


ROUGE RIVER WATERSHED PLAN

TOWARDS A HEALTHY AND SUSTAINABLE FUTURE

REPORT OF THE ROUGE WATERSHED TASK FORCE
2007

Rouge Park

Toronto and Region Conservation
for The Living City

ACKNOWLEDGEMENTS

This *ROUGE RIVER WATERSHED PLAN - Towards a Healthy and Sustainable Future* was written by Suzanne Barrett, under the direction of the Rouge Watershed Task Force, and represents the combined effort of many participants. Appreciation and thanks are extended to all of the members of the Rouge Watershed Task Force, as listed in Appendix C; to the Toronto and Region Conservation Authority and Rouge Park staff and consultants, as listed in Appendix G and to the government partners.

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November 30, 2006

Mr. Dick O'Brien
Chair
Toronto and Region Conservation Authority
5 Shoreham Drive
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Dear Mr. O'Brien:

The Rouge River Watershed Plan is the product of the Rouge Watershed Task Force. At the last meeting of the Task Force, following 2.5 years of discussion and study, the report was adopted with the final resolution.

Underlying the report is a wealth of scientific study including some groundbreaking modelling as well as innovative empirical social science research. These studies and the often lively discussions at the Task Force meetings have brought to the fore some key messages at once sobering and yet providing the opportunity for positive action.

The underlying science demonstrates unequivocally that the Rouge River watershed is at a crossroads. At its heart is the largest urban wilderness park in North America. Yet pressures on five municipalities, two regional governments, the province and the federal government (which owns substantial tracts of land in the watershed) create enormous and often conflicting management demands.

Concern for the environment is once again at the public forefront as this report is being finalised. There is no doubt that members of the public want to "do the right thing" when it comes to environmental matters. Yet the complexity of the problem can be overwhelming to an individual citizen. The phenomenal participation rate in blue and green box programs demonstrates how much change can be effected with appropriate leadership and direction. Research, the public will and economics all appear to be moving towards favouring a more truly sustainable way of living in

a North American urban area. Opportunities exist today for individual buildings, infrastructure, transportation, energy and water management that were merely theoretical only a few years ago. Decisions to take advantage or squander these opportunities will directly affect the future of this watershed.

The watershed plan provides general direction. It is the broadest of navigational tools. It points out the routes available and the desired destination. By itself, this document will not achieve any results. If there was one sentiment expressed consistently by members of this Task Force it was a desire that this report not be yet another report that would be filed away and gather dust. Leadership is needed to make specific decisions at all levels from governments, to planners, developers and individuals that are consistent with the goals of this plan. Not all decisions need necessarily cost money. Inaction, indecision and lack of leadership also have their costs– often to be paid for (with accrued interest) by future residents.

Within our own sphere, every citizen in this watershed is a leader and a decision maker. Every one of us has the power to make decisions that will affect the future of this watershed.

Yours Very Truly

Bryan J. Buttigieg
Chair, Rouge River Watershed Task Force

EXECUTIVE SUMMARY

The Rouge River watershed is an extraordinary resource in Southern Ontario, treasured and enjoyed by residents and visitors alike. It spans 336 km^2 of land and water in the Regions of York and Durham, Cities of Toronto and Pickering, and Towns of Markham, Richmond Hill and Whitchurch Stouffville. It includes all the lands that drain to the Rouge River and its tributaries, including the Little Rouge River, starting in the hills of the Oak Ridges Moraine and flowing south to Lake Ontario (see Figure 1-1).

Why do we need this watershed plan? If you live, work or play in the Rouge River watershed, you depend on its health in a number of ways. The Rouge watershed is a source of your drinking water – whether you rely on wells or water from Lake Ontario. Unpaved land absorbs water from rain and snowfall to replenish groundwater and streams and reduce the negative impacts of flooding and erosion. Healthy aquatic and terrestrial habitats support diverse communities of plants and animals. Agricultural lands provide local sources of food and green spaces provide recreation opportunities. A rich human heritage affords links to the past that enrich and inform our lives today. The natural beauty of the forests, meadows, farmlands, wetlands, rivers and creeks provides urban dwellers with solace, renewal and contact with nature.

Increasing concerns about the health of our cities and countryside, the safety of our drinking water and the future of the Oak Ridges Moraine have lead to a number of initiatives towards sustainable living in Ontario, the Greater Toronto Area (GTA) and the Great Lakes Region. Actions taken in the Rouge watershed can provide a model for actions in other watersheds, as well as influence the environmental health of larger systems.

What is the role of the watershed plan? Specifically, the watershed plan is intended to inform and guide municipalities, provincial and federal governments, TRCA, Rouge Park, non-government organizations and private landowners as they update their policies and practices for environmental stewardship.

This watershed plan was prepared by a multi-stakeholder task force that includes representatives from all levels of government agencies, private businesses, not-for-profit organizations and the public and was coordinated by TRCA and Rouge Park (see Appendix C). The plan has a strong technical foundation, based on decades of monitoring of environmental conditions combined with a leading edge approach to modelling of potential future conditions. A series of management summits was held to convene experts who could help identify best practices and recommendations to achieve the objectives of the Rouge Watershed Task Force.

The guiding framework for this watershed plan comprises an overall goal, a set of principles, nine goals and 22 objectives with specific targets. Our overall goal is:

> *To work towards a healthy and sustainable Rouge watershed by protecting, restoring and enhancing its ecological and cultural integrity within the context of a regional natural heritage system.*

Our goals, objectives and targets address:

- Groundwater
- Surface water
- Stream form
- Aquatic system
- Terrestrial system
- Air quality and climate change
- Cultural heritage
- Nature-based recreation
- Sustainable land and resource use

One of the foundations of this plan is the *Rouge River State of the Watershed Report*, **w**hich provides a wealth of recent information about natural and cultural resources and human activities in the watershed. Land use in the Rouge watershed today is approximately 40% rural, 35% urban, 24% natural cover and 1% open water. The lower watershed is dominated by Rouge Park, with a small but well established area of urban development to the west. The middle and western parts are experiencing rapid urban expansion and have sparse natural cover except in Rouge Park. The upper and eastern portions of the watershed are primarily rural and agricultural with some small towns and villages.

The Rouge watershed represents a rich inheritance for current and future communities. The Little Rouge River watershed is still relatively undeveloped with considerable natural cover and a water balance typical of a rural watershed. The aquatic systems in the upper Little Rouge and parts of the Main Rouge are healthy enough to support cold- and cool-water communities including species of concern such as redside dace and brook trout. Natural habitats support a high diversity of plants and animals, including many that are rare or at risk (such as the nationally threatened Jefferson salamander, provincially significant Cooper's hawk and regionally rare one flower cancer-root). Major blocks of publicly owned lands have been reserved for conservation and greenspace purposes, most notably the 41 square kilometre Rouge Park. The Rouge watershed also has a rich cultural heritage, including many archaeological and historic sites, landscapes, stories and artifacts from earlier inhabitants as well as the diverse cultures of present day communities.

Unfortunately, there are signs of stress. Decades of urban development have resulted in harmful changes that exceed the carrying capacity of natural systems. These changes include increased surface runoff, more water pollution, greater annual flow volumes in rivers and streams, increased erosion and sedimentation, channel instability, loss of biodiversity, and greater incidence of smog. They are signs that the ability of the air, land and water to absorb the negative impacts of human activities is strained and cannot be sustained over the long term unless fundamental changes are made. Rehabilitation of infrastructure and restoration of natural habitats to address these issues is underway, but these measures are expensive and time consuming.

To help us understand how the watershed might react to changes in land use, environmental management and climate in the future, we undertook a multi-faceted process of analysis and synthesis. This included modelling studies to compare eight potential scenarios, as documented

in our *Scenario Modelling and Analysis Report.* The results of this work were combined with an examination of existing conditions and trends in the watershed, a review of watershed research in other areas, and the best professional judgement of a range of experts in many fields.

What can we expect in future? We discovered that if future development proceeds with current approaches to community design and stormwater management, it will not be possible to maintain current watershed conditions, let alone improve them. If development practices are changed to use the best foreseeable community designs and management techniques, it may be possible to maintain and in some cases enhance current conditions. However many of the new designs and technologies for sustainable urban development are still evolving and being tested so we recommend that where permitted, development should proceed with caution. Evaluation should be undertaken, with extensive and meaningful public consultation, to assess how well watershed objectives and targets are being met and recommend adjustments to development practices when necessary.

Fortunately, the Rouge watershed offers many unique opportunities, including the assembly and renaturalization of lands as part of Rouge Park and the continuation of agriculture on public and private lands. Watershed municipalities are already working to address the negative impacts of existing developments and are among the leaders in promoting sustainable practices. These opportunities provide valuable tools to help address concerns with current watershed conditions, manage impacts from future land use changes and adapt to the uncertainties associated with global climate change.

The pathway to a healthy watershed that emerged from this analysis is based on a comprehensive and inter-dependent set of strategies that will protect and enhance valued resources, regenerate damaged systems, and build more sustainable communities. These strategies encompass three broad themes:

1. **Establish the targeted terrestrial natural heritage system:** Figure 5-2 illustrates an expanded natural heritage system that provides multiple benefits, including biodiversity and habitats, water balance maintenance and restoration, opportunities for nature-based recreation, improved quality of life, and greater resilience to urban growth and climate change. It can be accomplished by protecting existing valued assets, securing additional lands, regenerating degraded areas and improving stewardship of public and private lands.

2. **Build sustainable communities:** We have identified more sustainable approaches to urban form, infrastructure, transportation and resource use that will contribute to overall improved quality of life. They should be applied to new communities, as well as to the intensification or redevelopment of existing ones. Some of the key features include reduced imperviousness, measures to maintain or restore water balance, design features to facilitate sustainable choices (e.g. energy conservation, reduced vehicle use, support for local agricultural products) and protection and adaptive re-use of cultural heritage features. Development, where permitted, should proceed at a pace and extent that allows sufficient time to adopt, test and evaluate the effectiveness of new technologies and to make adjustments if the results do not meet our objectives and targets for the watershed.

3. **Recognize and develop a regional open space system:** The Rouge watershed has the basis for a significant, inter-connected regional open space system including Rouge Park and regional trails, conservation areas and major municipal parks. We recommend that this system be further developed to reach its potential to provide nature-based recreation experiences for a growing population, support for healthy communities, interpretation of natural and cultural heritage, linkages with local neighbourhoods and connections to surrounding watersheds.

An important prerequisite for action will be to increase awareness among watershed residents, businesses, developers and agencies of the importance of the watershed, its water cycles, natural systems and cultural heritage. We recommend a long-term outreach program to provide information and understanding, explain how people can act on this knowledge, and inspire action. Our social marketing study, *Action Plan for Sustainable Practices,* showed that there is a modest basis of understanding and support for sustainability, but the public needs more specific information, marketing campaigns and assistance to inspire action. It also highlighted a number of issues that reduce opportunities for businesses to adopt sustainable practices, therefore we plan to remove barriers and provide incentives for the business community.

The coordinated efforts of government agencies and community leaders are also crucial to the success of this watershed plan. They have many complementary tools available, including plans and policies, permits and regulations, enforcement, infrastructure operations and maintenance, stewardship and regeneration programs, and education and awareness initiatives. More details about how these existing tools can be used to help implement the watershed plan are provided in the *Implementation Guide.*

We are standing at a crossroads. In one direction lies a future modelled on the past, with continued losses of environmental quality, biodiversity and cultural heritage along with considerable costs to address the health, social and economic consequences of degraded environmental conditions. In the other direction is a future with healthy natural systems and a rich natural and cultural heritage, supporting a higher quality of life for our communities. This plan outlines the key steps to achieve the best possible future for ourselves and our grandchildren. We hope you will support it and become a partner in its implementation.

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CHAPTER

1

1.0 INTRODUCTION

The Rouge River watershed is an extraordinary resource in Southern Ontario, treasured and enjoyed by residents and visitors alike. It spans 336 km^2 of land and water in the Regions of York and Durham, Cities of Toronto and Pickering, and Towns of Markham, Richmond Hill and Whitchurch Stouffville (see Figure 1-1). It includes all the lands that drain to the Rouge River and its tributaries, including the Little Rouge River, starting in the Oak Ridges Moraine and flowing south to Lake Ontario.

The lower Rouge valley is relatively wild and forested, in contrast to the lower portions of other more urbanized watersheds in the Greater Toronto Area (GTA). This is because the southern portions of Rouge Park protect so much of the lower Rouge valley. At the mouth of the river, separated from Lake Ontario by a sand spit, is a provincially significant marsh. The upper areas of the Rouge watershed are predominantly agricultural, whereas the middle reaches are undergoing some of the most rapid urbanization in the GTA.

Rouge Park

Rouge Park, the largest urban park in North America, protects 41 km2 of the watershed, encompassing major stretches of rivers, creeks, forests, meadows and agricultural lands.

Lower Rouge River (Photography © Andy McKinnon)

Why do we need this watershed plan?

If you live, work or play in the Rouge watershed, you depend on its health in a number of ways. The Rouge watershed is a source of your drinking water – whether you rely on wells or water from Lake Ontario. Unpaved land absorbs water from rain and snowfall to replenish groundwater and streams and reduce the negative impacts of flooding and erosion. Healthy aquatic and terrestrial habitats support diverse communities of plants and animals. Agricultural lands provide local sources of food and green spaces provide recreation opportunities. A rich human heritage affords links to the past that enrich and inform our lives today. The natural beauty of the forests, meadows, farmlands, wetlands, rivers and creeks provides urban dwellers with solace, renewal and contact with nature.

> We do not inherit the earth from our ancestors; we borrow it from our grandchildren.
> (Chief Seattle)

Over the last few decades, increasing concerns about the health of our cities, the safety of our drinking water and the future of the Oak Ridges Moraine have lead to a number of initiatives towards sustainable living. Actions taken in the Rouge watershed can provide a model for actions in other watersheds, as well as influence the environmental health of larger systems. This Rouge River Watershed Plan fits within a broad context of plans and programs in the Great Lakes Region, Ontario and the GTA.

Specifically, the watershed plan is intended to inform and guide municipalities, provincial and federal governments, TRCA, Rouge Park, non-government organizations and private landowners as they update their policies and practices for environmental stewardship.

For example, the *Oak Ridges Moraine Conservation Plan* (ORMCP, 2002) requires municipalities to incorporate the requirements of watershed plans into their official plans before any major

Mouth of Rouge River, at Lake Ontario

Greenbelt Plan

The Greenbelt Plan identifies a 600m wide corridor for the Little Rouge River as the main ecological corridor between Lake Ontario and the southerly boundary of Oak Ridges Moraine Area, as well as several other Rouge River tributaries, in recognition of the longstanding commitment to establishing Rouge Park.

development on the Moraine can be approved. The *Clean Water Act* (2006) calls for watershed-based planning to protect sources of drinking water. The *Provincial Greenbelt Plan* (2005) recognizes the importance of the Rouge watershed as a vital ecological corridor linking the environmental systems of Lake Ontario to the Oak Ridges Moraine in the GTA. This watershed plan will also help to guide municipalities as they undertake their growth planning exercises in response to the *Provincial Growth Plan for the Greater Golden Horseshoe* (*Places to Grow, 2006*), which targets additional population growth beyond the current levels of the official plans.

The Rouge watershed is the most easterly of six Toronto Region watersheds identified by Canada, the United States and the International Joint Commission as an Area of Concern on the Great Lakes, where remedial action is being undertaken to restore environmental quality. Although the Rouge watershed is still the healthiest of the six, it is showing many signs of stress due to past land use practices, and there is concern that ongoing population growth, and the development to support it, will cancel out the benefits of restoration efforts. The watershed plan will guide protection and restoration efforts toward the ultimate de-listing of the Rouge watershed from the Toronto Area of Concern.

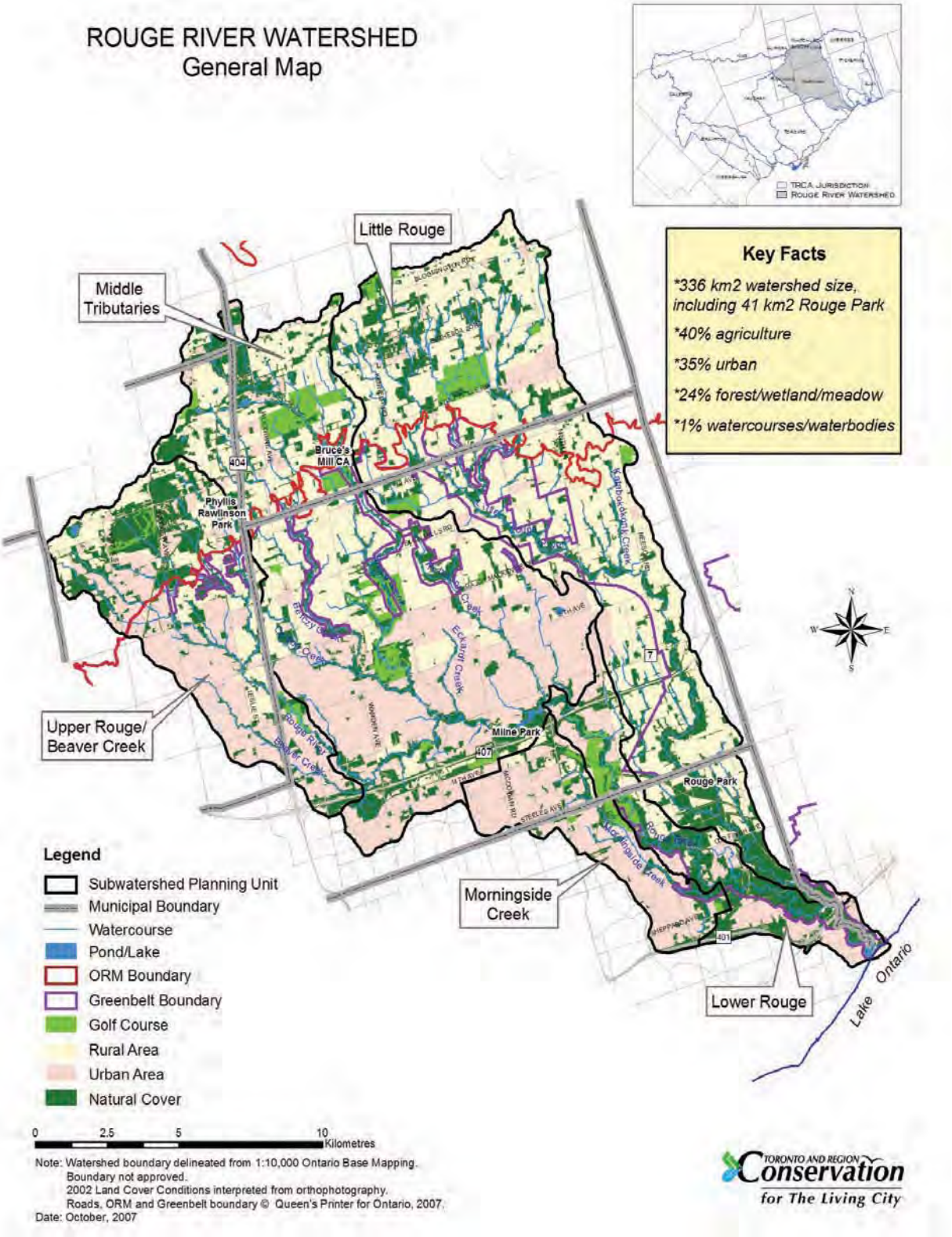
The Rouge watershed has many parks and conservation areas, but one – Rouge Park – is distinguished as the largest natural park in a city in North America. Rouge Park is managed by the multi-stakeholder Rouge Park Alliance with a vision to ensure that the Park remains a sanctuary for nature and the human spirit. A number of park plans have been developed to guide management of the Park, but their success also depends on sustaining a healthy watershed, and the Rouge Park Alliance has called for a watershed plan to identify how this can be assured.

This is the second major watershed planning initiative for the Rouge watershed. In 1990 the Metro Toronto and Region Conservation Authority (MTRCA) completed the *Comprehensive Basin Management Strategy for the Rouge Watershed*. It was one of the first watershed strategies in Ontario that attempted to address objectives beyond strictly water management and to involve the public through a public advisory committee. Its technical studies and public process were considered state of the art at the time. However, the urban growth forecasts that were the basis for the plan were quickly surpassed with the pace of development, while the science of watershed management did not evolve at the same pace. The result has been deterioration of the watershed, despite efforts to implement the *Comprehensive Basin Management Strategy*.

The lessons learned from the *Comprehensive Basin Management Strategy for the Rouge Watershed* about the importance of public engagement and the commitments needed by all partners to participate in implementation prompted TRCA's policy to prepare watershed strategies for each of its nine watersheds, in partnership with watershed stakeholders.

Watershed plan municipalities and other stakeholders have identified a number of issues and opportunities that they would like to see addressed by the watershed plan. The City of Toronto's Wet Weather Flow Management Plan has identified the need to improve stormwater management in the upstream municipalities to complement the downstream work being done in Toronto. Other concerns include stewardship and regeneration priorities, flooding, erosion and water quality problems, encroachments on public lands, alternative development standards and construction practices.

Figure 1-1: Rouge River Watershed General Map



Finally, we are working to contribute to TRCA's vision for The Living City which states:

> *The quality of life on Earth is being determined in the rapidly expanding city regions. Our vision is for a new kind of community, The Living City, where human settlement can flourish forever as part of nature's beauty and diversity.*

How was the plan prepared?

This plan was prepared by a multi-stakeholder task force that includes representatives from all levels of government agencies, private businesses, not-for-profit organizations and the public and is coordinated by TRCA and Rouge Park (see Appendix C). The plan has a strong technical foundation, based on decades of monitoring of environmental conditions combined with a leading edge approach to modelling of potential future conditions. A series of management summits was held to convene experts who could help identify best practices and recommendations to achieve the task force objectives. Meetings were held with agencies, other watershed partners and the public to review issues and seek feedback on the Plan's recommendations.

Plan Documents

This plan is the tip of an iceberg. Its foundations include:

- Rouge River State of the Watershed report
- technical documents
- implementation guide

To access any of these resources, visit www.trca.on.ca or www.rougepark.com

Our approach to watershed planning has evolved from the previous *Comprehensive Basin Management Strategy* to take a more integrated approach that focuses on interdependencies among watershed systems and evaluates proposed actions based on their ability to achieve multiple and synergistic benefits.

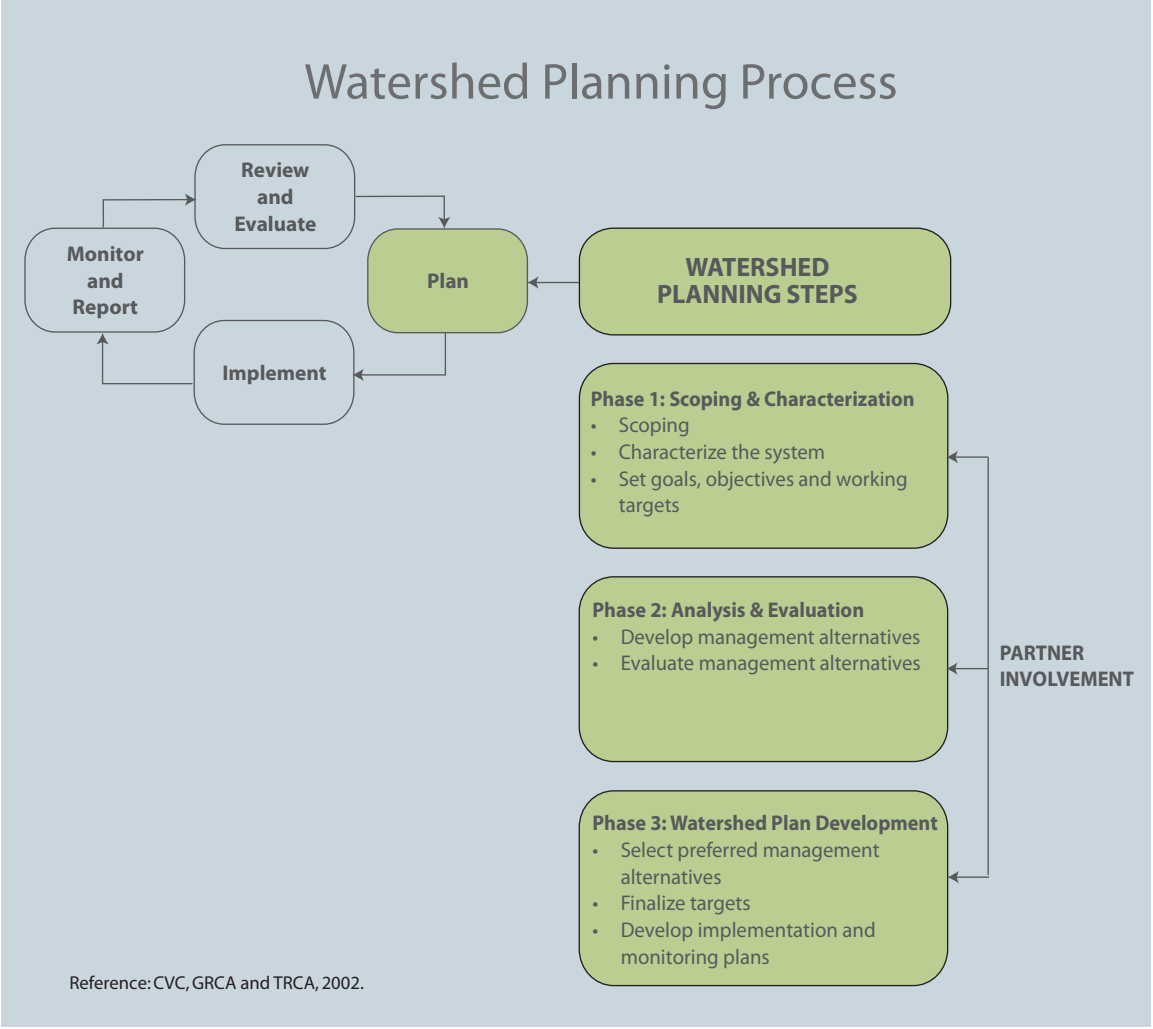
Rouge Watershed Task Force

Figure 1-2 illustrates how the watershed planning process is part of a continuous cycle of watershed management whereby a plan is prepared and implemented, progress is monitored, and the plan is updated. Thus the plan becomes a living document that will be revised in the future to reflect changing realities.

What's in this plan?

This plan begins with the principles, goals and objectives that have guided its development. A review of current conditions in the Rouge watershed provides a snapshot of key elements including geology and landform, water, aquatic and terrestrial communities, and human heritage and current activities. In Chapter 4, we consider possible futures under different land use and environmental management scenarios. Chapter 5 contains our management and implementation strategies. Our final conclusions outline the overall direction that the Task Force and its partners intend to pursue. The appendices include a list of reference materials, a glossary of terms, a list of Task Force members and a summary of recommendations.

Figure 1-2: Watershed Planning Process



Upper Rouge Valley, Richmond Hill

What's the bottom line?

Today, we find that the Rouge watershed is at a crossroads. Will the watershed continue to deteriorate as new development continues? Will it be possible to maintain existing conditions? Can we do even better, making improvements from existing conditions? You can help to achieve the latter– read on to see how.

CHAPTER

2

2.0 GUIDING FRAMEWORK

The guiding framework for this watershed plan comprises an overall goal, a set of principles, nine specific goals and 22 objectives for different aspects of the watershed. We have also developed targets for the objectives so that we can assess progress over time (see Appendix D).

> *Our overall goal is to work towards a healthy and sustainable Rouge watershed by protecting, restoring and enhancing its ecological and cultural integrity within the context of a regional natural heritage system.*

To achieve this goal, we have developed a set of nine principles that guide all our actions.

1. **Preserve the past:** We value linkages to the history and past uses of an area to help understand current conditions and to guide present and future actions.

2. **Protect and enhance the present:** Many previous and current human activities are causes of impaired conditions in the watershed; therefore we must critically evaluate and address their impacts.

3. **Plan for the future:** Our capability to see the past and present, identify our errors, learn from successes and decide how to change will allow us to sustain watershed values into the future.

4. **Adhere to broad ecological philosophies and adapt them to the watershed scale:** These include sustainable development, ecosystem management, ecological footprint, precautionary principle, carrying capacity, linkages, biodiversity, multi-dimensional management, the triple bottom line and net environmental gain.

5. **Make recommendations based on sound science:** Watershed agencies and partners should strive to develop scientifically defendable recommendations to assist in decisions about land use.

6. **Recognize the value of multi-interest partnerships:** This watershed plan establishes a common ground of goals, objectives and priorities that can be used by the Task Force and other

multi-interest partnerships to energize the activities of many individuals and groups across the watershed.

7. **Maintain attainable work targets and projects:** Each implementing group or individual should be able to achieve actions within their capability and be able to celebrate both individual and cumulative success (e.g. "I planted 75 trees", "our group planted 3000 trees" and "within the watershed 15,000 trees have been planted").

8. **Provide positive reinforcement that work is benefiting societal values:** At the watershed level, each improvement should be monitored for its contribution to watershed goals thus maintaining a sense of momentum and achievement among the partners.

9. **Recognize that education and knowledge are keys to the future of the watershed:** Public understanding and awareness of the health of the watershed are critical to reduce destructive behaviours and ensure that valued resources can be used and not diminished.

Our specific goals address:

- Groundwater
- Surface water
- Stream form
- Aquatic system
- Terrestrial system
- Air quality and climate change
- Cultural heritage
- Nature-based recreation
- Sustainable land and resource use

GROUNDWATER

Goal

Groundwater of sufficient quantity and quality to support ecological functions, aquatic habitats, native fish communities and sustainable human needs, including drinking water, agricultural, industrial, and commercial uses.

Objectives

1. Protect, restore and enhance groundwater recharge and discharge[1].
2. Protect, restore and enhance groundwater quality.
3. Ensure sustainable rates of groundwater use.

1 "Enhance" does not include increasing infiltration beyond natural background levels.

SURFACE WATER

Goal

Surface waters of a quality, volume and naturally variable rate of flow to

- protect aquatic and terrestrial life and ecological functions;
- protect human life and property from risks due to flooding;
- contribute to the protection of Lake Ontario as a domestic drinking water source;
- support sustainable agricultural, industrial, and commercial water supply needs;
- support swimming, fishing and the opportunity to safely consume fish; and
- contribute to the removal of Toronto from the Great Lakes list of Areas of Concern.

Objectives

4. Protect and restore the natural variability of annual and seasonal stream flow.
5. Maintain and restore natural levels of baseflow.
6. Eliminate or minimize risks to human life and property due to flooding and erosion.
7. Meet standards for body contact recreation at nearshore beaches and in the river.
8. Protect and restore surface water quality, with respect to toxic contaminants and other pollutants, to ensure protection of aquatic life, ecological functions, human health, and water supply needs.

STREAM FORM

Goal

Natural, stable stream channels, and corridors that allow for natural stream flow patterns, support diverse aquatic habitat, limit sediment loading, and protect human life, property and infrastructure from risks due to erosion and slope instability.

Objectives

9. Protect and restore natural channel morphology and stability.

AQUATIC SYSTEM

Goal

A healthy aquatic system that supports a diversity of native habitats and communities and provides sustainable public use opportunities.

Objectives

10. Protect, restore and enhance the health and diversity of native aquatic habitats, communities and species.
11. Provide for sustainable fishing opportunities and the safe consumption of fish.

Rouge River

TERRESTRIAL SYSTEM

Goal

A healthy terrestrial system that supports a diversity of native habitats and communities, a more natural watershed hydrology, cleaner air, and sustainable public use opportunities.

Objectives

12. Protect, restore and enhance natural cover to improve connectivity, biodiversity and ecological function.
13. Protect, restore and enhance terrestrial natural heritage system quality and function to minimize the negative influences of surrounding land uses.
14. Increase native terrestrial biodiversity.

AIR QUALITY AND CLIMATE CHANGE

Goal

Air of a quality that protects human health, natural ecosystems and crops, and does not exacerbate global climate change.

Objective

15. Protect and restore air quality.

CULTURAL HERITAGE

Goal

Recognition, preservation, and celebration of cultural heritage in the Rouge River watershed to increase awareness and understanding of human relationships with the environment.

Objective

16. Identify, document, protect and celebrate cultural heritage resources.

NATURE-BASED RECREATION

Goal

Opportunities for public enjoyment that are compatible with, and raise awareness of, the watershed's natural and cultural heritage.

Objectives

17. Ensure that recreation activities in the watershed are compatible with ecological and cultural integrity.
18. Provide opportunities for a variety of appropriate public uses and experiences in representative natural and cultural landscapes.
19. Develop a continuous trail network linking Lake Ontario to the Oak Ridges Moraine, with connections to local communities, neighbouring watershed trails systems, and natural and cultural heritage features.

SUSTAINABLE LAND AND RESOURCE USE

Goal

A healthy watershed with a mosaic of land and resource uses (at watershed and community scales) that are compatible with the protection and improvement of ecological health. Land and resource uses include: Rouge Park, urban and rural settlements, agriculture, golf courses, aggregate extraction, and transportation and utility corridors.

Objectives

20. Practice sustainable resource use by individuals, households, businesses, institutions and governments.
21. Improve sustainability in urban form at building site, community and watershed scales.
22. Protect agricultural lands for food and crop production and as a vital component of the watershed landscape, by sustaining a viable agricultural industry.

CHAPTER

3

3.0 CURRENT CONDITIONS AND ISSUES

3.1 WATERSHED PERSPECTIVE

A watershed is a complex system whose health depends on the proper functioning of all its parts, as shown in Figure 3-1. Climate and geology are its foundations, regulating the amount and distribution of both surface and ground water and the types of vegetation in the watershed. The movement of water, as well as the energy and chemicals it contains, affect the shape and size of creek and river channels and their associated floodplains. Different communities of plants and animals live where there are suitable aquatic and terrestrial habitats. While people depend on the resources of the watershed, their activities result in changes to all aspects of the system.

For several millennia after the last ice age, vast tracts of forest, interspersed with wetlands and meadows, dominated the Rouge River watershed. First Nations people used the rich resources of the area, but major conversions of land did not begin until the arrival of European settlers in the early 19th century. They altered the original landscapes, clear-cutting forests for timber and farms, draining wetlands, installing dams for power and building settlements. Major shifts in plant and animal communities followed. Over the last 50 years, much of the farmland and many rural settlements have been displaced by urban development, particularly in the south and west portions of the watershed. Natural habitats have been further reduced and fragmented, hydrological patterns have changed, and additional species of plants and animals have disappeared from the watershed, while others that thrive in disturbed areas have survived.

The land use in the Rouge watershed today is approximately 40% rural, 35% urban, 24% natural cover and 1% open water. The lower watershed is dominated by Rouge Park, with a small but well established area of urban development to the west. The middle and western parts are experiencing rapid urban expansion and have sparse natural cover except in Rouge Park. The upper and eastern portions of the watershed are primarily rural and agricultural with some small towns and villages.

The following descriptions of current conditions, relationships and issues in the Rouge watershed are based primarily on results of studies undertaken between 2002 to 2005, and are provided in

more detail in the *Rouge River State of the Watershed Report*, 2007. They are presented in three sections: physical conditions, biological conditions and social conditions.

Figure 3-1: Watershed Connections

3.2 PHYSICAL CONDITIONS

3.2.1 CLIMATE

The Rouge watershed, like other portions of southern Ontario, experiences a continental climate, moderated by the Great Lakes. The watershed is influenced by warm, moist air masses from the south and cold, dry masses from the north. It experiences a wide range of weather conditions throughout the course of an average year. Summer days are characterized by highs that usually reach the mid to upper 20s (degrees Celsius) but also include days that reach the low or mid 30s. During the winter, daytime highs normally fall a few degrees below 0 Celsius, but can also be much warmer (above 10 degrees) or colder (the record for the watershed is -36 degrees recorded in 1981).

In an average year, precipitation in the watershed typically ranges from 840 – 870 mm. Snowfall accounts for about 15% of annual precipitation. The Oak Ridges Moraine (described below) influences precipitation in the northern portions of the watershed, such that when air masses moving inland from Lake Ontario reach the higher ground surfaces of the Moraine, they are forced to rise causing precipitation. Lake Ontario also influences local climate. For example, storms tracking along the Great Lakes can bring higher amounts of precipitation to the southern portions of the watershed. Lake Ontario can also moderate temperatures from 5 – 10 km inland, decreasing summer temperatures and increasing the number of frost free days. This allows for the growth of plant species, such as the Carolinian species present in the Rouge watershed, that otherwise occur at lower latitudes.

