

Credit Valley Conservation Rising to the Challenge



A Handbook for Understanding and Protecting
the Credit River Watershed



**Rising to the Challenge:
A Handbook for Understanding and Protecting the Credit River Watershed**

First Edition

© 2009, Credit Valley Conservation

**Credit Valley Conservation
1255 Old Derry Road
Mississauga ON L5N 6R4
Phone: (905) 670-1615
Fax: (905) 670-2210
Email: education@creditvalleyca.ca
Website: www.creditvalleyca.ca**

TABLE OF CONTENTS

UNDERSTANDING AND PROTECTING THE CREDIT RIVER WATERSHED.....	4
CREDIT VALLEY CONSERVATION.....	5
THE CREDIT RIVER WATERSHED	6
WHAT IS A WATERSHED?	6
THE CREDIT RIVER WATERSHED	8
KEY LANDSCAPE FEATURES	9
THREE ZONES OF THE CREDIT RIVER WATERSHED.....	11
SUBWATERSHEDS.....	13
POLITICAL BOUNDARIES	13
DEMOGRAPHICS	13
KEY ISSUES: URBANIZATION AND CLIMATE CHANGE.....	16
CHALLENGES FACING THE CREDIT RIVER WATERSHED.....	17
PROTECTING WATER QUALITY AND QUANTITY	19
THE WATER CYCLE	19
THE IMPORTANCE OF WATER.....	20
RISING TO THE CHALLENGE: PROTECTING WATER QUALITY AND QUANTITY	22
<i>Challenge: Reduce the Impacts of Flooding and Drought</i>	<i>22</i>
<i>Challenge: Reduce the Impacts of Erosion and Sedimentation.....</i>	<i>27</i>
<i>Challenge: Reduce Point and Non-point Source Water Pollution</i>	<i>31</i>
PROTECTING NATURAL HERITAGE SYSTEMS	36
FORESTS, STREAMS, WETLANDS, AND SUCCESSIONAL HABITATS	36
THE IMPORTANCE OF NATURAL HERITAGE SYSTEMS	38
RISING TO THE CHALLENGE: PROTECTING NATURAL HERITAGE SYSTEMS.....	40
<i>Challenge: Protect and Restore Biodiversity</i>	<i>40</i>
<i>Challenge: Protect and Restore Significant Natural Areas.....</i>	<i>44</i>
<i>Challenge: Protect and Restore Connected Habitat</i>	<i>52</i>
CONCLUSION	56

TABLE OF FIGURES

FIGURE 1: GLOBAL OCEAN WATERSHEDS	6
FIGURE 2: THE CREDIT RIVER WATERSHED	7
FIGURE 3: THE CREDIT RIVER.....	8
FIGURE 4: EXPOSED ROCK ALONG THE NIAGARA ESCARPMENT	9
FIGURE 5: THE OAK RIDGES MORAINE.....	10
FIGURE 6: THE LAKE ONTARIO SHORELINE.....	11
FIGURE 7: KEY LANDSCAPE FEATURES OF THE CREDIT RIVER WATERSHED.....	12
FIGURE 8: ZONES OF THE CREDIT RIVER WATERSHED	14
FIGURE 9: SUBWATERSHEDS OF THE CREDIT RIVER WATERSHED	15
FIGURE 10: POPULATION FROM THE 1850S TO 2000S, CREDIT RIVER WATERSHED.....	16
FIGURE 11: THE WATER CYCLE.....	20
FIGURE 12: THE CREDIT RIVER UPSTREAM OF CHURCHVILLE	21
FIGURE 13: FLOODING IN GLEN WILLIAMS, 1946, CAUSED BY AN ICE JAM.....	23
FIGURE 14: FLOOD DAMAGE CENTRES IN THE CREDIT RIVER WATERSHED	24
FIGURE 15: SEVERE EROSION.....	27
FIGURE 16: THE CHELTENHAM BADLANDS	28
FIGURE 17: EROSION FROM A CONSTRUCTION SITE.....	29
FIGURE 18: GARBAGE AND OTHER POLLUTANTS ENTER STREAMS THROUGH RUNOFF.....	32
FIGURE 19: WATER QUALITY MONITORING SITE LOCATIONS	33
FIGURE 20: POLLUTION ENTERS RIVERS AND STREAMS THROUGH STORM SEWERS	34
FIGURE 21: PERCENTAGE FOREST COVER FROM THE 1850S TO 2000S, CREDIT RIVER WATERSHED	37
FIGURE 22: MOST FORESTS ARE LOCATED IN THE MIDDLE AND UPPER WATERSHED	37
FIGURE 23: WETLANDS ARE AN IMPORTANT PART OF NATURAL HERITAGE SYSTEMS	39
FIGURE 24: JEFFERSON SALAMANDER, A SPECIES AT RISK.....	40
FIGURE 25: GIANT HOGWEED, AN INVASIVE SPECIES.....	42
FIGURE 26: A PROVINCIALLY-SIGNIFICANT WETLAND IN TERRA COTTA CONSERVATION AREA	44
FIGURE 27: ESAs AND ANSIs IN THE CREDIT RIVER WATERSHED	45
FIGURE 28: WETLANDS IN THE CREDIT RIVER WATERSHED.....	46
FIGURE 29: FORESTS IN THE CREDIT RIVER WATERSHED.....	47
FIGURE 30: TEN MAJOR CONSERVATION AREAS IN THE CREDIT RIVER WATERSHED	49
FIGURE 31: THE BOARDWALK IN RATTRAY MARSH CONSERVATION AREA	50
FIGURE 32: RIVER AND STREAM VALLEYS FORM NATURAL CORRIDORS	53
FIGURE 33: BROOK TROUT REQUIRE COLD AND CLEAN WATER TO SURVIVE	54



UNDERSTANDING AND PROTECTING THE CREDIT RIVER WATERSHED

The Credit River passes through forests and farms; marshes and swamps; hills and valleys; towns and cities; making its way from Orangeville, over the Niagara Escarpment, past Georgetown, Brampton and Mississauga, and finally from Port Credit out to Lake Ontario, which drains through the St. Lawrence River into the Atlantic Ocean.

The Credit River Watershed – all the land that drains into the Credit River – covers about 860 square kilometres. Some of that land has been preserved as Conservation Areas, parks, and other protected areas. Some land has been carefully managed by farmers and other landowners to provide food and resources. Other land has been converted into small villages and rural towns, many of which have historical connections to the countryside. Still other land has been developed into diverse urban and suburban communities. All of these lands are part of the Credit River Watershed.

The past century has brought unprecedented change in the Credit River Watershed. Once, the watershed was an area of thick forests and clean, cold flowing water. Today, most of these forests have been cut down, wetlands have been drained, and even agricultural land is being lost.

Modern science shows us that human health depends on the health of our environment. For our sake, and the sake of generations to come, we need to remember the Credit River Watershed's history, understand what's happening now, and take action for the future.

“Rising to the Challenge: A Handbook for Understanding and Protecting the Credit River Watershed” has been created for residents and visitors to the watershed who want to learn more about the importance of this natural area, the challenges we're facing in the Credit River Watershed, and ways we can all take action and make a difference.

It is hoped that this handbook will promote learning, motivate discussion and collaboration, and inspire action to protect the Credit River Watershed today and for future generations.

Credit Valley Conservation

Credit Valley Conservation (CVC) was formed on May 13, 1954 and has been working for over 55 years to protect the natural environment in the Credit River Watershed. Credit Valley Conservation is one of 36 conservation authorities operating in Ontario and dedicated to conserving, restoring, developing and managing natural resources on a watershed basis.

This document was inspired by and developed in collaboration with many individuals and groups working to understand, restore, and protect the Credit River Watershed.

The purpose of this document is to assist in building widespread awareness of the challenges facing the Credit River Watershed among residents, community groups, and other stakeholders.

This handbook is not meant to be a report, technical manual, policy, or promotional booklet. Instead, this handbook is intended to be a starting point for increasing ecological literacy and engaging individuals and communities in taking action and finding lasting solutions to the challenges we all face in the Credit River Watershed.

Credit Valley Conservation would like to thank the many colleagues and partners involved in developing this handbook.



THE CREDIT RIVER WATERSHED

What is a Watershed?

A watershed (or drainage basin) is an area of land that drains into a stream, river, lake, or ocean.

The watershed is an important concept for understanding and managing human interaction with the natural environment. The health of a river is directly connected to the health of the land in its watershed. Watersheds overlap political boundaries and often cross regional, provincial, and national borders.

Watersheds occur on multiple scales, with smaller watersheds (or sub-watersheds) draining into larger watersheds. Most watersheds eventually drain into an ocean. All land on earth can be divided into watersheds.

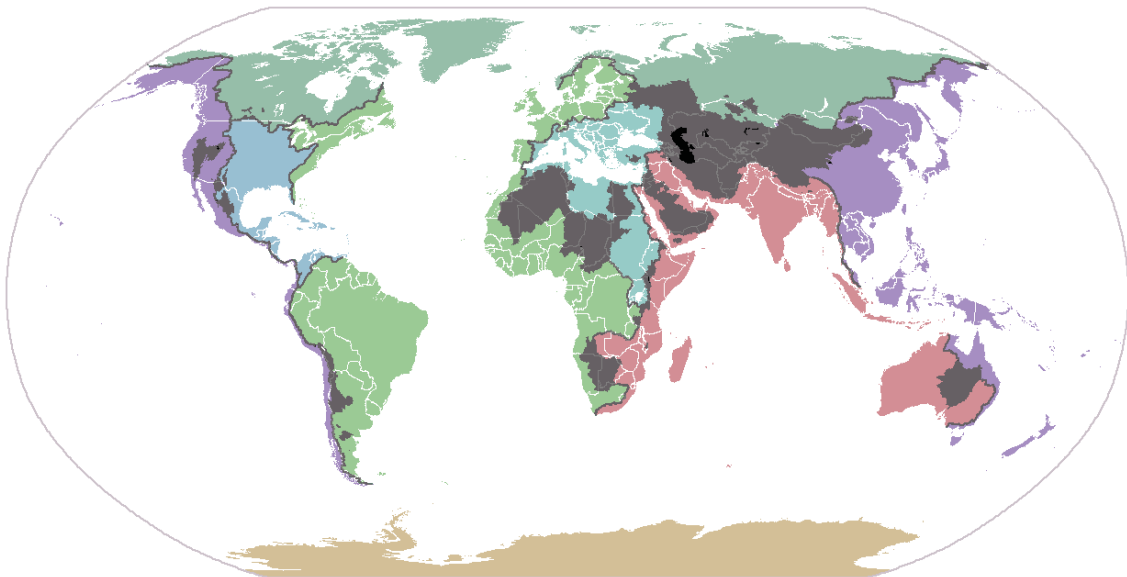


Figure 1: Global ocean watersheds

Source: Wikipedia

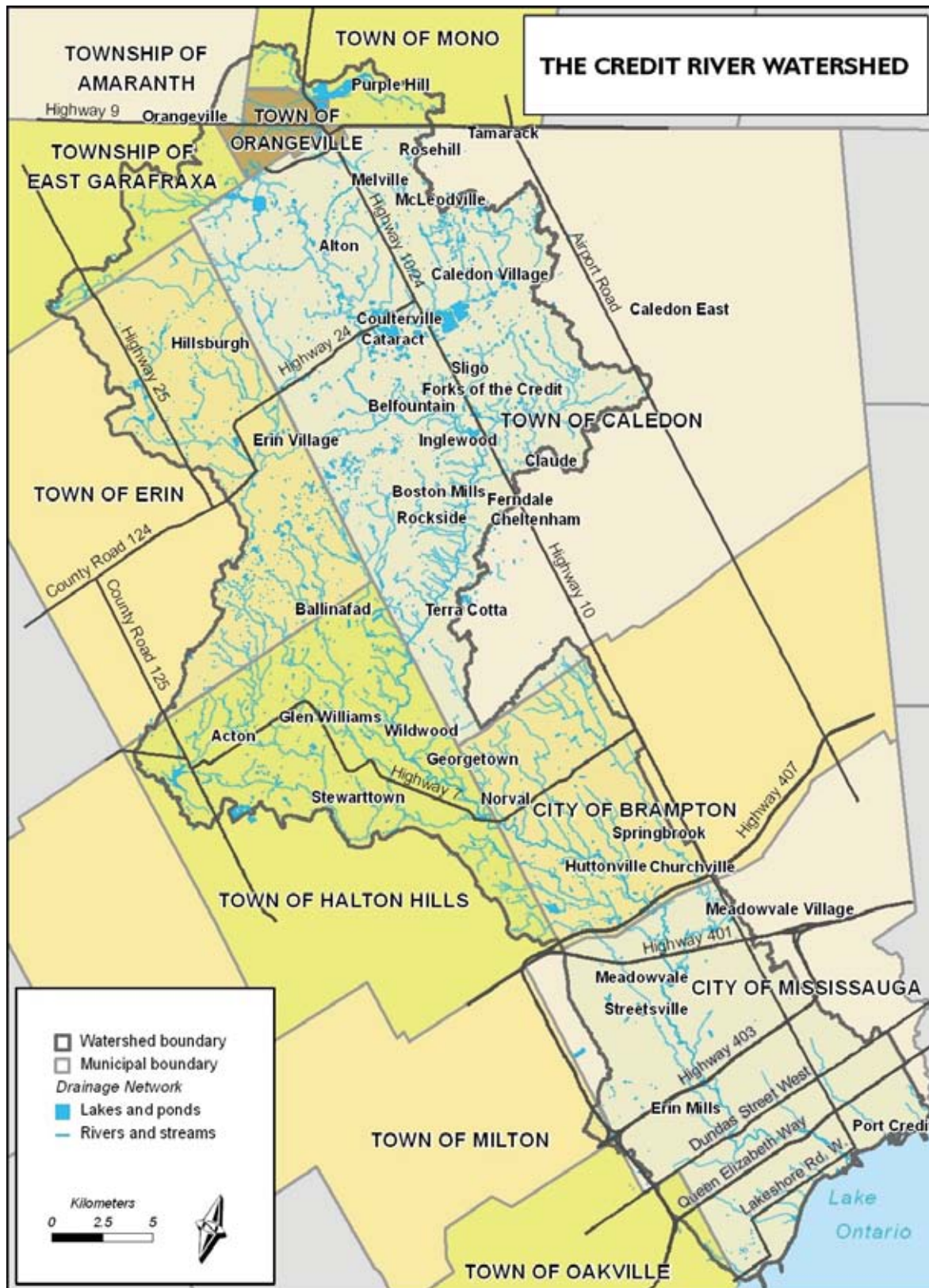


Figure 2: The Credit River Watershed

The Credit River Watershed

The Credit River Watershed is located in southern Ontario on the north shore of Lake Ontario. The watershed extends roughly from Caledon in the east to Halton Hills in the west and from Orangeville south to Lake Ontario at Port Credit. The Credit River Watershed is part of the Great Lakes Basin that drains into the St. Lawrence River and eventually the Atlantic Ocean.

