbellaria, and N = total number of individuals	> 30	10 to 30	< 10	Griffiths (1998) David et al. (1998)
Per cent midge	$= 100 \times \frac{\text{Chir}}{N}$ where, Chir = number of Chironomidae	> 40	10 to 40	< 10	Griffiths (1998)
Per cent sowbug	$= 100 \times \frac{\text{Isop}}{N}$ where, Isop = number of Isopoda	> 5	1 to 5	< 1	In part from Griffiths (1998)
Number of groups	Total number of different major taxonomic groups found	≤ 13		> 13	David et al. (1998)
Diversity	$H' = \sum p_i \log_2 p_i \text{ or}$ $H' = -3.322 \sum p_i \log_{10} p_i$ where p_i is the fraction of total animals belonging to group i	< 1	1 to 3	> 3	Wilm and Dorris (1968)
Per cent dominant group	$= 100 \times \frac{\text{Dom}}{N}$ where, Dom = number of most abundant group	> 45	40 to 45	< 40	David et al. (1998) Barbour et al. (1999)
Per cent EPT	$= 100 \times \frac{E + P + T}{N}$ where, E = number of Ephemeroptera P = number of Plecoptera T = number of Trichoptera N = total number of animals in sample	< 5	5 to 10	> 10	David et al. (1998) Kilgour (2000)

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Appendix III: Benthic Analysis Criteria and Calculations (cont.)

Benthic Analysis Criteria and Calculations					
Index	Explanation/Formula	Impaired	Potentially Impaired	Unimpaired	Source(s)
Per cent Diptera	$= 100 \times \frac{Dipt}{N}$ where, Dipt = number of Diptera taxa including Chironomidae, Ceratopogonidae, Culicidae, Simuliidae, Tabanidae, and Tipulidae.	< 15 or > 50	15 to 20, or 45 to 50	20 to 45	David et al. (1998)
Per cent insects	$= 100 \times \frac{Insect}{N}$ where, Insect = number of insect taxa including all taxa from per cent Diptera index, Anisoptera, Coleoptera, Ephemeroptera, Hemiptera, Megaloptera, Plecoptera, Trichoptera, Zygoptera	< 40 or > 90	40 to 50, or 80 to 90	50 to 80	David et al. (1998)
Hilsenhoff Biotic Index	$HBI = \sum \frac{n_i t_i}{N}$ where, n_i = the number of individuals in group i, and t_i = the tolerance value of group i. N = total number of animals	>7	6 to 7	<6	Kilgour (1998)



Etobicoke and Mimico
Creeks

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