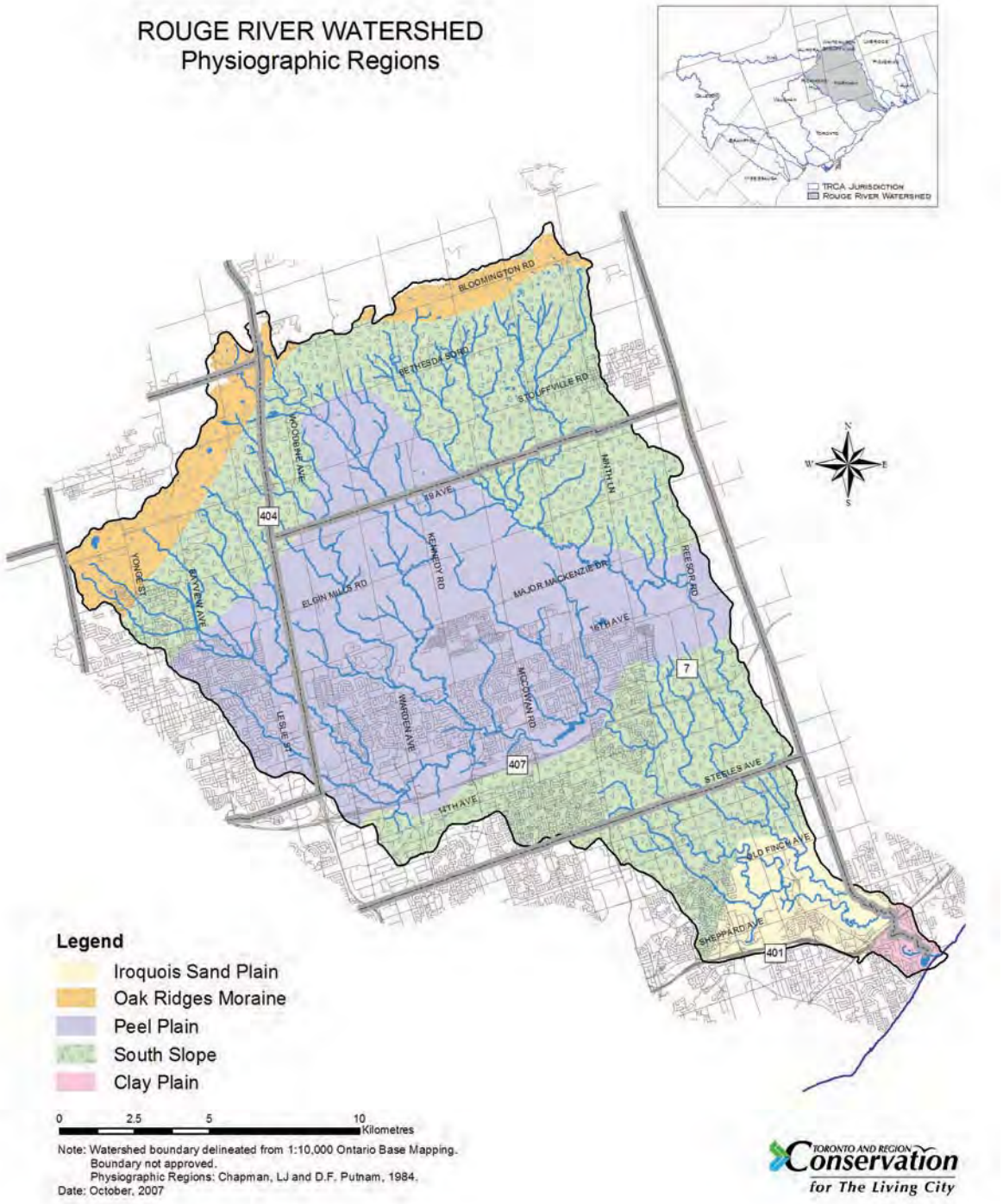
3.2.2 GEOLOGY AND LANDFORM

Many characteristics of the Rouge watershed are influenced by its geological foundations and associated landforms (physiography). The York-Peel-Durham-Toronto Groundwater Management Study provides an excellent knowledge base of the geology, landforms and their role in the watershed that was not available even five years ago. The major physiographic regions in the Rouge watershed are shown in Figure 3-2 and include: the Oak Ridges Moraine (ridge of sand and gravel), South Slope (a gently sloping glacial till plain), Peel Plain (a flat silty clay former lake bottom), and Iroquois Plain (former lake bottom).The shale bedrock beneath the Rouge River watershed is approximately 440 million years old. In several locations, most notably in the lower branches of the Main Rouge River and Little Rouge River, it is exposed by channels that cut down to the bedrock surface.

Successive layers of sedimentary materials were deposited over the bedrock by various processes (glacial, fluvial and lacustrine) in the Quaternary Period over the past 80,000 years. For example, the sand and gravels that compose the Oak Ridges Moraine were deposited approximately 12,000 years ago at the meeting place of two glacial lobes, the Simcoe Lobe to the north and the Lake Ontario Lobe to the south. The South Slope is composed primarily of till deposited by glacial ice and is a mixture of materials ranging in size from clay particles to boulders. Former glacial lakes resulted in deposits of silt and clay that retain water and create suitable conditions for wetlands, most of which have been drained for agriculture or urban development.

A second prominent landform in the Rouge watershed, south of Finch Avenue, is an escarpment representing the shoreline of Lake Iroquois, an ancestral lake formed approximately 10,000 years ago when lake levels were up to 60 metres higher than at present. The Iroquois Plain south of this shoreline consists of deposits of nearshore beach sands and gravels, and silts and clays that were laid down in deeper water.

Figure 3-2: Physiographic Regions



3.2.3 GROUNDWATER

Groundwater is vital to the healthy functioning of a watershed because it provides a constant source of clean, cold-water to lakes and streams. We estimate that in any given year about 40-60% of stream flow in the Rouge River and its tributaries comes from groundwater. Another important role of groundwater is water supply, with approximately 12,000 people in the watershed relying on wells.

The highly permeable sands and gravels and hummocky topography associated with the Oak Ridges Moraine provide ideal conditions for significant groundwater recharge, with infiltration rates as high as 300 mm/year (about 40 percent of the annual precipitation). In addition, the sand and gravel deposits associated with the Lake Iroquois shoreline are important for local recharge, with infiltration rates estimated at about 200 mm/year. The portion of the shoreline nearest Lake Ontario is a local discharge area, where upward gradients from the deeper aquifers can result in significant discharge. However, the Iroquois shoreline is much less extensive in the Rouge than in neighbouring watersheds due to the narrowness of the watershed where this feature crosses in a roughly west-east direction.

Water Cycle

The water cycle refers to the pathways and storage of water in various parts of the ecosystem. Precipitation in the form of rain or snow may follow one of three pathways. It can infiltrate into the ground, contributing to the recharge of groundwater aquifers and may emerge later as discharge into springs or streams. It can be returned into the air as water vapour by evapotranspiration from ground, buildings, plants and other surfaces. The remainder runs over the ground as surface runoff (stormwater) and finds its way into storm drains or watercourses.

Urbanization removes natural vegetation that would otherwise intercept, slow down and return water to the atmosphere. Grading eliminates natural depressions that capture and store surface water. Roads and buildings create impervious surfaces that prevent infiltration.

The increased surface runoff from urban areas results in a chain of effects in watercourses including higher peak flows and velocities, increased flood risks, stream bank erosion, degraded aquatic habitats, poor water quality and warmer water temperatures. Reductions in groundwater recharge limit the supply of water to aquifers and reduce the contributions of groundwater discharge to streams.

Further south, the silt and clay deposits of the Lake Iroquois plain are less permeable, and also have a large proportion of impermeable surfaces due to extensive urbanization, resulting in recharge rates of less than 100 mm/year. Although recharge on the South Slope and Peel Plain is also generally less than 100 mm/yr, these two physiographic regions cover about 80% of the watershed. They represent a vitally important contribution to groundwater supply that should be protected.

There are four major aquifer systems in the Rouge watershed: the Shallow System, Oak Ridges Moraine Aquifer, Thorncliffe Aquifer and Scarborough Aquifer (see Figure 3-3). Groundwater flow within the aquifers is predominantly south to southeast towards Lake Ontario. As shown in Figure 3-4

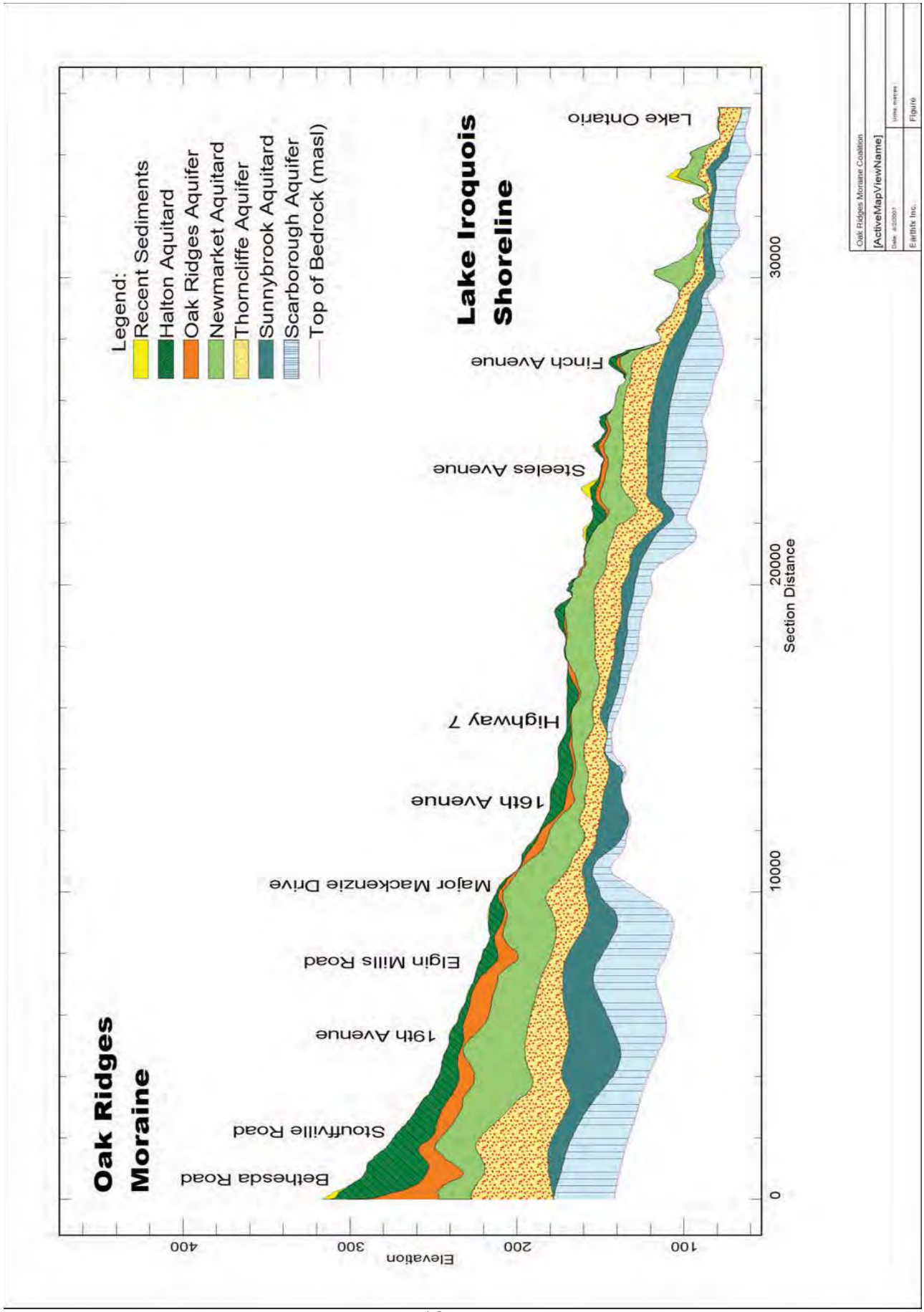
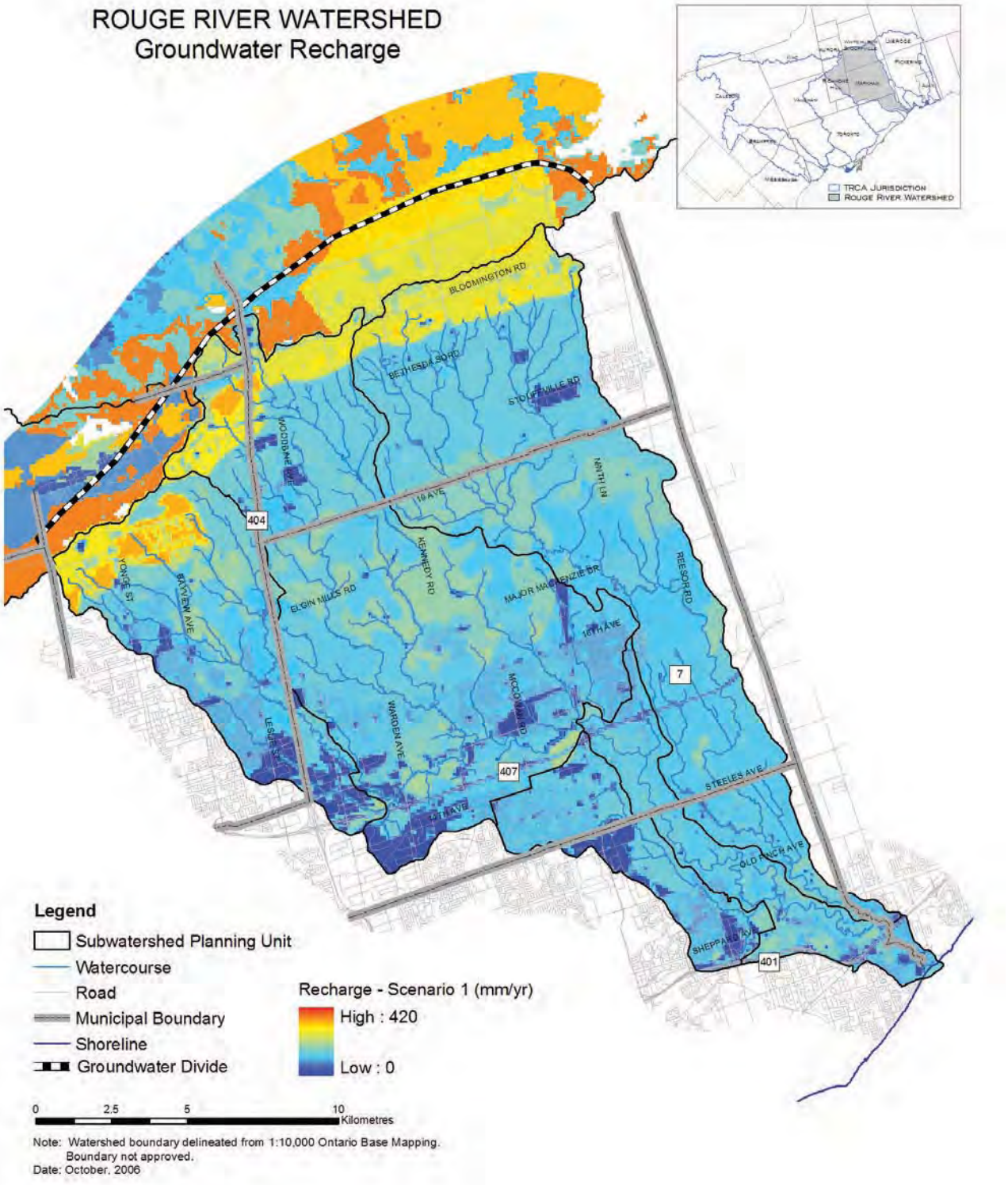


Figure 3-3: Geologic Cross Section of Major Aquifers

Figure 3-4: Groundwater Recharge



the groundwater divide does not completely coincide with the surface drainage divide (i.e. the watershed boundary). This is most significant to the north of the Rouge watershed divide, where recharge areas in the East Holland watershed supply groundwater to the Rouge River and its tributaries, and to the west of the Rouge watershed, where there are recharge areas in the East Humber watershed on the Oak Ridges Moraine. Land use decisions outside the Rouge watershed therefore have the potential to affect environmental conditions inside the watershed.

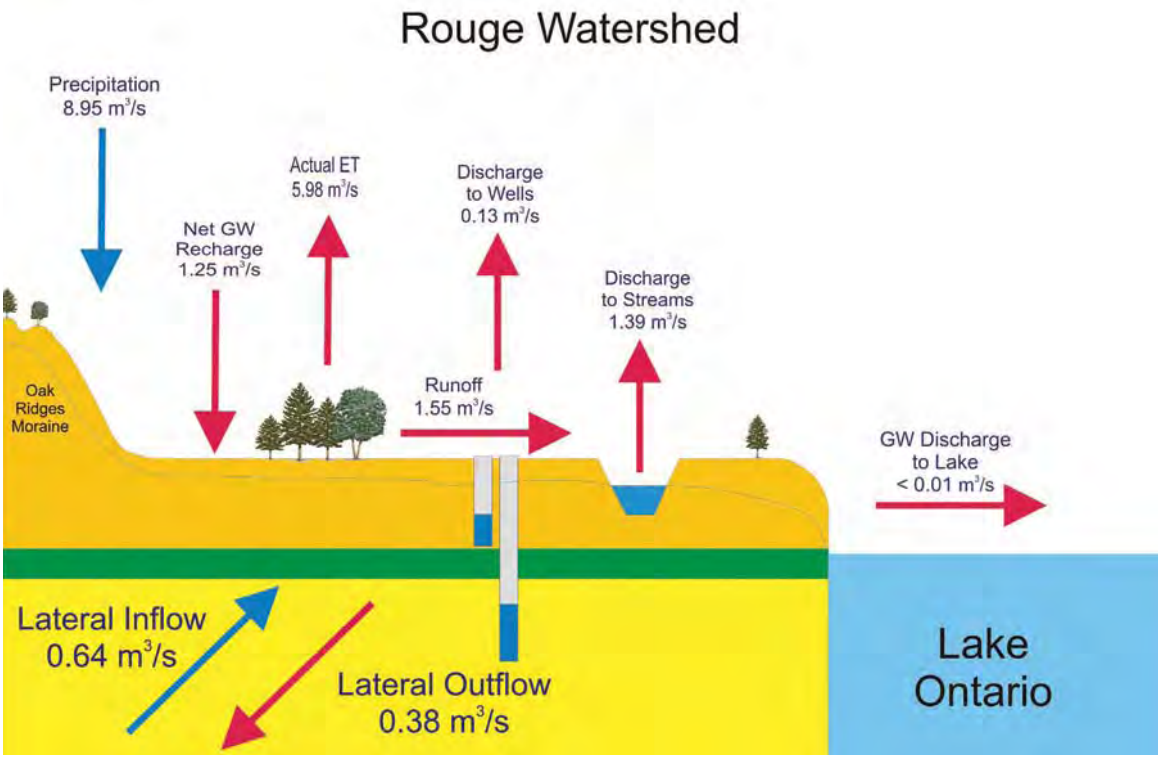
Urbanization has the potential to affect the functions of groundwater recharge and discharge areas. In recharge areas, an increase in impervious surface reduces the amount of rainwater and snowmelt that infiltrates into the ground, lowering water tables, unless mitigation measures are applied. In discharge areas, lowering of the water table and alterations to stream beds and wetlands may result in reduced groundwater contributions to watercourses. It is important to maintain both the pattern and volume of groundwater discharge especially where streams, wetlands and other vegetation and wildlife communities depend on this discharge.

Based on groundwater flow modelling to date, individual tributaries of the Rouge River receive from 40-80% of their total dry weather flow from the Oak Ridges Moraine Aquifer, with the greatest amounts in the northwest portion of the upper Rouge River, Bruce Creek and upper Little Rouge River. Reverse particle tracking analysis suggests that some tributaries, notably upper Robinson, upper Morningside and upper Main Rouge, receive most of their groundwater inputs from local shallow groundwater recharge sources, instead of the deeper, regional flow system.

Groundwater discharge sustains baseflow in headwater streams

Dewatering activities undertaken along Ninth Line and 16th Avenue to facilitate the construction of the York Durham Sewer System since 1999 have reduced water levels in the Upper (Oak Ridges) and Middle (Thorncliffe) Aquifers within an 8 km radius of that intersection, although groundwater levels have been recovering since the dewatering rates were reduced in 2006.

Figure 3-5: Water Budget (2002 Conditions)



Notes:
m3/s = m3/second; Time period = average over the year; ET = evapotranspiration;
GW = groundwater

Figure 3-5 presents the watershed's water budget, which summarizes the components of the water cycle on an average annual basis, accounting for both natural elements and human activities. Appropriate management of this water balance is important to sustain biological systems, ensure safe flow regimes and protect water supplies. Critical concerns are the potential impacts on recharge, groundwater levels and runoff that may result from urban development, water withdrawals and climate change.

Groundwater quality in the Rouge watershed is generally good, but high concentrations of iron, methane (in local areas) and other naturally occurring substances have been found in the Middle and Lower Aquifers. In addition, localized exceedances of nitrates and chlorides (from nutrients and road salt respectively) have been reported, particularly in the shallow system. These groundwater quality conditions are being assessed further as part of the TRCA's Source Water Protection program.

Summary of Key Issues

- Significant groundwater recharge from outside the Rouge watershed (East Holland and East Humber watersheds)
- Urbanization has the potential to reduce recharge, resulting in lowering of groundwater levels in aquifers, reduced discharges to streams and potential shortages of local well water supplies
- Loss of discharge (along streams, on flanks of Oak Ridges Moraine and Lake Iroquois Shoreline)

Rouge River

3.2.4 SURFACE WATER QUANTITY

The Rouge watershed has two main branches – the Main Rouge River and Little Rouge River. The Main Rouge is fed by six additional major tributaries, whose headwaters are in the South Slope of the Oak Ridges Moraine (see Figure 1-1).

The Main Rouge subwatershed already has a significant amount of urbanization, resulting in approximately 18% impervious cover. There has been a statistically significant upward trend in average annual flows, with an average increase of 1.3% per year since 1962. This can be attributed in large part to the change in runoff from increased impervious surfaces associated with urban development and not to climate variability, as similar trends are observed in other urbanizing watersheds and subwatersheds in the TRCA jurisdiction but not in rural ones. The trend to urbanization is continuing, particularly in Richmond Hill and Markham. Conditions in Beaver Creek, the Main Rouge River and Morningside Creek are already highly impacted by existing urban land uses. The middle tributaries (Carlton, Berczy, Bruce, Eckardt and Robinson Creeks), where the next wave of urbanization is occurring, are starting to show similar degradation, including increased stream bank

Annual Flows

Main Rouge at confluence with Little Rouge: average - 2.2 m^3/second; daily - 195,000 m^3/day; annual - 70,000,000 m^3/year.

Little Rouge at confluence with Main Rouge: average -1.25 m^3/second; daily - 110,000 m^3/day; annual - 40,000,000 m^3/year.

Left: Water withdrawal for irrigation. Right: Stormwater Management Pond in Headwaters Park, Richmond Hill

erosion and potentially greater flood risks. In contrast, about 2% of the Little Rouge River watershed is impervious, and it still has the hydrological characteristics of a rural watershed with more stable flow and longer time to peak flows after rainfall.

Ground and surface water supplies are used for a variety of purposes. The greatest volumes are withdrawn by aquaculture (35% of known total annual withdrawals by all water takers), golf courses (24%), municipal drinking water (22%) and industries (10%). Most of the water withdrawn is regulated by Permits to Take Water (PTTW) issued by the Ontario Ministry of the Environment. However the magnitude of impacts on baseflow (reductions of up to 150% were measured in upper reaches of the Little Rouge River in both 1997 and 2002) and concerns about the cumulative effects from many water takings suggest that the criteria and conditions of PTTW need to be reviewed. Furthermore, a 2003 study showed that a few large-scale users and many smaller water takers were operating without permits, although a recent upsurge in permit applications may have changed this situation. TRCA is conducting further analysis of the sustainability of these takings as part of a more detailed water budget study for the source water protection initiative. As opportunities arise, TRCA is also encouraging water users to seek alternate sources or move to a fixed intake system that prevents water takings below critical baseflow levels.

Approaches to managing the increased surface runoff resulting from urbanization vary throughout the watershed. For the most part surface runoff from urban areas south of Steeles Avenue during rainstorm events is relatively uncontrolled. Since the late 1970s, developments in the watershed have incorporated stormwater management ponds, initially for flood control. In the early 1990s, there was a shift to facilities that provide water quality and erosion control in addition to quantity control. However, monitoring of environmental conditions shows that this infrastructure is not adequate to protect the river system from negative impacts. For example, recent studies of Eckardt Creek show that even with state-of-the-art stormwater ponds, development has destabilized the

Stormwater controls

In the urban areas in the Watershed, approximately:

- 20% have no stormwater controls
- 10% have water quantity controls (typically dry ponds)
- 60% have water quantity and quality controls

See Figure 3-6

natural channel structure, indicating that we need to control the volume of surface runoff at source and retain a more natural water balance by ensuring sufficient infiltration and evapotranspiration.

Much of the stormwater management infrastructure in the watershed has been in place for several decades and probably requires maintenance or upgrade so that it can continue to function as designed or to incorporate new standards. For example, stormwater quality ponds typically have a design life of 10-15 years, after which the original designs assumed that the accumulated sediment would be removed. As many of the ponds in the area are at or approaching this age, they are in need of inspection to determine if they need maintenance.

Many urban areas in the Rouge watershed are vulnerable to significant flood risks, because they were developed prior to the implementation of regulations that keep development and infrastructure out of the flood plain. Figure 3-7 shows flood vulnerable areas (generally historic development) and flood vulnerable roads (generally due to under-sized culverts). New development, redevelopment or site-specific flood remediation works offer opportunities to reduce flood risk in these areas.

The major exception is some of the historic areas of Markham that were developed prior to flood plain planning regulations. These areas are subject to flooding from the regional design storm (and in some cases more frequent events) and require careful management of development within them as well as upstream, to minimize risks to life and property. A number of areas adjacent to the Main Rouge River between Warden Avenue to McCowan Road, as well as connecting areas adjacent to Bruce and Fonthill Creeks, are designated as Special Policy Areas (SPAs). SPAs are portions of a community that have historically existed in the flood plain, and are intended to provide for the continued viability of existing uses, provided there is compliance with site-specific flood hazard management policies such as flood-proofing, flood remediation and risk reduction measures. There was also historic development in the lower Rouge Valley in Toronto, and while some flood vulnerable properties remain, many of the flood plain lands were acquired in response to recommendations of TRCA's 1957 Flood Control Program. These extensive public valley lands provided a basis for the formation of Rouge Park.

Summary of Key Issues

- Continued urbanization is increasing surface runoff, total flow volumes, watercourse instability and erosion
- Water taking disrupts low flow conditions
- Flood vulnerable areas, especially in Town of Markham
- Stormwater management approaches vary throughout the watershed, with some areas receiving better controls of water quantity and quality than others
- Previous and current approaches to stormwater management are inadequate to protect healthy river systems
- Maintenance and upgrade requirements of existing stormwater management infrastructure

Figure 3-6: Stormwater Management Controlled Areas

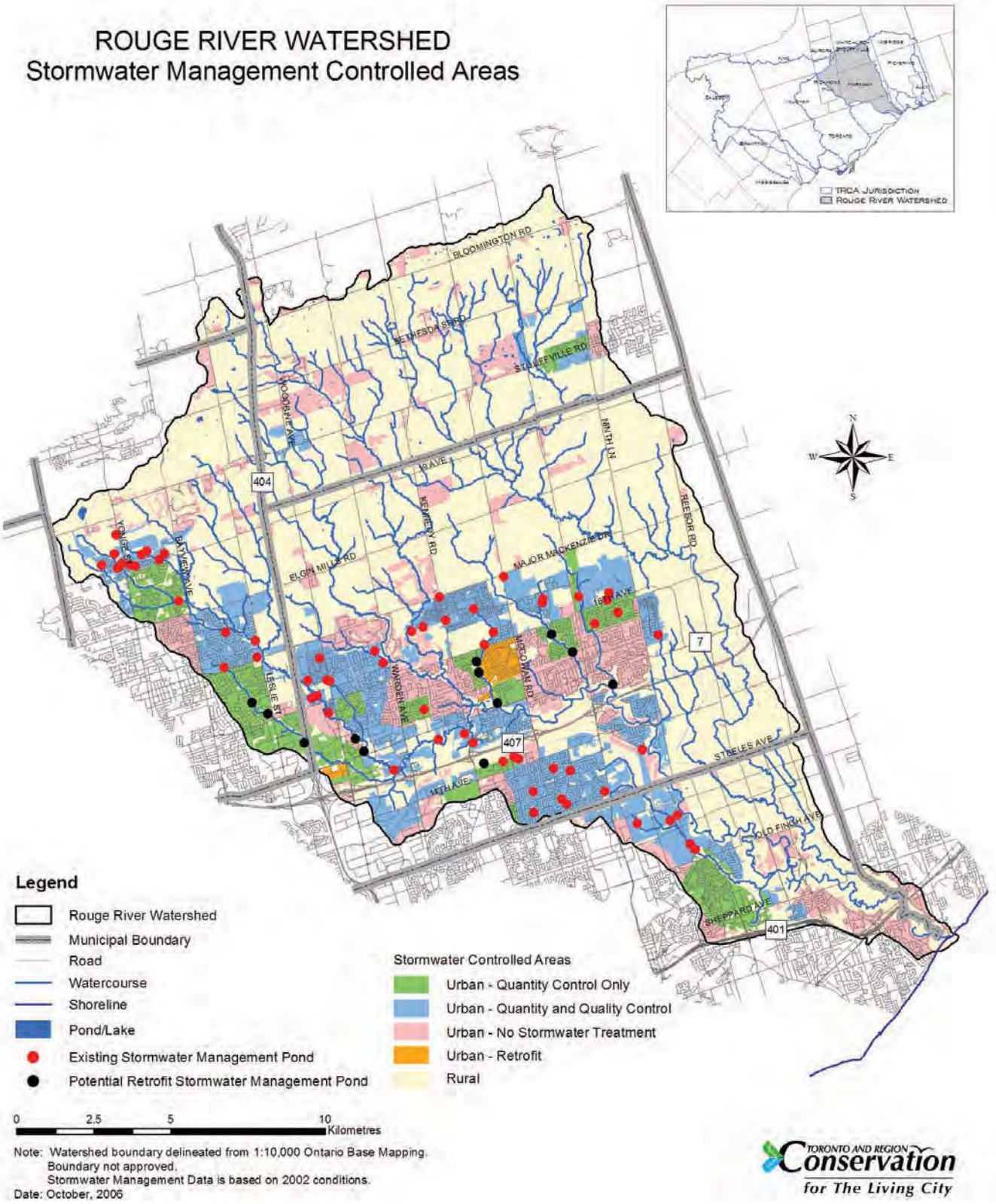
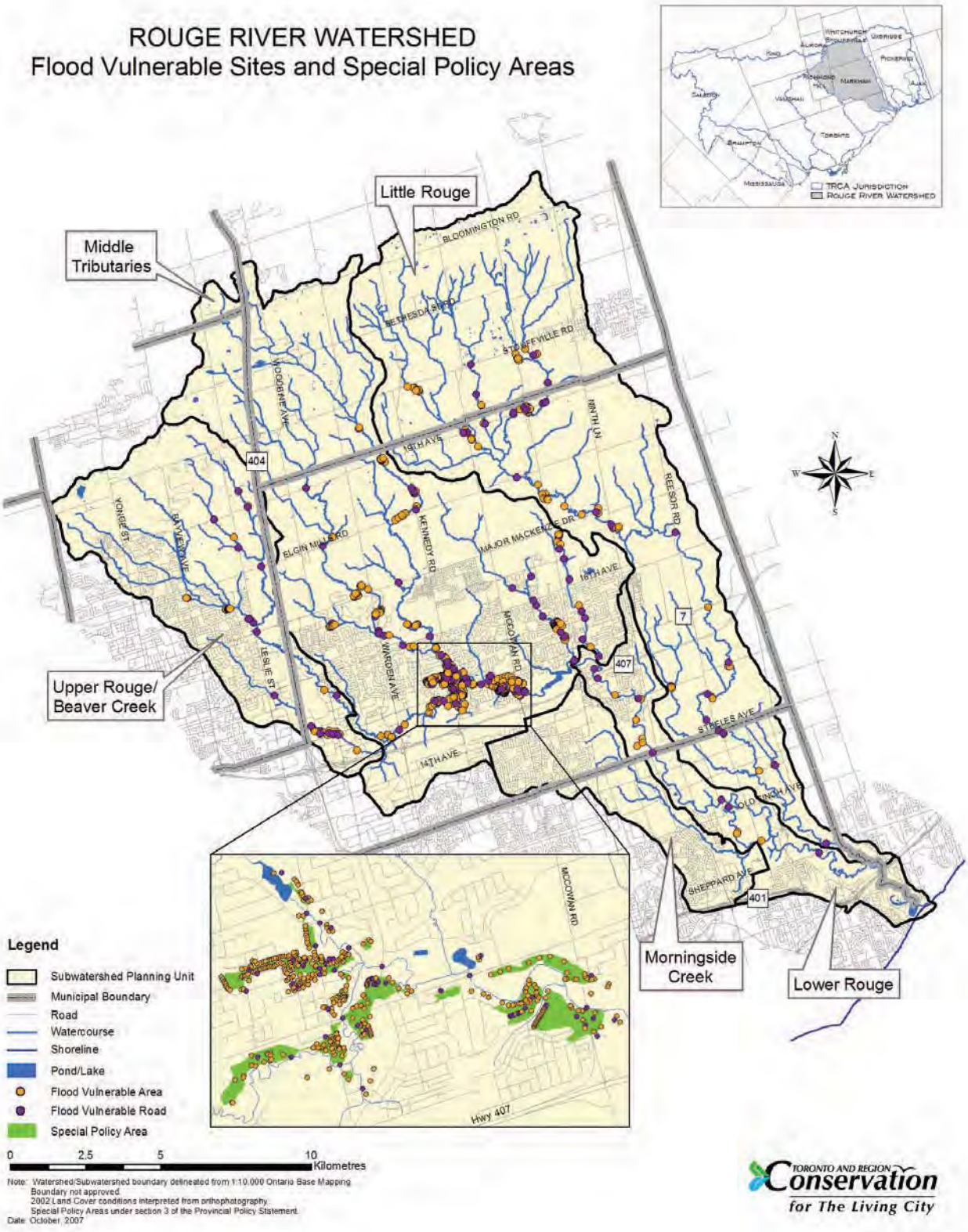


Figure 3-7: Flood Vulnerable Sites and Special Policy Areas



3.2.5 SURFACE WATER QUALITY

Overall, water quality in the Rouge watershed remains relatively clean, especially in contrast with other more urbanized watersheds such as the Don River and Highland Creek. Concentrations of only a few pollutants have increased since the 1970s whereas others have actually declined.

Chloride concentrations from road salt are increasing rapidly as urban development continues on the main branch of the Rouge. Current levels during the winter pose a threat to aquatic life in many parts of the watershed, especially downstream from high traffic areas. Unfortunately, current stormwater management practices do little to mitigate this issue because chloride is not removed by ponds and wetlands. Instead, this issue must be addressed by reducing the use of road salt, careful management of snow dump sites, and improved storage and handling practices. Infiltration is not generally recommended because it simply transfers chloride from the surface water system to groundwater.

Nutrient levels (particularly phosphorus) frequently exceed Provincial Water Quality Objectives across the watershed, due primarily to lawn and garden fertilizers, animal wastes, and farm runoff.

Concentrations of suspended solids, metals, phosphorus and nitrates increase dramatically during periods of wet weather due to runoff from urban and agricultural lands. In about 40% of the urban area, stormwater is discharged directly into the watercourses without water quality treatment. In newer urban areas, end-of-pipe stormwater quality treatment measures are provided.

Construction practices cause excessive erosion and sedimentation in streams in the watershed during the period of land disturbance, and the streams can take several years to recover. Eroded sediment particles can carry nutrients and other substances that are naturally found in the soil and that may have built up in the soil as a byproduct of intensive cultivation. Typical practices of land development in the Rouge watershed have often resulted in large concession blocks of soil being exposed at a given time. The current application of erosion and sediment control technologies and enforcement capability are inadequate to control this issue.

Bacteria levels in the Rouge River generally meet standards for body contact recreation in dry weather during most of the swimming season. However Rouge Beach is posted as unsafe for swimming during much of the season, suggesting that bacteria sources from local features (e.g. Rouge Marsh) and/or neighbouring waterfront areas may be affecting water quality. A microbial tracking study is currently being undertaken by the National Water Research Institute to investigate this issue.

Significant fluctuations in temperature have been found in the headwater portions of the watershed like the Upper Rouge, Berczy, and Bruce Creeks and Little Rouge River, where cold-water temperatures would be expected, due to the relatively high groundwater inputs to these watercourses. This suggests negative impacts resulting from on-line or stormwater ponds, lack of riparian vegetation, water-taking and/or development.