The Credit River is about 90 kilometres long and is connected to over 1,500 kilometres of smaller creeks and streams. Connected wetlands are also a part of this system, as are all of the lands that drain into the river. The entire river system is of great economic, social, cultural, and ecological value.



Figure 3: The Credit River

The entire Credit River Watershed covers about 860 square kilometres. Directly to the east and west of the Credit River are 14 smaller streams and creeks that drain directly into Lake Ontario, such as Cooksville Creek and Sheridan Creek, which fall under the jurisdiction of

Credit Valley Conservation. These smaller watersheds, combined with the Credit River Watershed, cover an area of almost 1,000 square kilometres.

In addition, Credit Valley Conservation has jurisdiction over Lake Ontario from the edges of the watershed boundaries to the centre of the lake.

NOTE: In the context of this publication, “the Credit River Watershed” consists of both the Credit River Watershed and the smaller neighbouring watersheds that drain directly into Lake Ontario and are within the jurisdiction of Credit Valley Conservation.

Key Landscape Features

The most significant landscape features in the Credit River Watershed are the Niagara Escarpment, the Oak Ridges Moraine, and the Lake Ontario Shoreline.

The Niagara Escarpment is the most distinctive landscape feature in the watershed: a scenic rocky ridge 725 kilometres long, winding its way from Queenston near Niagara Falls, through the centre of the Credit River Watershed and ending in Tobermory at the tip of the Bruce Peninsula. The Niagara Escarpment was formed over millions of years by erosion, and is often characterized by exposed rock and steep cliffs. In 1990, the Niagara Escarpment was recognized as a World Biosphere Reserve by the United Nations Educational Scientific and Cultural Organization (UNESCO).

❖ **FACT:** The group of protected areas in the Credit River Watershed that includes Terra Cotta and Silver Creek Conservation Area has been identified as a regionally significant “Nodal Park” by the Niagara Escarpment World Biosphere Reserve.



Figure 4: Exposed rock along the Niagara Escarpment

The Oak Ridges Moraine is a prominent sand and gravel ridge that forms the major drainage divide between Lake Ontario and Lake Simcoe–Georgian Bay. It is an area of rolling hills and stream valleys that formed about 12,000 years ago and extends 160 kilometres from the Niagara Escarpment in the west to the Trent River system in the east. The moraine is often referred to as “the rain barrel of southern Ontario,” as it is an important source of fresh water and contains the headwaters of many streams and rivers.



Figure 5: The Oak Ridges Moraine

The Credit River Watershed also contains 15 kilometres of Lake Ontario Shoreline. The Credit River Watershed and Lake Ontario are both part of the Great Lakes Basin that connects Lake Superior to the St. Lawrence River and the Atlantic Ocean, one of the largest freshwater ecosystems in the world. The Lake Ontario Shoreline and the natural features within two kilometres of the shoreline provide critical wildlife habitat. For example, bird and butterfly species need to rest near the shoreline before and after their migration across the lake, and Atlantic salmon move between Lake Ontario and the Credit River to spawn.



Figure 6: The Lake Ontario Shoreline

❖ **FACT:** The Credit River Watershed contains other important moraines and smaller landforms in addition to the Niagara Escarpment, Oak Ridges Moraine, and Lake Ontario Shoreline. The Paris, Galt, and Singhampton Moraines are all located in the Credit River Watershed and form part of a larger feature called the Horseshoe Moraines. The Peel Plain and Iroquois Plain occupy the lower watershed.

In addition to these landscape features, the main Credit River Valley forms a natural north-south corridor that links the Lake Ontario shoreline with the Niagara Escarpment and the Oak Ridges Moraine farther to the north. In general, wider valley corridors favour the movement of wildlife. Corridors containing water are more significant for wildlife than similar corridors without water. These valley lands along the main Credit River and other smaller creeks and streams form the ‘backbone’ of the watershed.

Three Zones of the Credit River Watershed

There are three general zones or regions within the Credit River Watershed, often referred to as the upper watershed (above the Niagara Escarpment), middle watershed (the Niagara Escarpment) and lower watershed (below the Niagara Escarpment).

The upper watershed includes areas of the Credit River Watershed north of Erin Village. Most of the watercourses in this section of the watershed remain in a relatively natural condition. Water quality in the area is generally good. About 60% of the upper watershed is forested. The main land use in the area has traditionally been agriculture, however, in the past decade the amount of land under cultivation has decreased significantly, and the number of small hobby farms has increased. Settlement areas in the upper watershed include Orangeville, Erin Village, Alton, Caledon Village and Hillsburgh.

The middle watershed includes the areas of the watershed between Inglewood to the north and Georgetown to the south. This part of the watershed is dominated by the Niagara Escarpment and Oak Ridges Moraine. Significant forests and natural areas and numerous protected areas exist in this portion of the watershed. In addition, a section of the Bruce Trail runs through this portion of the watershed. Settlement areas in the middle watershed include Inglewood, Cheltenham, Terra Cotta, Ballinafad, Acton, Georgetown and Norval.

The lower watershed includes the areas of the watershed south of Norval to Lake Ontario. This part of the Credit River Watershed is largely urbanized. Very few wetlands or forests remain in this area. Many small streams and creeks have been straightened or captured in municipal storm sewers. Water quality in this section of the Credit River and its tributaries is generally poor. The lower watershed includes the western half of Brampton, most of Mississauga and the eastern edge of Oakville.

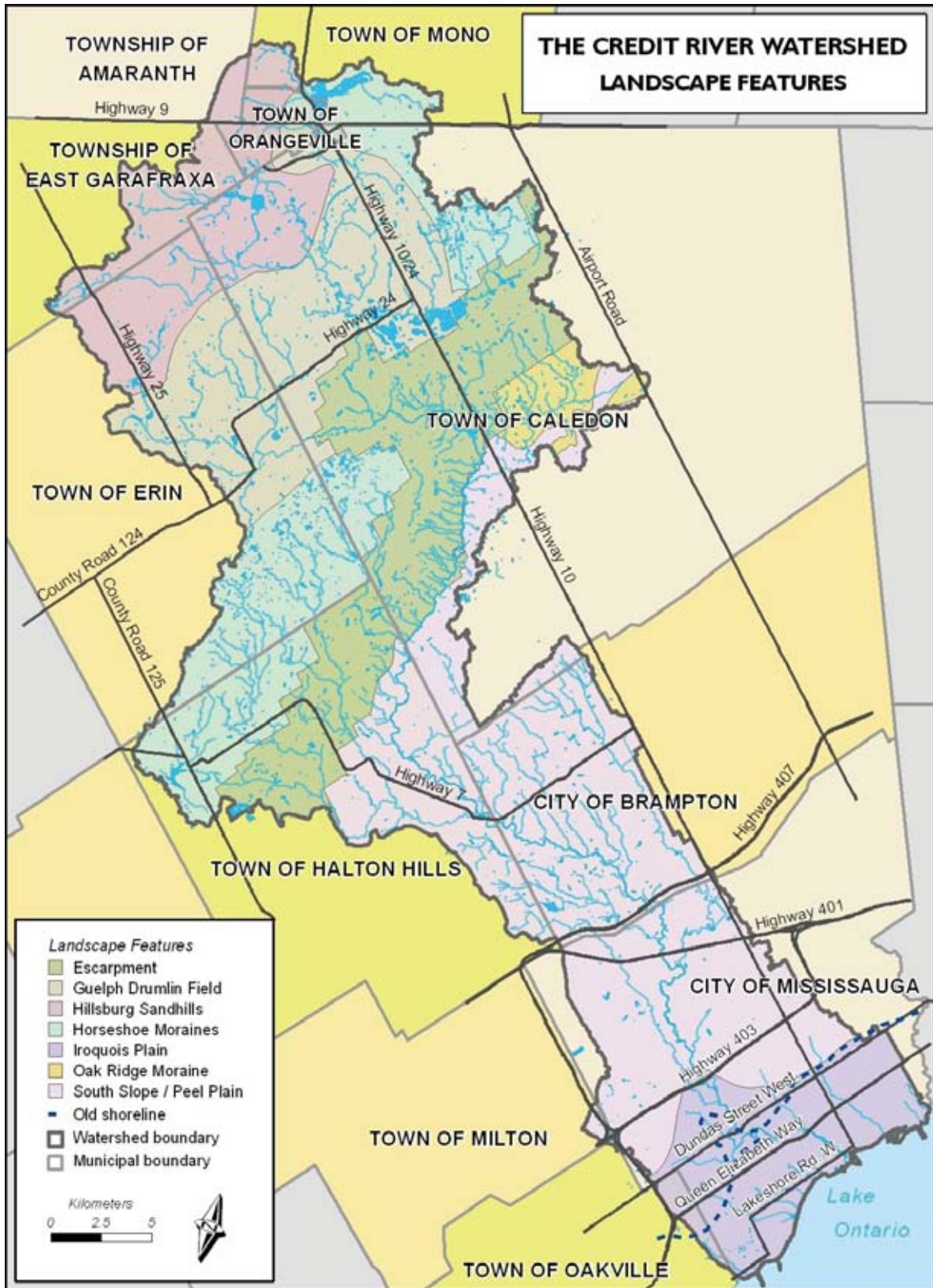


Figure 7: Key landscape features of the Credit River Watershed

Subwatersheds

The Credit River Watershed can be divided into 22 subwatersheds to reflect major tributaries (the streams and creeks draining into the main Credit River), major sections of the river, and groups of smaller watersheds that drain directly into Lake Ontario.

Political Boundaries

Watershed boundaries are natural and reflect the shape and elevation of the landscape. Because of this, watersheds often cross the political borders of cities, regions, provinces, and even nations. Managing common resources across an entire watershed requires cooperation between different regions and the coordination of many partners.

The Credit River Watershed contains parts of 15 municipalities and regions in the Province of Ontario. More than half of the Credit River Watershed is located within the Regional Municipality of Peel. The watershed also includes parts of Dufferin County, Wellington County and the Regional Municipality of Halton. Lower-tier municipalities in the watershed, from north to south, are the Town of Mono, Township of Amaranth, Town of Orangeville, Township of East Garafraxa, Town of Caledon, Town of Erin, Town of Halton Hills, City of Brampton, Town of Milton, Town of Oakville, and the City of Mississauga.

Demographics

Today, about 750,000 people live in the Credit River Watershed. Over 80% of this population lives in the lower watershed in the large urban centres of Mississauga and Brampton. According to the 2006 census, Mississauga is the sixth largest city in Canada. The Region of Peel, which includes Mississauga, Brampton, and Caledon, is one of the fastest growing regions in North America.

❖ **FACT:** The population of the Region of Peel is predicted to grow by almost 60% in 30 years while the Region of Halton is anticipated to grow by 100% over the same period. There is planned growth in all urban centres in the Credit River Watershed both above and below the Niagara Escarpment.

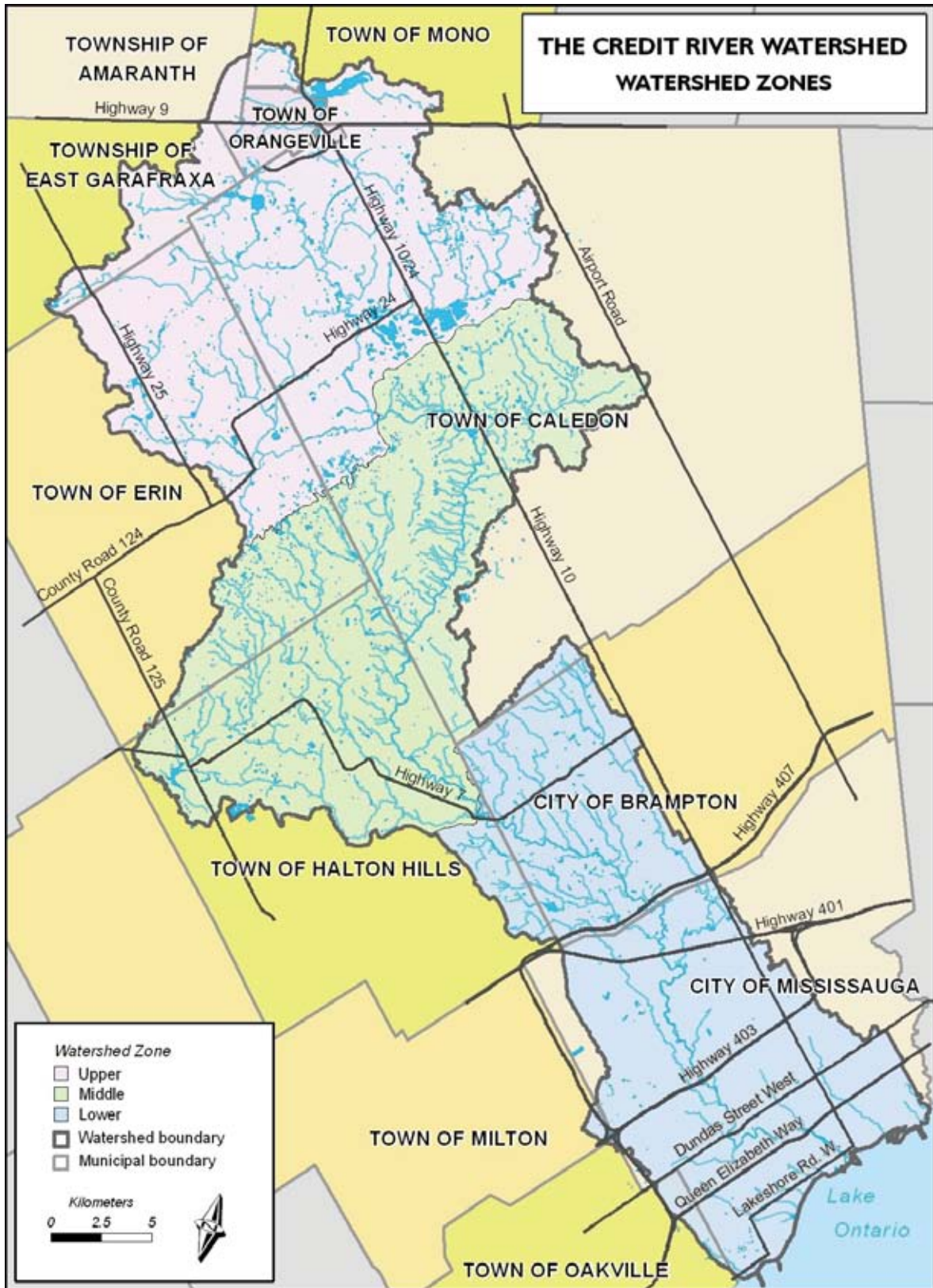


Figure 8: Zones of the Credit River Watershed

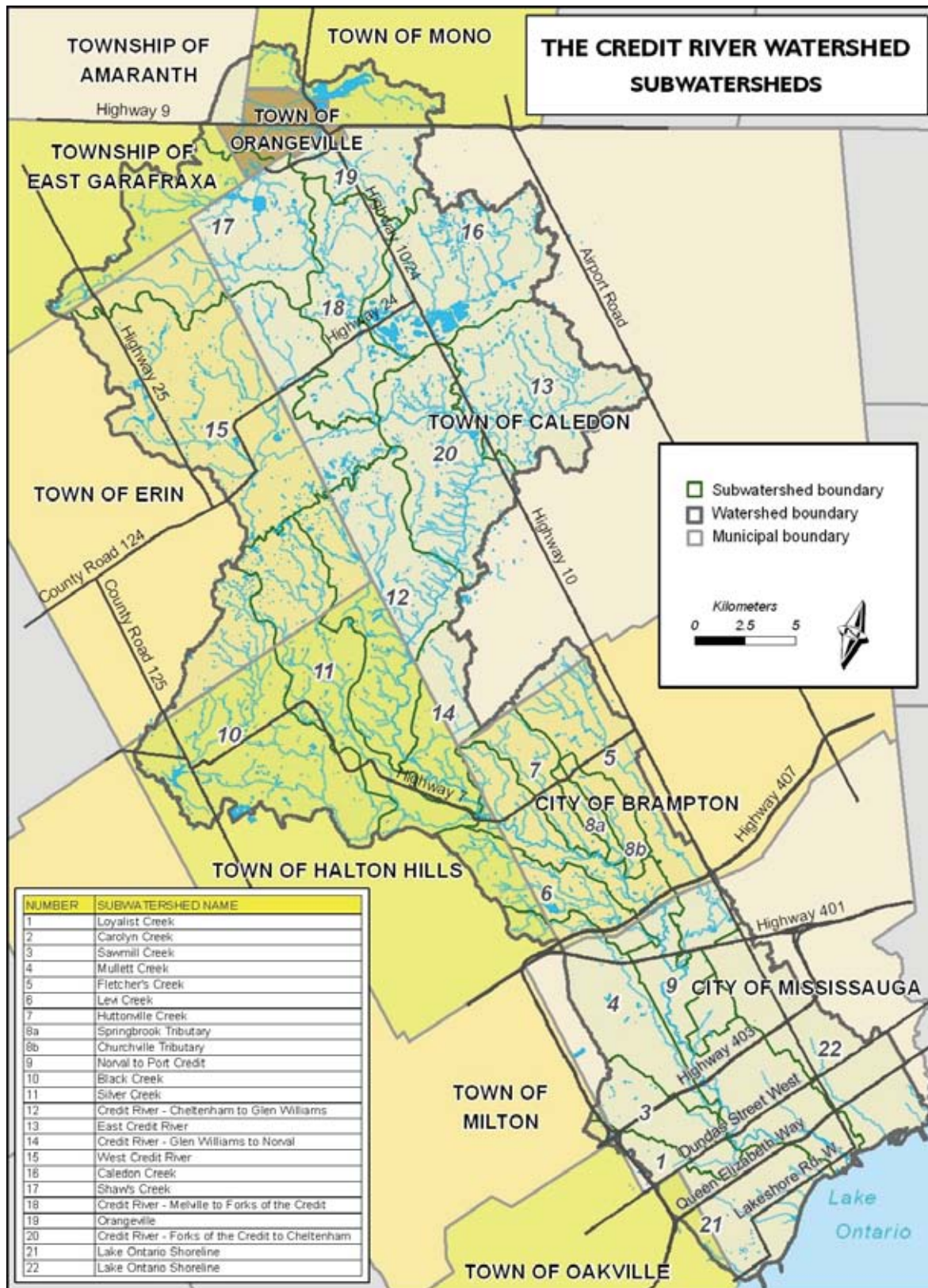


Figure 9: Subwatersheds of the Credit River Watershed

Key Issues: Urbanization and Climate Change

The Credit River Watershed is facing many ecological challenges that will affect the wellbeing of human communities. Despite efforts by Credit Valley Conservation, municipalities, local communities, and other organizations, water quality is generally declining, demand for water is increasing, ecosystems are being fragmented and destroyed, species are being lost, and pressures on ecosystems are on the rise.

Both terrestrial (or “land”) and aquatic (or “water”) ecosystems have normal ranges of change. But when these changes go beyond their normal ranges, the health and stability of ecosystems and ecological functions is threatened.

KEY TERMS:

- ➔ An *ecosystem* is a dynamic set of living organisms (microorganisms, plants, and animals, including humans) together with the non-living components of their environment.
- ➔ *Ecological functions* are the natural processes, products or services that living and non-living environments provide or perform including hydrological functions and biological, physical, chemical and socio-economic interactions.

Human activities have contributed to massive changes in the Credit River Watershed. In particular, urbanization and related activities (for example aggregate extraction, water-taking, and managing waste water) are a major stress on the environmental health of the Credit River Watershed. The Credit River Watershed lies within the most densely populated region of Canada. About 23% of the watershed is now considered urban, mostly concentrated in Mississauga, Brampton, and 14 other centres of development.

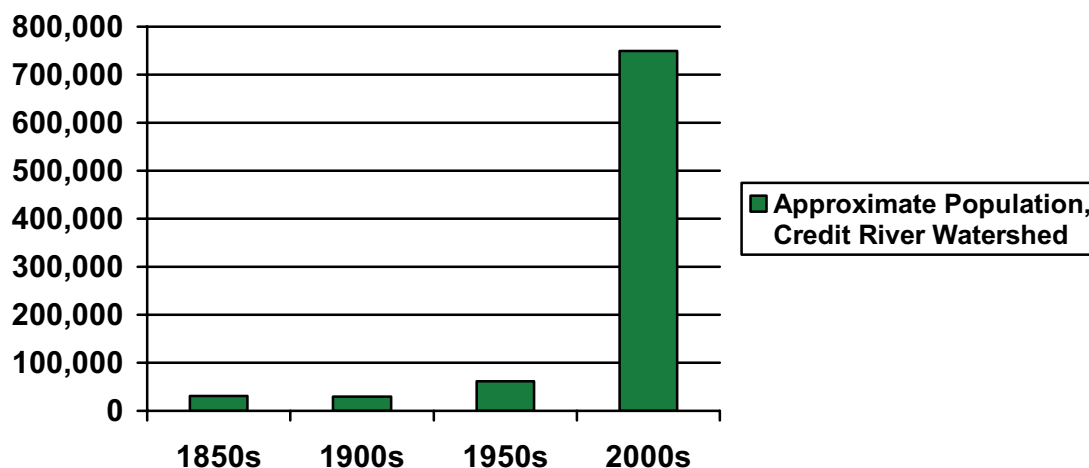


Figure 10: Population from the 1850s to 2000s, Credit River Watershed*

* Note: due to historical census collection methods, all figures are approximate and may include areas outside of the actual watershed boundary.

Urbanization across the watershed is increasing. What effect will this have on the watershed? Research has shown that urbanization can result in significant changes to natural systems. Water quality in the urban areas of the Credit River Watershed is already impaired and likely to get worse. Many wetlands and forests in urban areas have been altered or destroyed, leaving these areas more prone to problems like flooding and erosion.

Climate change is also expected to be a significant stress on the health of the Credit River Watershed. Modeling studies suggest that climate change will result in increases in the frequency and severity of extreme events such as floods; droughts; heat waves and winter storms; as well as long-term changes in climate conditions, ecosystems, and ecological functions.

The potential impacts of climate change on human health include issues of reduced drinking water availability and quality; degraded and reduced access to green space; degraded air quality; and increased spread of disease.

The exact changes that will occur due to climate change and the resulting impacts remain uncertain. How hot, dry or wet will it get? What changes will occur in the intensity, frequency and duration of storms and floods? How will ecosystems respond? How quickly will people adapt? Despite these uncertainties, most experts agree that the problem of climate change is urgent and there is an immediate need to take action. It is expected that healthy ecosystems will be better able to adapt to climate change and continue to provide vital goods and services to human communities.

Challenges Facing the Credit River Watershed

The Credit River Watershed is located within one of the most densely populated and fastest growing regions in Canada. Hundreds of thousands of people live and work within the area that drains into the Credit River.

In turn, the lands, waters, and natural processes of the Credit River Watershed provide vital goods and services to these human communities, such as:

- Storing and regulating the flow of water,
- Purifying water and air,
- Capturing greenhouse gasses,
- Providing natural resources such as forestry and fisheries,
- Providing soil and nutrients for agriculture,
- Providing genetic resources for medicines and other products,
- Providing natural areas for recreation and well-being.

The Credit River Watershed is also a significant natural region. Many small streams in the watershed support self-sustaining cold-water fish populations and the river supports the most productive and diverse coldwater fishery in the Lake Ontario basin. The southern

reach of the Credit River is nationally recognized for its impressive migratory runs of trout and salmon. The forests, streams, and wetlands are inhabited by many rare and threatened species of plant and animal.

Enormous challenges face the Credit River Watershed in the coming days, months, years, and decades. The ways that individuals and groups act in the face of these challenges will affect both human and natural communities and all plants, animals, and people that call the watershed home.

The sections that follow, “Protecting Water Quality and Quantity,” and “Protecting Natural Heritage Systems,” highlight seven major challenges facing the Credit River Watershed. Most importantly, they will show ways we can all “rise to the challenge” and work together for a healthy Credit River Watershed for present and future generations.



PROTECTING WATER QUALITY AND QUANTITY

The Water Cycle

The earth's water is always moving. Rivers flow. Rain falls. Snow accumulates and melts. Ocean currents move water from continent to continent. Water moves through the tissue of plants and animals.

All water is a part of the water cycle (also called the hydrologic cycle). Water is continuously moving and can change forms between liquid (water), solid (ice and snow), and gas (water vapour).