There are generally low levels of metals in the Rouge watershed. Levels of organics (e.g. pesticides, herbicides, polychlorinated biphenyls and polyaromatic hydrocarbons - PAHs) are generally low, but PAH concentrations still frequently exceed Provincial Water Quality Objectives, especially on the Main Rouge. PAH levels in other Toronto watersheds are considerably higher than those observed in the Rouge River. PAHs enter the watershed indirectly as by-products of combustion processes (e.g. vehicular exhaust, residential heating), and therefore invariably increase with urbanization. Concentrations above standards for DDT, PCBs and mercury have recently been detected in juvenile fish, indicating that they are bio-accumulating in the food chain.

There are no known direct discharges of industrial or municipal sewage effluents into the Rouge River.

Spills represent an unpredictable and often dramatic impact on the watercourses. Between 1988-2000 approximately 300 oil spills and 90 chemical spills were reported in the Rouge watershed, many of which drained to the River or one of its tributaries. Most of the oil spills occurred on major roads and the chemical spills were mostly associated with commercial plants, storage facilities and tanker trucks. However, many spills are not reported.

Overall, water quality is similar in the Main Rouge River and Little Rouge River. The main differences are that the Main Rouge typically has higher chloride and E. coli levels in its middle reaches, whereas the Little Rouge generally has higher nitrogen levels. Finally, it is important to recognize that because the Rouge River flows into Lake Ontario, water quality conditions in the River can affect those in the nearshore area. A more detailed assessment of the relationship between river and lake water quality is currently underway as part of the Western Lake Ontario loading study being conducted under the drinking water source protection program.

Rouge River water quality affects swimming conditions at Rouge Beach and Lake Ontario, our source of drinking water.

Summary of Key Issues

- Stormwater management measures in older urban areas are not adequate to protect Rouge River and tributaries from pollution and temperature fluctuations
- Need for maintenance of stormwater management infrastructure
- Poor land management practices (pollution, erosion and sedimentation) associated with urban development
- Elevated and increasing chloride levels may threaten aquatic life
- Continued occurrence of spills

3.2.6 STREAM FORM

Stream form refers to the physical form of rivers, creeks and floodplains. The urbanized portions of the Rouge watershed and the watercourses within and downstream from them, have experienced significant changes due to increased runoff and stream flows that increase rates of erosion. This in turn leads to widening and deepening of the channels, pollution of the water by eroded soil materials and increased sediment loading downstream. As stream bed and bank sediments are scoured away or altered by deposited sediment, bank vegetation washes away. The unstable banks prevent new vegetation from becoming established, and the channel bed and banks lose the variety of natural physical habitats needed to support many aquatic species. Many river and stream channels in the watershed have already enlarged by up to 50% and evidence suggests that this enlargement will continue for decades. A recent study of Eckardt Creek, plus experience in other watersheds, suggest that even current state-of-the-art stormwater management measures for urban development are largely ineffective in controlling these impacts on stream form.

Left: Erosion threatens infrastructure in Markham (Photo credit: Aquafor Beech Ltd.). Right: Eroded sediment contributes to poor water quality and degraded aquatic habitat

Summary of Key Issues

- Unnaturally high rates of erosion
- Lack of channel stability
- Habitat degradation

3.2.7 AIR QUALITY AND CLIMATE CHANGE

Vehicle emissions are a primary source of air pollution

In 2001, the Air Quality Index for 3 monitoring stations in and near the Rouge watershed was "good" to "very good" 93% of the time. However the number of smog advisory days has been increasing, and 9 advisories affected 18 days in 2002, primarily due to elevated ground-level ozone and fine particulates. In addition to the impacts of smog on human health, excessive ground-level ozone compromises the health, vigour and production of native vegetation and agricultural crops.

York Region residents commute longer distances to work than the average Ontario resident. As with the rest of the GTA, local air quality is influenced not only by local transportation, but by industrial emissions from as far away as the U.S. Vehicle emissions are a primary source of a broad range of pollutants, including greenhouse gases that contribute to global climate change. Our weather is expected to become generally warmer and wetter, seasonal rainfall patterns may be altered and extreme weather events may be more frequent. Higher temperatures will increase evaporation from surfaces and transpiration by plants, resulting in a greater need for water. Natural systems will be stressed as species are forced to adapt to the new changes, die or migrate. Infrastructure, such as pipes and bridges, may not be big enough to convey the expected large flows of water, resulting in costly damage and localized flooding. The current state of the aquatic and terrestrial systems in the Rouge watershed is not considered resilient enough to adapt to these changing future conditions and our ecological restoration strategies will need to take future climate into account.

With anticipated population growth to the north and east of regional employment centres more commuters will travel through the Rouge watershed, especially on Highways 401, 404 and 407. The growth in traffic volumes will result in higher emissions of air pollutants and greenhouse gases.

Summary of Key Issues

- Increasing ground-level ozone and smog days
- Implications for human health, native vegetation and agricultural crops
- Contribution of greenhouse gases to climate change
- Effects of climate change on natural systems and implications for infrastructure

3.3 BIOLOGICAL CONDITIONS

3.3.1 AQUATIC SYSTEM

The aquatic system in the Rouge watershed is still healthier than many others in the GTA because it continues to support a high quality headwater system, diverse habitats and associated native species. Surveys conducted from 2001-2005 recorded at least 167 benthic invertebrates and 54 species of fish, including 7 introduced species. Two of the fish species are target species for the Rouge watershed: brook trout and redside dace (a Federal "species of special concern" and Provincial" threatened species"). Figure 3-8 illustrates the fisheries management zones and target species.

There are three broad categories of aquatic system in the Rouge watershed:

1. A cold-water system in the headwaters.
2. A gradient of cool- to warm-water conditions in middle sections of the watershed.
3. A warm-water system in the Little Rouge and lower reaches of the Main Rouge.

The groundwater regime is a key factor in explaining existing aquatic habitats in the Rouge watershed. Both local and regional groundwater sources (i.e. the Oak Ridges Moraine) help to maintain the relatively good quality cold-water habitat in the headwaters. Figure 3-9 shows pathways and sources of groundwater recharge necessary to support discharge to reaches with cold-water aquatic communities.

Target species

Target species are those that are the most sensitive to change. Management of the aquatic system to ensure their survival will also ensure the health of the rest of the aquatic community.

The cool-water reaches appear more reliant on local groundwater than on regional sources, in particular in Robinson Creek and Morningside Creek. Although the mid to lower reaches of the Little Rouge are largely warm-water, there are two small, cool- and cold-water tributaries that appear to have local groundwater inputs (Katabakonk Creek and an unnamed branch joining the Little Rouge near Elgin Mills Road, respectively).

Brook trout

Redside dace

Fish Management Zone
A geographic area that has relatively homogeneous hydrogeological characteristics and ecological functions, and supports a characteristic fish community.

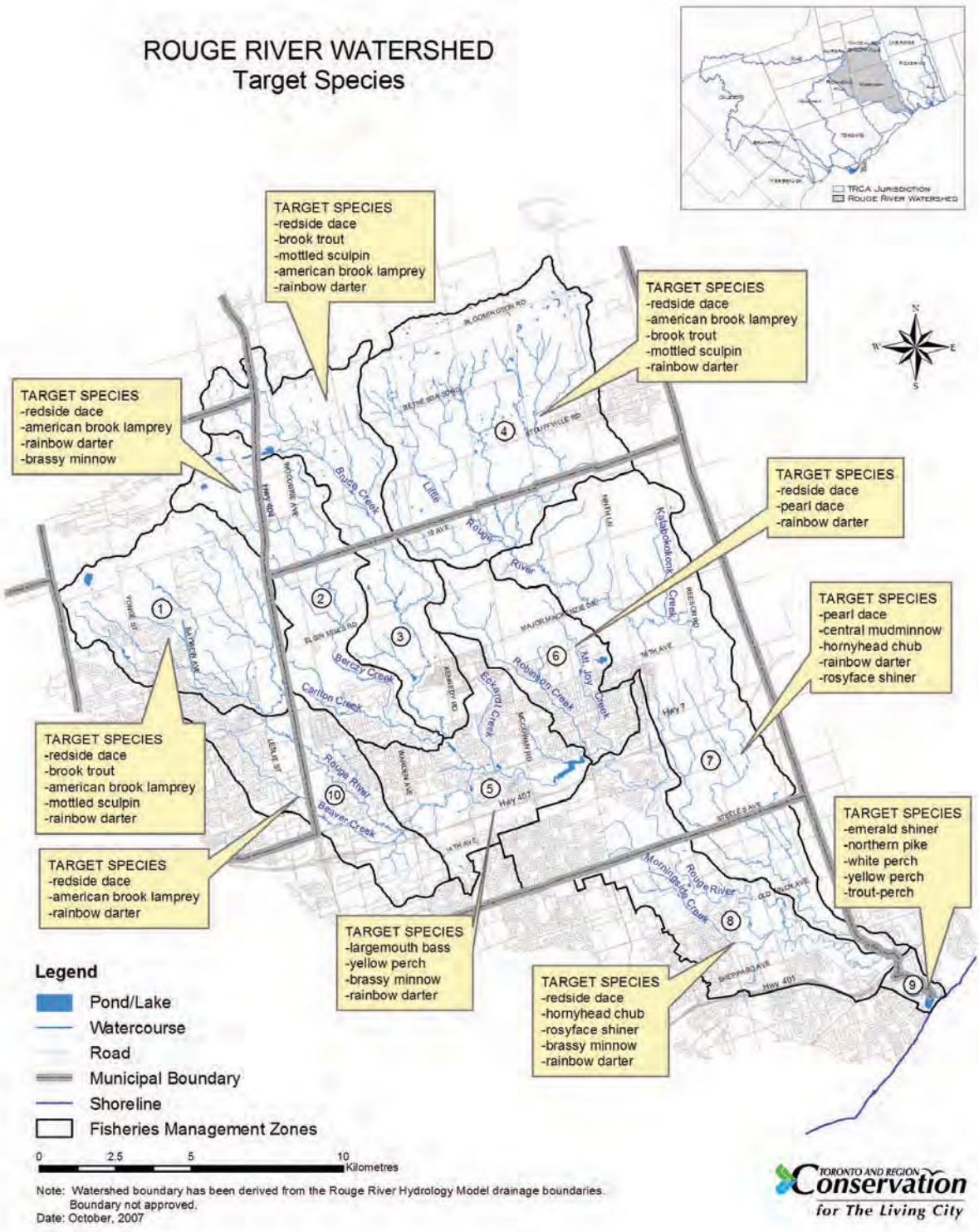
Approximately two thirds of existing groundwater enters the system via small streams. Not surprisingly, these are the prime locations for healthy populations of brook trout and redside dace.

We consider the warm-water fishery in the Little Rouge to be stable and still quite diverse despite the recorded decline in historic species. Of some concern are the low flows that characterize the Little Rouge, even in the lower reaches.

In comparison to the upper reaches, stream habitat degradation becomes a greater concern in the mid to lower parts of the watershed. Cumulative impacts from upstream development result in reductions in groundwater recharge, loss of cold-water discharge to streams, thermal instability, increases in peak flows and bank erosion. The populations of redside dace that are considered most at risk occur in these areas of cumulative impact (Lower Main Rouge and Morningside Tributary - FMZ 8).

High quality aquatic habitat and streamside vegetation

Figure 3-8: Fisheries Management Zones



FMZ 1 – Upper Main Rouge River
FMZ 2 – Berczy Creek
FMZ 3 – Bruce Creek
FMZ 4 – Headwaters of the Little Rouge River
FMZ 5 – Central Main Rouge River
FMZ 6 – Robinson Creek and Mt. Joy Creek
FMZ 7 – Mid to Lower Reaches of the Little Rouge River
FMZ 8 – Lower Main Rouge River & Morningside Tributary
FMZ 9 – Mouth of the Rouge River & Estuary
FMZ 10 – Middle Reaches of Main Rouge River

Figure 3-9: Groundwater Recharge Sources for Coldwater Reaches

Aquatic invasive species, particularly the rusty crayfish, are also found throughout the lower watershed. Round goby has been confirmed within the watershed south of Highway 2; the lower reaches being the most vulnerable to initial invasion. Carp have been found in the larger ponds (e.g. Milne and Toogood). Management efforts include dredging, reduction of large aquatic plants and carp removal. Sea lamprey are controlled with lampricide applications. These invasive species are a continuing issue for the coastal areas and mouth of the river, due to competition, parasitism, and predation of native species. In addition, carp create major impacts due to habitat destruction.

The Rouge River provides important habitat for the Lake Ontario fishery. Warm-water fish, such as pike, bass and emerald shiners, use Rouge Marsh and Estuary as spawning, feeding and nursery habitat. Migratory salmonids use the river to spawn – rainbow trout in the spring and chinook salmon in the fall. Migratory warm-water fish such as suckers and carp swim up the Little Rouge as far as Elgin Mills Road to spawn. Re-establishment of a self-sustaining salmonid fishery in Lake Ontario will require continued stocking of lake trout and Atlantic salmon in rivers until a critical population threshold is established.

There are many popular angling destinations in the watershed including the Rouge Marshes, Toogood Pond, Milne Reservoir, Little Rouge and Main Rouge River. The non-native brown trout and rainbow trout fishery is largely dependent on stocking rather than natural reproduction. There are consumption restrictions on smallmouth and largemouth bass caught in Rouge Marsh, and on salmon and trout from Rouge spawning runs, due to elevated levels of PCBs, DDT and mercury. The probable source of these contaminants is Lake Ontario, where river fish spend part of their life cycle. Sport fish in Milne Reservoir are considered safe to eat.

Index of Biotic Integrity scores are largely "unimpaired" in the headwaters and middle reaches. Scores reflecting "potentially impaired" and "impaired" are more frequent in the lower watershed, another indication of cumulative impacts.

Over 800 potential in-stream barriers, including stream crossings that could limit fish passage have been identified. Many of these contribute to habitat fragmentation and alteration, including velocity changes, warming of water temperature and changes to sediment movement. The habitat fragmentation caused by on-line ponds is particularly significant for resident brook trout and redside dace populations in the headwaters of Little Rouge River.

Index of Biotic Integrity

The IBI is a measure of the health of a watercourse based on fish and benthic invertebrate community characteristics and interactions.

Riparian, or stream-side, vegetation is essential to provide shade, reduce water temperatures, slow bank erosion, and contribute nutrients to aquatic ecosystems. Only 65% of stream length in the Rouge watershed has riparian vegetation, with only 38% of this being more desirable woody vegetation.

The Provincially significant Rouge Marshes form a unique habitat in the Rouge watershed, but have been altered significantly. Increased sediment inputs from upstream sources have reduced water depth and clarity. Water level controls in Lake Ontario have reduced the natural fluctuations necessary for a dynamic wetland ecosystem. The presence of large numbers of carp have increased turbidity and reduced aquatic vegetation. Rouge Park and its partners have undertaken extensive restoration of native vegetation and the area is now showing considerable improvement in habitat conditions. Blanding's turtles have now resumed breeding along the Rouge Marsh shoreline.

Summary of Key Issues

- Changes to the water balance affecting flows
- Habitat loss, fragmentation and degradation
- Loss of many native fish species
- Invasive non-native species
- Fish consumption restrictions

3.3.2 TERRESTRIAL SYSTEM

The Rouge watershed is situated at the transition between the Carolinian forest zone and the Great Lakes-St Lawrence mixed forest zone. Rouge Park is the only designated Carolinian Canada site in the Toronto area. Natural cover – forest, wetland, meadow, beaches and bluffs – covers about 24% of the Rouge watershed. This is a relatively high percentage in comparison with many other watersheds in the Greater Toronto Area, and the Rouge watershed makes an important contribution to the regional natural heritage system.

Forest habitat in the Lower Rouge Valley. (Photography © Andy McKinnon)

Natural Cover

Before European settlement, the Watershed was primarily forested with patches of meadow and wetland. Today, only 13% of the Watershed has forest cover, about 10% is meadow and less than 1% is wetland. Whereas the original meadow habitats were prairies, savannahs and sand barrens, today's meadows are mostly abandoned farm fields that include a mix of native and introduced herbaceous plants. Nevertheless they provide valuable wildlife habitats and are included in our definition of "natural cover".

Wetland (Photography © Andy McKinnon)

Terrestrial habitats are associated with the four broad regions in the watershed: the Oak Ridges Moraine, South Slope, Peel Plain and Iroquois Plain (see 3.2.2). The following descriptions include some of the highlights of each region. More detailed information is available in the *Rouge River State of the Watershed Report, 2007.*

Natural cover in the Oak Ridges Moraine forms three major clusters associated with the Jefferson Forest, Bloomington Wetland and the Little Rouge River headwaters. They feature some of the highest quality existing natural habitats in the Rouge watershed, including sandy meadows, mature sugar maple forests with small kettle wetlands, ponds surrounded by coniferous swamp, and dry coniferous plantations. These areas support several animal species of concern including wetland-dependent species such as sora, Virginia rail, wood duck, bullfrog, gray treefrog, woodfrog and the nationally threatened Jefferson salamander. Upland forest and meadow species of interest include ovenbird, vesper sparrow, red-shouldered hawk and the provincially rare burning bush. The kettle lakes, bogs and wetlands support many plants of concern, including fragrant water lily, coon-tail, leatherleaf, bog buckbean and cinnamon fern.

TRCA Species of Concern

Generally refers to species that are disappearing in the regional landscape, primarily as a result of land use changes, as further defined in TRCA's Terrestrial Natural Heritage System Strategy (2006).

The South Slope is sparse in natural cover but includes some relatively high quality valleyland in Rouge Park. It also includes the southern half of Jefferson Forest, most of the Simeon Forest Complex and the provincially significant Stouffville Marsh and Heise Hill Drumlin. Apart from these areas, most natural habitat on the South Slope is confined to relatively small patches of upland forest and riparian (stream-side) vegetation. They support a number of sensitive bird species including American woodcock, ruffed grouse,

Matrix Influence

The land use context for natural habitats is referred to as the matrix. It influences the value of the habitat to native species through such influences as predation, competition, disturbance and encroachment.

Fragmentation

Fragmentation of habitat patches into smaller units can affect movement of animals for breeding, hunting and migration; increase disturbance by humans and their pets; and reduce interior forest habitat needed by many sensitive species.

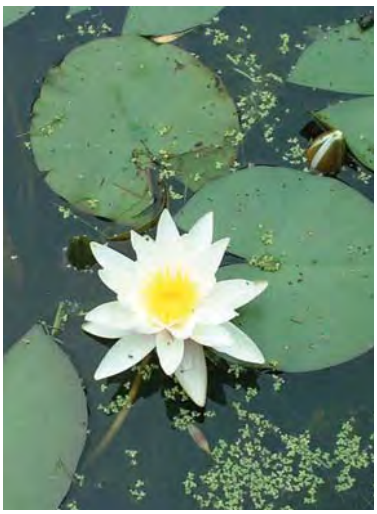
Groundhogs live in meadow habitat (Photography © Andy McKinnon)

Cooper's hawk, black-billed cuckoo and hooded warbler. Cedar swamps and meadow marshes include plants of concern including marsh pennywort, gold thread, golden saxifrage and the regionally rare one flower cancer root.

A notable feature in the Peel Plain is the provincially significant wetland, Robinson Swamp, home to naked mitrewort, wood frog, mink, Wilson's snipe and chimney crayfish. Among other species, the locally significant wetland at Milne Pond supports water arum, northern red-bellied snake, northern leopard frog and northern parula. Northern waterthrush and golden-crowned kinglet, both birds of concern, have been recorded at Bruce's Mill Conservation Area.

Gold thread

Pitcher plant



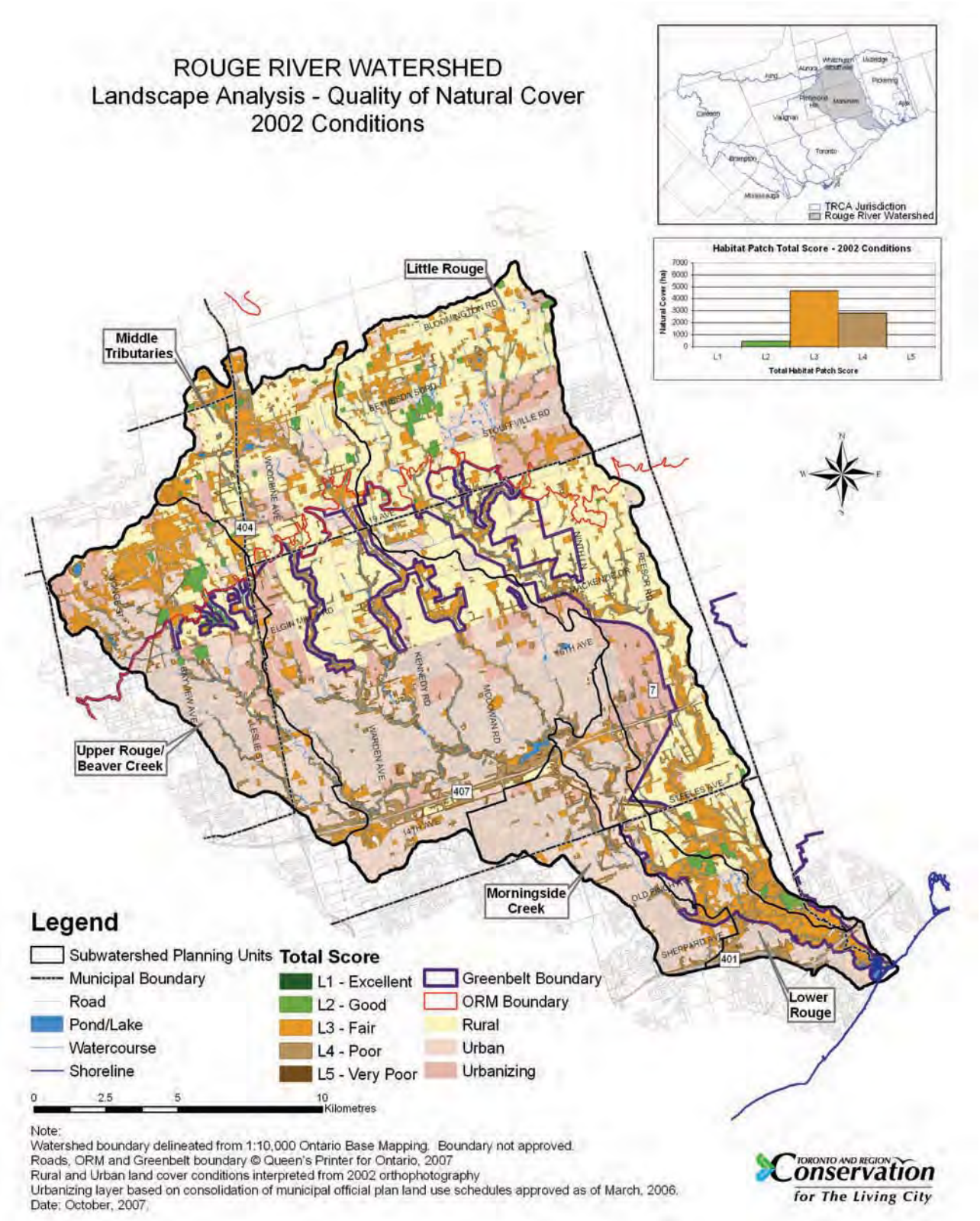
Fragrant water lily

Much of the Iroquois Sand Plain and Lake Ontario Shoreline are protected within Rouge Park, which includes extensive areas of mature mixed and deciduous upland and lowland forests, various types of wetland, savannahs and dry meadows. Plant species of concern include the provincially threatened ginseng and butternut and regionally rare white goldenrod. Animals of interest include veery, winter wren, pine warbler, scarlet tanager, northern flying squirrel, Blanding's turtle (a threatened species in Ontario) and red-backed salamander. The Rouge Beach supports sea rocket and bushy cinquefoil, both of which are plant species of concern.

Natural cover in most parts of the Rouge watershed is highly fragmented and poorly distributed. Unlike other watersheds in the Greater Toronto Area, natural cover is currently weighted towards the southern and eastern portion of the watershed. In the northern portions, natural cover is sparse due to agricultural land uses. Even on the Oak Ridges Moraine (ORM) where there are some larger forest patches, there is less natural cover than in other moraine watersheds such as the Humber and Duffins. Although the ORM Conservation Plan and Greenbelt Plan currently protect high quality natural areas in the ORM from development, recent surveys show that species losses may still be occurring, probably because of insufficient connections to other habitat patches and the rapidly urbanizing matrix to the south and west. Overall, current quality, distribution and quantity of natural cover are insufficient to support existing Rouge watershed communities and species in the long term (see Figure 3-10).

Scarlet tanager (Photography © Andy McKinnon)

Figure 3-10: Landscape Analysis – Quality of Natural Cover, 2002 Conditions



Mink (Photography © Andy McKinnon)

Interior forest habitat, at least 200 metres from the forest edge, is important because it is sheltered from impacts of adjacent matrix land uses. Many plant and animal species require this sanctuary from negative edge effects and/or they require large areas of territory. Only seven patches of natural cover remain in the watershed with interior forest greater than 200 metres from the forest edge. There are no patches with deep interior forest (greater than 400 metres from the edge). Rouge Park has the largest interior forest and meadow areas in the City of Toronto, and therefore has a greater diversity of habitats and plant and animal communities than is typical in urban watersheds south of Steeles Avenue.

Most habitat patches in the watershed have been rated "fair" in quality because of their small size, linear shape (typically along watercourses) and highly urbanized surroundings. The few high quality habitat patches remaining are generally vulnerable to changes in hydrology, pollution, refuse dumping, recreational pressures, invasive species and predation by pets. Unless the system is expanded and improved, these areas of higher quality are expected to lose many of their current species.

Invasive non-native plants include dog-strangling vine, European buckthorn, garlic mustard, common reed grass and purple loosestrife. Rail and utility corridors, road construction and recreational uses facilitate their spread into natural areas. In addition ecological restoration sites are sometimes opened up to further invasions following browsing by white-tailed deer.

A diversity of frog species indicates the presence of healthy wetland habitats that are well connected to healthy upland habitat. (Top left: Gray Tree Frog - Photography © Andy McKinnon) Top right: Wood frog; Bottom left: Bullfrog; Bottom right: Leopard frog)

Summary of Key Issues

- Limited amount and quality of natural cover
- Lack of interior forest (large blocks of continuous forest)
- Loss of wetlands
- Fragmentation of wildlife habitats
- Distribution is weighted to southern watershed
- Invasive species
- Negative impacts of human activities on plants, animals and habitats

3.4 SOCIAL CONDITIONS

3.4.1 CULTURAL HERITAGE

For more than 10,000 years, people have valued and have been sustained by the Rouge River and its abundant resources in a variety of ways. The early Aboriginal inhabitants in the Paleo-Indian, Archaic and Initial Woodland periods were primarily hunters. Around AD 700, the introduction of maize into Southern Ontario gave rise to a tremendous population increase and the establishment of permanent villages associated with the Late Woodland period. There are two National Historic Sites in the watershed: Bead Hill, the remains of an important Seneca Village protected in Rouge Park, and the east branch of the fur trading route known as the Toronto Carrying Place Trail to Lake Simcoe and Georgian Bay.

Early European settlement began in the 18th Century, with a group of German-speaking farmers lead by artist, architect and businessman William von Moll Berczy. By 1861, there were 17 recognized villages and 54 mills on the River, including sawmills, grist mills and woollen mills. Mennonite farming communities settled in the eastern and northern parts of the watershed, and many of their family names can be recognized on road signage. Recreational use of the area that is now Rouge Park started in Victorian times – the river valleys and adjacent countryside south of Highway 2 were a local "cottage country" until the 1950s. The expropriation of farmland in east Markham and Pickering by the federal government in the early 1970s for a potential future airport, and related land expropriation by the provincial government have resulted in the maintenance of considerable

Christian Reesor homestead together with Wurz-Pike farm complex and family cemeteries form a significant cultural heritage landscape along Reesor Road. (Photo credit: ENVision-The Hough Group)

Main Street Markham is a heritage conservation district (Photo credit: Heritage Section, Town of Markham)

areas of countryside landscapes, in contrast to the neighbouring urban areas. Recent urban growth has been focused in Scarborough, Markham and Richmond Hill, with immigrants from an increasingly broad range of cultural backgrounds. The 2001 Canadian census showed that in the Rouge watershed, people of Canadian or British heritage make up 31% of the population, with the remainder representing Chinese (21%), East Indian (9%) and at least 35 other cultures. Figure 3-11 highlights several areas considered representative of the cultural heritage of the Rouge River watershed, as identified by participants during a watershed planning study workshop.

The rich human heritage values of the Rouge watershed are illustrated by more than 1400 known archaeological and heritage sites as well as numerous historical accounts. Our Municipal Heritage Committees have inventoried 991 built heritage structures in the watershed, 42 of which are designated by municipal by-law for protection under the Ontario Heritage Act. There is growing concern about the decline of architectural features associated with farm buildings, as well as the loss of their associated landscape structure, such as hedgerows, farm lanes, and treed rural roads.

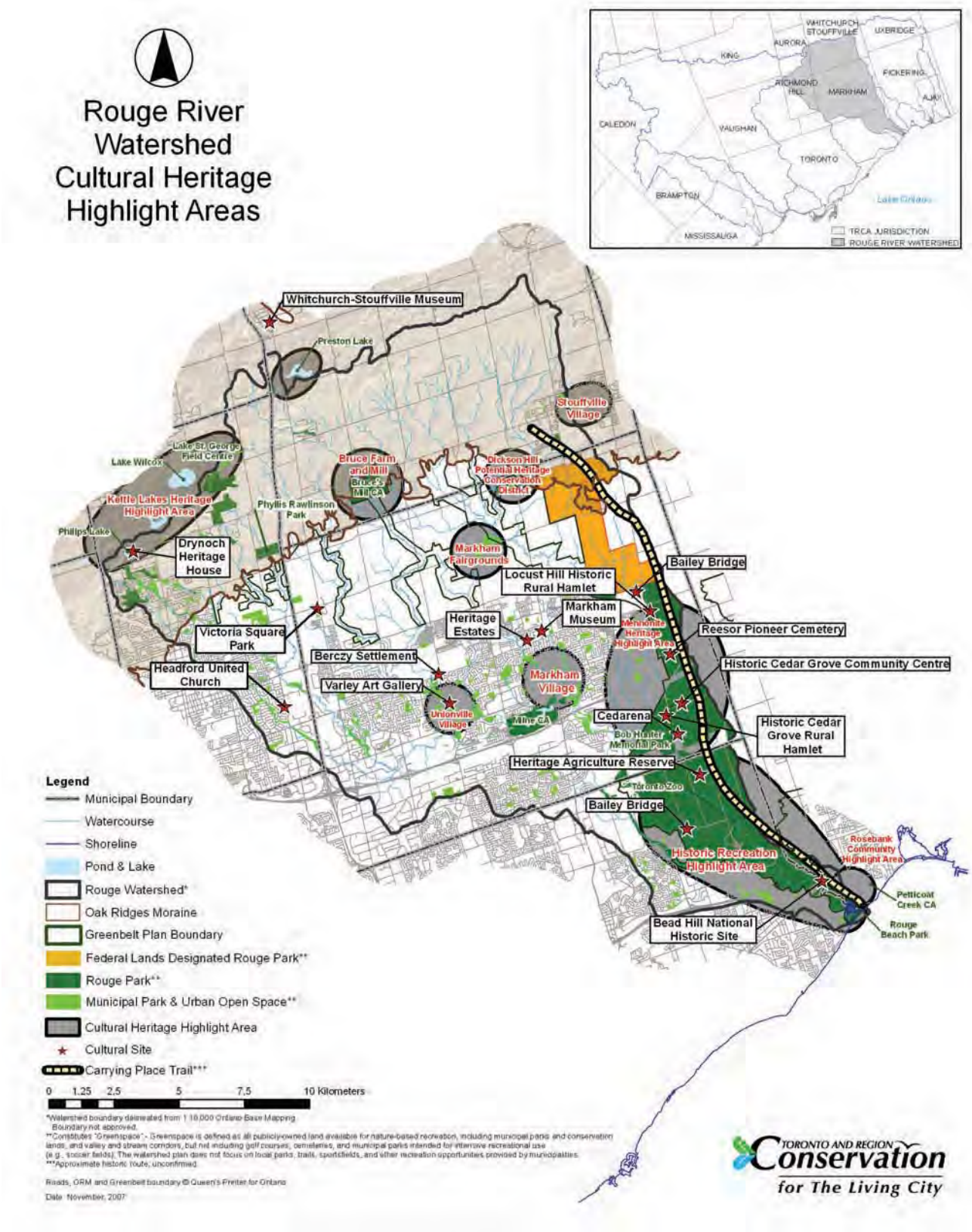
Although there is a substantial database of archaeological resources in the Rouge watershed, there is potential for many more sites to be found through continued field investigations. There is currently no central, accessible repository for archaeological artifacts; instead they are stored by licensed archaeologists at various locations.

The Markham Museum and Historic Village as well as several other local museums provide opportunities for the public to learn about human history in the watershed. There is considerable potential to expand this learning beyond the museums and bring it to a broader range of audiences, for example through tours, story-telling, public art, music and theatre. For example, Rouge Park has been working closely with the Varley Art Gallery in Unionville to promote connections between art and the natural environment.

Summary of Key Issues

- Rich cultural heritage but potential to lose many more heritage sites and landscapes
- Lack of suitable repository for archaeological artifacts
- Limited public awareness of both the positive and negative relationships between people and the watershed over time

Figure 3-11: Cultural Heritage Highlight Areas



3.4.2 NATURE-BASED RECREATION

This watershed plan focuses on outdoor public recreation activities that depend on healthy, attractive, natural and rural landscapes[2]. They include walking, hiking, cross-county skiing, wildlife-viewing, picnicking, camping, bicycling, horseback riding, canoeing, fishing, swimming, exploring rural heritage and agri-tourism.

While these activities depend on natural and rural resources, if not properly managed they can result in negative impacts on the sensitive ecological, cultural and hydrological resources of the watershed. Ongoing urbanization and population growth are creating challenges for sustainable management of public lands because of the increasing numbers of people using them. Some resulting problems include over use, unauthorized trails, incompatible uses, garbage dumping and encroachments.

The natural and rural resources of the Rouge watershed provide two broad kinds of experience: the urban wilderness experience of the Rouge Park and associated lands, and the countryside experience of the northern and eastern parts of the watershed (see Figure 3-12). In addition, the TRCA's conservation areas and the municipal parks systems, especially the major parks and trails, provide complementary experiences and help to connect communities to larger regional public use opportunities. Many of the older major parks and their associated buildings, trails and other infrastructure are showing signs of decline and are in need of refurbishment. Current funding sources are inadequate to support ongoing maintenance and development of the nature-based recreation system.

Rouge Park is a unique asset in the watershed. It is the largest natural environment park in an urban area in Canada. It encompasses over 41 square kilometres of natural habitats with pockets of rural countryside and provides significant passive recreation opportunities and urban wilderness experiences. In close proximity to the Park are other areas currently in public use, or planned for future public use, including the Toronto Zoo and Bob Hunter Memorial Park. A management agreement is in place between Rouge Park, TRCA and the City of Toronto to define roles and responsibilities for management, enforcement and funding. However, similar Rouge Park management agreements have not yet been made with the York Region municipalities.

The Northern Countryside is characterized by the rolling hills and kettle lakes of the Oak Ridges Moraine. It also includes the rural farmlands that remain undeveloped north of Major Mackenzie Drive, and parts of Rouge Park. Specific nature-based resources include Bruce's Mill Conservation Area, Phyllis Rawlinson Park, and the Oak Ridges Corridor Park (shared with the Humber watershed). Activities based on agriculture and rural heritage are becoming increasingly popular, for example at Lionel's Horse Centre, Markham Museum, Markham Fair, Forsythe

2 The plan does not focus on local parks, trails, sportsfields and other recreation opportunities provided by municipalities. While recognizing their important role, this plan focuses on regional or watershed scale nature-based recreation.

A scenic countryside road over the rolling hills of the south slope and Oak Ridges Moraine. Right: Orchard Trail (Photo credit: Rouge Park)

Family Farm, Whittamore's Farm, Reesor's Farm Market, Applewood Farm and Winery, and Willow Springs Winery.

Existing regional trails are concentrated in the Toronto portion of Rouge Park, although plans are underway for a comprehensive regional trail system throughout the watershed, with connections to the Oak Ridges Trail, Trans Canada Trail and Lake Ontario Waterfront Trail. Richmond Hill and Markham trail systems in the Rouge valley corridors are also extensive. In addition, there are many informal trails used by pedestrians, equestrians, and mountain bikers, which has impacted the health and enjoyment of the system. Potential issues associated with irresponsible trail use and the creation of informal trails include trampling of vegetation, cycling in inappropriate locations, spread of invasive species, soil and slope erosion, disturbance of sensitive wildlife, conflicts among users, dogs off-leash, garbage and vandalism.

As noted in the section on Aquatic Systems (section 3.3.1), many of the most popular fishing spots are associated with Rouge Park, notably Rouge Marsh, Milne Park, Toogood Pond and Little Rouge Creek. An annual urban fishing festival is held in Markham. There is little understanding of the impacts of recreational use and harvest of fish on fish communities in the watershed and no creel surveys have been undertaken by the Ministry of Natural Resources to accurately assess use.