The water cycle is continuous and has no beginning or end. Water gets heated by the sun and evaporates as water vapour. Water vapour can also come directly from ice and snow and from plants and the soil. Air currents bring vapour into the atmosphere where it cools and condenses into clouds.

Precipitation includes all forms of moisture falling from the atmosphere to the ground. Precipitation is produced primarily when water vapour in the atmosphere becomes saturated, condenses and falls to the ground in forms like rain and snow.

When precipitation falls on the earth, water soaks into the ground and flows across the land. Some water will infiltrate, or soak into, the ground and replenish aquifers, referred to as groundwater. Some water will not infiltrate the ground but will flow above-ground, referred to as surface water. Surface water flows downhill due to gravity and will flow through wetlands, creeks, and rivers, eventually into the oceans.

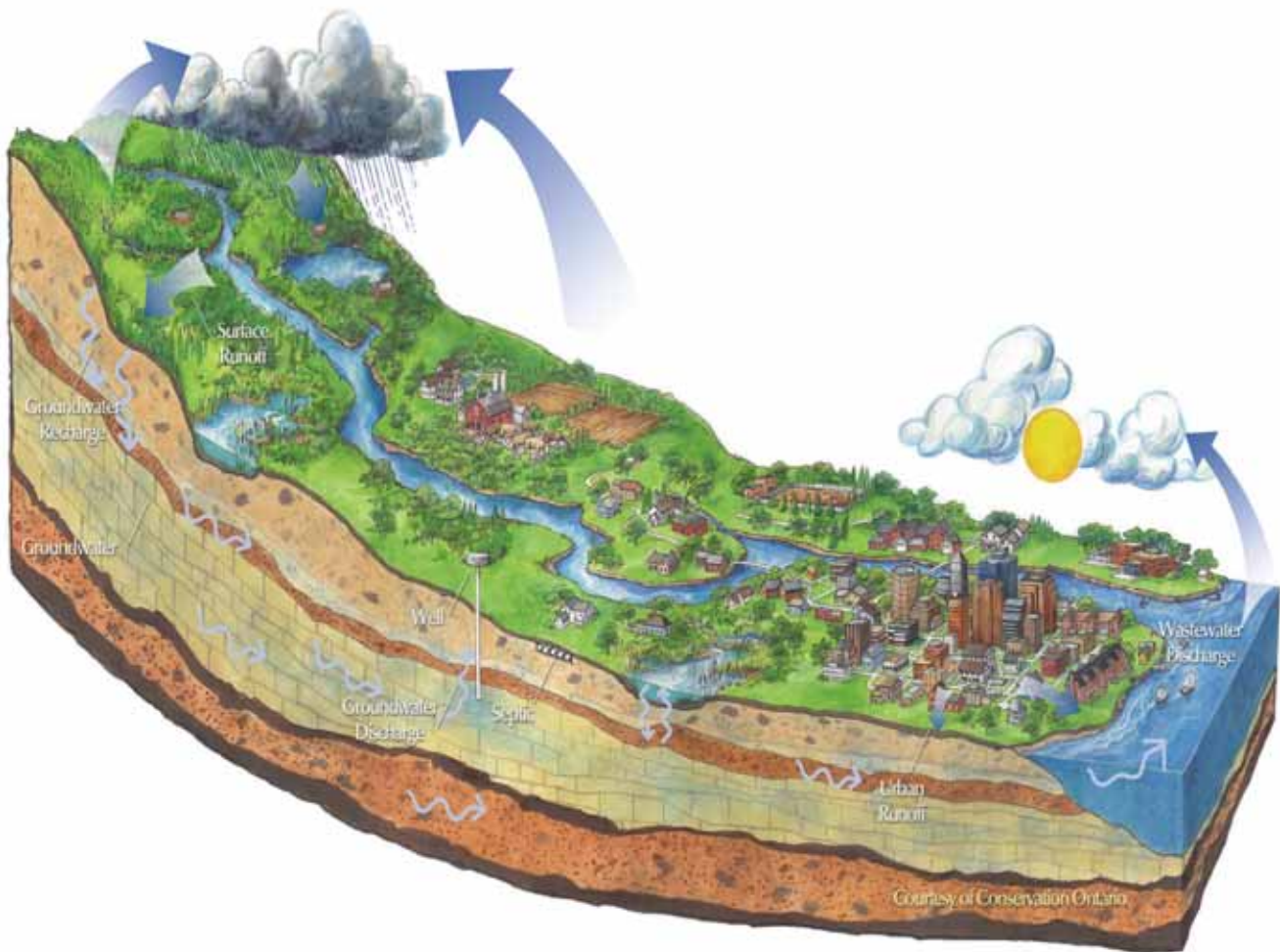


Figure 11: The water cycle
 Source: Conservation Ontario

The Importance of Water

Water is necessary for all life. In the human body, 70% of our tissue and 50% of our blood is water. Two-thirds of the earth’s surface is covered in water. Entire civilizations have risen around the world’s great rivers, lakes, and ocean coastlines.

Still, much of the world’s water is inaccessible to human communities and to terrestrial and fresh water ecosystems. The oceans contain 97% of the earth’s water, and 90% of the remaining fresh water remains frozen in the Antarctic ice sheet. Less than 1% of all water would be described as accessible fresh water, vital for life on earth.

Accessible fresh water can be found in lakes, rivers, streams, and wetlands. This water needs to be managed and protected to ensure safe, healthy water for all.



Figure 12: The Credit River upstream of Churchville

Rivers are vital arteries of water, providing life to human communities and ecosystems they flow through. In the Credit River Watershed, our diverse ecosystems; human well-being; community stability; agriculture and industry; as well as culture and recreation are all dependent on water. As more and more rivers and streams are becoming impaired due to human activities, both ecosystems and human communities will be negatively affected.

Individuals and groups need to take responsibility and take action to ensure clean and abundant water in the Credit River Watershed.

Rising to the Challenge: Protecting Water Quality and Quantity

Challenge: Reduce the Impacts of Flooding and Drought

What are Flooding and Drought?

Flooding occurs when a water body such as a river overflows, submerging adjacent land. This submerged land is considered a floodplain. Flooding can happen slowly, through long periods of rainfall or snow melt. Flooding can also happen very quickly through sudden events like storms or a combination of snow melt and rainfall.

Drought occurs when a region experiences a shortage of water, often due to below-average levels of rain or other precipitation. A drought can be brief or it can last for several years.

KEY TERMS:

- ➔ *Infiltration* describes the movement of water into the ground. The *infiltration rate* is the amount of water that soaks into the ground over a given length of time. The *infiltration capacity* is the maximum rate that water can infiltrate a given type of ground.
- ➔ When the rate of precipitation exceeds the infiltration capacity, it “runs” off the surface of the ground. This *runoff* is increased in urban areas by creation of more *impervious surfaces* (surfaces which water cannot infiltrate) like pavement and concrete.
- ➔ *Baseflow* is defined as that portion of the water flowing in a stream that comes exclusively from groundwater. Following a period of little or no precipitation, essentially all flow within a stream can be baseflow, notwithstanding possible human inputs (for example from sewage treatment facilities).

Physical factors such as the size and shape of watershed or sub-watershed; slopes; soil types; the amount of pervious and impervious surfaces; and the abundance of trees and other vegetation influence the location, timing, duration, and intensity of flooding and drought. Other causes of flooding and drought include climate factors such as changes in precipitation and temperature.

These factors also combine and interact. For example, a major cause of flooding in the Credit River Watershed is ice jams, which occur when ice forms a temporary barrier across a river or stream, usually at a sharp bend in the river or at a bridge crossing. In this case, temperatures, the shape of the river, and human factors combine to cause a flood.

Flooding and drought are both natural processes that vary in space and through time. Historically, the Credit River has always experienced flood and drought conditions. In a healthy and balanced ecosystem some degree of flooding and drought is natural and can even be beneficial. In an unhealthy and unbalanced ecosystem, flooding and drought can be

unnaturally frequent and severe. Hurricane Hazel, which passed through southern Ontario in 1954, has provided the benchmark for defining the worst flood likely to occur in the Credit River Watershed.



Figure 13: Flooding in Glen Williams, 1946, caused by an ice jam

Severe flooding can have tremendous negative impacts on both human and natural communities. It directly and indirectly kills many people throughout the world each year. Floods physically damage property like bridges, homes, businesses, farms, sewer systems, power systems, and roads. Some of this damage is due to encroachments, which include all man-made works built in the natural flood plains of the river. Flooding can contaminate water supplies and spread water-borne diseases to humans.

Flooding can also have negative impacts on natural communities by spreading disease, destroying habitat, harming water quality, and killing plants and animals.

Severe drought can have many negative impacts on human communities, including water shortages, harm to crops and livestock, and increased contamination of water. Drought can also damage terrestrial and aquatic habitat, cause wildfires, increase erosion, and cause unnatural migration in natural communities.

Rising populations lead to increased demand on ground and surface water resources for domestic potable water, as well as industrial, commercial, recreational and other uses. Currently there is no water allocation plan in the watershed that would give precedence to one stakeholder over another, or fairly manage water resources for communities.

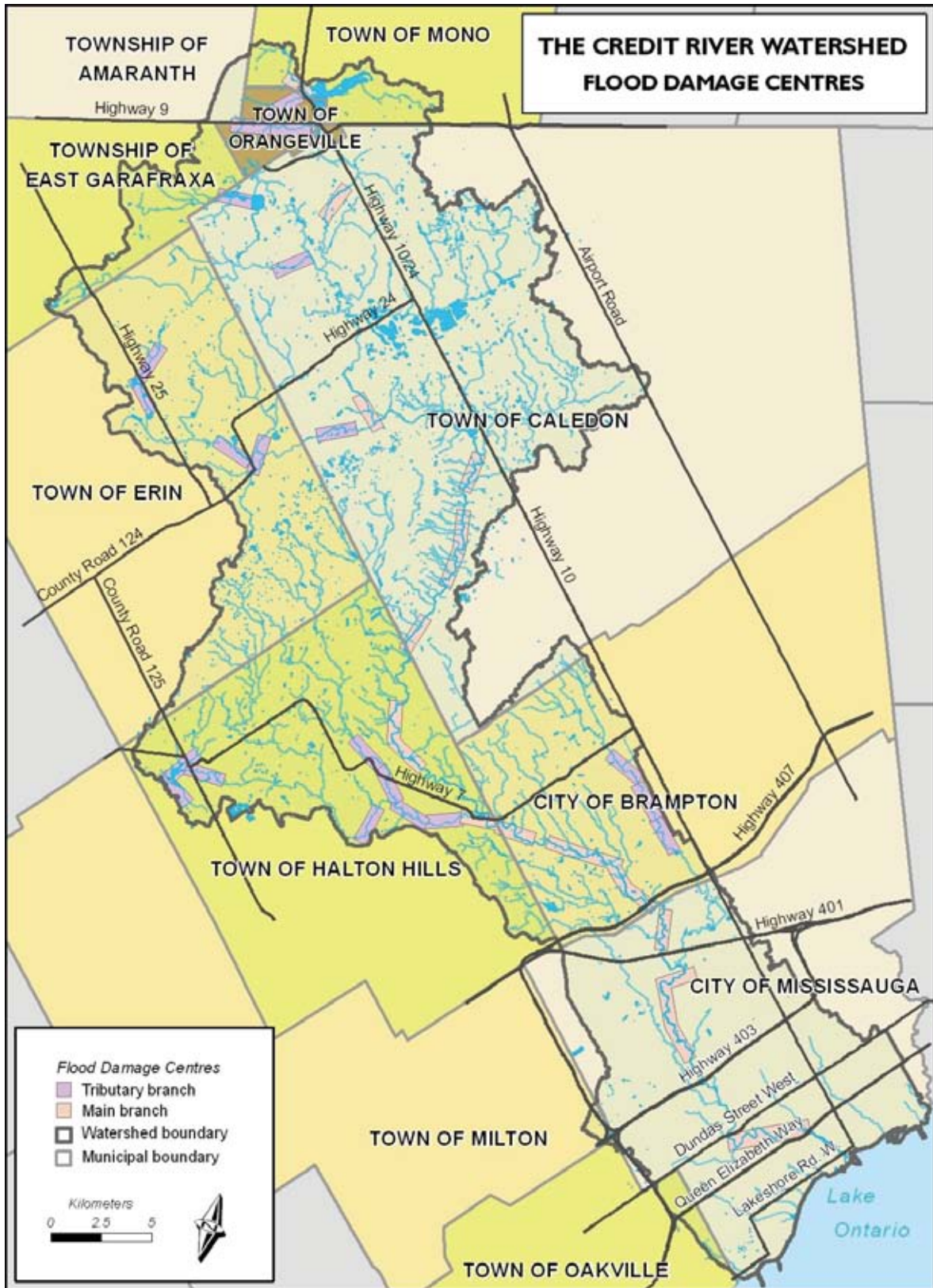


Figure 14: Flood damage centres in the Credit River Watershed

Current Outlook

One aspect of reducing the impact of flooding is to proactively identify areas that are prone to flooding (floodplain areas) and prevent new building and development from occurring within these areas.