Cedarena, a natural outdoor skating rink built in the late 1920s in the Rouge valley near the hamlet of Cedar Grove (Photo credit: Peter Attfield)

Boating in Rouge Park is focused on the marshes at Rouge Beach, with the majority of participants using canoes, kayaks and rowboats. Motorized boating is not permitted in the marshes or up the Rouge River to Kingston Road/Highway 2.

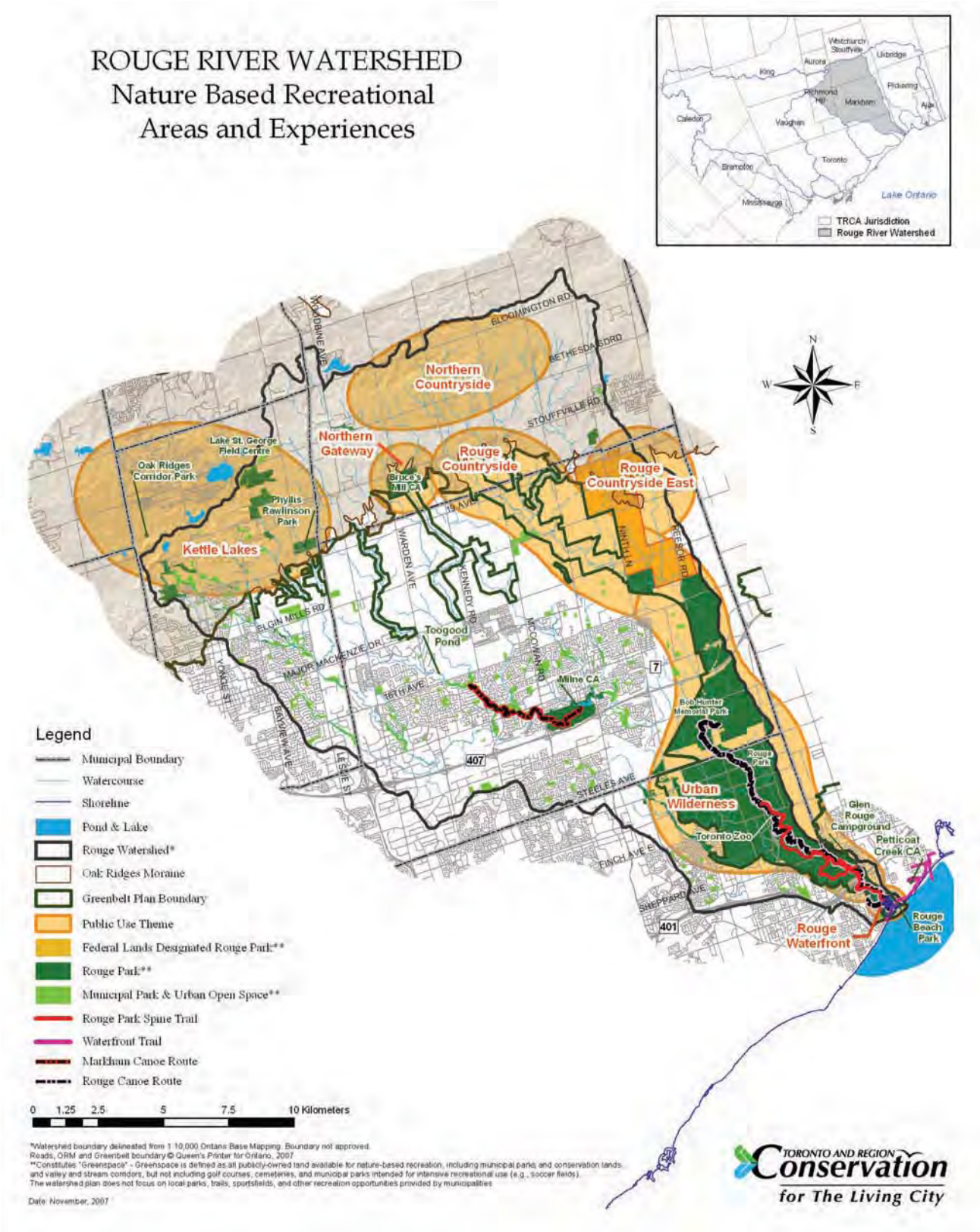
There is little information available on the numbers of people who use Rouge Park and regional and local trails. However Toronto Zoo reports 1.2 million visitors per year, Bruce's Mill Conservation Area averages 40,000 people and Glen Rouge Campground hosts about 7500 campers. Markham Fair attracts about 70,000 visitors over four days each year.

Although there are many recreational opportunities in the watershed, there is a lack of identity to link the individual components within an overall regional nature-based recreational system. The public often associates Rouge Park with the lands "south of Steeles", and there is a need to develop an identity for the Park north of Steeles as well. The visual identity and role of other major park areas, such as Bruce's Mills Conservation Area, should also be recognized.

Summary of Key Issues

- Finite resource with a growing human population
- Decline in major park infrastructure and identity
- Potential for conflicts with natural heritage protection
- Conflicts among park users
- Lack of data on user rates, fishing pressure and carrying capacities
- Lack of regional trails in middle and upper watershed
- Lack of overall identity of a regional nature-based recreational system
- Lack of management agreement between Rouge Park, TRCA and York Region municipalities

Figure 3-12: Nature-based Recreational Areas and Experiences in the Rouge River Watershed



3.4.3 LAND USE

Overview

Approximately 40% percent of the watershed area is in agricultural use and 35% is used for urban settlements (see Figure 3-13). Natural cover, which includes lands, covered by forest, successional vegetation (i.e., shrub land), meadow or wetland, makes up approximately 24% of the watershed area, with the remaining 1% comprising watercourses and water bodies. Over 12% of the watershed is protected in Rouge Park**.**

As described above Section 3.3.2, (Terrestrial System) natural areas are predominantly in the Little Rouge corridor and Lower Rouge in Rouge Park with patches of natural cover scattered in the headwaters on the ORM and along tributaries of the Main Rouge.

Agricultural lands are found mostly in the headwaters on the ORM, mid reaches and in the eastern portion along the Little Rouge corridor, in association with Rouge Park, the Federal Pickering Lands Site and the Duffins-Rouge Agricultural Preserve.

Audubon Cooperative Sanctuary Program

This program helps develop natural resource management plans for golf courses including integrated pest management, water quality and conservation, wildlife habitat, energy efficiency and waste management.

Aggregate extraction operations (active and retired) within the watershed are located in the Town of Whitchurch-Stouffville. Rehabilitation plans have been prepared to return these lands to some form of agricultural land use and natural cover, once the operations are retired.

There are 24 golf courses in the watershed, including private, semi-private and public courses. Most of them have participated in stewardship workshops provided by Rouge Park and the TRCA and two golf courses operate under the Audubon Cooperative Sanctuary Program. It is likely that increasing urbanization around golf courses will create pressures to sell lands that are not directly needed for golf, resulting in less available space for wildlife habitats.

The following sections provide information about agriculture, urban areas and transportation.

Agriculture

Most of the agricultural lands in the Rouge watershed are used for cash crops (soy, corn, grains and hay), market gardens, nurseries and some livestock. Urban community gardens are beginning to emerge in the developed areas of the watershed, such as Phyllis Rawlinson Park in Richmond Hill.

Land ownership, policy designations and changing markets are major factors influencing agriculture in the Rouge watershed.

A substantial amount of agricultural land in the watershed has been expropriated by the Provincial and Federal governments and is now in public ownership. Some is included in Rouge Park and is

Valuable farmland provides a basis for agri-business needed to serve diverse and expanding local markets. Right: Sometimes there are conflicts between farming and wildlife or adjacent land uses (Photography © Andy McKinnon)

designated for long-term Agricultural Heritage uses in Rouge Park plans. Other lands are held by Transport Canada for potential future airport uses. The agricultural lands are leased by farmers, including some descendents of original homesteaders, and the homes are leased by a variety of tenants. The lease terms are influenced by the legislation governing each public agency. For example, TRCA can approve lease terms up to 5 years without seeking provincial approval, upon direction from Rouge Park Alliance, however in the past it has typically approved one year leases. Short lease terms inhibit investment and longer term agricultural initiatives by farmers.

Many privately owned lands are currently designated for long-term agricultural uses under the ORM Conservation Plan or Greenbelt Plan. However there are ongoing concerns about the economic viability of these near-urban farm businesses.

Most of the privately owned farm lands in the mid reaches of the Rouge watershed are designated for agricultural land use in municipal official plans, but are within the area of the Provincial Growth Plan for the Greater Golden Horseshoe that is expected to be under urban growth pressure within the next 15-30 years. Consequently they are subject to land speculation, and about half of them are leased to farmers on a short-term basis.

Agriculture in the Rouge watershed faces similar challenges to the rest of the Greater Toronto Area. Urban markets have become increasingly dependent on imported, rather than local, sources of food. Farming operations frequently come into conflict with urban land uses in close proximity. Net annual revenues are inadequate to support farm families, ranging from $20,000-25,000 per farm in Peel, York and Durham Regions (based on 2001 Statistics Canada data). Increasingly, farms need larger areas and more technology to be economically viable. But farm operating costs per acre are

increasing and are higher than in other parts of the Province, for a number of reasons. These include high land values (due to urban development speculation), loss of local agricultural services, high taxes, and the costs of compliance with recent regulations such as the Nutrient Management Act. Because of these economic challenges, most farmers cannot afford to invest in measures that could increase their returns, such as land acquisition or new agricultural ventures to serve the urban market. Other opportunities to contribute to a healthy countryside, such as Environmental Farm Plans, cultural heritage protection and natural heritage stewardship are also frequently beyond their reach.

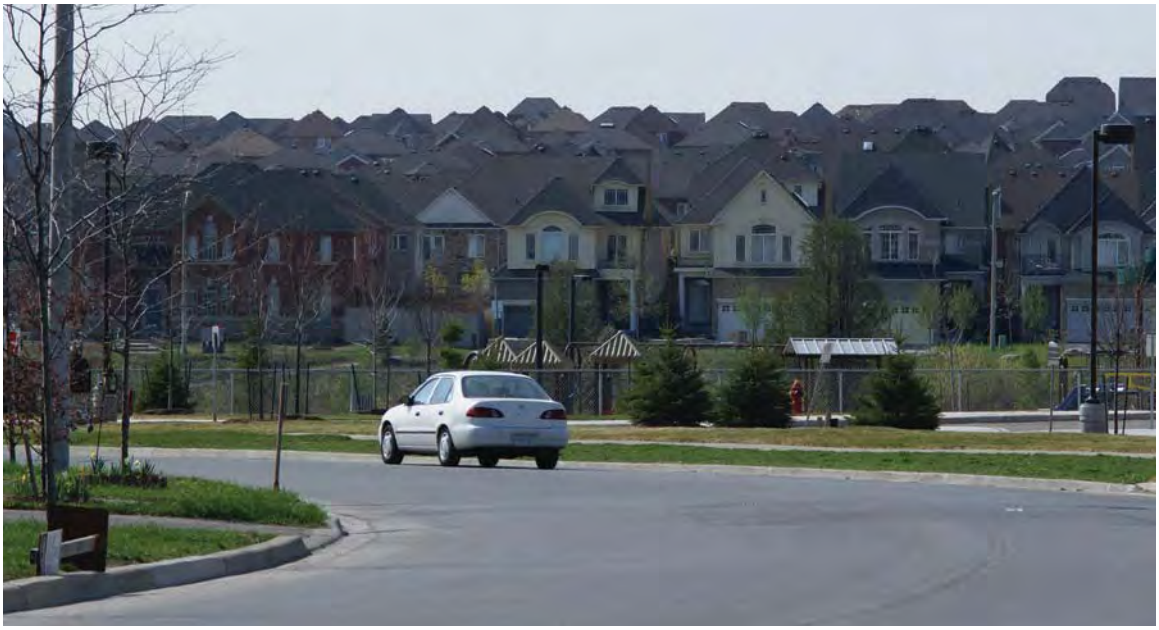
Summary of Key Issues

- Poor economic viability of agricultural industry
- High percentage of farmers with short-term leases
- Conflicts between farming and adjacent land uses

Urban Areas

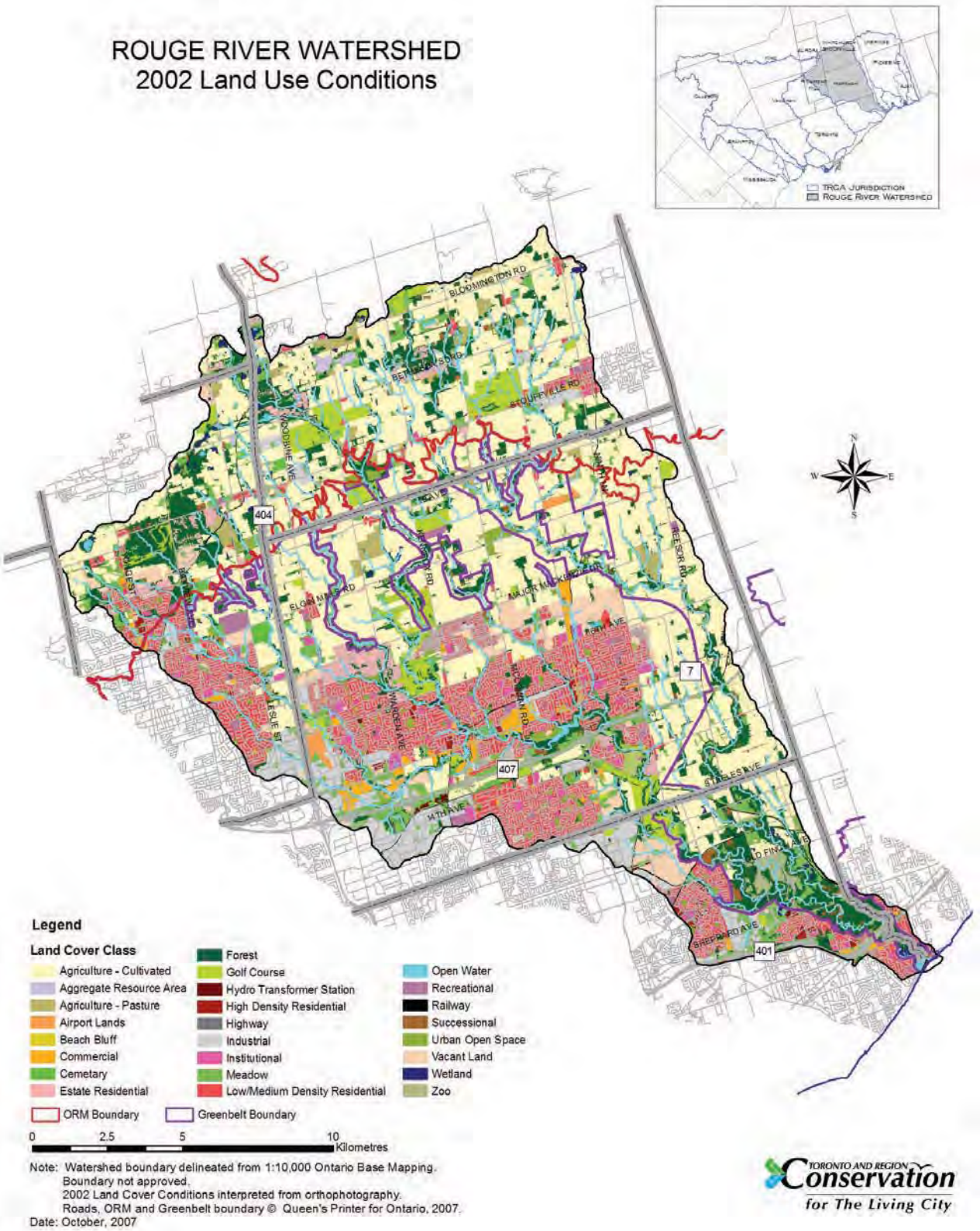
Over half of the total area of urban settlements in the watershed (approximately 53%) is used for residential purposes. Most of these settlements are low or low-medium density, car-dependent and do not easily support transit systems. Existing urban areas are in the western mid reaches and lower reaches of the Main Rouge in Toronto, Richmond Hill, and south Markham. The Town of Whitchurch-Stouffville has a number of rural hamlets in the upper Little Rouge watershed.

The headwaters of the Rouge River are mostly located within the Oak Ridges Moraine where land use change is currently regulated according to the Province's *Oak Ridges Moraine Conservation Plan*, 2002. In the headwaters of the Little Rouge River, expansion of existing urban settlements in the community of Stouffville is permitted by the Oak Ridges Moraine Conservation Plan and is on-going.



The sprawling nature of typical urban form fosters car dependency and the large areas of hard surface generate increased stormwater runoff.

Figure 3-13: 2002 Land-use Conditions



There has been a rapid pace of urban growth in the past two decades. New urban settlements are also in both planning and construction phases in the headwaters of the Main Rouge tributary within the Town of Richmond Hill, in the tributaries to the Main Rouge south of Major Mackenzie Drive, in the "Cornell" area of east Markham and around the Town of Whitchurch-Stouffville in the Little Rouge.

The total population in the Rouge watershed is currently about 240,000. Populations in the Town of Markham, Town of Richmond Hill and the Town of Whitchurch Stouffville are expected to nearly double between 2001 and 2026, reaching more than 348,000, 219,000 and 41,000 respectively. Intensification in the City of Toronto will also increase the population within the Rouge watershed.

Under the Provincial *Growth Plan for the Greater Golden Horseshoe* there is expected to be even further pressure for population growth. This will be accommodated through a combination of intensification of existing urban areas and new development in greenfield areas south of the ORM and outside the Greenbelt lands. Much of the area north of Major Mackenzie Drive to the ORM in Markham is slated for development, except along tributaries protected by the *Greenbelt Plan*, Rouge Park's *Rouge North Management Plan* (incorporated as OPA 140 in Markham's Official Plan) and TRCA's *Valley and Stream Corridor Program*.

Within the headwaters and middle reaches of the Main Rouge River and its tributaries there are many small streams that contribute to the vitality of the Rouge River system. These streams are not always within well-defined corridors and a large number have already been altered and stripped of vegetation as a result of past agricultural practices. Identifying, protecting and enhancing these small streams will be a major challenge in the planning of future urban settlement expansions. TRCA policies provide for protection of defined watercourses, while the Town of Markham has taken the initiative to protect smaller, non-permanent drainage features through the *Small Streams Study*.

City building requires infrastructure, including pipelines, railways, roads, highways, sewers, water supplies, treatment plants and reservoirs, and involves a broad range of associated challenges to ecosystem functions and natural landscapes. Much of the infrastructure that services watershed communities (i.e. gas, water and sewer pipes, hydro corridors and road corridors) has historically been built in or across valley lands and other natural features, causing negative short-term, long-term and cumulative impacts. Furthermore, natural processes of erosion, movement of the stream channel across its floodplain and changes to the valley wall can expose infrastructure and threaten its integrity. In future, we can expect the need for upgrades to existing infrastructure, as well as ongoing pressure to build new infrastructure to keep pace with urban growth. New plans should avoid negative impacts on valleys and other natural features and retrofit projects should look for opportunities to prevent or mitigate effects.

Summary of Key Issues

- Effects of existing urban form and development practices (e.g. car dependency, fragmented natural areas and negative impacts on water balance)
- Urban growth pressures for intensification of existing urban areas and greenfield development in middle reaches of watershed
- Infrastructure crossings of valleys and natural features

Buttonville Airport

Highway 404

Transportation

Transportation systems in the Rouge watershed include major highways (404, 401 and 407), Buttonville airport, and public transit including Via Rail, GO transit (rail and bus) and municipal bus systems. Highways, railways and airport lands comprise approximately 1.5% of the total watershed area and over 4% of urban lands. As noted above, existing transportation infrastructure has resulted in harmful impacts on natural systems in the watershed. There is also the potential for a new airport in the eastern part of the watershed in Pickering.

At present, Rouge watershed residents are heavily dependent on private automobiles for transportation. According to the 2001 Canadian Census, over 80% of York Region residents drove a car, truck or van to get to work; an additional 7% rode as passengers. The reliance on private vehicles was lower in the City of Toronto, where 52% of residents drove to work and 5% rode as passengers. Public transit was used by 33% of Toronto residents and 9% of York residents. Walking and bicycling to work was less common, accounting for just 7% of Toronto residents and 2% of York residents.

A significant amount of low density residential development exists in the Town of Richmond Hill and Town of Markham portions of the watershed, and low density developments are currently being approved for Whitchurch-Stouffville. These forms of development have resulted in population densities that do not support public transit services. Residents in these communities rely on automobiles as their primary means of transportation, contributing to such problems as traffic congestion, poor air quality, water pollution, greenhouse gas emissions, and the proliferation of impervious surfaces associated with roads, driveways and parking areas. Several major highway expansion proposals could place additional pressure on the Little Rouge corridor and heritage villages. On the other hand, intensification and redevelopment provide opportunities to achieve higher transit supportive densities.

Summary of Key Issues

- Car dependency, traffic congestion, vehicle emissions
- Roads and parking lots represent a significant area of impervious surface (more runoff and pollutants)

- Current and future pressure for more roads, resulting in more crossings of natural features and fragmentation of Rouge Park
- Low density developments are not transit supportive

3.4.4 RESOURCE USE

The major resource considerations in the Rouge watershed are water, wastewater, solid waste and energy.

Water supply

The potable domestic water supplies for communities in the Rouge watershed come from two sources: Lake Ontario and underground aquifers within York Region. The City of Toronto's water treatment facilities at Lake Ontario supply potable water to City of Toronto residents as well as the urban areas of Markham and Richmond Hill. Whitchurch-Stouffville is serviced by municipal wells.

In rural areas, private wells provide domestic/potable water supplies. Based on 2001 census data, an estimated 12,000 residents rely on private wells for their water supply within the Rouge watershed.

York Region has prepared a long term water supply infrastructure plan, which includes a number of infrastructure expansion projects to increase its storage and conveyance capabilities, including the Markham watermain and reservoir construction and the Stouffville elevated tank and watermain project. It considers extension of lake-based water supply servicing rather than further reliance on groundwater to provide for the growth of Whitchurch-Stouffville.

The average resident in the Rouge watershed uses approximately 250-300 litres of water per day, of which only 1% is used for drinking. Canadian water consumption rates are higher than those of many other countries. Furthermore, we use potable quality water for purposes that don't require such a high degree of water treatment (e.g. toilet flushing, lawn watering).

Water Efficiency Programs
More information is available at:
www.region.durham.on.ca/waterefficiency;
www.water4tomorrow.com;
www.toronto.ca/watereff/plan/htm.

Municipal water efficiency programs, such as the Region of York's Water for Tomorrow program and Water Efficient Durham, as well as seasonal water use restrictions, have been initiated within the Rouge watershed to help reduce both residential and commercial water demands. This York Region program hopes to save 8% of 2001 water demand levels. Similarly, the City of Toronto expects to save 12-14% of 2001 water demand levels and 14% of 2001 wastewater treatment demand levels by 2011. Information about other water users (e.g. irrigation, commercial etc.) is included in the Section 5.3 on Water.

Summary of Key Issues

- High water consumption rates, although progress is being made to increase water efficiency
- Quality of water provided is not always matched with quality required for purpose
- Energy demands and cost of wastewater treatment increase with growth in water use

Wastewater

Wastewater from areas of the Rouge watershed in the City of Toronto is treated at the Highland Wastewater Treatment Plant on Lake Ontario. Most of York Region's wastewater is collected and transported via the York Durham Sanitary Sewer (YDSS) to the Duffins Creek Water Pollution Control Plant in Pickering. The YDSS was first constructed in the 1970s as part of a broader strategy to address concerns of the International Joint Commission about nutrient loads to Lake Ontario and to relieve stress on the Lake Ontario tributaries from local sewage treatment plants that were historically located on the Rouge River. Water quality of area streams has improved dramatically since the decommissioning of these localized treatment facilities.
Within the Rouge watershed portion of the Region of York, the 9th Line Trunk Sewer extension to Stouffville has recently been implemented and the 16th Avenue YDSS sewer extension will be complete by February 2007. An environmental assessment is currently underway for the YDSS Southeast Collector that will convey wastewater from the Rouge and Humber watersheds to the Duffins Creek Plant. York Region is currently working on an update to the 2002 YDSS Master Plan and intends to develop a Stage 2 Plan for the Water Efficiency Program. The Region is also working in cooperation with the local municipalities to reduce infiltration to local systems.

From a water budget perspective, lake-based water supplies that are consumed and then returned to the lake via wastewater collection systems and lakeside wastewater treatment plants, have a relatively neutral effect on the watershed's water budget (except for relatively minor losses due to lawn watering or pipe leakage), assuming proper construction and operations of the system.

Summary of Key Issues

- Urban growth creates need for expansion of wastewater servicing infrastructure
- Improved knowledge from YDSS construction about planning and implementing large infrastructure projects

Solid waste

The closed Beare Road landfill, located near the northeast boundary of the City of Toronto near Rouge Park, was operated between 1968-1983 and now holds 9M tones of waste. In 1996 the City of Toronto initiated, with Enercogen, a gas-to-energy project, whereby methane gas vented from the landfill is burned to produce 26,600,000 KW-hr or power for roughly 2300 homes and a reduction in greenhouse gas emissions through displacement of fossil fuels. The power is sold to Ontario Power Generation.

(Photo Credit: Town of Markham)

Since the closure of the Keele Valley Landfill Site in Vaughan, residual waste from the City of Toronto, York Region and Durham Region has been transported to landfill sites in Michigan and the City has recently approved acquisition of a disposal site in St. Thomas, Ontario. This creates greater pressure on roads, higher energy costs and increased vehicle emissions. To avoid the costs of sending wastes out of the region, municipalities are increasing their waste diversion initiatives including home composting and enhanced recycling programs.

The City of Toronto achieved its goal to divert over 30% of its waste by 2003 through the implementation of such strategies. Toronto has set waste diversion targets of 60% by 2006 and 100% by 2010.

Residual waste
Residual waste is that portion of waste that is not re-used, recycled or composted.

In April 2004, Durham adopted a waste diversion target of over 50% by 2007 and will likely align to the Provincial target of 60% diversion by 2008. A pilot green bin (organic waste) program, *Mission Green*, was introduced in Markham, creating a three-stream waste management system (organic waste, recyclables and garbage) in an attempt to reduce residential waste in Markham by 60%. The Town has succeeded in achieving the highest diversion rates in Canada of 69%, and in 2007 increased its initial waste reduction target to 75%. York and Durham Regions are jointly undertaking a residual waste disposal study for "post-diversion waste" and they are looking at further opportunities to recover recyclables or recover energy from waste.

Improvements in waste management will benefit the watershed because waste reduction and re-use will decrease energy use (compared with the costs of recycling and waste disposal, especially when they involve long distance transportation). This represents a reduction in the emission of greenhouse gases and other air pollutants.

Summary of Key Issues

- Residual waste being transported out of the region
- Need to reduce waste generation and increase re-use and recycling

Energy

Ontario Power Generation has a number of generating stations in the Greater Toronto Area, including the nuclear plants in Pickering (3104 megawatt (MW) capacity) and the Pickering Wind Generation Station (1.8 MW capacity). There are also at least 2 biogas plants in the GTA, including one at the old Keele Valley landfill site and one, as noted above, at the Beare Road landfill site in the Rouge watershed. Toronto Hydro operates a wind turbine (750 kilowatt (kW)) at Exhibition Place and a pilot solar power plant (36 kW) on Commissioners Street in the City of Toronto.

In 2006, the Ontario government set a goal of having 10% of its power supply from renewable power generation sources by 2010. City of Toronto targets 25% renewable sources of power for its own facilities as well as a 15% reduction in energy demand. York Region's preferred alternative for dealing with garbage in the future incorporates incineration of wastes, which is anticipated to result in net energy generation of 86,180 MWh. In this way, local wastes could be converted to a local, renewable fuel source. York Region has also conducted energy audits of many of its regional facilities, resulting in a savings of $251,000 in 2004.

Despite growing awareness of the relationships between energy use, poor air quality and global climate change, energy consumption continues to climb. In 2005, total electricity consumption for Toronto was 26,372,168 megawatt hours (MWh), with a total electricity peak demand of 4,936 MW (IndEco Strategic Consulting Inc., 2006). Rotating blackouts have been predicted for the City by 2008, unless energy conservation is maximized and 500 MW of new generation capacity is built by 2010.

Markham Centre is an example of how energy efficiencies can be considered at the community design scale by planning for district energy and setting targets for energy efficiency. Markham Centre aims for a 30% reduction in energy demand overall, in comparison with a typical urban development.

Summary of Key Issues

- Excessive and increasing energy demand
- Greenhouse gas pollution from non-renewable fossil fuel use
- Current community form does not facilitate local renewable energy generation/distribution

CHAPTER

4

4.0 FUTURE CONDITIONS

The Rouge watershed will experience major changes in land use over the next few decades. Approved official plans allow for an additional 4000 hectares of new urban lands beyond 2002 land uses. Once these plans are implemented, we can expect additional urban development pressure to the boundaries of the Greenbelt and Oak Ridges Moraine established in legislation (see Figure 4-1). Although this legislation will be subject to review in 2014-2015, the scientific foundation of our plan should provide the Province with strong support for the continued protection of these areas.

The Rouge watershed also offers unique opportunities, including the assembly and renaturalization of lands as part of Rouge Park and the continuation of agriculture on public and private lands. Municipalities in this watershed are already working to address the negative impacts of existing developments and are among the leaders in promoting sustainable practices. These opportunities provide us with valuable tools to help address concerns with current watershed conditions, manage negative impacts from future land use changes and adapt to the uncertainties associated with global climate change.

Climate Change Scenarios

Two climate change scenarios for the year 2080 were selected for the modelling studies. Each predicts substantively different types of change in weather, allowing us to examine two variations of "worst case" climate change.

- CGCM2 (Scenario A21): Coupled Global Climate Model developed by Environment Canada.
- Hadley (HadCM3 AOECM; Scenario A1F1): Coupled Atmosphere-Ocean General Circulation Model developed by Hadley Centre for climate change in the UK.

To help us understand how the watershed might react to changes in land use and environmental management in the future, we developed a set of eight scenarios and undertook modelling studies to compare their impacts on watershed conditions and assess the relative effectiveness of management approaches. The land use scenarios included existing (2002) land uses, build-out of existing official plans and Rouge Park plans on publically owned lands and full build-out of all the lands in the watershed not protected by

Management of the projected urban growth is a key focus of the watershed plan

the Greenbelt and Oak Ridges Moraine legislation and other accepted policies, such as the TRCA's *Valley and Stream Corridor Management Program*. Environmental measures such as expanded natural cover, better stormwater management and a sustainable community scenario were super-imposed on these land use scenarios.

The sustainable community scenario represented a vision of the watershed with protection of an expanded natural heritage system from 24 to 31% of the watershed, and full build-out implemented with the most innovative concepts in sustainable community design including:

- reduced percent impervious cover,
- maintenance of infiltration and runoff components of water balance,
- enhanced urban canopy (30% of community) and
- 25% backyard naturalization.

The scenario also includes improved sustainability in already urbanized areas (e.g. stormwater retrofits, naturalization, green buildings, etc.), increased stewardship of natural areas and improved individual behaviours including energy conservation, water conservation and purchase of local foods. This scenario and the literature basis for assumptions are described in *Development of a Sustainable Community Scenario for the Rouge River Watershed,* TRCA, 2007.

Models used to evaluate the 8 scenarios

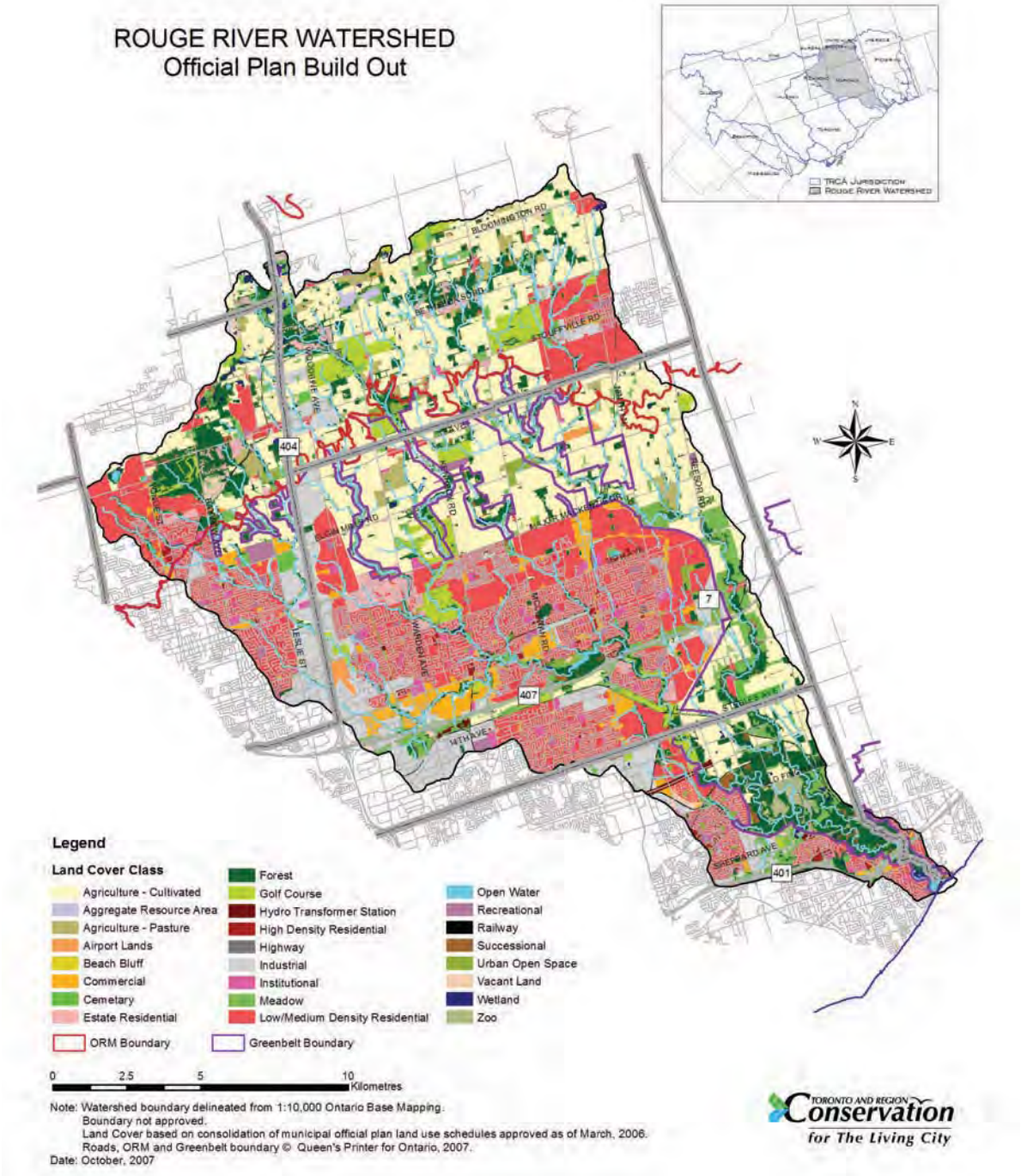
WABAS – water budget, infiltration
MODFLOW – groundwater
HSP-F - surface water.
LSAT - aquatic communities and species.

For more information, see TRCA, 2007.

Finally, the effects of potential climate change were added to the development and environmental scenarios. More details on the characteristics and assumptions in each scenario are available in Appendix E as well as in a separate report (*Rouge River Watershed Scenario Modelling and Analysis Report,* TRCA, 2007).

The intent of the modelling studies was not to predict specific future conditions, but rather to help us compare different land use and management scenarios, ascertain the types of change that might occur and identify areas of relative sensitivity in the watershed. Modelling was just ONE source of information. To complement it, we examined existing conditions and trends in the watershed, reviewed watershed research in other areas, and used the best professional judgement of a range of experts in many fields. This multi-faceted process of analysis and synthesis increased our understanding of possible future conditions. Here are some of the highlights for three broad themes of watershed health: water, nature and people.

Figure 4-1: Official Plan Build-out



4.1 WATER

As we saw in Chapter 3, the key to understanding environmental conditions in the watershed is to understand the balance between infiltration, evapotranspiration and surface runoff. Because urbanization increases the amount of impermeable surfaces, it alters the water budget by intercepting precipitation that would otherwise become groundwater or evapotranspiration and converting it to surface runoff.