Credit Valley Conservation has identified 22 “flood damage centres” throughout the Credit River Watershed. These flood damage centres are areas where buildings and other structures have been established within the floodplain prior to establishment of floodplain protection area. Each damage centre has a different level of concern depending on the number of buildings within the flood plain and the amount (and depth) of flooding which may occur. For example, the depth of flooding expected in one damage centre may be in the order of centimetres, while another may expect several metres. Given that the majority of the watershed population lives in the lower watershed, the majority of the flood damage centres are located here.

Droughts are generally not localized in one area, but occur across the watershed and often across larger regions such as the Great Lakes Basin.

Within the Credit River Watershed, water for drinking and household use is withdrawn from both groundwater and surface water bodies. The municipalities of Brampton and Mississauga use water from Lake Ontario.

Areas west of Brampton, including Georgetown, mostly rely on groundwater aquifers for their municipal water supply needs. The rest of the watershed relies on groundwater aquifers or smaller surface water features for water use.

Over the past several years significant investments have been made by Credit Valley Conservation, municipalities, and the Province in studies that are improving understanding of groundwater systems and overall water budgeting.

Key Issues

- Climate – climate change will likely increase the frequency and severity of flooding and drought in the Credit River Watershed.
- Encroachments – encroachments and development in flood plains can directly put life and property at risk to floods.
- Impervious Surfaces – impervious surfaces in urban developments increase the severity of flooding and drought in urban areas. Current impervious cover is about 15% of the watershed and is expected to increase to 25% (fish are negatively affected at about 10-15% impervious cover).

- Water taking – groundwater and surface water taking has the potential to negatively impact surface water quality, fisheries, wetlands, surrounding natural areas, and human communities.
- Water demand – an increasing demand for water for human consumption is expected across the Credit River Watershed.

Rising to the Challenge: Actions to Reduce the Severity of Flooding and Drought

- Be aware of flood conditions:
 - Credit Valley Conservation operates a flood warning system to help predict and warn municipalities and residents of flooding.
- Protect life and property through better land use practices:
 - Land use and development policies are in place to ensure that future development does not create an increased risk to life or property for either proposed or existing development.
- Reduce impervious surfaces:
 - Through urban planning and design (Low Impact Development techniques, for example), impervious surfaces like asphalt and concrete can be reduced in favour of natural and more permeable surfaces which slow runoff and increase infiltration.
- Enhance forests and wetlands:
 - Forests and wetlands can slow runoff, enhance groundwater recharge and reduce flooding and drought.
- Conserve water in the home, yard, and garden by:
 - Fixing leaks
 - Installing water conservation technology, like low-flow toilets and faucets
 - Mulching trees and plants to conserve moisture
 - Installing rain barrels to collect water for lawns and gardens
 - Watering only when necessary and during early morning and evening hours
 - Purchasing products that require less water to produce.

For more ways that you can “Rise to the Challenge” visit www.creditvalleyca.ca/education.

Challenge: Reduce the Impacts of Erosion and Sedimentation

What are Erosion and Sedimentation?

Erosion is the process of sediment, organic matter, soil, and other solids being carried away by water, wind, and other natural forces. Sedimentation is the process of those solids settling. Erosion and sedimentation are common and widespread natural processes: soils are removed from one area (erosion) and deposited in another (sedimentation). A certain amount of erosion and sedimentation is natural and healthy for aquatic ecosystems.

Factors such as riparian (or river bank) vegetation, soil conditions, stream channel slope, and stream flow can influence erosion and sedimentation.

KEY TERMS:

- ➔ *Fluvial* (or stream) *geomorphology* is the study of landforms and processes associated with rivers, including the stream channel as well as the floodplains and valleys in which it is situated.
- ➔ *Riparian area* refers to a natural area adjacent to a stream. These areas are transitional areas between aquatic and terrestrial systems. They provide habitat and movement corridors for many species; prevent excessive erosion or sedimentation; shade and cool surface water; and contribute organic and inorganic matter to watercourses.

Human activities can also heavily influence erosion and sedimentation. Poor land use practices like deforestation, overgrazing, construction and other human activities on steep slopes or in river valleys can increase erosion and sedimentation to a rate that is unnaturally high and damaging to both human and natural communities.



Figure 15: Severe erosion

Erosion and sedimentation problems associated with urbanization and construction site activities can also contribute to water pollution; flooding; stream channel damage; damage to fish and fish habitat; and damage to adjacent and downstream properties.

Current Outlook

Credit Valley Conservation's erosion inventories have identified numerous erosion sites throughout the Credit River Watershed.

The lower watershed is vulnerable to excessive erosion and sedimentation primarily because of urbanization. Most rivers and streams have been altered to facilitate agriculture, followed by urbanization.

The middle and lower watershed are also more prone to erosion due to the dominance of clay-based soils. An extreme example of erosion can be seen at the Cheltenham Badlands.



Figure 16: The Cheltenham Badlands

Studies conducted and commissioned by Credit Valley Conservation indicate that erosion will likely increase with future development, resulting in increased erosion rates at existing sites and creation of new erosion sites.

Increased erosion will likely occur along the Credit River tributaries where the highest increase in peak flow rates occurs, with increased sedimentation downstream. This increased erosion and sedimentation will result in significant environmental impacts by carrying pollution downstream, changing stream bottoms, and changing the temperature of streams.

Key Issues

- Climate – climate change will likely increase the frequency and severity of erosion and sedimentation in the Credit River Watershed.
- Urbanization – increased urban development and construction can be significant causes of erosion and sedimentation.



Figure 17: Erosion from a construction site

Rising to the Challenge: Actions to Reduce the Impact of Erosion and Sedimentation

- Control erosion on construction and building sites:
 - Credit Valley Conservation has an active program for managing erosion within the watershed. Land use or development policies and procedures are in place to help control that development follows erosion control best practices.

- Protect and enhance natural riparian areas:
 - Reforesting riparian areas can slow runoff and reduce excessive erosion and sedimentation. The roots of trees and native plants and grasses penetrate deep into the soil and stabilize the banks of rivers, streams, and wetlands.

For more ways that you can “Rise to the Challenge” visit www.creditvalleyca.ca/education.

Challenge: Reduce Point and Non-point Source Water Pollution

What is Pollution?

Pollution is contamination of the natural environment. Water pollution refers to pollution of rivers, lakes, groundwater, and oceans, which cause instability and damage to humans and other living organisms and natural systems that support them.

There are many types of water pollution, including:

- Chemical pollution, including metals and other toxic substances which often don't occur naturally in ecosystems;
- Nutrient pollution, including phosphorous and other naturally-occurring substances;
- Sediment pollution caused by excessive erosion and sedimentation;
- Heat (or thermal) pollution from water that has been heated through human use or by a lack of natural vegetative cover over rivers and streams.

Water pollution can enter natural systems through spills, discharges of wastewater, surface runoff (which carries litter and other pollutants into streams), and contaminants leaching into groundwater.

KEY TERMS:

- ➔ *Point source* pollution refers to pollution from a single source, like a pipe or spill. An example would be discharge from a factory or a leak from a boat.
- ➔ *Non-point source* pollution refers to pollution that is diffused and doesn't originate from a single source. An example would be runoff from urban areas, which picks up contaminants from roads, sidewalks, parking lots, and other surfaces which all end up in the watercourse. All water that enters the storm sewer system goes, untreated, into the Credit River or Lake Ontario.

Both point and non-point source pollution can contaminate groundwater if contaminated surface water infiltrates the soil and the groundwater below. Groundwater can be affected by contamination from sources that may not directly affect surface water bodies.

Pollution negatively affects human health and ecosystem health. Some water pollution, such as E. coli bacteria, can have extremely negative effects on humans. Livestock, wildlife, domestic animals, faulty septic systems and inadequately treated sewage are the common sources of bacteria in the Credit River Watershed.

Other pollution, like an increase in phosphorous, can seriously harm aquatic ecosystems. Nitrogen and phosphorus are nutrients needed for plant growth. In large amounts these nutrients can deplete oxygen levels in water and stress or kill fish and other aquatic life. The primary sources of nutrients such as phosphorus and nitrates entering the Credit River come from urban and rural runoff; wastewater; and contaminated groundwater.

Often, pollution affects both humans and the natural systems that humans depend on. Toxins, for example, can poison humans and other organisms and accumulate in living tissue. Toxins can affect the growth and reproduction of plants and animals as well as cause cancer and disease in humans.



Figure 18: Garbage and other pollutants enter streams through runoff

Current Outlook

Runoff from urban and rural areas contributes pollutants to the Credit River Watershed, as well as discharges from wastewater treatment plants and other point sources of pollution.

Water quality is generally good in the upper watershed, with the main human influences on water quality coming from the Orangeville Water Pollution Control Plant, the Island Lake reservoir, and urban land uses.

Water quality is also generally good in the middle watershed, with the main human influences on water quality coming from urban and rural land uses.

Water quality is poor to fair in the lower watershed, with the main human influences on water quality coming from urban land uses.

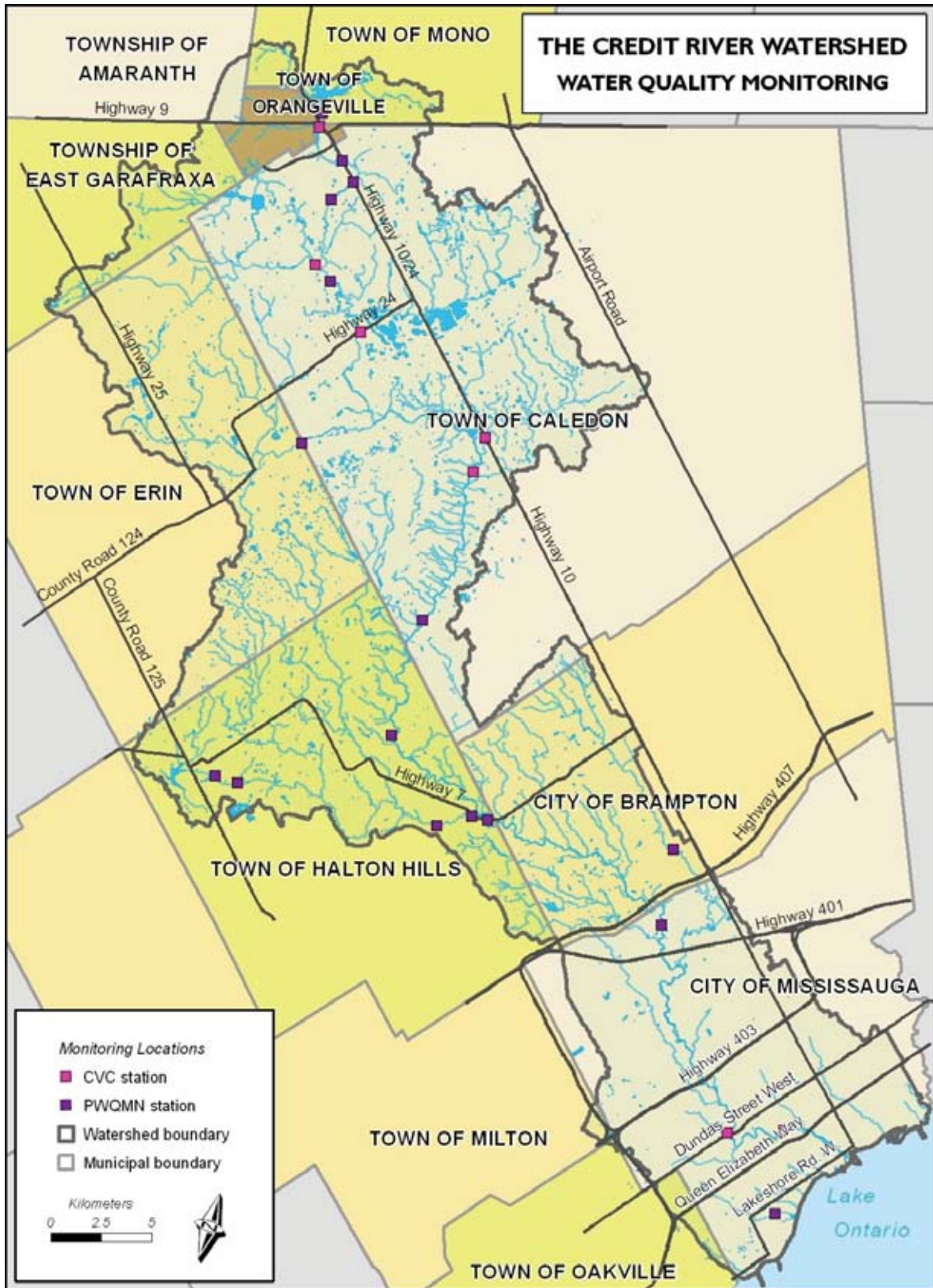


Figure 19: Water quality monitoring site locations

Key Issues

- Spills – spills have serious potential to harm human health and impact the natural environment. Since 1982 there have been over 6,000 spills reported by municipalities in the Credit River Watershed. Spills may originate from many sources, including industry, businesses, and homes.
- Rural pollution – rural pollution includes point and non-point sources. Such sources can include some septic systems and some agricultural practices. Other key land uses that can contribute to rural pollution include residential subdivisions, landfill sites and manicured areas such as golf courses.
- Urban stormwater – surface runoff from storms and precipitation is a significant source of pollution, particularly from urban areas, where it washes litter; pesticides; fertilizer; dust and debris; road salt; and other contaminants such as fossil fuels directly into rivers, streams, and Lake Ontario.



Figure 20: Pollution enters rivers and streams through storm sewers

- Wastewater treatment plants and septic systems – wastewater treatment plants and improperly maintained septic systems can be a significant contributor of pollution in the Credit River Watershed. Concerns include phosphorous, ammonia, nitrate, chloride, and E. coli pollution. Many chemicals, including pharmaceuticals, pass through wastewater treatment and are discharged back into the environment untreated.

Rising to the Challenge: Actions for Reducing Point and Non-point Source Water Pollution

- Reduce sources of pollution in the home, yard and garden:
 - Use no or fewer fertilizers on your lawn and garden
 - Wash your car in a carwash (carwashes treat their waste water, rather than having it go into the storm sewer and into the river)
 - Use salt sparingly on sidewalks and driveways in winter
 - Dispose of household hazardous materials properly
 - If your house has a septic system, ensure it is properly maintained

- Reduce sources of pollution in the community:
 - Pick up after your pet
 - Put litter and recycling in the appropriate containers
 - Report spills and pollution sources

For more ways that you can “Rise to the Challenge” visit www.creditvalleyca.ca/education.



PROTECTING NATURAL HERITAGE SYSTEMS

Forests, Streams, Wetlands, and Successional Habitats

A natural heritage system is made up of natural heritage features linked by natural processes. Natural heritage features include forests, streams, and wetlands such as swamps and marshes. These features include lands that are in an existing natural state; lands that have been restored; and lands with the potential to be restored to a natural state. Natural processes include the water cycle and succession.

Prior to European settlement, it is estimated that land in the Credit River Watershed was almost entirely covered in forests, with many cold water streams, wetlands (especially swamps), and small patches of other types of natural habitat such as prairie.

European settlement began in the early 1800s, and much of the forest in the Credit River Watershed was cleared for settlement areas, agriculture, industry, and other human uses. Streams were dammed and diverted. Wetlands were drained and prairies were removed.

KEY TERMS

- ➔ *Natural Heritage* refers to the flora (plants), fauna (animals), and other natural features and processes that make up the environment, including micro-organisms.
- ➔ *Succession* refers to changes in an ecosystem that occur after a disturbance. Disturbances can be natural, like a fire, or human-caused, like logging. Primary succession occurs in an area with no soil, for example after a volcanic eruption. Secondary succession occurs in an area with soil, for example after a logging clear-cut.

Throughout the history of human settlement in the Credit River Watershed, the number and size of forests, wetlands, and other successional habitats have generally been in decline. Small and intermittent (or seasonal) streams have also been disappearing as they are replaced by ditches and sewers in human settlements.

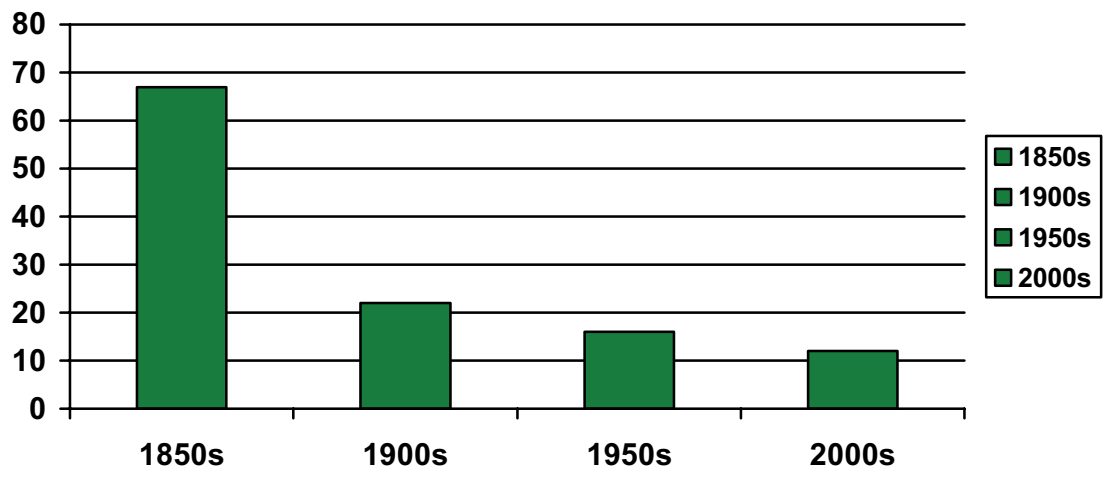


Figure 21: Percentage forest cover from the 1850s to 2000s, Credit River Watershed[†]

There are 1,179 forest patches in the Credit River Watershed ranging in size from less than half of a hectare to 607 hectares. The median size of forests is 3 hectares (half of all woodlands are above and half are below this size). Only a quarter of all forest patches are above 10 hectares.

Forest cover is also unevenly distributed over the Credit River Watershed. The middle and upper watershed have significantly more forest cover than the lower watershed.



Figure 22: Most forests are located in the middle and upper watershed

[†] NOTE: 1850s to 1950s figures likely include forests as well as forest plantations and swamps.

KEY TERMS

- ➔ *Edge habitats* are the boundaries between different ecosystems or communities, for example the border between a forest and wetland or agricultural field. Edge habitats are exposed to highly variable environmental conditions. They can be extremely diverse and productive areas. Edge habitats adjacent to disturbed areas are vulnerable to stresses such as invasive species.
- ➔ *Interior habitats* are usually more stable, sheltered environments, for example the middle of a large forest. Interior habitats offer refuge for plants and animals. Human activity tends to increase edge and decrease interior habitat.

As forests become smaller, the amount of interior habitat in the watershed decreases, and the amount of edge habitat grows. Shrinking habitat and increasing edges between ecosystems and human communities causes significant stress on many plant and animal populations.

❖ **FACT:** Forests currently represent about 12% of the total area of the Credit River Watershed.

Approximately one-third of the Credit River Watershed remains under natural and semi-natural cover that would include forests and forest plantations; successional areas; as well as wetlands and other aquatic communities.

Forests represent 12% and wetlands represent 6% of the total area of the Credit River Watershed. Successional habitats such as meadows, thickets, and savannahs, represent 10% of watershed area. Left undisturbed, these areas undergoing succession have the potential to become forests once again.

Guidelines published by Environment Canada suggest that a watershed should have 30% forest cover and 10% wetland cover in order to maintain viable wildlife populations and healthy ecosystem functions.

The Importance of Natural Heritage Systems

Human health depends on a healthy natural environment. Healthy lands, including forests, streams, wetlands, and other successional habitats, ensure a stable supply of ecosystem goods and services over the long term and help maintain healthy air, soil, and water.

KEY TERMS:

➔ *Ecological goods and services* include all of the things that are provided to natural and human communities by healthy ecosystems. Examples of ecological goods include clean water, healthy soil, energy (i.e. solar, wind, and hydro power) and natural resources for food, goods, and medicine. Ecological services include purification of air and water and pollination of plants. Ecological goods and services are vital to healthy, sustainable human communities.



Figure 23: Wetlands are an important part of natural heritage systems

Natural heritage systems are necessary to support irreplaceable biological and geological diversity. Forests and wetlands and areas undergoing succession need to be connected through a natural heritage system to maintain healthy ecosystems and provide food, shelter, and territory for viable populations of native species and genetic diversity. Natural heritage systems also ensure that natural functions such as the water cycle remain stable.

For human communities, natural heritage systems provide countless ecological goods and services; increase the value of nearby property; provide opportunities for recreation, education, and research; provide jobs; and enhance quality of life.

Rising to the Challenge: Protecting Natural Heritage Systems

Challenge: Protect and Restore Biodiversity

Overview: What is Biodiversity?

Biodiversity refers to the variety of all forms of life that live within a given ecosystem. Often, biodiversity is used to refer to the number of species of plants, animals and micro-organisms. Biodiversity can also include genetic diversity within species and even the diversity of whole ecosystems in a larger landscape. Globally, biodiversity is declining and more species are becoming “at risk”.

A species is considered to be at risk when population numbers, sizes, or locations of the species fall below nationally, provincially, or regionally determined thresholds. There are over 180 species at risk in Ontario. The Credit River Watershed is known or expected to provide habitat for a number of federally and provincially listed species. Species at risk are protected by federal legislation (the *Species at Risk Act* or *SARA*), and by provincial legislation (the *Endangered Species Act*). Credit Valley Conservation has identified, in addition to federal and provincial designations, a list of species of conservation concern specific to the Credit River Watershed.

Many species have already been lost from the watershed. Because species interact with each other and their environment in many complex ways, the loss of one species can affect many others. The loss of some species, for example pollinating insects, can affect entire ecosystems.



Figure 24: Jefferson Salamander, a species at risk

The major threats to biodiversity include fragmentation of natural heritage systems and loss of habitat. Other threats to biodiversity include diseases, pests, and invasive species.

Species are termed invasive when they are introduced into a new ecosystem and their expansive growth presents a risk to native species, the economy, or human health.

Biodiversity is often used as a measure of health of natural heritage systems. In general, greater biodiversity ensures a stable supply of ecosystem goods and services over the long term. As biodiversity decreases, species disappear from ecosystems and those ecosystems become less stable and less healthy.

❖ **FACT:** Some species or groups of species can be considered indicators of the overall health of an ecosystem. For example, some aquatic insects are considered indicators of water quality and fish are considered indicators of the health of an entire watershed. While some species are highly tolerant of pollution and degraded habitat, other species will only survive in the most healthy, pristine ecosystems. Based on a survey of diversity and abundance of fish, it is possible to determine the health of the overall watershed ecosystem.

Bird populations are recognized as reliable indicators of biodiversity. Declines in bird populations and the diversity of bird species can indicate the decline of other species. Scientists in Ontario have seen significant declines of many bird populations in the last 20 years.

Current Outlook

The number of species known to occur in the Credit River Watershed includes 17 amphibians, 244 birds, 81 fish, 48 mammals, 14 reptiles, and 1255 vascular plants.

As a consequence of habitat loss and other factors, biodiversity is declining in the Credit River Watershed. Fish are absent from several small creeks and streams in the watershed, especially in urban areas. Pollinators such as bees and butterflies are in decline. Reptiles and amphibians are also in decline.

To date, approximately 25 species at risk (rare, threatened, endangered, or special concern) have been identified within the Credit River Watershed. Almost half of the watershed's reptile species are at risk due to habitat loss, predation, road mortality, pollution and human activity. There are also hundreds of plants and animals that are considered regionally rare for the Credit River Watershed, though these species are sometimes abundant in other regions.

Species at Risk within the Credit River Watershed include the Acadian Flycatcher (*Empidonax vireescens*), Jefferson Salamander (*Ambystoma jeffersonianum*), Southern Flying Squirrel (*Glaucomys volans*), and Ginseng (*Panax quinquefolius*). The aquatic species at risk within the watershed with the highest profile is the Redside Dace (*Clinostomus elongates*).

Invasive species (usually non-native species that spread rapidly) are a significant and growing threat to other species and natural areas within the watershed. Invasive species tend to be tolerant to disturbance and reproduce rapidly, often eliminating more sensitive native species locally. The effects of invasive species may be widespread as other species lose the food sources and other resources on which they are dependent.

Examples of invasive species in the watershed are Garlic Mustard, Giant Hogweed, Common Buckthorn, Dog-strangling Vine, Carp, Round Goby, Zebra mussels and Rusty Crayfish. Invasive species can sometimes be controlled. For example, the Streetsville Dam acts as a barrier for Sea lamprey and prevents this invasive species from moving upstream into the middle and upper watershed.



Figure 25: Giant Hogweed, an invasive species

A number of tree species in the watershed are threatened by disease, pests, and invasive species, most notably Emerald Ash Borer, an introduced beetle from Asia that attacks and kills all ash species, and Asian Longhorn Beetle, which can injure and kill all hardwood trees. Examples of other diseases, pests, and invasive species that contribute to tree mortality include Gypsy Moth affecting oaks and other hardwood trees and Beech Bark Disease affecting beech trees.

In the middle watershed and along the Niagara Escarpment, large areas of relatively undisturbed habitat remain intact and support a wide variety of species. Biodiversity in this area is higher than other areas of the watershed, but more research is needed to accurately understand the state of biodiversity in the upper, middle, and lower watershed.

Key Issues

- Habitat loss – the loss of natural habitat due to human activities directly impacts biodiversity.

- Habitat disturbance – habitats can be disturbed by features such as buildings or dams, uses such as resource harvesting (fishing, forestry) and recreation, and even noise and light pollution.
- Invasive species – new introductions of invasive species are constantly threatening biodiversity in the watershed.
- Climate change - as climate change progresses, habitats will be altered and invasive species are likely to increase, both leading to further declines in biodiversity.

Rising to the Challenge: Actions for Protecting and Restoring Biodiversity

- Learn about the diversity of life in the Credit River Watershed by attending workshops, walks, and talks delivered by local naturalist clubs and environmental organizations. Learn to identify and report rare species.
- Keep invasive species out of the watershed:
 - Plant native plants in the garden,
 - Volunteer to help control invasive species.
- Promote wildlife on your property with wildlife-friendly gardening and landscaping and put up wildlife feeders and habitat boxes.
- Participate in volunteer events and work days that help protect species and restore habitat.