Our analysis showed that we can expect the following changes as a result of build-out according to existing official plans and full build-out, using conventional approaches to development and stormwater management:

- Increases in annual flow volumes in rivers and streams due to increased runoff in proportion to the degree of upstream development and impervious cover, with the greatest increases in summer;
- Increasing stream bank erosion, despite implementation of stormwater ponds in new development;
- Decreases in recharge of the Oak Ridges Aquifer;
- Reductions in groundwater discharge (ranging from <1% to 31%) across the watershed;
- Deterioration of water quality in streams and rivers, with increases in phosphorus, bacteria, some metals and chloride (however there would be no significant changes in total suspended solid concentrations because stormwater management ponds are very effective at removing them). In all cases, loads would increase more than concentrations because flow volumes would also increase:
  - Phosphorus levels in watercourses would increase only slightly, due to effective removal by stormwater ponds;
  - Bacteria levels would increase;
  - Copper and zinc would likely increase in the watercourses, but probably not to levels that exceed receiving water standards more than 25% of the time;
  - Chlorides (primarily from road salt) would increase in watercourses downstream of development, potentially to levels that are toxic to aquatic life. (The middle Beaver Creek already has median concentrations of chloride above the guidelines)

These effects would be more significant in the Main Rouge River and its tributaries than the Little Rouge, because much less development is anticipated in the Little Rouge watershed. The most significant changes in water budget are expected to occur during implementation of current OPs, with full build-out having a comparatively smaller effect.

We considered the effects of improving existing stormwater management ponds or constructing new ones in all existing developed areas where there are opportunities. These measures would result in local downstream benefits, but due to the limited numbers of opportunities for new or improved ponds in existing developed areas we found that in most subwatersheds, these measures alone would not be enough to provide significant improvements in terms of surface run-off, erosion potential

and water quality. As discussed in section 3.2.4, ponds are also limited in the benefits they can provide for erosion control, and need to be augmented by source and conveyance control measures that address the total volume of runoff. Retrofitting an existing pond may achieve an additional 50-70% benefit in water quality treatment for sediment removal in comparison with the greater benefit of introducing ponds to areas that previously had no stormwater treatment (for example in older urban areas, new ponds sized to current standards could achieve 80% benefit). The effectiveness of end-of-pipe retrofit projects could be increased by identifying additional storage sites, for example underground. However the cost of securing these additional sites may be significantly greater than the cost of the lot level stormwater management and naturalization strategies that are being recommended and that also provide a number of other watershed management benefits. For example, rain gardens and naturalization contribute habitat, rain-harvesting offsets potable water demand, green roofs moderate climate and provide energy conservation and air quality benefits. However there is some potential to mitigate erosion of Beaver Creek with stormwater pond retrofits, because there appear to be enough site opportunities to make a significant reduction in erosion potential. In addition, the retrofits could probably be implemented quickly while the lot level stormwater management practices and naturalization initiatives are pursued.

Expanding natural cover from 24% to 31% of the watershed area, as shown in the targeted natural heritage system map, is expected to result in reductions of stream flows and erosion potential proportional to the amount of additional vegetative cover provided within each sub-watershed. For example, changes will be greatest in the Little Rouge Corridor and some of the middle tributaries, where there are the most opportunities for new plantings. In some cases (Carleton, Berczy and Bruce Creeks) we expect that improvements can be made in comparison to existing degraded conditions and anticipated future impacts from urban growth, but only if substantial reforestation can be achieved in a timely manner. From a water management and stream erosion perspective, strategic reforestation programs should focus work in the targeted system throughout the upper Main Rouge and middle tributaries. In the Little Rouge River system, the most strategic locations for plantings would initially be in the headwaters of the tributary that flows through the Town of Whitchurch-Stouffville to buffer impacts of urban growth and in Rouge Park along the Little Rouge River.

The combination of sustainable community initiatives in both new greenfield development and existing urban areas, enhanced stormwater management and increased natural cover as applied in the sustainable community scenario, would reduce the negative effects of urbanization described above, but are generally not expected to fully offset them. The reductions in negative impacts would likely be more pronounced in areas of new development than in existing urban areas, where opportunities to retrofit with sustainable technologies are limited. For example, Figure 4-2 illustrates the relative change in erosion potential in response to the sustainable community scenario, as compared to the conventional approaches of the full build-out scenario. The potential for erosion is relatively lower or decreased with the innovative practices assumed in the sustainable community scenario, and increased by up to 40% in some reaches under the conventional full build out scenario. Erosion potential is an important indicator in the watershed, as studies suggest that

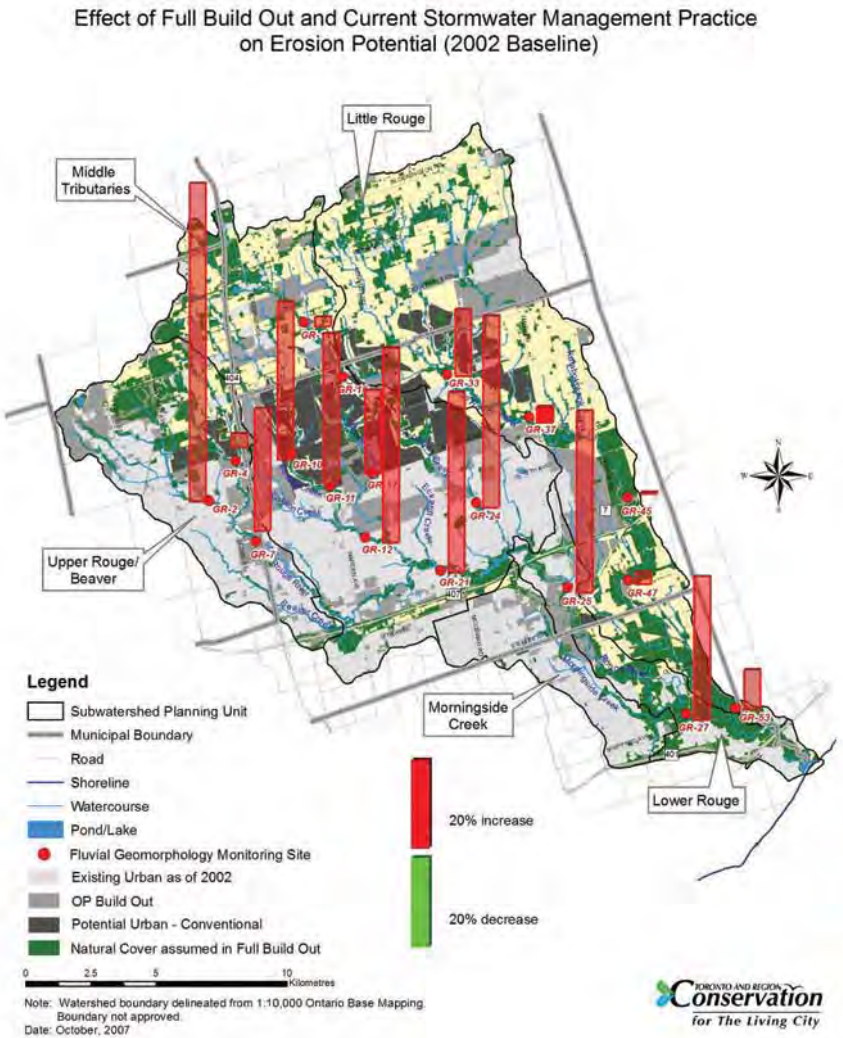
up to half the streams in the Main Rouge system downstream of urban areas are already unstable or are becoming unstable as a result of excess erosion caused by urban impacts. Stream channel instability is linked to other management issues associated with surface water flow, water quality and aquatic system health.

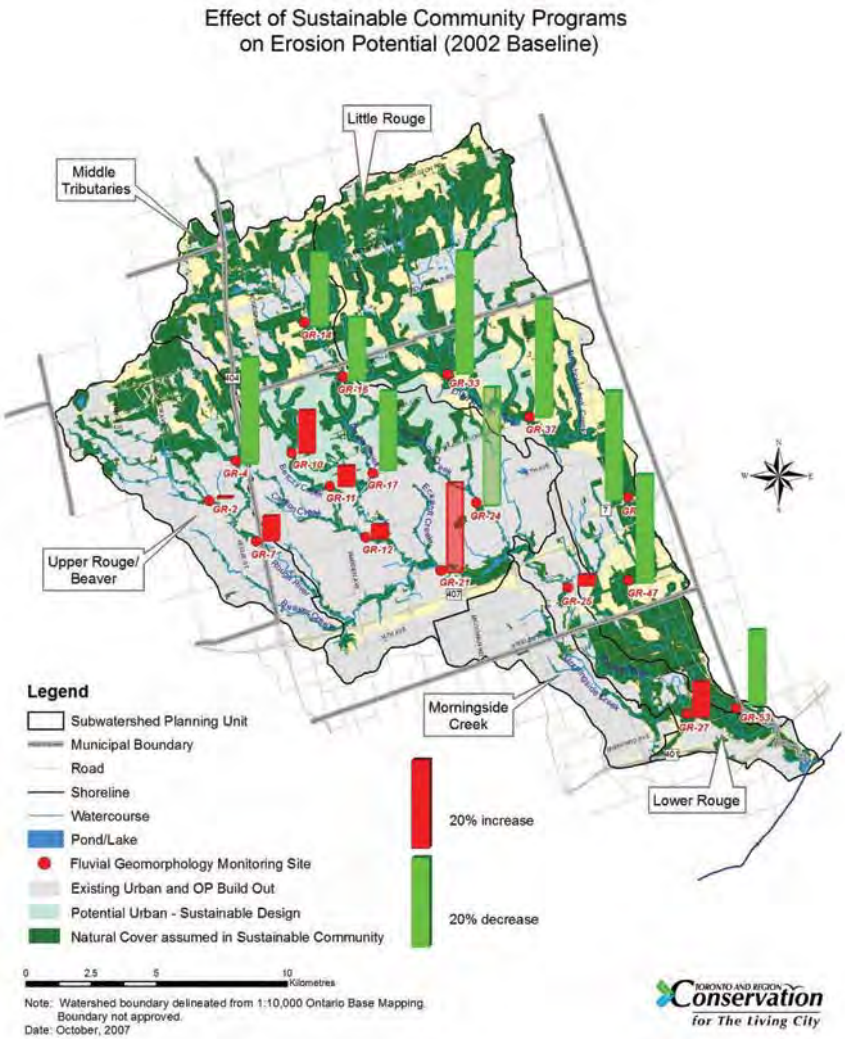
We expect that annual volumes of stream flow would decrease under all the climate change scenarios we examined, despite precipitation increases, due to increased temperatures and evapotranspiration. Providing that sufficient infiltration opportunities are retained, groundwater recharge, discharge and aquifer levels could increase because of higher rainfall. However, due to limitations in the science of current climate change prediction, our modelling could not account for the increase in frequency and intensity of major storms, which is a likely outcome of climate change and would probably result in short periods of significant flow volumes with corresponding spikes in flooding and erosion potential.

From a groundwater management perspective, the protective policies of the Oak Ridges Moraine Conservation Plan will contribute greatly to protecting important recharge areas. Full build out anticipated by the Growth Plan would occur on the Peel Plain that has silty clay soils with generally low recharge rates in the order of 100 mm/yr. However, this portion of the Peel Plain is overlain by a lens comprising thin layers of silty sand, on average less than 5 metres thick, with recharge capacity of 150-200 mm/yr. While these areas will be locally important in their capacity for infiltration, they also will likely have a shallow depth to water table. Another complicating factor for urban development is the fact that the regional groundwater flow gradient in this area is upwards, so recharge isn't as great as would be expected based on soil type. The management implication of this geological setting is that urbanization on the silty clay soils of the Peel Plain (with low recharge and high surface runoff) may have less impact on water budget than in other areas. However it is important to note:

- The local recharge capacity of the shallow lens of silty sand should be preserved to the extent possible to make use of the opportunity to contribute to maintaining overall water budget as well as discharge to local streams, especially those that are dependent on local recharge (e.g. Robinson Creek).
- Future infrastructure that may be constructed below the water table may require perpetual dewatering to address safety or flooding issues. This would interrupt flow patterns and may reduce local discharge.
- Buildings may require perpetual foundation drainage or need to be re-designed in areas of shallow depth to water table. We would recommend any foundation drainage be directed to the river system rather than to the stormwater management system to avoid contamination and increases in temperature of surface water.
- The most sensitive subwatershed in the potential growth area from a groundwater perspective would be upper Robinson Creek because of its reliance on local recharge (double the rate of the surrounding till plain) and shallow depth to water table.

Figure 4-2: Comparison of the Effects of Full Build-out and Sustainable Community Scenarios on Erosion Potential





4.2 NATURE

Analysis of potential aquatic communities showed that with official plan build-out, the majority of fish communities would shift to warm-water systems. Cool-water communities and a diminished cold-water community would likely persist in isolated headwater streams. With full build-out, the more sensitive cold- and cool-water communities would also disappear and biodiversity would be dramatically decreased, with only the most tolerant fish species remaining. Consideration of all available technical information suggests that the primary causes of these effects would be changes to the water balance (more surface water, less groundwater recharge and less discharge to streams), loss of natural cover, increased water temperatures and fragmentation of habitats.

Increased natural cover would probably benefit fish habitats and associated communities, at least under official plan build-out. These benefits would be most pronounced in the headwaters of the watershed. Increased natural cover is expected to "hold the line" (i.e. maintain current conditions) in Robinson Creek, Mt. Joy (formerly Exhibition Creek), Lower Main Rouge, Morningside Creek and the river mouth and estuary. In contrast, the lower Main Rouge, Beaver Creek and central Main Rouge would not appear to benefit from the increased natural cover (as defined in the targeted system used in our scenario) but instead would experience continued degradation. This is because there are limited opportunities to expand natural cover in these areas. These are some of the areas slated for the most intense development in the watershed, suggesting that the effects of urbanization would overwhelm the benefits from the limited planting opportunities there.

Monarch Butterflies

Planning for population growth will need to protect and enhance natural habitats, create spaces for nature-based experiences and celebrate the growing cultural diversity of local communities

We expect that if sustainable community initiatives and enhanced stormwater management measures were applied in addition to increased natural cover, it would be possible to maintain and perhaps achieve improvements to existing aquatic systems in most areas of the watershed.

Terrestrial habitats are currently fragmented in the watershed, although there are considerable blocks in Rouge Park in the lower and Little Rouge River watersheds. Much of the future development will occur in the watersheds of the Main Rouge and its tributaries, where natural areas are already fragmented to a significant degree. In addition, the increased human population is likely to increase encroachment and public uses, perhaps to the extent of over use.

Implementation of the targeted natural heritage system would increase terrestrial habitats to a large measure and improve the quality and connectivity of habitats and corridors. The presence of trees along riparian corridors, as required in the *Rouge North Management Plan*, will improve water temperature for aquatic communities via shading and, while trees increase evapotranspiration, there is evidence that they also increase infiltration and reduce erosion. The scenario comparisons also suggest that specific groups of some species (amphibians, some forest birds and perhaps some mammals) will decline with increasing urbanization because of habitat changes, disturbance and direct losses through road kill etc.

4.3 PEOPLE

Our analysis of potential future scenarios also helped us to consider the likely relationships between environmental conditions and human communities in the watershed. For example, an increasing

population will place additional stress on existing nature-based recreational resources and create demand for additional resources. On the other hand, expanded terrestrial natural heritage systems will enhance opportunities for nature-based recreational experiences and, together with features of sustainable community designs, contribute to improved quality of life.

Further urban development could result in loss of undiscovered cultural heritage sites, if proper advance investigation and protective actions are not undertaken. However, the settlement of more people in the watershed will continue to enrich the cultural diversity of the population. It will be important to provide more opportunities to raise awareness of the watershed's past cultural heritage as a basis for creating a new fabric of living culture.

With development will come increased traffic, resource use (e.g. water and energy), air emissions, and loss of farmland and local food production capacity. But if development is undertaken on the basis of sustainability principles, the new communities will facilitate sustainable choices (e.g. reduced vehicle use, water re-use, and alternative energy use), foster awareness and appreciation of cultural and natural heritage, and create improved environments for human health.

4.4 SUMMARY OF FUTURE CONDITIONS

This analysis of potential future conditions provides some valuable insights that will help us to guide future activities towards a healthier, more sustainable watershed.

With respect to water, we believe that in the Main Rouge it will be possible to "hold the line" (i.e. avoid further degradation), providing that extensive work is undertaken to increase terrestrial natural heritage and implement new approaches to development and stormwater management. There are opportunities to protect the Little Rouge by adopting new approaches to prevent and effectively mitigate negative impacts from additional growth, because there is a significant amount of protected land in the Little Rouge River watershed relative to the amount of existing development and future growth areas.

With respect to nature, there are excellent opportunities for protection, restoration and expansion of natural cover based on the protective policies applying to the Greenbelt, Oak Ridges Moraine and Rouge Park, combined with the potential of private landowner stewardship. In the aquatic systems, the key requirement will be to protect and maintain the water budget, especially with respect to groundwater discharges and water temperature.

We expect that climate change may exacerbate the negative impacts of stresses already at work in the watershed, including fragmentation of the landscape; land, water, and air pollution and disruption of natural system functions. This highlights the need to take actions that will increase the resilience of natural systems and reduce the potential future costs of addressing environmental issues.

In the following chapter, we recommend specific strategies to address both existing and potential issues and to take advantage of the many opportunities available to achieve our goals and objectives for the watershed.

CHAPTER

5

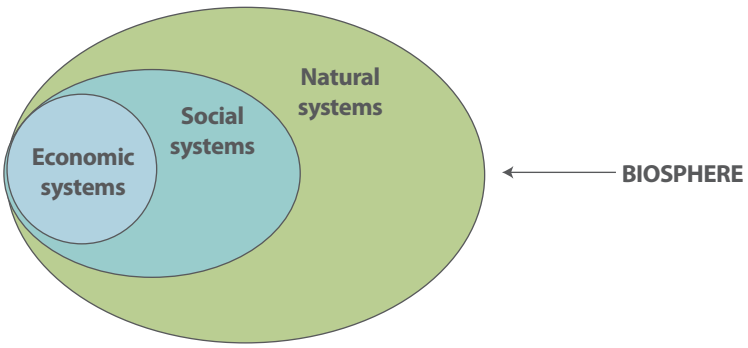
5.0 STRATEGIES

5.1 MANAGEMENT PHILOSOPHY – THE NEED FOR A NEW APPROACH

Overall goal: to work towards a healthy and sustainable Rouge Watershed by protecting, restoring and enhancing its ecological and cultural integrity within the context of a regional natural heritage system.

The Rouge watershed has experienced rapid urbanization in recent decades, and is beginning to show signs of stress on its environmental systems and quality of community life. With the projected population growth of another 4.5 million people in the Greater Toronto Area over the next 20 years (Hemson, 2005), the watershed will continue to experience urban development pressures. Indeed, "full build-out" of the watershed – to the boundaries established by the Growth Plan for the Greater Golden Horseshoe and the Greenbelt Act – is expected to occur by 2031.

Today, the watershed faces ongoing urban growth pressures combined with an urgent need to improve sustainability of existing urban areas and restore degraded streams. Clearly, we need a new approach to address these challenges. Fortunately, our understanding of watershed management has improved over the past two decades, and we can draw upon a considerable body of science, technical advances and real life examples to show a better way forward.



We believe that this new approach must be rooted in the concept of sustainability because it provides a comprehensive framework for meeting multiple objectives, not only for a healthy environment, but also for economic vitality and community health and well-being. The diagram below provides a way of visualizing the relationships among these three major systems. The biosphere includes all living organisms on earth, together with their physical environments. The natural systems are the non-human elements of the biosphere. Human social systems are dependent on the natural ones for their health and survival. Economic systems are embedded within the social systems.

Increasingly, public agencies in the watershed and in other regions across the country are recognizing the interdependencies of our environment, our economy and our communities. Examples include sustainability strategies developed by the City of Toronto and York Region, the sustainable approaches to development of Markham Centre and TRCA's vision for a Living City. All these initiatives are working towards a healthy, attractive, sustainable urban region. They are rooted in the understanding that sustainability means "meeting the needs of the present generation without compromising the ability of future generations to meet their needs" (United Nations Brundtland Commission, 1987). They guide us to change our approaches to watershed management:

- From mitigation to prevention
- From degradation to restoration and net gain
- From end-of-pipe to source control
- From waste to resource
- From single focus to multiple benefit
- From piecemeal to integrated management

What will this mean for the Rouge River watershed?

First, it means that we need to understand and manage for the integration and interdependencies among systems and at all scales in the watershed (Figure 5-1) We need to start by protecting and enhancing a healthy, functioning natural system as the basis for a sustainable community. Then we need to apply sustainability concepts at all scales (community, lot, building, and individual) such that the matrix supports the broader system and the built forms facilitate sustainable choices.

Sustainability in Greater Vancouver

Recent work in Greater Vancouver provides another example of thinking about sustainability. Their strategy is based on a green web composed of linked blocks of natural cover interlaced with the blue ribbons of rivers and streams. It envisages attractive, liveable and compact communities nestled within the green web and between the blue ribbons. Each community and each lot will be designed and managed for sustainability.

We must establish a land use framework that provides adequate space for people and their activities while minimizing disruption to the water balance above and below ground. We must designate sufficient space for natural vegetative cover and wildlife habitats. There must also be space for agriculture, recreational activities, learning opportunities, human heritage and culture. Transportation, water and sewer systems and

Figure 5-1: Linking Lot to Watershed

other infrastructure must support sustainability objectives. The Greater Golden Horseshoe Growth Plan for the Greater Golden Horseshoe and the Greenbelt Plan provide overall direction for this land use framework. The *Rouge Park Management Plan* and *Rouge North Management Plan* provide positive guidance for restoration of the 12% of the watershed represented by Rouge Park. This Rouge River Watershed Plan provides specific guidance for development and urban retrofits for sub-watersheds, communities and individual properties.

We have developed specific strategies to restore a more natural water balance and remediate degraded rivers and streams. They show how new development areas can be planned and managed differently from past and current practices. Our strategies also address ways to accommodate human activities to capitalize on the rich natural and cultural heritage of the watershed without damaging its resources.

5.2 HOW WE DEVELOPED THE STRATEGIES

Our management and implementation strategies are based on collaborative work undertaken by the Rouge Watershed Task Force, TRCA and Rouge Park staff, stakeholders, consultants and peer review experts over a three year timeframe. Following a review of current conditions (*Rouge River State of the Watershed Report, 2007*), the Task Force identified goals, objectives and targets for each major element of the watershed (see Chapter 2.0). Modelling was undertaken to help describe potential future conditions. Experience from other watershed jurisdictions was reviewed. A list of potential management actions was developed to achieve the objectives and targets. And a series of management summits was held to identify key management strategies and refine the specific actions.

The integrated approach taken in this management plan means that each management strategy may address a number of different goals. For example, the management strategy for stormwater retrofits addresses goals for groundwater, surface water, fluvial geomorphology and aquatic communities. Generally, we grouped strategies according to the primary goal they would accomplish, and cross-referenced to other goals where relevant.

The following sections describe management and implementation strategies under three broad headings: Water, Nature and People. A summary of recommendations can be found in Appendix F. More detailed listings of management actions and implementation tools are available in the *Rouge River Watershed Plan Implementation Guide.*

5.3 WATER

WATER

Goals

- Groundwater of sufficient quantity and quality to support ecological functions, aquatic habitats, native fish communities and sustainable human needs including drinking water, agricultural, industrial and commercial uses.
- Surface waters of a quality, volume and naturally variable rate of flow to support ecological functions, habitats and sustainable human needs and avoid risks from flooding and erosion.
- Natural, stable stream banks and channels that allow for natural stream flow patterns, support diverse aquatic habitat, limit sediment loading, and protect human life, property and infrastructure from risks due to erosion and slope instability.

Objectives

1. Protect, restore and enhance groundwater recharge and discharge.[3]
2. Protect, restore and enhance groundwater quality.
3. Ensure sustainable rates of groundwater use.
4. Protect and restore the natural variability of annual and seasonal stream flow.
5. Maintain and restore natural levels of baseflow.
6. Eliminate or minimize risks to human life and property due to flooding and erosion.
7. Meet standards for body contact recreation at nearshore beaches and in the river.
8. Protect and restore surface water quality, with respect to toxic contaminants and other pollutants, to ensure protection of aquatic life, ecological functions, human health, and water supply needs.
9. Protect and restore natural channel morphology and stability.

The water balance is crucial to the health and functioning of the entire watershed ecosystem. In order to achieve our goals and objectives, we need to restore and maintain to the extent possible an appropriate year-round and seasonal balance and quality of groundwater and surface water.

Our review of current conditions highlighted the following issues:

Groundwater

- Significant groundwater recharge from outside the Rouge watershed (East Holland and East Humber watersheds).
- Urbanization has the potential to reduce recharge resulting in lowering of groundwater levels in aquifers, reduced discharges to streams and potential shortages of well water supplies
- Loss of discharge (along streams, on flanks of Oak Ridges Moraine and Lake Iroquois Shoreline)
- Local contamination from excess nutrients and chloride

3 "Enhance" does not include increasing infiltration beyond natural background levels.

Surface water quantity

- Continued urbanization is increasing surface runoff, total flow volumes, watercourse instability and erosion
- Water taking disrupts low flow conditions
- Flood vulnerable areas, especially in Town of Markham
- Stormwater management approaches vary throughout the watershed, with some areas receiving better controls of water quantity and quality than others
- Previous and current approaches to stormwater management inadequate to protect healthy river systems
- Maintenance requirements of existing stormwater management infrastructure

Surface water quality

- Stormwater management measures in older urban areas are not adequate to protect Rouge River and tributaries from pollution and temperature fluctuations
- Need for maintenance of stormwater management infrastructure
- Poor land management practices (pollution, erosion and sedimentation) associated with urban development
- Elevated and increasing chloride levels may threaten aquatic life
- Continued occurrence of spills

Stream form

- Unnaturally high rates of erosion
- Lack of channel stability
- Habitat degradation

Many of these issues will continue to worsen, even if there was no more development in the watershed, because the streams have not finished responding to the altered flows caused by existing development. So they will continue to erode, widen and deepen. The uncertainties of climate change will add further stresses to the system.

Little Rouge River (Photo Credit: Rouge Park)

However we know that development of the Rouge watershed will continue through the implementation of existing official plans. Beyond that time, there is likely to be further development up to the boundaries of Rouge Park, the Greenbelt and the Oak Ridges Moraine protected areas, assuming that these policies are maintained.

Clearly we need new approaches to restore and maintain an appropriate water balance for a healthy watershed. But first, it is helpful to review what we have learned from previous approaches to stormwater management.

Stormwater retrofit
Installation of new stormwater management measures or upgrades to existing infrastructure at the lot level, conveyance system or at end-of-pipe, in order to improve the level of stormwater management.

Over the past six decades, different approaches to stormwater management have been applied in an effort to address downstream conditions resulting from urbanization. Following the devastating effects of flooding caused by Hurricane Hazel in 1954, the primary approaches were to prevent building in floodplains, and to convey water away from urban areas as quickly as possible. Urban design standards required lot grading to maximize runoff from each building site so that roadways, ditches and storm sewers could transfer water to streams and rivers. In some cases, watercourses were straightened, enlarged and lined with concrete or stone to accommodate the increased runoff volumes and velocities. In the early 1980s it was recognized that these measures actually worsened downstream flooding and erosion. In response, there was a move to direct water from subdivisions to detention ponds that reduced the peak stream flows from major storm events. In the early 1990s, the design of stormwater ponds was modified in an attempt to treat water quality and reduce downstream erosion by increasing detention times, providing more time for pollutants to settle and reducing outflow rates. Experience has shown that such ponds can be an adequate means of improving water quality and managing flood risks, when combined with strong floodplain management policies. However emerging monitoring studies in the Rouge watershed and elsewhere shows that they are insufficient to reduce erosion and impacts on aquatic habitats caused by an increase in stormwater runoff volume.

The realization that urban stormwater runoff has been contributing to serious declines in river system health has lead to a significant shift in approach towards urban stormwater management. The new philosophy takes a more holistic approach aimed at achieving multiple benefits including control of flooding, protection of water quality and aquatic and terrestrial habitats, reductions in in-stream erosion, maintenance of groundwater recharge and avoidance of groundwater contamination by pollutants. The thrust of this new philosophy is a three-pronged approach.

First, efforts are made to retain the existing water budget to the extent possible by first encouraging infiltration and evapotranspiration through community design that minimizes imperviousness and through measures on each building lot, or "at source". The second line of defence is to infiltrate water into the ground during conveyance (e.g. from stormwater pipes). Third, "end-of-pipe" measures such as detention ponds and underground tanks are viewed as part of the treatment train or multi-barrier approach. Sometimes referred to as "Low Impact Development", this approach for protecting and managing the natural heritage and hydrological systems is an integral part of our broader sustainable community concept.

Unfortunately, implementation of strategies to remediate environmental conditions caused by previous development is a long-term and costly endeavour. For example, the City of Toronto estimates a cost of $40 million/year over 100 years to retroactively implement such strategies through its Wet Weather Flow Management Plan, and even then it will not be possible to return to pre-development environmental conditions. As development continues in the Rouge watershed, it is

now obvious that it will be more cost effective, and less harmful to the environment, if we can apply this new approach to new development and avoid future remediation needs.

Looking ahead to potential future conditions, we expect that the Main Rouge River and its tributaries will be subject to the greatest amount of new development and increases in the severity of the issues noted above. Because the Little Rouge will experience much less development, due to the protective policies of the Oak Ridges Moraine Conservation Plan, Greenbelt Plan and Rouge Park, it will show fewer negative impacts, but will still require management to meet our goals and objectives.

Our analysis showed that in order to avoid these further impacts, and in some cases achieve improvements over existing conditions, it will be necessary to apply an integrated suite of measures: improvements to stormwater management (mostly at the lot level, with selected end-of-pipe retrofits in existing urban areas, especially in commercial and industrial lots), increased natural cover and sustainable community initiatives, both to retrofit existing urban areas and to develop new greenfield areas. Sustainable community initiatives for greenfield developments encompass a number of key strategies, including reduction of impervious cover through innovative community design, stormwater management strategies based on source control at the lot level to minimize disruption to the water budget, pollution prevention and other stewardship practices.

New greenfield development should be phased in small increments that will reduce the extent of overall soil disturbance in the watershed during the construction phase while other water budget management approaches (e.g. increased natural cover, lot level stormwater management) are established to buffer the effects of future urban growth. This phased approach will also allow monitoring and evaluation of the performance of new technologies, as well as the watershed's response, such that continuous improvements can be incorporated in future applications. Flexibility will be required to adjust management strategies promptly if necessary.

It is critical that existing stormwater management and flood control infrastructure be maintained and that education and awareness and incentive programs be put in place to foster improved voluntary uptake of lot level practices and long term care of such measures, recognizing the challenges of maintenance and enforcement on private property.

Current Initiatives

The City of Toronto's Wet Weather Flow Management Plan (and accompanying Interim Implementation Guidelines, 2006) recommends retrofits to existing stormwater systems to improve control of runoff that flows to the lower reaches of the Rouge River. Richmond Hill and Markham have prepared similar stormwater retrofit plans. Planned pilot testing of water balance benefits from commercial/industrial and residential infiltration systems in the Box Grove development area in Markham will provide valuable information about the use of these techniques on clay soils. Existing and planned pilot testing in the Yonge West development area in Richmond Hill will provide information about the performance of soakaway pits and permeable pavement.

Strategies

Our strategies for water encompass ten inter-related themes:

1. Protect recharge and discharge
2. Increase natural cover
3. Improve sustainability of development design
4. Improve erosion and sediment control and site restoration
5. Implement stormwater retrofits
6. Maintain stormwater infrastructure
7. Prevent pollution
8. Manage flood risks
9. Protect stream form
10. Monitor, evaluate and adjust

1. Protect recharge and discharge

It is essential to protect or enhance infiltration, an important element in managing water balance. We also recommend that municipal plans, policies and regulations identify and protect key recharge and discharge as well as subsurface flow directions (see Section 3.2.3). Two priority considerations are local recharge and significant regional recharge.

Some of the highest priority local recharge areas are for those tributaries (Robinson Creek, Morningside Creek and upper Main Rouge River) that are heavily reliant on local sources, rather than those draining from the more stable Oak Ridges Moraine area.

It is vitally important to protect recharge in high volume recharge areas. These include two notable areas that lie outside the Rouge watershed boundary (in north-east Humber watershed and East Holland watershed in Lake Simcoe Region) are important in supporting baseflow at least in the upper tributaries. We endorse the Oak Ridges Moraine Conservation Plan and its protective designations that will contribute to appropriate management of land uses in these areas. We intend to work with the Lake Simcoe Region Conservation Authority, the Town of Whitchurch Stouffville, Town of Richmond Hill and the Region of York to raise awareness of the importance of recharge areas outside the Rouge boundary to environmental health within the watershed. The Region of York Official Plan should be amended to include the delineation of these key recharge areas in the Region's natural heritage system.

Mechanisms to protect and enhance infiltration include protection and expansion of natural cover, careful development site design, and stormwater management including lot level retrofits in existing urban areas (see strategies below). The best way to maintain recharge in developing areas is to review opportunities early in the development planning process, and set aside key recharge areas for inclusion in the natural heritage system. We recommend that this broad site planning and optimization of site design be done through larger scale studies, for example at a subwatershed scale. This watershed plan and supporting documents should be consulted for background technical information and other related recommendations.

Natural vegetation slows the rate of stormwater runoff

2. Increase natural cover

The targeted terrestrial natural heritage system identified later (Section 5.4.2) is an essential part of our strategies to maintain and improve the water balance. It will help to reduce surface runoff, attenuate peak flows and improve water quality. Components of this system that are particularly important to water balance are wetland protection and restoration and the protection of surface streams and other ephemeral water features.

We recommend that implementation of natural cover improvements should proceed as quickly as possible in the upper Main Rouge and middle tributaries in advance of future urbanization, to provide some buffering capacity when development begins. In the Little Rouge subwatershed, the most strategic locations for plantings would initially be in the headwaters of the tributary that flows through the Town of Whitchurch-Stouffville to buffer impacts of urban growth and in Rouge Park along the Little Rouge River.

We recognize the important role of Rouge Park in contributing to natural heritage and water management and endorse its implementation through such policies as Markham's OPA 140, which implements the Rouge North Management Plan and the Rouge North Implementation Manual's "ecological criteria" in the middle reaches of the watershed, outside the Greenbelt Plan's protected countryside. We also support the principle of the Markham Small Streams Study and its role in protecting the hydrologic function of small drainage features and we recommend that further work be done to simplify its implementation through development planning.

Markham Small Streams Study (2006)

This study is designed to guide the long term management of small streams and intermittent drainage features to maintain and enhance their functional contribution to the health of the Watershed ecosystem, including enhancement of water quality, stream flow and aquatic habitats.

3. Improve sustainability of development design

Behavioural shifts and innovative urban design forms will be necessary to achieve our objectives for water management. The form, design and stormwater management of all new developments should minimize impervious areas, and aim to maintain pre-development rates of infiltration, evapotranspiration and surface runoff. We also recommend consideration of a policy for "no net loss of topsoil", as a means of reducing loss of soil moisture storage capacity.

To accomplish these changes, we recommend that the Province, in cooperation with the Association of Municipalities of Ontario and Conservation Ontario should prepare development standards to guide more sustainable community design, as part of the implementation of the Growth Plan for the Greater Golden Horseshoe and consistent with section 3.2.6 of the Greenbelt Plan concerning

Stormwater as a resource

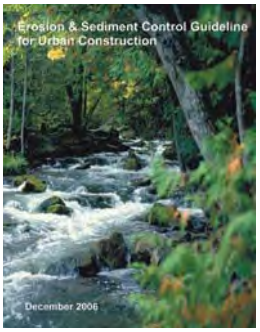
- Adopt enabling policies (e.g.to use rainwater for grey water purposes such as irrigation and toilet flushing),
- Educate watershed residents, businesses, agencies and regulators regarding the benefits of lot level source control measures such as rainwater harvesting and water conservation, and
- Use social marketing strategies and develop incentives for desirable stormwater management measures.

additional plans/policies guiding decisions in the Rouge watershed and Rouge Park. Related to this effort is the need for updated stormwater management guidelines. These development standards should guide provincial and municipal growth planning initiatives.

Similarly, we recommend that watershed municipalities should review their engineering and community design standards and make revisions and upgrades where possible to ensure that they allow adequate flexibility to meet stormwater management objectives (e.g. road drainage measures, plumbing code changes to encourage rain water harvesting and grey water use.

From our analysis we were able to improve our understanding of cumulative effects and learned that state-of-the-art stormwater management ponds alone cannot control erosion to existing levels on a watershed scale (see also section 3.2.4). We therefore recommend that stormwater management strategies for future urban expansions should consider the sub-watershed scale, in addition to impacts to receiving tributaries. This will provide a better basis for stormwater pond design and other supportive measures in the stormwater management system (e.g. at the lot level and during conveyance).

Examples of lot level stormwater management practices: bioretention swales, porous paving, green roofs, and rain gardens.



Aerial view of a construction site, (Photo credit: L. Wise) Example guideline document.

4. Improve erosion and sediment control and site restoration

Even with controls, construction activities can result in considerable soil erosion, higher runoff and harmful effects on watercourses due to increased flows and sedimentation. Traditional greenfield development frequently occurs at the scale of the concession block. If this pattern continues, several blocks across the middle Rouge tributaries could be exposed to erosion simultaneously, representing a significant, detrimental impact on stream aquatic life. Therefore we recommend a focus on erosion prevention first, by phasing development in each sub-watershed to limit the extent of exposed soil at a given time and second, by stabilizing soils as soon as possible. Specifically, municipalities should:

- Adopt policies that phase topsoil stripping to smaller geographic areas and require site stabilization/re-vegetation as soon as possible
- Restrict topsoil stripping until draft plan approval

Another key issue is the proper installation, inspection and maintenance of erosion and sediment controls and site restoration. We recommend that municipalities review and strengthen where necessary their bylaws regulating land disturbance (e.g. Site Alteration, Fill, Topsoil, Erosion and Sediment Control Bylaws and Subdivision Agreements). They should also undertake increased inspection and enforcement in partnership with TRCA's Enforcement Officers. The *GTA Erosion and Sediment Control Guideline for Urban Construction* currently being finalized will provide additional guidance and should be adopted by the municipalities.

The following additional recommendations will support efforts toward the improvement of erosion and sediment control and site restoration practices:

- Conduct regular training seminars for municipal and CA staff, consultants, and contractors to promote awareness of best practices and application and testing of innovative, environmentally-friendly products for erosion control and site restoration
- Develop new provincial standards for various technologies and practices to encourage product manufacturers to improve them (e.g. filtering capacity of sediment devices)
- Improve site maintenance and restoration during and following construction
- Adopt a policy requiring replacement of topsoil and subsoil and reducing on-site compaction, to ensure the site is amenable to restoration and supportive of lot level stormwater management
- Require use of native species in site restoration planting plan and require sign-off by qualified professional on "as-installed" site
- Review and identify mechanisms for requiring long-term monitoring and replacement of stabilization measures until sites are restored as planned

Examples of stormwater management techniques

Lot level

- Rain gardens
- Green roofs
- Porous paving

Conveyance

- Exfiltration pipes
- Infiltration trenches
- Swales

End-of-pipe

- Stormwater ponds
- Underground detention

For more information, see TRCA STEP (Sustainable Technology Evaluation Program) www.sustainabletechnologies.ca

5. Implement stormwater retrofits

Retrofits and improved management of stormwater management systems should be undertaken as described in such studies as the *City of Toronto Wet Weather Flow Management Plan* and stormwater retrofit studies of the Towns of Markham and Richmond Hill.

Lot level and conveyance systems should be implemented where possible in existing urban areas to achieve greater retention of water on site, through infiltration and evapotranspiration. For example, when impervious surfaces such as driveways and parking lots need replacement, more porous paving materials should be selected. It is generally preferable to emphasize infiltration over evapotranspiration, especially in sub-watersheds of upper Main Rouge, Robinson Creek and Morningside Creek, where local recharge to groundwater provides a significant proportion of baseflow recharge and is critical to maintain aquatic habitats. Innovative technologies will be needed to accomplish infiltration in areas of low permeable soils, such as third pipe exfiltration/infiltration systems, clean water collectors, bioswales, and parking lot infiltration trenches. Other, non-infiltration strategies for water management may include naturalization of residential properties, rain gardens, rain harvesting and green roofs on commercial/industrial/institutional properties with extensive impervious surfaces.

The Town of Richmond Hill has been monitoring the performance of many of its existing stomwater management ponds and believes there may be "recommissioning opportunities" through minor modifications that could optimize their performance with respect to water quality and erosion control. Additional stream flow data should be collected in headwaters streams to assist in refining hydrologic models which contribute to improved design (see monitoring recommendations in Chapter 7). Similar recommissioning programs should be formalized as part of the regular operations and maintenance programs of all the watershed municipalities.

Our studies suggest that priority be given to undertaking end-of-pipe retrofits and improved stormwater management in the highly urbanized Beaver Creek sub-watershed, as part of the erosion management strategy and as set out in the Town of Richmond Hill and Town of Markham stormwater retrofit studies. We recommend that this initiative should be reviewed and reconfirmed in five years following verification of the benefits of all potential retrofit and recommissioning initiatives on Beaver Creek and other sub-watersheds, based on additional flow data and new calibrated hydrologic models. Our study results indicated that this effort would have localized benefits in reducing erosion potential. As a first step in undertaking these projects, we recommend a comprehensive sub-watershed exercise to generate detailed designs. In other areas we recommend that end-of-pipe retrofits be implemented as opportunities arise, such as during maintenance initiatives or road or park redevelopment projects.

Municipalities should continue to develop and implement revised municipal engineering standards to ensure that they allow adequate flexibility to meet stormwater management

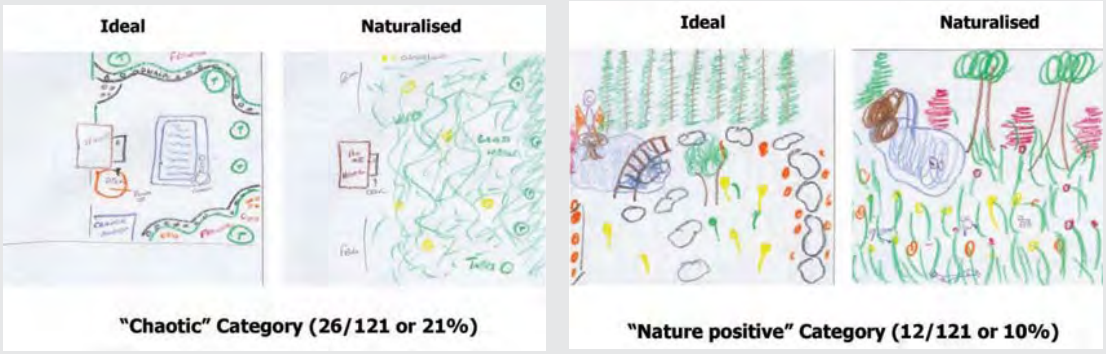
objectives (e.g. road drainage measures, plumbing code changes to encourage rain water harvesting and grey water use).

The *Action Plan for Sustainable Practices* developed by Freeman Associates (see box) should be implemented to dispel myths about sustainable water practices and naturalized landscapes and provide positive examples, information and incentives. Areas within the Rouge watershed, such as Unionville (where the survey showed a particularly positive response from residents) could be selected as pilot projects. Key components of the plan for residential landowners include:

- A multi-pronged marketing campaign in the GTA.
- Partners include municipalities, NGOs and retailers.
- Components of the campaign could include a poster campaign, advertising in community newspapers, direct mailings, point of purchase displays, workshops, demonstration projects, tours and garden competitions.
- Builders should be encouraged to include low maintenance landscaping with native plant species as an option available for new homes.

For businesses, it will be necessary to go beyond this marketing approach to address some of the key barriers. The *Action Plan for Sustainable Practices* recommends:

- Streamlined approvals process for projects that go beyond regulatory requirements.
- Regulatory changes.
- Financial incentives such as no-interest loans and grant programs
- Information tools such as a guide book, workshop, demonstration projects and email advice ("ask an expert").



Single family residential homeowners in the GTA were asked to draw their ideal backyard landscape and their perception of a naturalized backyard. About 21% of them perceived naturalization as chaotic and very different than their ideal, while 10% were at the other extreme end of the spectrum of respondents in that they viewed a naturalized yard as similar to their ideal. When shown photos of naturalized landscaping 84% of respondents liked it! This study taught us that there is already a willing market for implementation of some of the lot level strategies in this plan, yet more information is needed to overcome deeply held perceptions.

Social Marketing Opportunities for Sustainable Practices

Two recent studies provide valuable insights into the design and likely success of programs to encourage naturalization and lot level stormwater management by businesses and the public. They are the Action Plan for Sustainable Practices in the GTA – residential and businesses - by Freeman Associates and the Canadian New Home Builder Customer Satisfaction Study by J.D. Power and Associates. Key findings of these studies:

Residental

GTA homeowners' landscapes are viewed as an extension of their homes and themselves. A key barrier to adoption of sustainable practices for landscape design and maintenance is that homeowners have a deeply held landscape aesthetic (manicured, colourful, tidy, designed) that they do not associate with a "naturalized" landscape. However, when shown photographs of examples of naturalized landscapes and lot level stormwater infiltration methods, most people found them attractive and 84% were willing to consider changes to their home landscape. 46% of new home buyers would accept a low maintenance landscaping package requiring less water and fertilizer use if offered by the builder. Landscape professionals, nurseries, garden centres and large stores such as Home Depot and Canadian Tire are key trusted advisors for garden design and purchase of plants and products.

Business

There are opportunities associated with the growing environmental ethos penetrating business and government decision-making. Energy efficiency and the reduction of water use and wastes are growing priorities, and green building design is gaining acceptance. Innovative stormwater management and naturalized landscapes receive much less attention. There are regulatory, financial, information and technical barriers that should be addressed with a multi-faceted, regional strategy.

- Awards program to provide visibility and profile.
- Corporate leaders program.

6. Maintain stormwater infrastructure

There are approximately 200 stormwater management ponds in the Rouge watershed, many of which have been in place for several decades and need to be cleaned out (sediments removed) so that they continue to contribute to control of flooding, water quality and erosion.

Other stormwater infrastructure, such as catchbasins, swales and oil/grit separators, also need improved maintenance to ensure that they function as effectively as possible. We recommend that municipalities continue to develop and implement operation and maintenance plans for their stormwater management infrastructure. Innovative financing mechanisms are needed to ensure sustainable funding of stormwater maintenance programs. These funding strategies should also consider including costs of retrofit programs. They could include stormwater management fees associated with the municipal water and sewer bill, and credits for property owners who undertake good stormwater management practices and reduce their site runoff and pollution.

7. Prevent pollution

The first line of defence against pollutants is always pollution prevention. For example, in developing our sustainable community scenario, we assumed 10% reduction in pollution generated

from fertilizers, pesticides, metals, and suspended solids, and 30% reductions in chloride from careful management of road de-icing. In addition, lot level retrofits to retain water on individual properties will reduce the conveyance of pollutants to streams and rivers.

To accomplish these improvements, there is a need to develop, communicate and enforce bylaws and regulations to control use, storage and management of potential pollutants. This will require coordinated actions by the Province and municipalities.

Key elements of Nutrient Management Act

- Riparian corridor and natural heritage protection and rehabilitation.
- Best management practices for rural land uses.
- Establishment of local clean water advisory committees with mandate to oversee the implementation of rural water quality improvements. Progress will be reported to local and regional municipalities.
- Public agency leadership in addressing rural water quality improvements (i.e., as major landowners, the Federal and Provincial Governments, Rouge Park and the TRCA should demonstrate opportunities for improvement on their own lands).
- Reclamation of wetlands to retain nutrients and prevent soil erosion.

For example, we encourage the Province to:

- Develop Provincial guidelines for inland fill operations to ensure acceptable fill quality and location.
- Adopt ecological policy, criteria and guidelines that address water temperatures and chloride.
- Continue to develop and implement a rural water quality stewardship program to address priority contaminant sources and support nutrient management standards under the Nutrient Management Act. Because of the large numbers of publicly owned farmlands in the Rouge watershed, there are opportunities to link stewardship agreements to leases. Rouge Park is already implementing such measures with its tenant farmers.

We encourage municipalities to:

- Develop monitoring programs to track the amount, timing and distribution of road salt applications.
- Review and implement snow disposal and road salt management plans, prepared in response to the Federal designation of road salt as a toxic substance under the Environmental Protection Act, with special consideration for roads on vulnerable aquifer recharge areas.
- Provide routine staff training for spills prevention and control programs.
- Adopt bylaws limiting the cosmetic use of pesticides (City of Toronto and Markham have already done this).
- Encourage programs to control, minimize and treat runoff (e.g. green roofs).
- Promote education and awareness programs, such as Yellow Fish Road, Healthy Yards etc in cooperation with TRCA, Rouge Park and other community partner groups.

- Naturalize stormwater ponds to discourage use by Canada geese and provide educational signage advising the public not to feed the geese.
- Retrofit existing stormwater management facilities to incorporate water quality and erosion control as opportunities arise.
- Ensure that sewer use by-laws are up to date including application to storm sewers and regional roads, requirements for the preparation of pollution prevention plans, and provisions for the establishment of an inspection program.
- Establish award incentives for each target audience (i.e. residents, businesses, government), such as "Most Environmentally-Friendly Design".

We also recommend an Integrated Pesticide Management (IPM) Program for golf courses and cemeteries.

8. Manage flood risks

Flood risk management is achieved through various means including planning and development legislation and municipal programs such as infrastructure improvements. Under the Planning Act, municipalities must be consistent in their land use decisions with the Natural Hazards policies of the Provincial Policy Statement (PPS) to ensure that any new development is directed away from areas where there is an unacceptable risk to public health, safety or property damage. Complementary to the PPS, TRCA administers the "Development, Interference with Wetlands and Alterations to Shorelines and Watercourses Regulation" (Ontario Regulation 166/06 under the Conservation Authorities Act) and TRCA's Valley and Stream Corridor Management Program.

Within the Town of Markham, the historical Unionville Village and some of the existing development along the Highway 7 corridor between Warden Avenue and McCowan Road were established prior to the implementation of a Provincial flood plain planning policy and are located within the Regional Storm flood plain of the Rouge River. In 1990, through the provisions of the PPS, the Ministers of Natural Resources (MNR) and Municipal Affairs and Housing (MMAH) designated these lands as a Special Policy Area (SPA) in Markham's Official Plan (Official Plan Amendment No. 100). The intent of the SPA designation is to provide for the continued viability of existing uses to sustain these communities provided that flood hazard management measures are taken, such as flood-proofing, flood remediation and risk reduction. Any change within the SPA, above and beyond what has already been approved by the Province, must be supported by both the MMAH and MNR. In this regard, a comprehensive risk assessment plan would be required to define how additional risk to both life and property that is created through land use changes can be managed by the municipality. In the absence of a risk management plan, changes in land use and intensification potentially increase the liability for all public bodies.

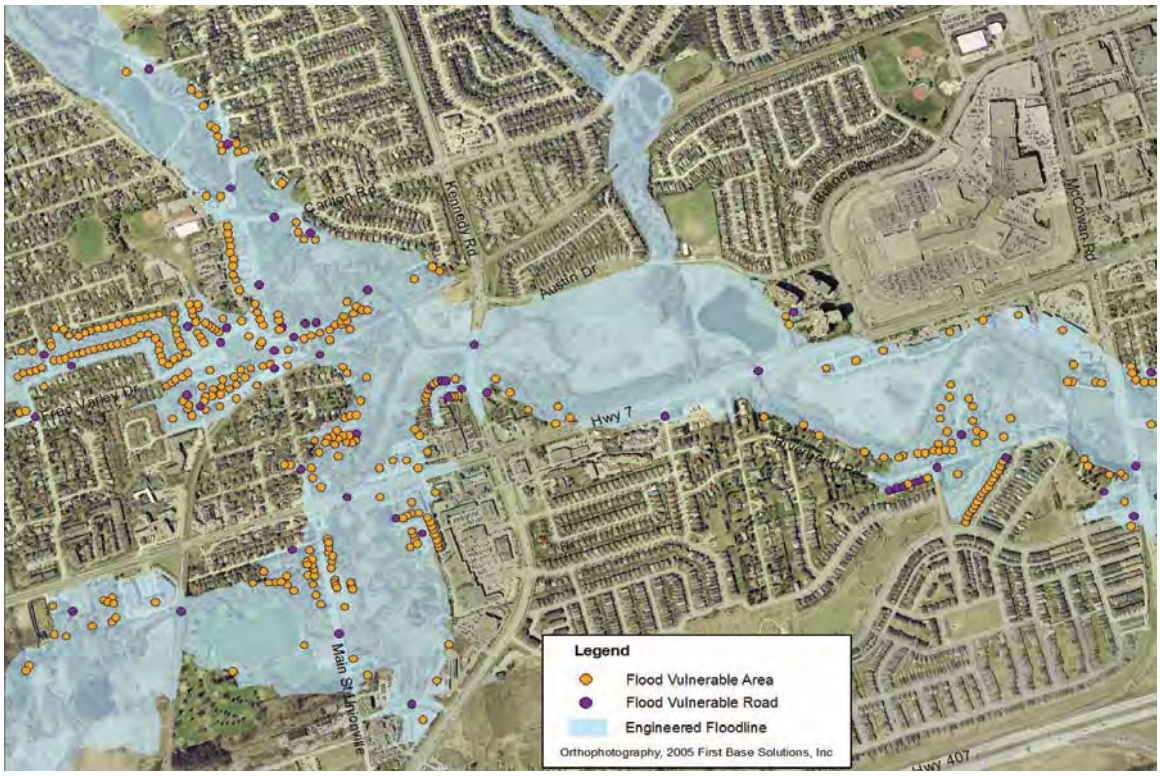
Efforts to remediate flood risk in the watershed are a priority, especially in the SPA. We recommend that a flood risk study be undertaken to identify improvements to the hydraulic capacity of road and rail crossings in the Markham SPA. All road or rail reconstruction projects, as well as applications for development/redevelopment, should be designed to incorporate opportunities to remediate flood vulnerable roads or sites. Given past practices of incremental filling within the

SPA, future applications that propose filling as a flood proofing measure should be reviewed in a comprehensive manner that considers the cumulative impact of filling on the flood plain as well as compatibility with site design of adjacent lands.

Intensification of historic communities in the flood plain through the province's *Places to Grow* initiative presents a potential conflict with the avoidance of development in flood prone areas. We recommend that TRCA work with the Province, municipalities and developers to reconcile this conflict, through flood studies, flood remediation and flood proofing measures, and seeking opportunities for intensification outside the flood plain.

Tied to the municipal growth management exercise, it will be necessary to evaluate the effects of development beyond the existing Official Plan designations and the potential to increase the frequency and severity of flooding, particularly within existing flood vulnerable areas, including the SPA. Regular review of flood plain modelling assumptions that trigger new updates is required to ensure flood hazards are accounted for and to confirm that appropriate stormwater management controls are implemented as growth proceeds.

Advancements in the prediction of regional and local climate change should be tracked, and impacts on local flood risk assessed such that local stormwater and floodplain management approaches can be modified as required. This is especially important given the anticipated increase in the intensity and severity of storm events due to climate change that could affect peak flows and related flood risk.



Digital regional floodline mapping (Markham Special Policy Area) is used to identify individual properties at risk of flooding and facilitate notification during a flood emergency

We also recommend a suite of other measures to prevent, eliminate or reduce flood risks including:

- Continue to operate the flood forecasting and warning program.
- Continue to develop and enhance the real time precipitation and stream gauge network.
- Continue to maintain and upgrade the flood vulnerable site database response model to assist municipal emergency response.
- Assess opportunities and develop a plan for remediating hydraulic constrictions and reducing flood vulnerability.
- Educate homeowners regarding flood risks associated with improper practices such as backyard dumping and impediments to water movement.
- Implement active and passive re-vegetation programs to promote attenuation of flood flows (e.g., no mow zones, riparian plantings, grass swales).
- Develop flood emergency response plans at the municipal level.

9. Protect stream form

The protection of streams from erosion and sedimentation was addressed earlier in our recommendations regarding recharge, natural cover, development design and stormwater management.

A number of other tools are available to protect natural stream form. They include the *Rouge Park Management Plan, Rouge North Management Plan*, TRCA's *Valley and Stream Corridor Management Program*, TRCA's *Evaluation, Classification and Management of Headwater Drainage Features: Interim Guidelines* and the *Markham Small Streams Study*, which will include implementation methods. We recommend that where policy areas overlap, the more restrictive policy shall apply.

Road crossings over watercourses should be sited at appropriate locations to minimize potential for alterations to channel form and allow for natural movement of the channel within the floodplain (for example, not on a meander), avoid or reduce channel lowering, relocate to maintain channel forms, monitor channel stability and guide restoration of channels using bioengineering. In addition, opportunities should be investigated to acquire lands in strategic locations to allow stream corridors to evolve naturally, without impacting property or infrastructure.

When rivers and streams move across their floodplains, they may expose infrastructure that was historically located in valley corridors. Catastrophic events can create the need for immediate emergency projects that do not allow adequate time for planning. As further discussed in the sustainable infrastructure section, we recommend that planning for new infrastructure should avoid placing infrastructure in valleys in order to allow room for natural movement of the channel across the floodplain.

We also recommend that municipalities and other agencies maintain an inventory of "at-risk" infrastructure and conduct regular monitoring of these sites, so that they can initiate proactive planning for remediation projects. These infrastructure remediation projects should incorporate opportunities for net gain in achieving objectives of this watershed plan.

10. Monitor, evaluate and adjust

TRCA's Sustainable Technologies Evaluation Program (STEP) provides a valuable forum for coordinated performance monitoring and evaluation among a number of agencies and private partners. We recommend that it should be provided with long-term support to continue to:

- Develop policies and design guidelines for new technologies such as green roofs and permeable pavement, and assess barriers to implementation.
- Arrange for third-party verification of technology performance.
- Implement and evaluate pilot projects using innovative technologies.
- Communicate results through web, seminars and publications.

It is also important to monitor the effects of new and retrofitted urban development design and stormwater management practices and implement adaptive management where necessary. We recommend that this should include:

- Require developers to undertake or contribute to compliance monitoring and enforcement to ensure that the approved stormwater management facility design performance targets are met.
- Conduct monitoring studies at the technology scale and sub-watershed scale to determine the extent to which community design standards and innovative stormwater management practices mitigate the cumulative effects of urban development on the water balance and aquatic systems.
- Develop targets for identifying and monitoring the maintenance of a natural range in variation of flow regime (e.g. ratio of baseflow to average annual flow). Review and update targets periodically, based on long term monitoring data.
- Monitor on a long-term basis baseflow, stream flows, groundwater levels, and precipitation in the Rouge watershed, as part of the Regional Watershed Monitoring Network (see also Section 5.6).
- Evaluate all impacts of environmental change (including climate change) on baseflows and revise the management recommendations and criteria of this watershed plan as necessary.
- Adopt modified management strategies, criteria and guidelines, as necessary.

5.4 NATURE

5.4.1 AQUATIC SYSTEM

The aquatic system includes the physical and chemical conditions and the communities of fish, invertebrates and other animals and plants that live in the streams, rivers and wetlands of the Rouge watershed. Its health is very dependant on the status of other elements of the watershed, especially the water cycle and natural cover.

Our review of current conditions in the watershed showed that the aquatic system is still relatively healthy, with high species diversity and a range of cold, cool, and warm water habitats. However, it

highlighted the following issues:

- Changes to the water balance affecting flows
- Habitat loss, fragmentation and degradation
- Loss of many native fish species
- Invasive non-native species
- Fish consumption restrictions

AQUATIC SYSTEM
Goal

A healthy aquatic system that supports a diversity of native habitats and communities and provides sustainable public use opportunities.

Objectives

10. Protect, restore and enhance the health and diversity of native aquatic habitats, communities and species.
11. Provide for sustainable fishing opportunities and the safe consumption of fish.

Looking ahead to potential future conditions, our analysis showed that unmitigated urban development will result in deterioration of aquatic communities, with the likely loss of cold and cool water fisheries and considerable reductions in species diversity. Enhanced natural cover alone would not be sufficient to counteract the full impact of urbanization in most areas, so additional technological solutions such as lot level stormwater management are needed to maintain groundwater recharge/discharge and flow conditions.

Current Initiatives

A Fisheries Management Plan is currently being developed for the Rouge River by the Ontario Ministry of Natural Resources, Fisheries and Oceans Canada, Toronto and Region Conservation Authority and Rouge Park. The draft plan should be complete by December 2007 and will be implemented by a range of interest groups and agencies, under the guidance of an Implementation Committee. Other valuable initiatives to guide improvements to the aquatic system include the Little Rouge Corridor Management Plan, Rouge Park North Ecological Criteria, TRCA's Rouge In-stream Barrier Assessment and the Town of Markham's Small Streams Study.

Throughout the last decade, Rouge Park has funded extensive restoration efforts in the Rouge Marsh complex and throughout riparian areas in the watershed. These efforts will continue.

A fishway has been installed on the Milne Dam and has been in operation for three years. Monitoring results indicate that a variety of cold water species such as rainbow trout and Chinook salmon, and warmwater species such as smallmouth bass, pumpkinseed, shiners, suckers and bullhead have successfully ascended the fishway to gain access to upper sections of the Main Rouge River.

Strategies

Whereas the Fisheries Management Plan provides specific strategies for each of the ten fish management zones (see Figure 3-8 in section 3.3.1), this watershed plan provides guidance to protect

and improve aquatic ecosystems at a broader level. Protection of the groundwater system, base flows and surface water flows, combined with implementation of a robust terrestrial natural heritage system with a strong riparian component, will help to maintain the integrity of aquatic ecosystems.

Therefore the thrust of our management recommendations is to protect water balance and habitats in the smaller streams in the watershed and manage the surrounding landscapes to provide a healthy, functional ecosystem for redside dace and native brook trout. Management in support of these target species will provide conditions that are suitable for other species that require stable, cold or cool water habitats. There are also opportunities to protect and enhance the very diverse warm water communities in the lower reaches of the watershed. Overall, maximizing the diversity of species and habitats will help to buffer the expected effects of urbanization and climate change.

There are four priority management strategies for the aquatic system:

1. Protect habitat and maintain flow conditions
2. Optimize fish passage for native fish species
3. Install or maintain barriers to partition species or exclude invasive species
4. Improve recreational fishing opportunities

1. Protect habitat and maintain flow conditions

Approximately two thirds of groundwater discharge occurs in small temporary or permanent streams, both in the upper watershed and in a significant number of downstream locations. These headwater streams should be protected from landform alterations and from changes to the amount and seasonal distribution of groundwater contributions. A number of tools are available to help protect streams, including the *Valley and Stream Corridor Management Program* policy, Conservation Authority regulations, TRCA's *Evaluation, Classification and Management of Headwater Drainage Features: Interim Guidelines* and the proposed *Town of Markham Small Streams Program.* Where policy areas overlap, we recommend the more restrictive shall apply.

Aquatic insects provide a food source for fish and indicate good quality habitat. (Photography © Andy McKinnon)

Since existing stream flow regimes in the headwaters and middle reaches (where groundwater discharge is strong) are compatible with supporting redside dace and brook trout, our goals are to maintain these flow regimes as well as increase the extent of locations where they occur. Our modelling studies showed that the system hasn't fully responded to previous development so we also recommend improvements to mitigate the ongoing degradation that can be expected, even without new development. We should also maintain

the seasonal distribution of surface flow and the relative contribution of groundwater to low flow conditions. To accomplish these results, it will be necessary to maintain local groundwater discharge rates by implementing appropriate lot level stormwater management for all new development as well as retrofitting existing developed areas. The management strategies for Water (Section 5.3) provide more details.

From the fisheries perspective, it is important to increase the amount of tree cover along stream corridors as well as the total amount of upland forest in the watershed. This will provide benefits in terms of shading and cooler water temperatures as well as retention of water and infiltration. The priorities for improving natural cover are in the upper watershed (upper Main Rouge, Berczy, Bruce and upper Little Rouge sub-watersheds) and in recharge areas that are especially important in contributing discharge to cold-water streams (the Fisheries Management Plan provides more details on specific locations).

It is particularly important to maintain and restore a properly functioning riparian zone adjacent to sensitive headwater streams. This will shade the stream, provide detritus as a nutrient source, and filter excess nutrients and sediment from adjacent fields so that the stream doesn't become too eutrophic.

Natural channel design principles should be applied to enhance aquatic habitats. This requires investigation and understanding of the function of each section of stream, and the aquatic habitat contained within it, before any restoration or rehabilitation activities are implemented.

On-line dams pose a barrier to fish movement

Attention to non-fish components of aquatic ecosystems should be increased, including ecological information from benthic invertebrate collections and availability of breeding areas for resident insects, amphibians and reptiles. This information will also provide valuable material to inform aquatic management decisions and for interpretive purposes for Rouge Park.

2. Optimize fish passage for native fish species

A field inventory of all barriers in the Rouge River watershed was undertaken in the summers of 2005 and 2006. A strategic plan will be developed to identify those barriers that are causing the most significant habitat fragmentation issues by blocking fish passage, or altering coldwater habitats with discharges of warmer water from ponds. These key barriers will be targeted for mitigation projects.

3. Install or maintain barriers to partition species or exclude invasive species

Aquatic invasive species, such as the rusty crayfish, sea lamprey, carp and round goby are present in Lake Ontario, and have open access to the lower Main Rouge and most of the Little Rouge sub-watershed. If these species become established in the watershed, they will severely disrupt the native aquatic communities, and many native species could be eliminated. Similarly, migratory salmonids, such as rainbow trout, chinook and coho salmon may have negative impacts on sensitive native species such as redside dace and brook trout. Strategic barriers to control access from Lake Ontario to the upper watershed need to be considered. Details on this issue are included in the Rouge River Fisheries Management Plan.

Rusty crayfish, an invasive species found in the Rouge River.

Areas of unexploited native fish communities, such as those reaches that have been isolated by barriers, should be identified for their interpretive and research benefits.

4. Improve recreational fishing opportunities

The Rouge watershed has numerous healthy fish communities that can support recreational angling. In order to increase the opportunities to utilize this resource in a sustainable manner, access needs to be directed to areas with abundant populations. The Rouge River Fisheries Management Plan outlines strategies for managing the various fish communities, including fish stocking, angling regulations and access trails and facilities.

Some specific recommendations of the Fisheries Management Plan include:

- A thorough creel survey should be conducted to define the fishery and assess fishing pressure throughout the watershed.
- Opportunities should be investigated to promote viewing opportunities for fish.
- Private stocking should be prohibited in the watershed.
- Efforts should be made to work towards a native gene pool for key Rouge River native species.

5.4.2 TERRESTRIAL SYSTEM

TERRESTRIAL SYSTEM

Goal

A healthy terrestrial system that supports a diversity of native habitats and communities, a more natural watershed hydrology, cleaner air, and sustainable public use opportunities.

Objectives

12. Protect, restore and enhance natural cover to improve connectivity, biodiversity and ecological function.
13. Protect, restore and enhance terrestrial natural heritage system quality and function to minimize the negative influences of surrounding land uses.
14. Increase native terrestrial biodiversity.

"More than 70% of buyers of new homes in the GTA rate proximity to a park, common outdoor area or natural area as important or extremely important in their purchase decisions." J.D. Power Survey, 2006.

The terrestrial system includes forests, meadows, wetlands, beaches, and urban vegetation, along with the plants and animals that inhabit them. These natural systems provide many benefits that contribute to the health of the watershed. They help to maintain the water balance and stream stability, protect aquatic ecosystems, provide wildlife habitats, moderate climatic conditions, absorb air pollution, create recreation opportunities for people and generally improve the quality of life for our communities.

Our review of current conditions in the watershed showed that Rouge Park is a tremendous asset, providing substantial areas of existing and potential natural cover and supporting many species of birds and other animals that depend on large areas of undisturbed forest or diverse habitats. Our review also highlighted the following issues in the watershed:

- Limited amount and quality of natural cover
- Lack of interior forest (large blocks of continuous forest)
- Loss of wetlands
- Fragmentation of wildlife habitats
- Distribution is weighted to southern watershed
- Invasive species
- Negative impacts of human activities on plants, animals and habitats

TRCA Terrestrial Natural Heritage Strategy (TNHS)

The TNHS is designed to develop a regional natural heritage system that effectively supports healthy communities and economic activity. For each watershed in the jurisdiction, it sets targets for the securement and enhancement of existing natural cover and for securement and restoration of potential natural cover. For the Rouge, this target is 31% of the Watershed.

Looking ahead to possible future conditions, our modelling work showed that the terrestrial system of the Rouge watershed is at a crucial crossroad. Unless significant steps are taken to change the way our communities are developed and managed, the quality of the terrestrial system will continue to decline, in response to historical and current human impacts as well as future land use changes. Climate change will add further stresses to the system, resulting in probable losses of native species and increases in invasive, non-native species. The scenarios involving development according to existing official plans and the "full build-out" to the boundaries of the Greenbelt and Oak Ridges Moraine are expected to result in major declines in the amount and quality of the terrestrial system.

We have developed an approach to improve terrestrial habitat conditions as well as to help offset the impacts of future development. It involves securing and restoring additional natural areas to increase the percentage of natural cover from the current 24% to at least 31% of the watershed. (see Figure 5-2). This is the recommended amount to meet the goals, objectives and targets for the Rouge watershed. It can be accomplished by implementing the securement and restoration initiatives of the Terrestrial Natural Heritage Strategy (see box), the Rouge Park Plans and municipal initiatives.

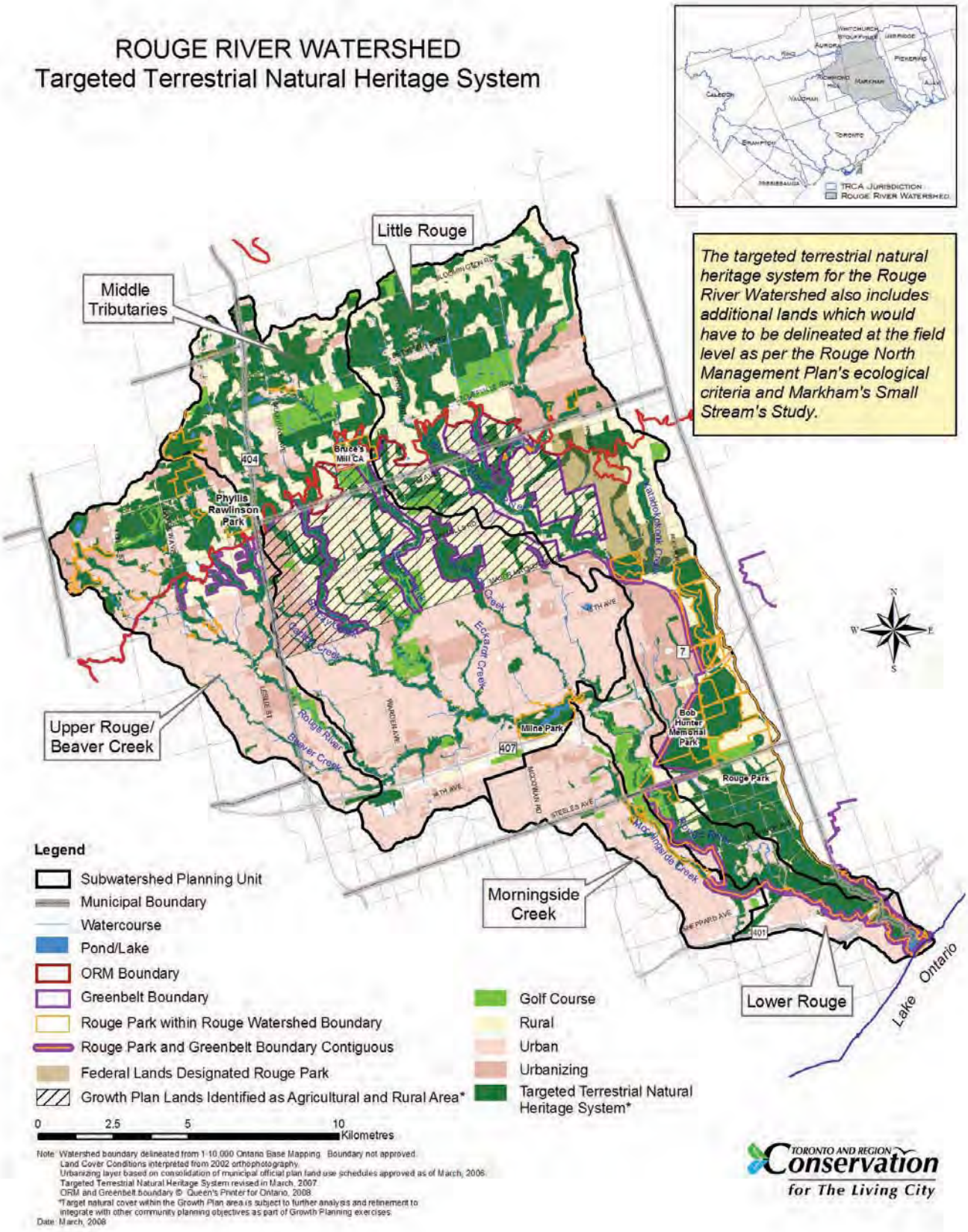
The best results for the terrestrial system would be achieved if this expanded natural cover was implemented and new urbanization occurred only within current official plan boundaries (Scenario 4). With full build-out, the most comprehensive and aggressive sustainability measures (Scenario 7) will need to be implemented along with the natural cover plan in order to not only maintain current conditions but also improve on them to meet our terrestrial system targets.

Current Initiatives

Many tools are available to guide the protection and management of the terrestrial system. They include legislation for the Oak Ridges Moraine and Greenbelt, Rouge Park plans, TRCA's Terrestrial Natural Heritage Strategy, and municipal plans and policies. In addition to expanding Rouge Park, many agencies and non-government groups are engaged in various initiatives to secure and increase natural cover in the watershed.