For more ways that you can “Rise to the Challenge” visit www.creditvalleyca.ca/education.

Challenge: Protect and Restore Significant Natural Areas

What are Significant Natural Areas?

Significant natural areas include significant natural terrestrial and aquatic habitats at a variety of scales which are important for their environmental and social values as a legacy of the natural landscapes of an area.

Internationally, UNESCO has identified the Niagara Escarpment as a significant natural area by designating it a World Biosphere Reserve. The importance of the Great Lakes is recognized internationally. The Canadian government works with other agencies to protect and manage international waters.

Provincially, the Ontario Ministry of Natural Resources identifies Life Science or Earth Science Areas of Natural and Scientific Interest (ANSI) and Provincially Significant Wetlands (PSW) based on their biological and social importance; hydrological functions; and special features. As well, the province identifies significant habitats of threatened and endangered species.

Provincial legislation also identifies and protects large, provincially-significant natural areas such as the Greenbelt, Niagara Escarpment, and Oak Ridges Moraine.



Figure 26: A provincially-significant wetland in Terra Cotta Conservation Area

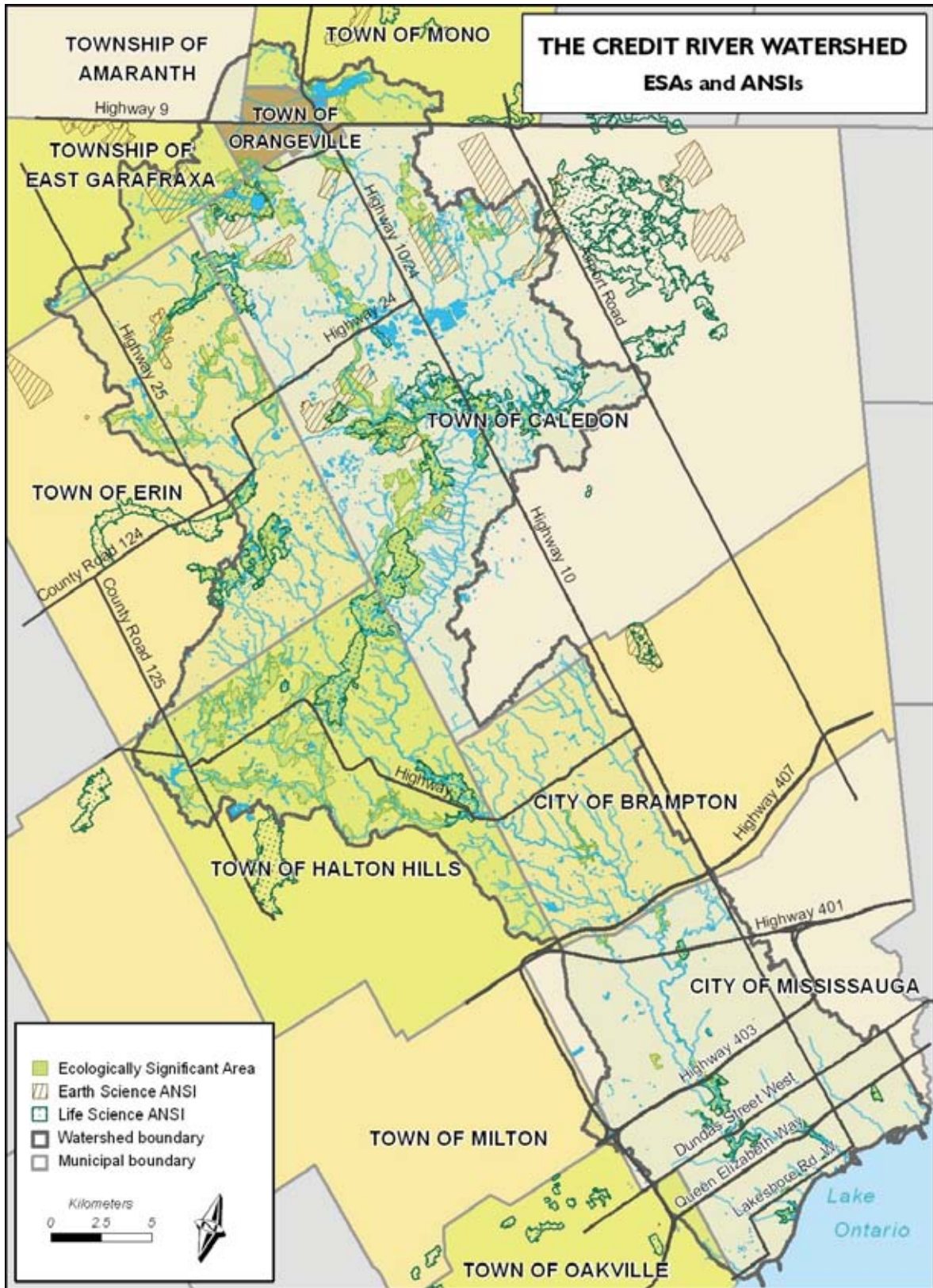


Figure 27: ESAs and ANSIs in the Credit River Watershed

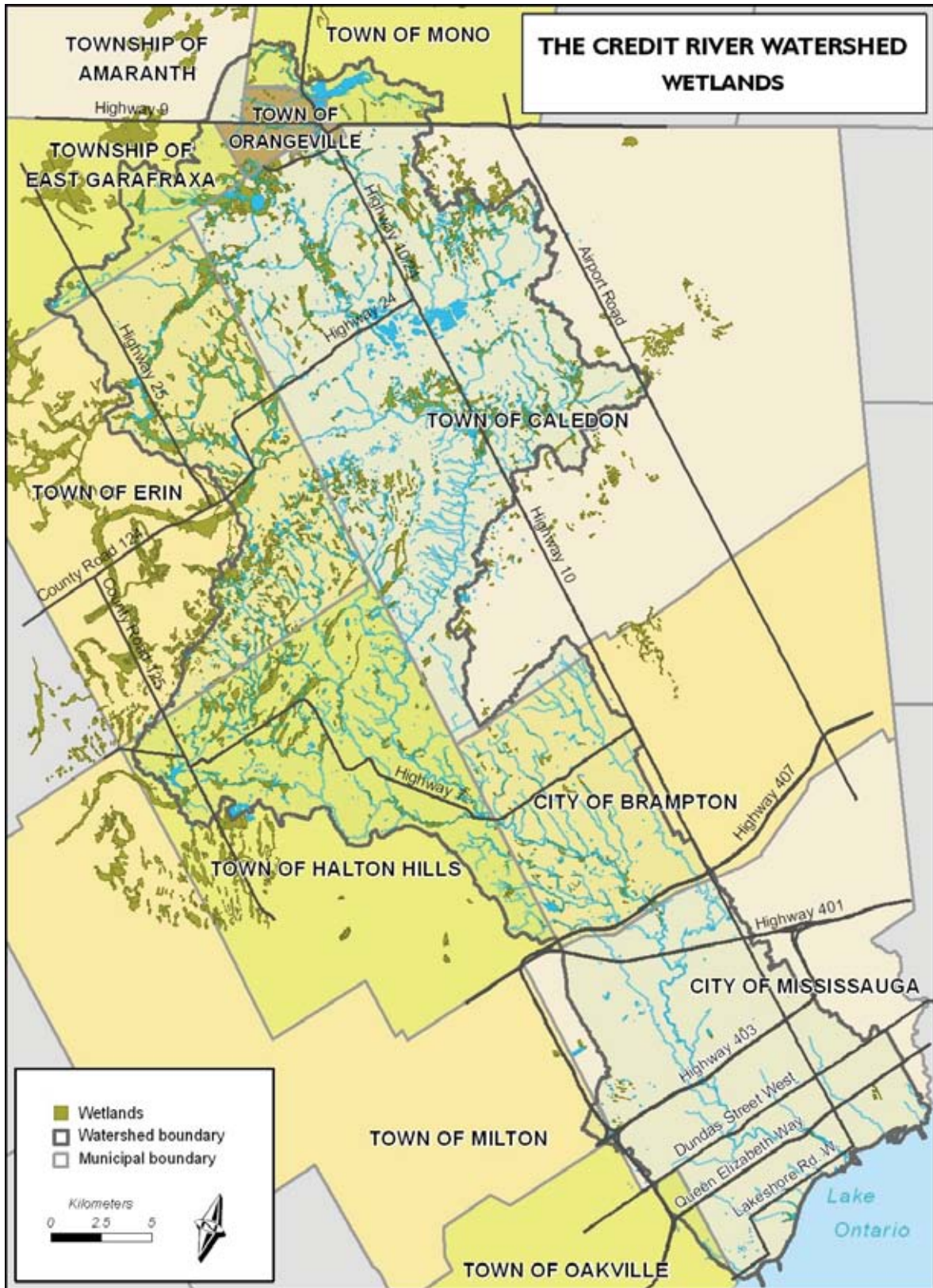


Figure 28: Wetlands in the Credit River Watershed

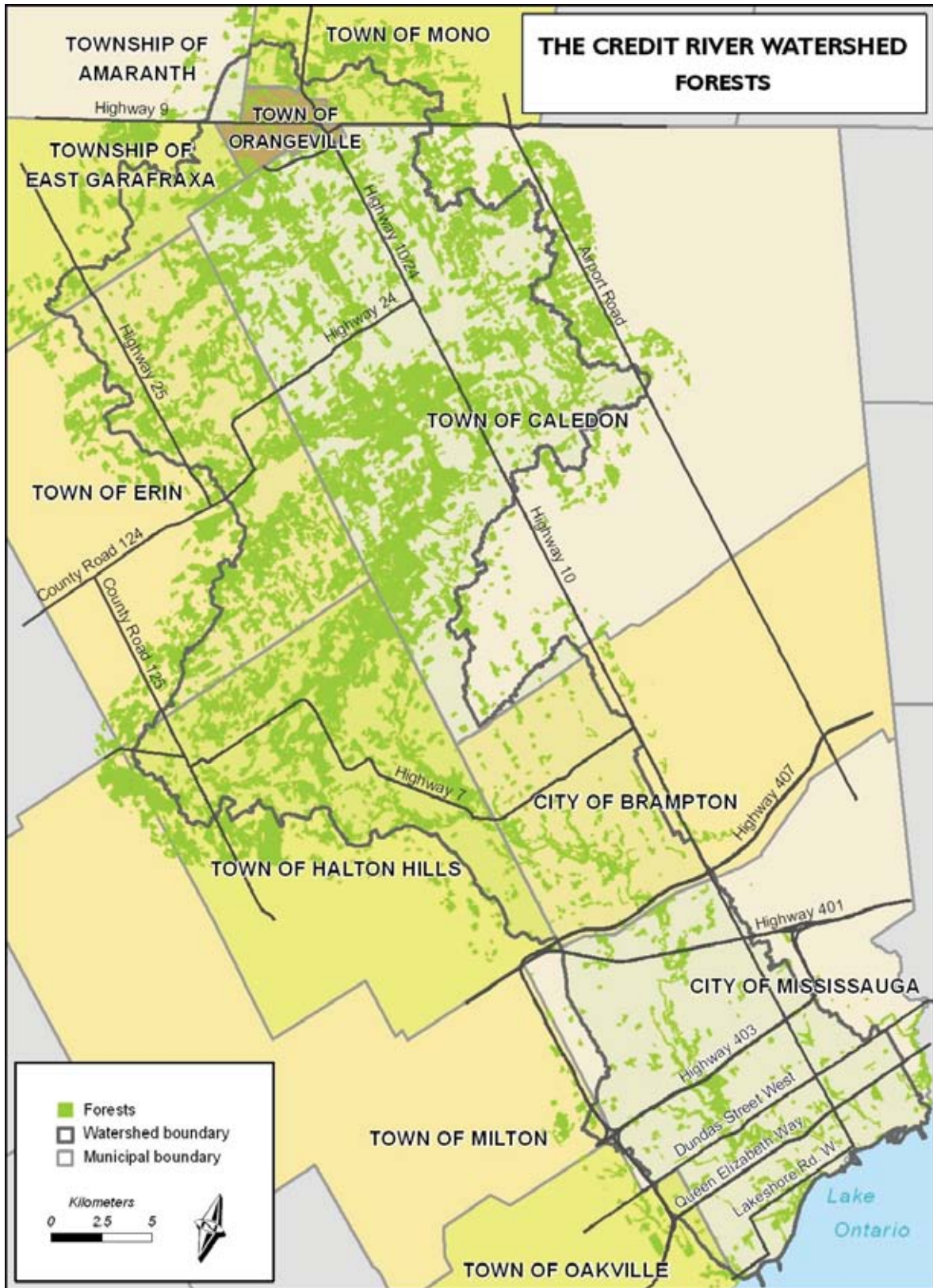


Figure 29: Forests in the Credit River Watershed

Regionally, Environmentally Significant Areas (ESAs) in the Credit River Watershed have been identified by Credit Valley Conservation based on a watershed-wide program. These areas are considered important because of their geological features, the presence of native plants or animals, or their role in the healthy functioning of natural systems.

Other natural features such as woodlands, valley lands, and wildlife habitat may also be designated as “significant” by planning authorities (consistent with the Provincial Policy Statement) for their contributions to the functioning of the natural heritage system.