Many partners have been working to restore extensive areas of forest, wetland and meadow over the past decade in Rouge Park and throughout the watershed, and much more is planned for the upcoming decade (e.g. Friends of the Rouge Watershed's Beare Wetland, Town of Richmond Hill's Newberry Park Wetland Restoration Project). Many programs are available to assist private landowners to restore and manage natural cover, including the Rural Clean Water Program, Canada-Ontario Environmental Farm Plan, Oak Ridges Moraine Environmental Enhancement Fund, Greenbelt Farm Stewardship Program, and TRCA's Private Land Stewardship Programs.

Figure 5-2: Targeted Terrestrial Natural Heritage System



Monitoring activities are undertaken throughout the watershed by municipalities, agencies and community groups. The TRCA's Regional Watershed Monitoring Program conducts field inventories of flora and fauna in partnership with volunteers. Rouge Park also conducts annual surveys of winter breeding birds.

The City of Toronto with input from TRCA has identified policy and mapping for an expanded natural heritage system for the City in its Official Plan. Toronto's Ravine by-law supports the implementation of this policy.

The Region of York's Greening Strategy aims to ensure that York's natural heritage is maintained for future generations and provides a context for policy and implementation decisions that affect natural heritage features. The Greening Strategy includes a range of activities including greening targets for York Region, securement of priority greenlands, naturalization and rehabilitation, community education and urban forest management.

Strategies

Our analysis of current conditions and future scenarios has shown us that in order to maintain and improve ecological conditions in the watershed, we need a more robust terrestrial system. Achieving this requires that we understand the whole system, not only the protected natural areas but also the many influences from the matrix of other land uses around them. Our recommended management strategies are therefore three-fold:

1. Secure the targeted system
2. Restore and enhance natural cover
3. Manage the matrix

1. Secure the targeted system

Our targeted natural heritage system identifies lands that should be secured through protective policy, acquisition, easements or stewardship agreements to increase protected natural cover from 24% to 31% of the watershed (see Figure 5-2). In addition to Rouge Park, there are five broad priorities. Our top priority location for securement is in potential urban growth areas where some natural areas are not afforded specific protection. The second priority area is in the Greenbelt, where there is some degree of protection for natural heritage. The third priority is the natural core and linkage areas designated in the ORM Plan. The fourth priority is areas of redevelopment in existing urban areas and the fifth is to consolidate Rouge Park lands.

Protection of the targeted terrestrial natural heritage system

Our targeted system is 31% of the watershed area, which is about 10,400 hectares. Only about 1,400 ha of this (14%) is not already covered by some potential implementation policy mechanism, and in many cases there are a number of overlapping mechanisms for the same targeted habitat patch. The mechanisms include: 600 metre Little Rouge Corridor of Rouge Park, Greenbelt Plan, ORMCP, TRCA's Valley and Stream Corridor Policy and Markham Small Streams Study.

Within each of these five priority areas, additional emphasis should be placed on areas where natural cover will achieve multiple benefits, such as riparian zones, groundwater recharge areas, and sub-watersheds where reductions in surface runoff are required to improve water balance and reduce erosive flows.

Municipalities should identify in their official plans a targeted natural heritage system for the Rouge watershed, based on the system recommended in Figure 5-2, and adopt policies to protect existing natural vegetative cover and restore lands to increase natural cover. All levels of government should apply the principle of "net gain" to provide compensatory habitats to replace features and habitats that cannot be retained during private development as well as infrastructure and other public sector projects.There will be challenges to achieve the targeted terrestrial natural heritage system together with the assigned Provincial growth targets. However, new approaches being undertaken toward more integrated community planning and design, whereby the environmental and servicing objectives are considered early in the community planning process, suggest greater likelihood of achieving improved outcomes overall as compared to past approaches. For example, York Region intends to undertake transportation, water and wastewater servicing master planning concurrently with its community planning exercise. This will help to ensure that negative impacts on the targeted natural heritage system and other environmental features can be minimized and opportunities for net gain explored. Therefore, it is expected that the targeted terrestrial natural heritage system for the watershed will undergo further analysis and refinement at more detailed scales to integrate it with other community planning objectives as part of Growth Planning exercises for designated "white belt" lands which will aim to optimize lands for all uses.

Many agencies and non-government groups (e.g. Nature Conservancy, TRCA, municipalities etc) have natural heritage strategies and policies at various scales, depending on the mandate of each body. These should be adapted where necessary to reflect the priorities established in this watershed plan and to ensure that they are complementary and mutually supportive.

In order to inform and provide a foundation for growth planning, a study should be conducted to apply the ecological criteria from the *Rouge North Implementation Manual* and define the Rouge Park and Greenbelt boundaries. The measures identified in Section 3.2.6 of the *Greenbelt Plan* need to be adopted by the *Growth Plan for the Greater Golden Horseshoe* for lands outside the protected countryside of the Greenbelt.

Continued monitoring is required to measure progress towards meeting our targets. The Regional Watershed Monitoring Network should be continued, including remote sensing, biological field inventories and community volunteer-based monitoring. Rouge Park should expand its plant and animal monitoring such as the winter bird survey and breeding bird surveys. In particular, additional monitoring of ecological restoration success should be implemented to help maximize effectiveness of future efforts.

2. Restore and enhance natural cover

Within each of the priority areas for securement noted above, further priority should be assigned to restoration to increase natural cover in targeted areas where this will also achieve other benefits as identified in the strategies for water and aquatic systems (e.g. riparian zones, groundwater recharge areas, and subwatersheds where reductions in surface runoff are required to improve water balance and reduce erosive flows). Restoration activities should focus on the most vulnerable areas (for example the woodlot near Warden and 16th that has high species diversity but has recently become fragmented). The assignment of restoration priorities should also consider the importance of maintaining agricultural land use in the watershed; natural cover restoration should avoid productive farmlands (see Section 5.5.2).

Restoration may be accomplished through natural succession, without human intervention, or with plantings of communities and species that are native to the Rouge watershed. Rouge Park should be encouraged to accelerate its restoration plans and be provided with the necessary resources to do so. All natural cover restoration plans should carefully consider and wherever possible avoid the potential for adverse impacts on cultural heritage landscapes, built heritage and archaeological resources. Information about natural and cultural heritage features, functions and management priorities found in this plan should be used to guide more detailed planning at the implementation project scale.

Natural heritage restoration through tree plantings and wetland creation is an integral part of the Rouge watershed management strategy (Photo credit: Town of Richmond Hill)

Management guidelines for natural areas

- Ensure that native species and communities are maintained, and restored where possible.
- Encourage natural disturbance dynamics, such as fire and flooding, where possible.
- Monitor and control the spread of invasive alien plant species. Involve the public where possible.
- Increase representation of upland communities and wetlands on tableland.
- Restore and maximize connections between existing features and plan for species movement corridors, with a focus on restoring west-east connections on tableland.
- Restore old fields and manicured areas to forest and wetland communities.
- Limit public access to sensitive areas and provide explanatory signage where appropriate.
- Design trail systems to avoid sensitive areas.

Opportunities to develop a stewardship priorities map for private lands in the Greenbelt, similar to the one for the ORM, should be investigated.

Private landowners should be involved in protecting, enhancing and restoring natural cover, encouraged by a variety of means, including education, information, incentives and awards. Specific incentive opportunities for rural areas include:

- Grant programs (especially for the targeted system on rural lands outside the ORM and Greenbelt as they are subject to a greater range of alternative uses that compete with natural cover).
- Stronger penalties for non-compliance with municipal tree preservation or natural heritage protection by-laws and policies.
- Tax incentives, such as the Managed Forest Tax Incentive Program and Conservation Land Tax Incentive Program.
- Land donations and conservation easements with associated tax relief and other financial benefits.

Public landowners, such as Rouge Park, TRCA, all three levels of government, school boards and other agencies should continue to set an example and provide or obtain adequate resources for natural heritage protection, stewardship and restoration on their lands. This should include aggressive planting programs to increase natural cover and provision of at least 7 metres buffer between mown areas and watercourses.

3. Manage the matrix

The matrix of agriculture, forestry, transportation, recreation, residential, commercial and industrial land uses has many negative impacts on the quality of natural habitat areas. There are numerous opportunities to apply good stewardship practices to increase ecological values in the matrix, support ecological functions of adjacent natural areas and reduce harmful impacts on wildlife.

Encroachment of residential gardens into the natural valley corridor (Photo credit: Town of Richmond Hill) Right: Dog strangling vine, an invasive non-native species

Compatible landscape design and practices on adjacent lands can have a significant benefit in reducing negative matrix influences through the provision of wildlife habitats and buffers, maintenance of hydrological functions and improved microclimate. For example, new urban areas and infill developments should incorporate design elements, such as buffers and barrier plantings, which improve the interface with existing natural areas. Naturalization should be included in the landscape design of larger public and private properties such as industries, institutions, golf courses, transportation corridors and large residential lots. Smaller properties, commercial areas and streetscapes can emphasize the use of native plants and environmentally friendly gardening practices.

It is also important to control the movement of pet cats and dogs to reduce access to wildlife and their habitats. Dogs should be kept on leashes at all times and cats indoors, especially during the bird-breeding season in areas near natural habitats. Encroachment and dumping on natural areas should be regulated and enforced. Lighting and noise should be controlled adjacent to natural areas. Assistance should be provided to farmers to encourage stewardship of natural features and functions on agricultural lands (see also Agriculture Strategy, section 5.5.2).

Invasive alien species, such as dog strangling vine, garlic mustard and purple loosestrife, should be addressed through public education and greater involvement of groups (e.g. scouts and guides) in removal projects. Development of educational materials about invasive alien species for horticultural and nursery industries and retail outlets would be a strategic means of encouraging a shift away from sales of invasive alien species and greater stocking of native plant materials. Partnerships among municipal parks departments and other experts could facilitate information sharing about research and effectiveness of control and removal methods. *The Strategic Plan Report for Managing Ontario's Invasive Species* (City of Toronto Forestry Services, 2006) provides support and additional approaches for the many organizations, agencies and individuals involved in managing invasive alien species.

Stewardship of public and private lands should be promoted with a variety of existing and additional tools, including:

- Rouge Park Stewardship Program.
- Public awareness and marketing programs (see summary of *The Action Plan for Sustainable Practices* in the Water Strategy, section 5.3).
- Backyard certification and awards (e.g. healthy yards, environmentally friendly neighbourhoods).
- Increased enforcement capability to address tree cutting, floodplain filling, dumping etc.
- Municipal policies to promote improved soil, water and air quality in urban environments to improve the success of native species and green infrastructure.

Outreach and education programs should be developed for the horticultural industry, including nurseries and retail outlets. This could include increasing the supply of native plant materials, staff education to promote their use to the public and discouragement of the sale of invasive alien species.

5.5 PEOPLE

5.5.1 URBAN LAND USE

SUSTAINABLE LAND AND RESOURCE USE

Goal

A healthy watershed with a mosaic of land and resource uses (at watershed and community scales) that are compatible with the protection and improvement of ecological health. Land and resource uses include: Rouge Park, urban and rural settlements, agriculture, golf courses, aggregate extraction, and transportation and utility corridors.

Objective

21. Improve sustainability in urban form at building site, community and watershed scales.

Major steps towards a healthy watershed have already been taken with the *Oak Ridges Moraine Conservation Plan*, the *Greenbelt Act* and the creation of Rouge Park. The strategies presented above for water and nature will further help to protect and enhance natural systems. Ecological health, robust natural heritage and productive agricultural lands are all important foundations for a sustainable urban community.

Unfortunately, our review of current conditions showed that previous and ongoing urban development is causing degradation of many parts of the Rouge watershed. The Main Rouge, Beaver Creek and Morningside Creek have been significantly altered by existing urban land uses. The middle tributaries (Carlton, Berczy, Bruce, Eckardt and Robinson Creeks), where the next wave of urbanization is occurring, are starting to show similar declines. In contrast, the Little Rouge watershed has experienced much less urban growth and is in better health overall. Clearly, historic approaches to environmental management during urban development have not been sufficient to maintain a healthy, functioning ecosystem.

Looking ahead, we foresee a number of challenges. They are also recognized in the final report of the Towards Sustainability in York Region Advisory Group, which summarizes them as follows:

Healthy Communities:

- Accommodating a rapid pace of growth;
- Implementing the provincial target of 40% intensification;
- Providing a range of housing options that includes affordable housing;
- Implementing the Regional Transit and Rapid Transit Plans;
- Building an infrastructure system to keep pace with growth;
- Providing adequate and quality human services;
- Engaging the public and Regional stakeholders; and,
- Providing an environment that promotes a healthy community.

Sustainable Natural Environment

- Enhancing, restoring and investing in the Regional green infrastructure system;
- Protecting the Countryside and other natural core areas and linkages to natural core areas;
- Improving air quality;
- Protecting the quality and quantity of the Region's ground and surface waters; and,
- Restoring environmentally degraded areas.

Economic vitality

- Strengthening and diversifying the Regional economy;
- Creating jobs to match residential growth; and,
- Ensuring Regional fiscal sustainability.

Current Initiatives

As discussed in the introduction to this chapter, the emergence of new approaches to living more sustainably provide us with a template to design and manage our communities so that we address these challenges, enhance quality of life, provide economic opportunities and protect ecological integrity. These approaches are being implemented world wide. They include eco-villages, transit-oriented compact communities, co-housing, low impact development, green building design and new urbanism. In the Rouge watershed, Markham Centre is providing a local example. It is a distinctly urban, higher density development with pedestrian-friendly streetscapes complemented by ample greenspace. It is compact and transit-supportive, with other resource conservation features, such as district energy (where one building's waste becomes another building's energy source).

Policies and guidance toward more sustainable community planning are also provided by the Provincial *Growth Plan for the Greater Golden Horseshoe* as well as federal and provincial programs associated with gas tax revenue sharing. The revised Provincial Policy Statement (2005) under the Ontario Planning Act provides guidance for a better balancing of economic, social and environmental policies and requires municipalities to set targets for intensification within built up areas as a pre-requisite to expanding urbanization.

What is LEED?

The Leadership in Energy and Environmental Design (LEED) Green Building Rating System™ is a benchmark for the design, construction, and operation of high performance green buildings. It encompasses sustainable site development, water savings, energy efficiency, materials selection, and indoor environmental quality. LEED for Neighborhood Development (LEED-ND) includes compact design, proximity to transit, mixed use, mixed housing type, and pedestrian- and bicycle-friendly design.

TRCA's Living City programs have gathered information, established local partnerships and developed networks with world leaders in sustainable community design. Example activities include the Sustainable House Architectural Design Competition and Demonstration Building that will be constructed at the Kortright Centre for Conservation in 2007. TRCA also participates on a national committee of the Canada Green Building Council to develop certification standards for LEED for Neighbourhoods.

Many municipal initiatives complement the objectives of this Rouge River Watershed Plan. The City of Pickering's Sustainable Pickering Program provides concepts of sustainable development as a key consideration in municipal activities in order to encourage the development of a "Sustainable City". Specific projects include: benchmarking standards for sustainability, a greenhouse gas emissions reduction program, sustainability guidelines for new development and various environmental awareness programs. The City of Toronto's Green Development Standard (July, 2006) provides a "Made in Toronto" set of integrated targets for site and building design to guide development of City-owned facilities and to encourage sustainability in the private sector. The document addresses air quality, greenhouse gas emissions, energy efficiency, light pollution, water quality and efficiency, solid waste, the urban forest and wildlife habitat. The Town of Richmond Hill and Town of Markham offer Healthy Yards Programs which provide information to support private stewardship.

Strategies

Our strategies for urban land use are:

1. Implement sustainable urban form
2. Implement sustainable infrastructure
3. Implement sustainable transportation

1. Implement sustainable urban form

Built and natural systems are interdependent: how a community is planned and built affects the function of the natural system. And the more robust the natural system, the more resilient it will be to negative impacts from human activities. Our new strategies for stormwater management and natural heritage systems will be more easily and creatively achieved through innovative community design. Community design also affects the ease, convenience and efficiency with which its residents can practice sustainable behaviours. Sustainability principles must be applied to new development in greenfield areas, intensification projects and in the rehabilitation or redevelopment of existing urban communities. More specific details are provided in our report on *Development of a Sustainable Community Scenario for the Rouge River Watershed* (TRCA 2007). We recognize that many of the new designs and technologies for sustainable urban development are still evolving and being

Strategies, guidelines and demonstration projects will help accelerate the shift to more sustainable community designs

tested. Therefore we recommend that where permitted, development should proceed with caution. Evaluation should be undertaken, with extensive and meaningful public consultation, to assess how well watershed objectives and targets are being met and recommend adjustments to development practices when necessary.

At the watershed scale, we recognize the importance of protecting the function of natural systems. We recommend implementing our targeted natural heritage system as quickly as possible (see section 5.4.2). Natural heritage and agricultural lands should remain protected under the Provincial Policy Statement, Greenbelt and Oak Ridges Moraine legislation, TRCA's Valley and Stream Corridor Program, as well as Rouge Park's Management Plans.

At the community scale, we recommend innovative design to achieve pedestrian oriented, ecologically sustainable, mixed use communities. This includes:

- Protection and enhancement of natural systems (see water and nature strategies)
- Protection and interpretation of cultural heritage (see cultural heritage strategies)
- Securement of additional public sector lands for infiltration and stormwater management to complement the lot level practices (e.g. along road rights of way, along trails, in parks, on municipal properties)
- Re-use of stormwater, for example for irrigation of landscapes
- Renewable energy sources and district energy schemes
- Smaller lot sizes and increased building density
- Mixed use development to reduce travel needs
- Sustainable transportation (e.g. transit, cycling and walking)
- Pedestrian scale streetscapes that promote walking and social interaction
- Retrofitting of existing urban areas and design of new ones to increase ecological values and reduce resource use

An important new implementation mechanism will be the adoption of municipal policies encouraging new community designs to be certified using such programs as LEED for Neighbourhoods or Green Globe ratings.

At the scale of the individual building site, we recommend the following techniques to minimize resource use, maintain water budget and improve environmental quality:

- Lot level stormwater management (see water strategies)
- Minimal negative impacts on adjacent natural heritage system
- Policies to ensure that all new public buildings are designed to achieve LEED (Leadership in Energy and Environmental Design) or similar certification and that all existing buildings are retrofitted to improve performance (e.g. public buildings should achieve LEED Gold or higher)
- Incentives for builders to promote green building design
- Building orientation to maximize sunlight, passive solar energy, wind shelter and natural ventilation
- Landscaping to reduce energy needs

- Dual plumbing to use recycled water for toilet flushing or irrigation.
- Building design for multiple uses and diverse densities to increase life span and maximize land use efficiency

To facilitate these changes, it will be important to ensure that review and approval processes accommodate non-traditional, innovative design. Awareness should be increased among developers and builders of new approaches and successful experiences from other jurisdictions. Homebuyers will need increased awareness and information to help them make purchasing decisions. Residents should be encouraged and assisted to make sustainable choices in all aspects of their lifestyles including housing, food, transportation, infrastructure, garden and lawn care, consumption and waste. Sustainable practices should be recognized, celebrated and promoted through recognition awards for residents, businesses, agencies and institutions.

2. Implement sustainable infrastructure

Urban infrastructure includes pipelines, railways, roads and highways, sewers, water supplies, treatment plants and reservoirs, and involves a broad range of associated challenges to ecosystem functions and natural landscapes. We learned some important lessons from the planning and construction of the York Durham Sanitary Sewer along 16th Avenue that can improve the implementation of large infrastructure projects in future and have already been implemented in several projects. As advocated in York Region's 2006 strategy "Towards a Sustainable York Region", environmental and servicing objectives should be considered in advance of the community planning process. This will help to avoid or minimize negative impacts to natural systems and achieve net gain wherever possible through innovative design. It may require more detailed work initially to establish baseline environmental conditions, so that more informed choices can be made between alternatives.

Specifically, we recommend that:

1. an Environmental Assessment (EA) be undertaken for the possible complete project so that the public and approving agencies see the possible overall and cumulative impacts;
2. the construction of any underground service should strive to minimize or avoid groundwater and surface water withdrawals and transfer of water across watersheds;
3. carrying capacity, need (sizing) and "alternatives to" the undertaking must be fully assessed to avoid negative impacts wherever possible through demand management and innovative alternatives and application of precautionary principle;
4. all options for different horizontal and vertical alignments be considered for their cumulative impact(s) on underground aquifers;
5. all construction options be explored to demonstrate to the public and agencies that the proponent has considered viable alternatives;
6. the decision making matrix be clearly defined to balance the needs of the various stakeholders and ensure the principle of the 'Quadruple Bottom Line';
7. the preferred solution clearly identify the impacts on the underground water regime and that the construction tender documents include the requirements;
8. any changes in undertaking design or construction technique should require further public and agency notice and consultation and an addendum to the EA;

9. the construction method be monitored to ensure that the predicted impacts are not exceeded by the actual impacts;
10. the proponent adjust the construction phase if the monitoring determines that any predicted negative impacts have been exceeded;
11. after construction is completed the proponent verify that environmental conditions have been restored, or improved, to those that existed before construction started; and
12. a performance bond of sufficient magnitude be held by the MOE and/or TRCA or other appropriate public body to ensure that conditions are restored or improved, if the proponent fails in their obligations.

It is important that infrastructure projects should maintain existing groundwater flow patterns. Therefore we recommend that groundwater should not be diverted to surface water via such mechanisms as foundation drains connected to stormwater ponds or groundwater-based water supplies connected to Lake Ontario-based sewage treatment systems.

Environmental agencies, including DFO, MOE, MNR and TRCA, should continue to work with York Region to monitor aquifer water levels over the long term and ensure that the aquifer recovers from the dewatering undertaken to facilitate construction of the York Durham Sanitary Sewer.

3. Implement sustainable transportation

The City of Toronto, York Region and Durham Region have prepared plans that identify new and improved transportation infrastructure needed to serve existing communities and future growth. Recognizing the linkages among transportation mode, energy use, air quality and climate change, these plans include strategies to develop and encourage the use of transit systems and alternatives to private automobiles (e.g., walking and cycling) and to make the best use of existing infrastructure.

In particular York Region's Transportation Master Plan, now being revised, advocates extensive transit improvements focused on creating connections with adjacent municipal transit systems, significant highway and arterial road improvements, and strategies for improving pedestrian and cycling modes of transportation. The York Transportation Master Plan aims to double average transit use from 8% of all morning peak period trips (in 1996) to 17% by 2031. In order to achieve this goal, the Region is establishing a rapid transit corridor along Yonge Street, Highway 7, and along the Highway 404/Warden Avenue corridor. Known as York's VIVA rapid transit system, it was introduced in 2005 and involves a frequent bus service along these routes.

York's VIVA rapid transit system (Photo: Adam E. Moreira)

It should be emphasized that the large reservoir of biodiversity represented by the 41 square kilometre Rouge Park was not in existence when many of these transportation plans were initially

formulated. Given the importance of this major piece of green infrastructure to the GTA, new and innovative engineering and planning approaches are needed to prevent the further fragmentation of the Park as a north-south and east-west ecological corridor. This significant challenge will require full participation by provincial, as well as regional and municipal transportation planners.

We recommend vigorous implementation of these transportation strategies, particularly the transit, cycling and pedestrian components, including:

- strategic transportation corridor and network planning studies and systems planning before environmental assessments are undertaken for specific projects,
- comprehensive transportation planning and coordination among jurisdictions,
- planning for transportation early in the growth planning process so that all opportunities can be taken to reduce the number of crossings of stream and other natural heritage corridors, and
- application of the recommendations listed under "sustainable infrastructure" for the planning of transportation infrastructure.

5.5.2 AGRICULTURE

SUSTAINABLE LAND AND RESOURCE USE

Goal

A healthy watershed with a mosaic of land and resource uses (at watershed and community scales) that are compatible with the protection and improvement of ecological health. Land and resource uses include: Rouge Park, urban and rural settlements, agriculture, golf courses, aggregate extraction, and transportation and utility corridors.

Objective

22. Protect agricultural lands for food and crop production and as a vital component of the watershed landscape, by sustaining a viable agricultural industry.

Agricultural lands comprise about 40% of the Rouge watershed. They make an important contribution to Ontario's economy and help to reduce our ecological footprint by supplying locally grown food and decreasing our reliance on unsustainable imports. In addition, they contribute to the health of the watershed in a variety of ways. Farm crops act as carbon sinks, helping to reduce greenhouse gases. Farmlands are more conducive to the protection of natural systems (e.g. water balance, natural cover and wildlife habitats) than other land uses. Countryside landscapes are also part of the watershed's cultural heritage and provide a context for many recreation activities and rural lifestyles. In the City of Toronto, the only remaining working farms are protected in Rouge Park.

Unfortunately, as we saw in our review of current conditions (Chapter 3), the ability of agricultural lands to provide these benefits is constrained by some critical issues:

- Poor economic viability of agricultural industry
- High percentage of farmers with short-term leases
- Conflicts between farming and adjacent land uses

Current Initiatives

In February 2005, the GTA Agricultural Working Group composed of staff and stakeholders from the Regions of Durham, Halton, Peel, York and the City of Toronto, published an Agricultural Action Plan to address the long-term sustainability of agriculture in the GTA. The plan includes 37 recommendations regarding economic development, education/marketing, land use/policy, accountability and responsibility. The Rouge Watershed Task Force shares the overall goal of this plan and endorses its recommendations. We will ensure that actions taken to improve watershed health are not only compatible with it, but also help to achieve its objectives.

Rouge Park is implementing Best Management Practices and assisting its tenant farmers to move forward with Environmental Farm Plans.

Strategies

The main thrust of our strategies to improve agricultural vitality is to support implementation of the GTA Agricultural Action Plan. Our best opportunities to do this are associated with the following actions:

1. Provide GTA-wide services for local farm businesses
2. Support local food and increase public awareness about sustainable agriculture
3. Implement land use policies to support agriculture
4. Support agricultural vitality on publicly owned agricultural lands

1. Provide GTA-wide services for local farm businesses

Among the recommendations in the GTA Agricultural Action Plan, the following initiatives are especially relevant to stakeholders in the Rouge watershed. Local leaders should coordinate with the GTA Agricultural Action Plan implementation committee to advance them.

- Develop new products for local niche markets (e.g. new Canadians, specialty and gourmet restaurants).
- Promote best management practices, awareness of resource materials and grant opportunities.
- Assist farmers to address requirements for nutrient management, source water protection, environmental farm plans, natural heritage stewardship etc.
- Facilitate complementary activities based on agriculture, such as farm vacations, bed and breakfast, tours, recreation/entertainment ventures, farm markets etc.

2. Support local food and increase public awareness about sustainable agriculture

We support the United Nations Urban Environmental Accord target that 20% of our food should be supplied from local, rather than imported, sources by 2012. Community supported agriculture, whereby participants pre-purchase weekly produce from local farms, is an emerging trend in urban

Purchasing locally grown food helps the local farm economy and reduces energy use associated with long distance transportation.

areas, particularly with organic growers. We encourage watershed stakeholders, particularly institutions and businesses with significant buying power (such as schools, colleges, universities, hospitals, hotels and restaurants) to participate in such programs. This will bring more predictability to farm incomes as well as fresh, local food to city residents. Education, awareness and marketing materials should be translated into languages spoken in Toronto Region watersheds.

Specific actions and messages should include:

- Development of "local food first" programs
- Recognition and profile for institutions, restaurants and businesses that feature local food selections.
- Values of maintaining viable farms in the watershed
- Importance of respecting the business needs of agricultural enterprises
- Links between local foods and their contribution to health

3. Implement land use policies to support agriculture

We support the continued protection of agricultural lands through Provincial legislation and municipal official plans. This requires complementary measures such as:

- Encourage compact urban development, infill and re-development
- Maintain firm urban/rural boundaries
- Improve transit and travel demand management

Another opportunity to strengthen agriculture in the watershed is to restore productive agricultural lands and natural cover during the rehabilitation of former aggregate pits.

4. Support agricultural vitality on publicly owned agricultural lands

The significant amount of publicly owned farmland in the Rouge watershed provides valuable opportunities to support agricultural vitality. We support the Rouge Park policy of identifying and preserving working farms through agricultural heritage zoning in its management plans. Further, we encourage public landowners to explore ways to:

- Provide longer term leases (e.g. at least 10 years)
- Demonstrate cultivation of new products for local niche markets, with appropriate research partners
- Demonstrate best management practices
- Establish community gardens for urban residents
- Provide sites for farm markets
- Coordinate farmland initiatives with other publicly owned agricultural lands in the GTA

5.5.3 RESOURCE USE

SUSTAINABLE LAND AND RESOURCE USE

Goal

A healthy watershed with a mosaic of land and resource uses (at watershed and community scales) that are compatible with the protection and improvement of ecological health. Land and resource uses include: Rouge Park, urban and rural settlements, agriculture, golf courses, aggregate extraction, and transportation and utility corridors.

Objective

20. Practice sustainable resource use by individuals, households, businesses, institutions and governments.

In Chapter 3 we saw that resource uses in the Rouge watershed are similar to other communities in the GTA. We are using water, energy and materials, and generating waste water and solid wastes at unsustainable rates and releasing pollutants to the atmosphere. Some of the key issues are:

- High water consumption rates from all sources (Lake Ontario, wells and surface water withdrawals)
- Energy demands and cost of wastewater treatment associated with water use
- Expansion of water and wastewater infrastructure required for future urban growth
- Solid waste being transported out of the region
- High energy demands
- Greenhouse gas pollution from non-renewable fossil fuel use;
- Current community form does not facilitate local renewable energy generation/distribution

Current Initiatives

As noted in Chapter 3, all levels of government are engaged in initiatives to reduce resource use and the associated negative impacts. These initiatives provide a foundation for increasing awareness and encouraging actions towards sustainability.

For example, the GTA Mayors Megawatt Challenge has provided a friendly competition to encourage municipalities to reduce energy use in their facilities. Municipal water efficiency and waste reduction strategies have been extremely successful at engaging homeowner participation. TRCA's Sustainable House Demonstration, to be constructed at Kortright Centre for Conservation in 2007, will provide the public with examples of how they can reduce their resource use in the home.

Strategies

Our recommended strategies for resource use include:

1. Increase water efficiency and conservation
2. Reduce energy use and increase non-fossil fuel alternatives
3. Reduce waste

1. Increase water efficiency and conservation

Water conservation contributes to the protection of aquatic ecosystems, protection of drinking water sources and cost effectiveness of public services. It postpones the need for water supply infrastructure expansion, as new growth/intensification can be accommodated within the present supply. Conservation also reduces the energy costs associated with excessive pumping from Lake Ontario up to the headwater service areas and the associated energy and other costs of wastewater treatment, as the consumed water is discharged through the sanitary sewage system.

As described in Section 3.4.4 the Region of York, Region of Durham and City of Toronto have well established and successful water efficiency programs that have set targets for water conservation, as part of their long term water supply strategies and the associated supportive studies that considered effects on the local environment. These programs involve comprehensive public education and awareness initiatives, including incentives for implementing water conservation practices. We strongly support the continuation of these important programs and recommend additional considerations. We recommend that municipalities use targets and information provided in this watershed plan as a guide in any future updates of the water supply and water efficiency strategies.

With respect to use of municipal and well water supplies, we recommend measures to promote water conservation and alternate sources of water suited to end-use quality needs and which pose less stress on natural systems. These include:

Municipal water efficiency programs are an important component of watershed management

- Support the continued implementation of the Region of York's *Water for Tomorrow* program, Durham Region's *Water Efficient Durham* and the City of Toronto's *Water Efficiency Program:*
  - Consider the role of rain-harvesting as a water conservation mechanism.
  - Monitor indoor and outdoor water use over time.
  - Monitor rates of water use by local service area and evaluate trends over time.
  - Consider pricing incentives as a potential component in future updates to water efficiency plans.
  - Incorporate relevant findings and recommendations from the *Action Plan for Sustainable Practices* to improve rates of participation in water conservation programs by residents and businesses.
  - Raise awareness of water conservation practices and technologies through partnerships with schools and community groups (e.g. ultra low flush toilets, low flow shower heads, rain sensor switches for automated irrigation systems).
- Adopt policies that allow rainharvesting and use within buildings for non-potable uses.
- Improve public confidence in the public water supply to reduce demand for bottled water.

Rainharvesting and reuse is an integral part of a sustainable community

- Investigate water pricing in combination with stormwater management fees as tools to provide incentives for more efficient water use (e.g. use of rainwater on site as a resource to offset potable water needs).
- Renaturalize lawns and parks with use of native species that are more drought tolerant.

With respect to surface water takings, we recommend that the baseline baseflows defined in this watershed plan be used to determine the baseflow threshold below which no surface water may be drawn from a watercourse, as per the Ontario Ministry of Environment's protocol for water takings, unless detailed studies are undertaken to support other withdrawal volumes. Water users should install fixed intakes, to prevent withdrawals below the baseflow threshold. Irrigation water supply systems should be retrofitted to replace stream sources with rainwater from surface water storage reservoirs, where possible.

We also recommend that efforts should be made to work with MOE to ensure that all required water users have a valid permit to take water and monitor their withdrawals, and that applications for permit renewals are reviewed regularly for consistency with the directions of this watershed plan.

2. Reduce energy use and increase non-fossil fuel alternatives

Overall energy use should be reduced and the use of non non-fossil fuel and green power sources should be increased:

- Promote partnerships between utilities and municipalities to facilitate the use of district energy schemes and renewable energy sources as part of the community design.
- Encourage public transit use, walking, cycling and other alternatives to the private vehicle.
- Provide incentives for use of hybrid or non-fossil fuel powered vehicles.
- Continue the GTA Mayors' Megawatt Challenge.
- Provide incentives for the retrofit of buildings to improve energy efficiency to 30% or more energy efficient than the model National Energy Code for Buildings.
- Require new homes to meet standards such as EnergyStar Certification requirements or an EnerGuide rating greater than 80.

Cleaner, renewable sources of energy

- Increase application of energy conservation practices (e.g. visual monitoring systems that allow users to see energy use; discontinue bulk metering, photosensor and motion sensor controls; lower speed limits for commercial vehicles and transit).
- Promote in house, grid-tied energy generation capacity using renewable energy sources, with surplus energy purchased by the utility at the market rate.

3. Reduce Waste

The amount of waste generated should be reduced and wherever possible, "waste" should be used as a resource:

- Reduce, recycle and re-use.
- Reduce packaging.
- Foster partnerships between waste generators and waste re-users.
- Re-use or recycle construction and demolition waste to meet or exceed the Canadian Green Building Council's target for 20% or less construction waste to landfills (currently 35% goes to landfills).
- Establish programs to test the performance of products made with re-used materials.
- Incorporate recycling areas throughout buildings with a central collection area to make source-separation convenient.
- Standardize requirements for minimum recycled aggregate material.

5.5.4 AIR QUALITY AND CLIMATE CHANGE

AIR QUALITY AND CLIMATE CHANGE

Goal

Air of a quality that protects human health, natural ecosystems and crops, and does not exacerbate global climate change.

Objective

15. Protect and restore air quality.

Air quality in the Rouge watershed is similar to that of other parts of the GTA, and is influenced by emissions associated with transportation of people and goods, industrial activities, and heating and cooling of buildings, not only in the watershed but elsewhere in the region and even further afield in the United States. Actions taken in the watershed to reduce air pollution will make a valuable contribution both locally and in the regional context. In addition, we have a shared responsibility to reduce emissions of greenhouse gases from the burning of fossil fuels.

Our review of current conditions highlighted the following key issues:

- Increasing ground-level ozone and smog days
- Implications for human health, native vegetation and agricultural crops
- Contribution of greenhouse gases to climate change
- Effects of climate change on natural systems and implications for infrastructure

Current Initiatives

The Clean Air Partnership has produced *A Model Clean Air Plan for the Living City*, with support from TRCA and the federal government. The report includes a broad spectrum of possible actions to help municipalities develop clean air plans.

The GTA Clean Air Council was formed in 2001 to work on air quality issues. Once a year, the Council holds a Smog Summit to review progress on efforts to reduce air pollution. During the 2004 Summit, the municipalities of Toronto, Markham, Richmond Hill, Whitchurch Stouffville and Pickering and the Regions of York and Durham were among those who signed the 2004 Intergovernmental Declaration on Clean Air.

The GTA Clean Air Council maintains updated info about the air quality initiatives of GTA municipalities on its web site (www.gtacleanaironline.ca) under the themes of transportation; energy; business, industry and government (e.g. fleet management, employee incentive programs); natural environment and education.

Richmond Hill and Pickering have joined the Federation of Canadian Municipalities' Partners for Climate Protection – a national program that brings together municipal governments to solve greenhouse gas problems by developing and implementing local action plans. The City of Pickering has completed Milestones 1, 2 and 3 of the Partners for Climate Protection Plan and Council has endorsed a Local Action Plan to reduce greenhouse gas emissions by the community as well as for municipal operations. The City of Toronto supports the Toronto Atmospheric Fund and is a lead sponsor of Green$aver's Home Rewards audit and retrofit program, development of the Corporate Air Quality Strategy and financing for the wind turbine now operating at Exhibition Place.