All fish habitat is protected by Fisheries and Oceans Canada as a federal resource. In agreement with Fisheries and Oceans Canada, Credit Valley Conservation administers section 35 v(1) of the *The Fisheries Act*: "No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat."

Other significant natural areas may be afforded protection through other mechanisms such as land securement programs and designated as different types of protected areas, such as Conservation Areas, Provincial Parks, municipal parks and open space.

Additional mechanisms for protecting natural features and areas on private lands include conservation easements, stewardship programs, and planning tools such as official plans and zoning. Private lands can also be donated to conservation organizations such as Credit Valley Conservation and regional land trusts for protection and management. These areas and other natural and semi-natural areas contribute to maintaining the health and biodiversity of the watershed.

Current Outlook

The Credit River Watershed contains many ESAs and ANSIs. Forty-five Provincially Significant Wetland complexes (or portions of them) are found in the Credit River Watershed. All wetlands within the Credit River Watershed fall under the authority of Credit Valley Conservation regardless of significance or designation. Credit Valley Conservation and other agencies also oversee the management of all watercourses within the Credit River Watershed as well as a portion of Lake Ontario.

Much of the upper and middle watershed falls under the Provincial Greenbelt Plan area, which includes the Niagara Escarpment, the Oak Ridges Moraine, and the Natural Heritage System for the Protected Countryside. This plan was designed to protect key natural heritage and hydrological features that sustain ecological and human health.

In the middle and lower watershed municipal natural heritage systems (such as Mississauga’s Natural Areas System, the Town of Caledon’s Environmentally Protected Areas, and the Region of Peel’s Greenlands System) also require protection for many natural heritage features.

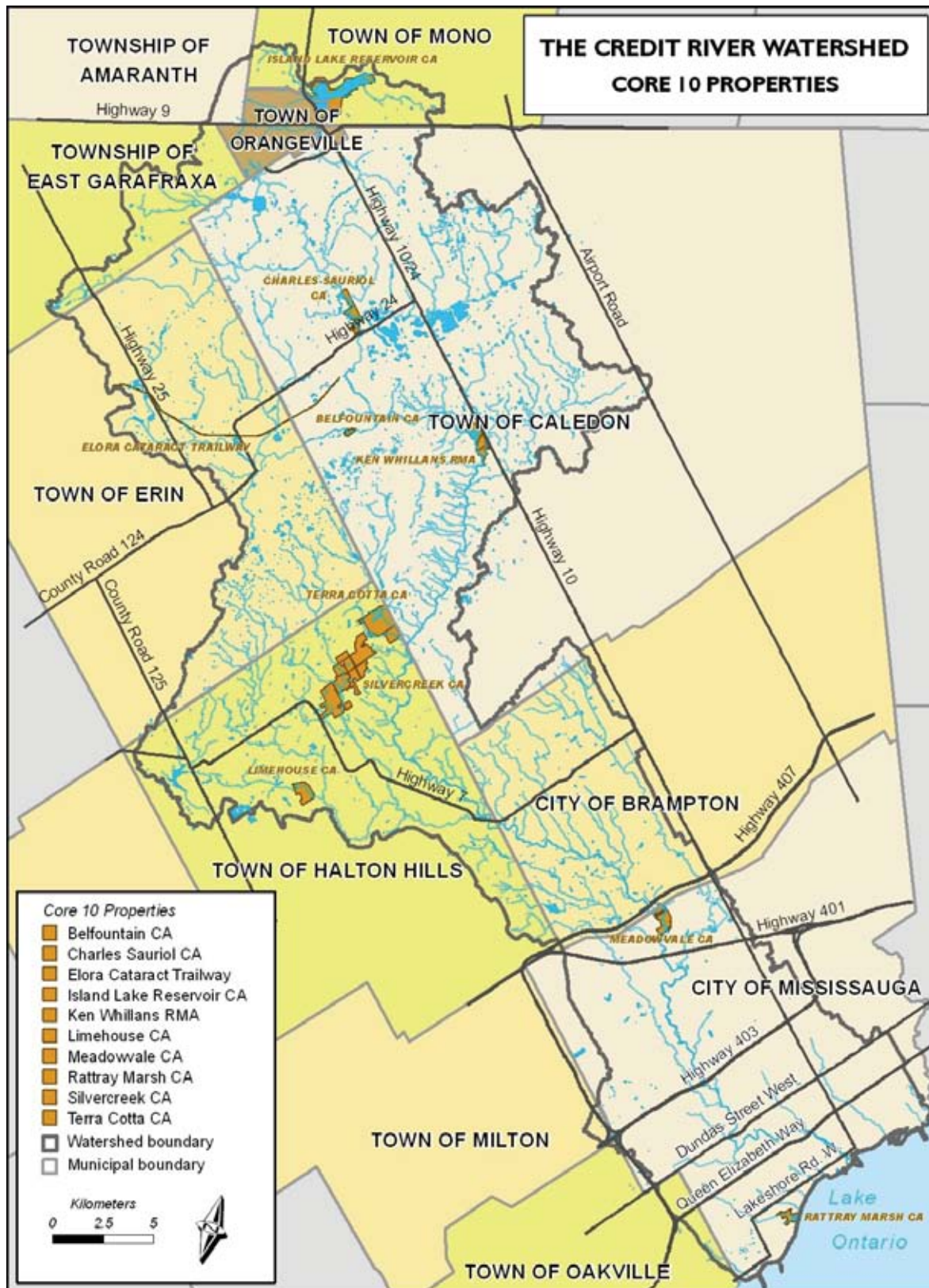


Figure 30: Ten Major Conservation Areas in the Credit River Watershed

Credit Valley Conservation owns and manages over 2,400 hectares of lands primarily for conservation purposes, including Conservation Areas such as Island Lake, Belfountain, Terra Cotta, and Rattray Marsh. The watershed also includes one Provincial Park, Forks of the Credit.

All of these natural areas require active monitoring, and management to ensure they remain intact, protected, and contributing to the health and biodiversity of the Credit River Watershed.

Key Issues

- Prohibited uses of natural areas – prohibited activities within designated and protected natural areas disrupt and damage ecosystems and threaten biodiversity. These prohibited uses include encroachments, poaching, inappropriate trail use, urban pressures, pollution, and illegal dumping.
- Acquiring new protected areas – as the human population in the watershed increases there is a need for more protected natural areas to allow for sustainable recreation, education, and appreciation of the natural environment.



Figure 31: The boardwalk in Rattray Marsh Conservation Area

Rising to the Challenge: Actions for Protecting Significant Natural Areas

- Avoid encroaching on conservation lands and other significant natural areas.

- Be aware of prohibited uses in each specific conservation land and natural area, which can include motorized vehicle use, camping, cycling, and other activities. Report any prohibited uses to the organization that manages the area.
- Visit conservation areas and support the protected areas in the Credit River Watershed.

For more ways that you can “Rise to the Challenge” visit www.creditvalleyca.ca/education.

Challenge: Protect and Restore Connected Habitat

What is Connected Habitat?

Habitat refers to the area where plants and animals (including humans) live and go about their day-to-day lives. Habitats provide organisms with necessary elements of life like food, shelter, and water. Habitat can be both terrestrial (such as a forest) and aquatic (such as a river). Habitat loss occurs when natural areas are converted to other human-dominated land uses. Habitat can also be damaged or destroyed by flooding and drought; erosion and sedimentation; pollution; and other direct and indirect human activities.

Connectivity refers to how easily species can move between different habitats. Connectivity is extremely important for healthy ecosystems. Animal species need to move between habitats for feeding, breeding, shelter, or migration. Plant species reproduce using seeds to spread into other habitats. Connectivity is essential for succession, allowing habitats to recover from disturbances by receiving genes and species from neighbouring habitats. Connectivity is also essential for allowing long-term migration of genes and species that enables adaptation and evolution to occur.

KEY TERMS:

- ➔ *Functional connectivity* refers to how connected an area is for a process, such as the migration of an animal or the hydrological cycle. For example, roads can impair functional connectivity for some species groups, such as amphibians or reptiles, but not affect the functional connectivity for bird species.
- ➔ *Structural connectivity* refers to the physical connections between habitats. In general, structural connectivity declines as gaps increase between natural features.

Connectivity can be impaired through destruction of habitat and by structures such as roads and dams.

Some habitats in the Credit River Watershed are connected through bioregional landscapes such as the Niagara Escarpment and Oak Ridges Moraine. These areas allow the migration of species across large areas of the province.

Other regional corridors include the Lake Ontario Shoreline and Credit River Valley corridor. Large regional corridors are important for connecting terrestrial and aquatic habitats and providing shelter, food sources, and migratory corridors through which species can move, relatively undisturbed, from one part of the watershed to another.



Figure 32: River and stream valleys form natural corridors

Current Outlook

Habitat loss and degradation continues to be a major threat to the health of the Credit River Watershed. Natural habitat continues to be lost to urbanization and other land use changes. Habitat degradation through encroachment, unsanctioned trails, off-road motorized vehicle use, garbage dumping, and other direct and indirect activities impact the quality of existing habitat.

The Credit River Watershed contains several thousands of kilometres of roads and over 400 dams blocking small creeks, larger tributaries, and the main channel of the Credit River.

Approximately 17% of the upper watershed is covered by forests and forest plantations. Wetlands cover about 9.5% of the upper watershed and provide habitat for many species. Areas undergoing succession are the most abundant type of natural area in the upper watershed. These successional habitats are ideal for restoration into forests and wetlands

that would improve the connectivity of the natural heritage system. The upper watershed also includes cold water stream habitat that supports native brook trout.



Figure 33: Brook trout require cold and clean water to survive

Approximately 26% of the middle watershed is covered in forest or forest plantation and 7.5% is covered in wetlands. The main Credit River and the tributaries in the middle watershed provide excellent cold water fish habitat for species like brook and brown trout. This portion of the Credit River is the focus of efforts to re-establish the Atlantic salmon fishery.

❖ **FACT:** Both warm water and cold water habitats are natural and necessary for healthy, functional fish populations. While some species such as brook trout require cold water to survive, warm water streams are actually more diverse and productive than cold water streams, providing habitat for bass, pike, darters, and many other species. In total, warm and cold water habitats in the Credit River Watershed support about 70 different species of fish.

About 7% of the lower watershed is covered in forest or forest plantation. Less than 1% of the lower watershed is covered in wetland. Many of the natural features in this area of the watershed have been lost or seriously degraded through urban development. The main

Credit River in the lower watershed provides cool water fish habitat, although tributaries generally only support warm water fish habitat. This portion of the Credit River also supports a migratory cold water fishery including Chinook salmon, rainbow trout and brown trout.

Key Issues

- Urbanization and other land use changes – increased urbanization (including utility corridors and the infrastructure surrounding urban areas) destroys and impairs habitat and disrupts natural corridors. Species and genetic diversity are harder to maintain in natural areas that are fragmented by non-natural areas.
- Climate change – changes in climate will likely cause significant changes in habitat, though these changes are hard to predict. Water temperatures are expected to increase, impairing cold water stream habitat. Climate change will also increase the number of invasive species in the watershed.
- Aggregate extraction – aggregate pits and quarries cover about 4% of the watershed. This activity can disrupt groundwater, impact the flow of rivers and creeks, and cause loss of terrestrial and aquatic habitat.
- Barriers – roads, particularly multi-lane highways, are significant barriers to movement of some species. Dams prevent or reduce fish and wildlife movement; affect the water flow of streams and riparian zones; cause increased nutrients and sediments in waterways; and raise stream temperatures, impacting fish habitat.

Rising to the Challenge: Actions for Protecting and Restoring Connected Habitat

- Create habitat in your garden and landscape around your home by:
 - Planting native plant species;
 - Providing water, food and shelter for birds and amphibians.
- Create habitat in rural areas:
 - Increase the size of hedge rows and riparian areas;
 - Naturalize and create habitat in ponds, streams, and wetlands.
- Create habitat in your community:
 - Participate in local tree planting events;
 - Volunteer with organizations involved in natural heritage conservation;
 - Support organizations involved in the study and protection of habitat.

For more ways that you can “Rise to the Challenge” visit www.creditvalleyca.ca/education.

CONCLUSION

How can we learn to live sustainably in the Credit River Watershed? How can we ensure the future health of all human and natural communities?

Despite rapidly increasing urbanization, climate change, deteriorating water quality, shrinking natural areas, and declining biodiversity, the Credit River Watershed remains one of the most diverse and ecologically important regions in southern Ontario. The watershed supports a diverse cold-water fishery; many rare, threatened and endangered species; and many significant and protected natural areas.

There are many challenges ahead for the Credit River Watershed. No single individual or organization can meet these challenges alone. To protect the health of the watershed we need a diversity of voices and many strong partners all working together.

The Credit River Watershed provides us with fresh water and clean air, healthy soils for growing food; resources for jobs and communities; and spectacular natural places for learning, contemplation, and living healthy, active lives. How can we take action to protect our watershed? What can we give back? Let's rise to the challenge!

For more ways that you can "Rise to the Challenge" visit www.creditvalleyca.ca/education.



Credit Valley Conservation
1255 Old Derry Road
Mississauga, ON L5N 6R4
education@creditvalleyca.ca
www.creditvalleyca.ca