TRCA's air quality and greenhouse gas initiatives include: a commitment to increase use of "green" electricity at all of its facilities; smog day policy requiring that activities such as use of two stroke motors, painting etc. not be performed during a smog advisory; and installation of an air biofiltration system or "breathing wall" at Head Office along with a new energy efficient HVAC system. The Kortright Centre for Conservation is home to the largest alternative energy demonstration in Canada and conducts

Urban Transit

A single urban transit vehicle can save 70,000 litres of fuel and keep 9 tonnes of pollutants out of the air each year (York Region Transportation and Works Newsletter, 2004, Vol.5).

many workshops on renewable energy. As part of the development of the Kortright Centre for Conservation as the Living City Centre, a number of new programs aimed at encouraging GTA-wide energy conservation and efficiency have been initiated (e.g. Mayor's Megawatt Challenge and Greening the Urban Village).

Bullfrog Power (www.bullfrogpower.com) provides residents, institutions and businesses in the Rouge watershed, as elsewhere in Ontario, with the opportunity to purchase 100% green electricity from low-impact water power (80%) and wind producers (20%) who meet or exceed the federal government's EcoLogo standard for renewable energy.

Strategies

We recommend the following strategies:

1. Undertake a vegetation impacts study
2. Reduce vehicle use and other emissions
3. Enhance natural vegetation sinks

1. Undertake a vegetation impacts study

We recommend a GTA-wide study to determine the economic and ecological impacts of poor air quality on local agricultural crops, urban forests and natural heritage.

2. Reduce vehicle use and other emissions

In Section 5.5.1 on Urban Land Use, we recommend more sustainable approaches to urban form and transportation that include measures to reduce vehicle use and to encourage clean, renewable forms of energy generation and district energy schemes.

3. Enhance natural vegetation sinks

Vegetation can take up considerable amounts of carbon dioxide, thereby reducing the concentrations of greenhouse gases in the air. Plants trap particulates and other airborne pollutants. The urban canopy also helps combat the urban heat island effect.

Our strategies to secure, restore and enhance natural cover (Section 5.4.2) would result in a significant increase in the amount of vegetation in the watershed with corresponding benefits in terms of the uptake of carbon and air pollutants.

5.5.5 NATURE-BASED RECREATION

NATURE-BASED RECREATION

Goal

Opportunities for public enjoyment that are compatible with, and raise awareness of, the watershed's natural and cultural heritage.

Objectives

17. Ensure that recreation activities in the Watershed are compatible with ecological and cultural integrity.
18. Provide opportunities for a variety of appropriate public uses and experiences in representative natural and cultural landscapes.
19. Develop a continuous trail network linking Lake Ontario to the Oak Ridges Moraine, with connections to local communities, neighbouring watershed trails systems, and natural and cultural heritage features.

The natural and rural lands of the Rouge watershed offer the public a range of "urban wilderness" and countryside experiences[3] (see Figure 3-12 in Current Conditions and Issues section). They provide participants with opportunities for healthy exercise, fresh air, contact with nature, spiritual rejuvenation and connections with rural heritage. They also provide us with opportunities to interpret the natural and cultural heritage of the watershed and encourage good stewardship to help meet the objectives of this watershed plan.

Our review of current conditions in the watershed highlighted the following issues:

- Finite resource with a growing human population
- Decline in major park infrastructure and identity
- Potential for conflicts with natural heritage protection
- Conflicts among park users
- Lack of data on user rates, fishing pressure and carrying capacities
- Lack of regional trails in middle and upper watershed
- Lack of overall identity of a regional nature-based recreational system
- Lack of management agreement between Rouge Park, TRCA and York Region municipalities

Our challenge therefore is two-fold. First, we must reduce current impacts from unauthorized and unregulated uses. Second, we can seize the opportunity to provide well-managed public use activities and experiences for the increasing numbers of residents and visitors that we expect in the future.

Current Initiatives

The development and management of public use and recreation opportunities in Rouge Park are guided by a number of existing plans, including the Rouge Park Management Plan, Rouge North Management Plan and Little Rouge Corridor Management Plan. Rouge Park is currently preparing an Interpretation Plan. TRCA in partnership with a stakeholder advisory committee is currently developing an updated Conservation Area Land Management Plan for Bruce's Mill Conservation Area. TRCA and partners have just completed a plan for the Oak Ridges Corridor Park that

3 This plan does not focus on the many local parks, trails, sportsfields and other recreation facilities provided by municipalities in the Watershed.

straddles the Humber and Rouge River watersheds. Other recent enhancements to recreation opportunities in the Rouge watershed include the Port Union Waterfront Park in Toronto and the forest on Bayview Avenue in Richmond Hill. Markham is in the process of developing a Cycling and Pedestrian Master Plan and a Pathways and Trails Master Plan which will contribute to a network of connected trails including new trails both on and off road. The annual Urban Fishing Festival, held in July at Toogood Pond, is an Ontario Ministry of Natural Resources initiative to educate and encourage urban fishing. The Town of Richmond Hill has completed the Phyllis Rawlinson Park Phase II Master Plan and delivers the Walks on the Wild Side Environmental Education Program.

Strategies

We have identified eight priority strategies for nature-based recreation in the watershed:

1. Recognize the regional system for nature-based recreation
2. Implement an inter-regional trail network
3. Develop a recreation strategy for the Northern Countryside
4. Protect the urban wilderness experience of Rouge Park
5. Develop a plan to balance public access and resource protection
6. Interpret natural and cultural heritage
7. Establish management and operational agreements for Rouge Park and other public lands in York Region
8. Form community partnerships for implementation

1. Recognize the regional system for nature-based recreation

Many partners, including the Regions of York and Durham, local municipalities, City of Toronto, TRCA, and Rouge Park, have existing and proposed parks, trails and programs that collectively provide the basis for a regional, nature-based recreation system for regional use as well as neighbourhood access. As noted in our cultural heritage strategies, there is also a role for heritage structures and landscapes to complement recreation programs by serving as visitor's centres or destinations such as restaurants or local farmers markets. In order to maximize these opportunities, we recommend the establishment of a multi-partner program with long term funding commitments and a funding formula. This will help to support integrated planning for the system, maintenance and reinvestment in existing properties as well as further expansion and enhancement of the system.

2. Implement an inter-regional trail network

Existing designated regional trails are mostly in the Toronto portion of Rouge Park and are identified on the *Rouge Park Map and Visitor Guide* (2005). The proposed inter-regional trail network would extend along the Little Rouge corridor, with links to the Oak Ridges Trail to the north and connections across the Rouge River's headwaters to the Humber watershed in the west, and to the TransCanada Trail in the Duffins Creek watershed to the east.

Management strategies are needed to protect and enhance recreational activities in the scenic rural countryside

This network should be implemented, as proposed on the *Rouge River Watershed Inter Regional Trails Plan* (Figure 5-3). It should include:

- Integration of local community trail plans with the inter-regional trail system.
- Completion of community trail plans early in the planning process for greenfield development areas. Funding for implementation should be allocated from development charges.
- Cooperation with neighbouring jurisdictions to establish greenspace and trail connections to adjacent watersheds.
- Collaboration with golf course operators, farmers and other private landowners to ensure compatibility of public uses on or adjacent to their properties and to secure trail easements where appropriate.
- Public consultation on trail alignment and design.
- Identification of funding mechanisms for trail development and long term maintenance.

3. Develop a recreation strategy for the Northern Countryside

The countryside and kettle lakes nodes in the Northern Countryside currently have few developed public use opportunities. Recognizing the growing demand for recreation opportunities that will

accompany population growth in this area, strategies should be developed with guidance from the Cultural Heritage Highlights in Rouge watershed (Figure 3-11) and Nature-based Recreational Areas and Experiences in the Rouge watershed (Figure 3-12). The strategies should include:

- Delineation of trail routes as part of the inter-regional trail network.
- Definition of unique public use experiences and opportunities.
- Assess the road system to identify opportunities for scenic corridors and inventory cultural heritage landscapes.
- Identification of opportunities to interpret natural and cultural heritage.
- Management approaches to optimize user experience and avoid problems associated with over use or inappropriate use.
- Integration of the northern countryside strategy, with the broader regional open space system.

4. Protect the urban wilderness experience of Rouge Park

The urban wilderness experiences associated with Rouge Park are among the many benefits of the Park. However they are vulnerable to inappropriate uses, conflicts between users and over-use. It is crucial to educate park users and local decision-makers about natural and cultural resources, watershed functions and the negative impacts of human activities in order to encourage responsible behaviour and compliance with regulations. Rouge Park currently undertakes a number of measures to control impacts of public use. These should be intensified before the Inter-regional Trail System is completed. The linkages with the Lake Ontario Waterfront Trail and other regional trails are particularly important because they will introduce a larger population of trail users to the Rouge Valley. Our priority recommendation is therefore to develop education, awareness and interpretive materials for the lower Rouge watershed and Rouge Marsh complex before connections are made with the Waterfront Trail.

Rouge Park provides an urban wilderness experience. Left: Canoeing in the Lower Rouge River (Photo credit: Peter Attfield) Right: Coyote

Figure 5-3: Rouge River Watershed Inter Regional Trails Plan

5. Develop a plan to balance public access and resource protection

Public enjoyment of the natural and rural landscapes of the Rouge watershed is an important benefit of a healthy watershed, but it can also affect the resources on which it depends. The lack of data on current uses, including fishing, should be addressed with the help of municipalities, trail/hiking groups, anglers and other users. A plan should be developed to achieve a balance between public access and protection of sensitive ecological and cultural heritage areas. It should include:

- Policies and guidelines for the phasing out or relocation of public uses that are incompatible with the objectives of this watershed plan and Rouge Park's management plans.
- Decommissioning of unauthorized trails.
- Development of policies and enforcement of regulations for unauthorized or incompatible uses and harmonization of appropriate by-laws among municipalities.
- Standards of practice for public use operators, such as environmental management systems for public agencies, Audubon Program or equivalent for golf courses, and Environmental Farm Plans for agri-tourism businesses.
- Monitoring of trail use and participation rates in other activities such as bird-watching, boating, fishing and picnicking to assist in planning and regulating public activities.

6. Interpret natural and cultural heritage

The *Cultural Heritage Highlights Map* (Figure 3-11) and *Nature-based Recreational Areas and Experiences Map* (Figure 3-12) provide overall guidance for establishing consistent themes, experiences and

Bruce's Mill Conservation Area Maple Syrup Festival

interpretive possibilities. The ongoing initiatives noted below offer opportunities to achieve this coordination. Specifically:

- The Rouge Park Management Plan (1994), Rouge North Management Plan (2001) and Little Rouge Corridor Management Plan (2006) should be consolidated to provide one comprehensive planning document for Rouge Park.
- Public use strategies should be incorporated into the Master Plan for Transport Canada's Green Space lands where appropriate and compatible with Rouge Park and other adjacent lands.
- TRCA should complete and implement the master plans for Bruce's Mill Conservation Area and the Oak Ridges Corridor Park.
- Municipalities should provide adequate lands for sportsfields and other active recreation facilities outside Rouge Park, without negatively impacting other natural and cultural heritage landscapes.

7. Establish management and operational agreements for Rouge Park and other public lands in York Region

There is a need to develop operational agreements for Rouge Park and other public lands in York Region, specifying clear maintenance and enforcement responsibilities and providing for sufficient financial and other resources among Rouge Park, TRCA, York Region and the relevant local municipalities. The existing agreement among Rouge Park, the TRCA and City of Toronto, which provides a solid basis for the day-to-day operations and maintenance of Rouge Park in Toronto, could be used as a model.

8. Form community partnerships for implementation

Partnerships should be formed with the community across the watershed to assist with raising public awareness, creating a trail association, special events, fundraising, recruiting volunteers for restoration projects and ecological monitoring. Partners could include NGOs, user groups (e.g. trails, fishing, heritage etc), organized First Nations representatives, residents and ratepayers associations.

5.5.6 CULTURAL HERITAGE

CULTURAL HERITAGE

Goal

Recognition, preservation, and celebration of cultural heritage in the Rouge watershed to increase awareness and understanding of human relationships with the environment.

Objective

16: Identify, document, protect and celebrate cultural heritage resources.

It is important to understand our cultural heritage because it helps to define our sense of place and provides insights into today's landscapes and environmental conditions. For the purpose of

this plan, cultural heritage includes archaeological resources, built heritage resources and cultural heritage landscapes as well as the stories associated with them. It also includes living culture pursuits, such as art, performing arts and gardening, that are a means of expressing present relationships with our environment.

Our review of current conditions illustrated the rich human history and diverse cultures of today's communities in the Rouge watershed. (See Figure 3-11– in Section 3.4.1). It also highlighted some key issues that must be addressed in the watershed plan:

- There is a rich cultural heritage but potential to lose many more heritage sites and landscapes
- There is limited public awareness of both the positive and negative relationships through time between people and the watershed
- There is no suitable repository for archaeological artifacts

Current Initiatives

The TRCA Archaeological Resource Management Services Unit has partnered with Rouge Park to conduct archaeological surveys of ploughed fields that are currently under cultivation. This process identifies locations and characteristics of archaeological sites as well as opportunities for interpretation and public involvement (such as the Boyd Archaeological Field School).

In areas experiencing new urbanization, such as east and north Markham, south Stouffville and north Richmond Hill, private consulting archaeological firms identify and document archaeological sites and Post-Contact farmstead landscapes. The Planning Act and updated Provincial Policy Statement allow municipalities to adopt official plan objectives and conservation policies and procedures to protect cultural heritage, such as demolition control by-laws and requirements for heritage impact assessments and conservation plans. The revised Ontario Heritage Act includes conservation measures such as property listing and designation, easements, architectural design guidelines and grants for heritage conservation. The Ministry of Culture has published an on-line guide to "Heritage Resources in the Land Use Planning Process."

Strategies

In order to address current issues and move towards our goal and objective for cultural heritage, we have identified five priority strategies:

1. Investigate and conserve cultural heritage prior to changes in land use
2. Establish a comprehensive communication plan with Aboriginal groups
3. Fill gaps in archaeological knowledge
4. Develop active and participatory programs to increase awareness
5. Develop a living cultural heritage program

1. Investigate and conserve cultural heritage prior to changes in land use

Investigation and conservation of cultural heritage must be undertaken prior to changes in land use, including development, trail creation and reforestation, in accordance with the requirements of the Ontario Heritage Act (2005). Although TRCA is conducting surveys and municipalites are requiring archaeological assessments prior to development, a more coordinated proactive approach is needed in areas of archaeological potential in advance of development. Municipalities are encouraged to undertake archaeological master plans and identify internal processes and protocols to identify, protect and conserve archaeological resources. These master plans should identify both pre-contact and historic archaeological resources, and identify any further assessments required or planning considerations for resource protection. The greatest pressures for change will occur in the lands identified for potential urban growth in the Growth Plan for the Greater Golden Horseshoe, so cultural heritage should receive priority attention in these areas.

Investigation of cultural heritage prior to land use changes will identify opportunities to integrate heritage features, landscapes and stories into new developments. For example, heritage buildings can be incorporated into proposed developments rather than being demolished. Cultural heritage landscapes (e.g. countryside roads such as 14th Avenue, Reesor Road and Twyn Rivers Drive, agricultural communities, clusters of century homes and 20th century ethnic architecture) should

Retention and conservation of heritage buildings on their original site is encouraged, as well as the integration of these resources into new development proposals in their original use or an appropriate adaptive re-use.

be recognized in municipal plans so that they can be assessed before any proposed development. Aboriginal archaeological sites should be protected as green spaces, where possible, with limited investigative excavations with the majority of the site protected for the future.

Various mechanisms exist to facilitate conservation of heritage features. For example, the Ontario Heritage Trust should be provided with information and encouraged to investigate properties with both cultural and natural heritage values for their Natural Spaces Land Acquisition and Stewardship Program.

In order to provide easier access to information resources, oral and archival histories and other reference materials about the Rouge watershed should be housed in the Rouge Park office or another centralized location (such as a heritage repository for artifacts, and copies of maps and other archival documents, with research and meeting space).

2. Establish a comprehensive communication plan with Aboriginal groups

There is a need and opportunity to enrich our celebration of heritage through improved relationships with Aboriginal groups. A communications plan could identify key groups and contacts as well as partnership opportunities for interpretation and awareness programs, viewing of artifacts, program development, education and events. It would benefit current non-Aboriginal residents and visitors as well as those Aboriginal groups with ancestral ties and other interests in the Rouge area. A protocol for consultation with recognized Aboriginal bodies should be developed as an important component of the communications plan. Preparation of this protocol should be facilitated by TRCA with participation of all recognized Aboriginal groups, municipal partners and the Ontario Ministry of Culture. This could set an example for the Ministry of Culture to use in establishing a system of Nation- to-Nation two-way meaningful consultation that individual archaeologists and First Nations and Métis communities can follow to share information with each other.

Standardizing the identification and protection of archaeological and built heritage

- New Ontario Heritage Act (2005) requirements and Ontario Ministry of Culture Standards and Guidelines (2006) need to be followed as minimum procedures for the investigation and protection of archaeological sites, with participation by First Nations representatives.
- A similar level of identification and protection should be developed for built heritage sites, with the cooperation of Municipal Heritage Committees, to enhance the requirements already in place through municipal Official Plans.

3. Fill gaps in archaeological knowledge

A program should be developed to fill gaps in our archaeological knowledge and improve our understanding of early human cultures, particularly in the upper middle reaches of Bruce Creek and sub-watersheds of Little Rouge River. This could be achieved by conducting strategic archaeological field studies of uninvestigated areas that are identified for future urban growth, as part of archaeological master plans.

A permanent repository should be established for the storage of archaeological artifacts, with participation by Aboriginal representatives.

Storage and interpretive facilities are needed to ensure the long term care for archaeological artifacts

The repository should provide secure artifact storage and community-friendly spaces, including places for researchers to work, artifact layout space, and flexible areas for public use (e.g. displays reflecting Rouge watershed, meeting rooms for visiting students and community groups). Funding strategies could include box levies on the remover (e.g. landowner or project proponent) of the artifact. A trustee approach can be encouraged if ownership (e.g. of Aboriginal artifacts) is an issue.

4. Develop active and participatory programs to increase awareness

Active and participatory programs should be developed to provide learning opportunities and increase awareness of cultural heritage (e.g. heritage walks, bus tours, field courses, audio/visual/oral histories). These types of interactive programs are expected to appeal to a broad audience and have greater likelihood of engagement and effectiveness than more passive programs. Special attention should be given to reaching out to new Canadians. Living culture, such as photography, drawing, painting and performance arts, should be incorporated. User-pay approaches are expected to be a feasible means of supporting these programs.

The Ontario Heritage Trust should be approached for local markers or provincial plaques for areas of heritage significance.

Community-based projects should be developed to incorporate cultural heritage values and themes into the local community fabric. We recommend the following priorities:

- Determine appropriate teaching sites for archaeological field schools at a Pre-Contact site, with Aboriginal consultation and approval, and on a Post-Contact site, with community consultation and approval, partnered with the TRCA Archaeology Program, the Ontario Heritage Trust, the Ontario Archaeological Society, local school boards, and other stakeholder organizations.
- Designation of cultural heritage landscapes and multiple properties that share cultural heritage significance as Heritage Conservation Districts under the Ontario Heritage Act.
- Provide expertise and resources to local ethnic groups to establish forms of public recognition of their culture in the watershed, including First Nations, Métis and the Mennonite community as well as other 19th - 21st century ethnic communities and influences.

Other recommended initiatives include:

- Recognition of the eastern Carrying Place Trail with interpretive signage on contemporary trails.
- Promotion of links between human and natural heritage, for example with interpretive signs about the influences of human activities on historic and current environments.
- Signage for communities, streets and public buildings with historic names, trail guides/ maps and public art.

Living culture in the Rouge. (Right photo credit: Rouge Park)

Kathleen McKay Art Gallery, Unionville (former Fred Varley home) – an example of adaptive re-use of a heritage building.

- Protection and interpretation of cultural features that also serve as wildlife habitat (e.g. barn swallows and chimney swifts shelter in farm buildings, turkey vultures nest in old silos or barns).
- Celebration of agriculture and community gardens as an expression of culture, in addition to their roles in food production and land/water stewardship.
- Involvement of existing programs such as the Stouffville Public Library's lecture series.

The heritage character of Cedar Grove and Locust Hill should be maintained through designation as a historic area and development of interpretive programs. Existing heritage buildings could be restored for adaptive re-use. New lease arrangements or ownership models should be considered to foster a sense of community.

Program opportunities and materials should be provided to schools to assist them in implementing the new (2006) Ontario school curriculum on Aboriginal and pioneer life. Opportunities for TRCA's archaeological field school to contribute to the new curriculum should be explored and a sustainable funding plan developed. A feasibility study should be conducted for continuing education courses for adults to learn practical skills such as archaeological fieldwork, artifact analysis and site interpretation, and archival research.

5. Develop a living cultural heritage program

A living cultural heritage program could enhance interpretive and tourism opportunities in the watershed. It would draw upon the databases and inventories of cultural heritage, including built structures and landscapes. It would identify architectural assets in need of restoration and look for opportunities to revitalize heritage properties by forming partnerships to increase revenue and find adaptive re-use, such as community centres, art centres, pubs, restaurants, and other businesses.

CHAPTER

6

6.0 IMPLEMENTATION

We have outlined many specific strategies to achieve the goals and objectives of this watershed plan. Implementation of the plan will now rely on the adoption of supportive policies, programs and practices by the various partners. The watershed plan is intended to inform and guide municipalities, provincial and federal governments, TRCA and Rouge Park as they update their policies and programs for environmental protection, conservation, and restoration within the contexts of land and water use, and the planning of future urban growth. The plan provides direction to local non-governmental organizations and private landowners with regard to best management practices and opportunities for environmental stewardship. Implementation of these strategies will be most effective if existing partners coordinate their efforts, and make creative use of existing tools, as well as some new ones, as outlined below.

1. Existing policies and programs
2. Provincial initiatives
3. Stewardship and regeneration
4. Education and awareness
5. Enforcement
6. Operations and maintenance
7. Monitoring
8. Implementation Oversight

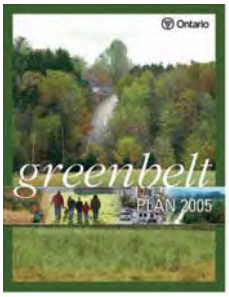
6.1 EXISTING POLICIES AND PROGRAMS

Many stakeholders, including federal and provincial governments, municipalities, Rouge Park, TRCA, Toronto Zoo, NGOs (e.g. Friends of the Rouge watershed, Milne Conservation Association, Rouge Valley Foundation, Ontario Archaeological Society), industry/business (golf courses, agriculture, developers) and citizens will be able to play a role in implementation of this watershed plan. Many of these partners already have policies and programs in place and the capacity

to implement aspects of the plan. We recommend that all partners use the information and recommendations of the watershed plan to inform their ongoing programs and decision making. Where necessary, we ask partners to consider opportunities to update and amend their programs with new information in our plan. The ten year workplan (see *Implementation Guide*) will provide an opportunity to set priorities and coordinate actions.

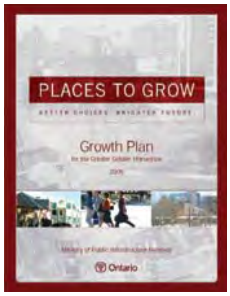
6.2 PROVINCIAL INITIATIVES

Recent provincial initiatives – the *Greenbelt Plan*, *Growth Plan for the Greater Golden Horseshoe, Oak Ridges Moraine Conservation Plan* and Source Water Protection programs – provide a broad context for the protection and sustainable use of natural resources and a framework for development and investment. This watershed plan provides more specific guidance for their implementation.



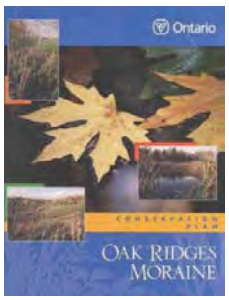
Greenbelt Plan

Section 3.2.6 of the *Greenbelt Plan* identifies the significance of the Rouge River watershed and Little Rouge River as a vital ecological corridor. The plan says that land use planning and resource management within the Protected Countryside shall comply with the provisions of the *Greenbelt Plan* and the *Rouge North Management Plan.* However, outside the Protected Countryside, it states that the *Rouge North Management Plan, Rouge North Implementation Manual*(north of Steeles Avenue) and *Rouge Park Plan* (south of Steeles Avenue) should be considered as guiding documents, along with any municipal or conservation authority plans or initiatives that build on and/or support them. Therefore we recommend, as per section 3.2.6 of the *Greenbelt Plan*, that all stakeholders should recognize the Rouge River Watershed Plan as a guiding document that builds on and supports *the Rouge North Management Plan, Rouge North Implementation Manual,* and *Rouge Park Plan.*



Growth Plan for the Greater Golden Horseshoe

The *Growth Plan for the Greater Golden Horseshoe* (2006) covers those areas outside the Protected Countryside noted above, and requires municipalities to amend their official plans to comply. Therefore we request the Ministry of Public Infrastructure and Renewal and other relevant agencies to address the Rouge River Watershed Plan's recommendations through Implementation Analysis & Sub-Area Assessment (s.5.3/p. 35 of the *Growth Plan*), in keeping with special status accorded the Rouge lands through the *Greenbelt Plan's* section 3.2.6.



Oak Ridges Moraine Conservation Plan

Section 24 of the *Oak Ridges Moraine Conservation Plan* (ORMCP) requires every upper-tier municipality and single-tier municipality to begin preparing a watershed plan, for every watershed whose streams originate within the municipalities area of jurisdiction. The objectives and requirements of each watershed plan are to be incorporated into the municipality's official plan, and major development within the ORMCP area commenced after April 23,

2007 is prohibited unless it conforms with the watershed plan. We therefore request the Region of York, Town of Whitchurch-Stouffville, Town of Richmond Hill, and Town of Markham to recognize and act on the Rouge River Watershed Plan's recommendations as per section 24 of the Oak Ridges Moraine Conservation Plan.

Source Water Protection Planning

The *Clean Water Act* sets direction for the preparation of source water protection plans within each source water protection planning region in Ontario. TRCA is the lead conservation authority for the Credit Valley – Toronto - Central Lake Ontario (CTC) Region. We therefore request that the CTC Source Protection Committee be advised of the *Rouge River Watershed Plan* and its recommendations.

6.3 STEWARDSHIP AND REGENERATION

Many of our strategies (e.g. targeted natural heritage system, stormwater retrofits, restoration of water balance, aquatic habitat improvements, nature based recreation opportunities) can be achieved through improved stewardship and regeneration of public and private lands.

We recommend a coordinated program among various partners to accelerate securement and expansion of the terrestrial natural heritage system with a focus on:

- securing the 14 % (1,400 ha) of the targeted system that is currently not protected by other policy mechanisms within 5 years, and
- achieving an increase in natural cover by 10% (net 2.4% of watershed or about 270 ha) over 2002 levels within 5 years

Naturalization/plantings

Left: Richmond Hill Healthy Yards Program booth (Photo credit: Town of Richmond Hill). Right: Conservation Partner sign recognizing rural landowner stewardship.

We also recommend a coordinated program among various partners to accelerate implementation of lot level stormwater management retrofits, in conjunction with a social marketing pilot project focusing on residential and business sectors in the Rouge watershed.

6.4 EDUCATION

A recurring theme in this plan is the need for initiatives to increase awareness and provide more information about ways that individuals, businesses and governments can contribute to a healthy, sustainable Rouge watershed. We recommend that the Rouge River Watershed Plan Implementation Committee (see below) should coordinate partners' activities to ensure consistent messaging, avoid duplication and facilitate integration of funds and other resources.

Name that Wildflower (Photo credit: Town of Richmond Hill). Right: Educational Park signage (Photo credit: Town of Richmond Hill).

Rouge River sign in Richmond Hill. River signage is an important way of improving public awareness and river stewardship.

The overall theme for education is to encourage behavioural shifts to sustainable practices. This can include:

- energy conservation, water conservation and waste reduction
- importance of lot level stormwater management
- organic lawn care
- planting drought tolerant native trees, shrubs and wildflowers
- pollution prevention
- spills prevention and management
- avoidance of practices that aggravate flood risk
- control of invasive alien species
- backyard and front yard naturalization
- production and purchase of locally grown food
- stewardship of natural areas
- naming and signage for Rouge River and all its tributaries
- awareness of cultural heritage
- erosion and sediment control and site restoration practices for construction sites
- integrated pest management for golf courses
- rural best management practices for farms, golf courses etc.

6.5 ENFORCEMENT

Public education and awareness must be complemented by rigorous and coordinated enforcement of policies and regulations by the responsible agencies. Current enforcement capability of the agencies (e.g. TRCA, municipalities, MNR, MOE, and DFO) are inadequate and should be increased. They should:

- identify and secure necessary resources;
- investigate means to improve partnering among relevant agencies;
- post signage using universal symbols and/or in multiple languages about permitted and non-permitted activities;
- promote public awareness of who to call and facilitate referrals of mis-directed calls, and
- adopt protocols for feedback to the public on actions taken.

6.6 OPERATIONS AND MAINTENANCE

Property managers responsible for operations and maintenance of public property such as roads, parks and infrastructure, or private property such as golf courses, cemeteries or commercial/ industrial lots, should consider ways they can incorporate the watershed plan's directions into their ongoing practices and programs. For example, naturalization schemes could be adopted as part of landscaping practices and thereby contribute to improved lot level water management and the achievement of our terrestrial natural heritage goals.

Maintenance recommendations are noted within many of the strategies, however there are two significant recommendations for new formalized maintenance programs. Our water strategies underscore the need for municipal operation and maintenance programs for stormwater

Illegal dumping (Photography © Andy McKinnon).

Sediment removal is part of regular stormwater management facility maintenance (Photo credit: Town of Richmond Hill)

management infrastructure, including the clean out of accumulated sediment in ponds. Routine maintenance activities may present opportunities to optimize the performance of these stormwater management facilities through minor adjustments in operation, while larger maintenance projects may represent cost efficient opportunities to undertake major retrofit projects to improve facility performance.

The second new maintenance program being recommended relates to Rouge Park and other public lands in York Region. The nature-based recreation strategies identify the need for operational agreements for these lands, particularly with respect to responsibility and funding for maintenance.

6.7 MONITORING

Ongoing monitoring will be essential to identify whether the management strategies in this watershed plan are effective and adapt them if necessary. For example:

- Are the management measures performing as designed?
- How are environmental conditions responding?
- Do we need to change our strategies and if so, how?

We recommend three broad areas of monitoring:

1. Evaluation of innovative technologies
2. Ambient watershed conditions and long-term trends
3. Adaptive management

1. Evaluation of innovative technologies

Our strategies for water (Section 5.3) describe TRCA's Sustainable Technologies Evaluation Program (STEP) and recommend long-term support to ensure that it continues to provide a valuable forum for coordinated performance monitoring and evaluation among a number of agencies and private partners.

Stream monitoring

2. Ambient watershed conditions and long-term trends

The Regional Watershed Monitoring Network (RWMN), led by TRCA in partnership with its member municipalities and other monitoring groups, provided a substantial information base for this watershed plan. The RWMN was developed based on regional and watershed scales and to the extent possible at the sub-watershed scale. During the preparation

of this Plan, it was found that additional information is needed at a sub-watershed scale to fully understand watershed systems. We recommend that the TRCA continue to implement the RWMP in order to provide data on ambient conditions and long term trends. In addition, we recommend the following enhancements:

Climate change

Uncertainty associated with the likely degree and timing of changes to climate within the Rouge watershed creates challenges for the development of comprehensive strategies that will help the watershed to adapt. We recommend continued data collection in the Rouge watershed to track changes resulting from global climate change. Additional watershed-based hydrologic modelling should be undertaken when data becomes available from the regional scale climate models that are currently being developed to anticipate climate change for the Region.

Precipitation

Additional rain gauges should be installed in the northeast, middle and southern parts of the watershed to supplement the data from the Buttonville Airport gauge and address the need for subwatershed-level data for calibration of hydrologic models. This will assist in future hydrologic modelling and calibration. Implementation of the new gauges should be coordinated with similar efforts to augment the rain gauge network in neighbouring watersheds.

Groundwater

Additional funding partnerships should be sought to install nests of groundwater monitoring (water level and groundwater quality) wells at additional sites in the watershed to improve spatial coverage and at various depths to improve knowledge of each of the three major aquifers. There are currently only three groundwater monitoring wells within the Provincial Groundwater Monitoring Network in the Rouge and we recommend adding three new locations with nests of 2-3 wells at each location. They should be located to assess water level changes in aquifers that discharge at surface water flow gauge locations as well as to facilitate the assessment of both regional and local effects of urban development and land conservation. Potential locations include:

- North-east corner of the watershed on the Oak Ridges Moraine (3 wells)
- Near Major Mackenzie Drive and McCowan (3 wells); Assume York Region's wells as part of the RWMN, once their project monitoring is complete.
- Lower Rouge south of the Iroquois shoreline (2 wells)

Surface Water

Additional stream flow gauges are recommended at the following locations to improve hydrologic modeling capability, floodplain mapping and flood flow prediction, as well as for tracking the hydrologic impact of any new upstream development:

- Install one additional stream flow gauge on the Main Rouge River downstream of the Morningside Creek confluence and the Little Rouge River south of Finch Avenue to facilitate watershed-scale calibration of models.
- Install one additional stream flow gauge on each of the major headwater tributaries ("Middle Tributaries") to assist in subwatershed-scale calibration and analysis. Gauges should be located on Beaver Creek, Upper Rouge River upstream of the Beaver Creek Confluence, Berczy Creek, Bruce Creek, and Robinson Creek as close to the confluences with the Main Rouge as possible.
- There may also be opportunities to restore historic Water Survey of Canada sites on the Main Rouge and to formalize temporary gauges established for the York Durham Sewer System and North Leslie projects.

Stream form

We recommend the following improvements to monitoring of stream form:

- Additional fluvial geomorphology monitoring sites should be established just downstream of the area of future urban expansion in order to track the effects of development on erosion and channel form at a local and subwatershed scale. These should be established as soon as possible to determine an existing conditions baseline and should be monitored annually, probably for at least 20 years.
- There should also be reference sites established downstream of the developing areas. Locations to consider include Bruce Creek, Berczy Creek, Robinson Creek, and the Little Rouge River just upstream of Major Mackenzie Drive, plus corresponding reference sites for all of these upstream of the areas of potential future development.
- Enhancements to the current monitoring protocol applied at the established fluvial geomorphic monitoring sites (i.e. additional cross-sectional surveys, greater frequency).

Water Quality

Since the Rouge River watershed planning study began, two additional water quality stations have been monitored on the Main Rouge River and on the Little Rouge River at Steeles Avenue. With these additions, the total network of seven ambient water quality stations is deemed to be adequate, if supported by targeted monitoring studies conducted on a project basis to answer specific questions (e.g. effectiveness of road salt management plans, bacteria source monitoring – pending the outcome of the Environment Canada source tracking study, etc.).

Aquatic System

Most of the Rouge Fish Management Zones currently have one or more aquatic monitoring stations. To address current data gaps, we recommend consideration of additional stations in Fish Management Zones 3 (Bruce Creek), 5 (Main Rouge through Markham including Eckardt Creek), and 10 (Beaver Creek and Upper Main Rouge).

Terrestrial System

Our strategies for terrestrial natural heritage include recommendations for additional monitoring, including expanded winter bird and breeding bird surveys and additional monitoring of ecological restoration success.

Nature-based Recreation

The lack of data on use of nature-based recreational opportunities in the watershed limited our full understanding of issues. Our strategies recommend the need for monitoring of trail use and participation rates in other related recreational activities.

3. Adaptive management

We recommend an adaptive management program for the Rouge watershed that will use feedback from monitoring activities to make adjustments to policies, plans and programs to ensure that our goals, objectives and targets are met.

This should include:

- A review of the adequacy of existing and enhanced monitoring mechanisms (e.g. RWMN and requirements for compliance monitoring by proponents).
- Definition of analytical, assessment and reporting protocols.
- Definition of triggers for initiating policy or planning adjustments.
- Identification of the mechanisms and procedures for engaging watershed partners in a process for amending the watershed plan.

6.8 IMPLEMENTATION OVERSIGHT

The Rouge Watershed Task Force has played an important role in the preparation of this Plan. The multi-stakeholder representation on the Task Force enabled us to share different perspectives, contribute considerable depth of knowledge and experience, and develop creative solutions. In addition, we established relationships that extended beyond the work of the Task Force and into our working environments.

Moving forward, we recommend the formation of a Rouge River Watershed Plan Implementation Committee - with representation from all key stakeholders in the watershed - to guide implementation of the Plan. The Committee should: (1) Report to the TRCA and the Rouge Park Alliance; (2) be given a terms of reference, mandate and duration of term; (3) Report regularly on progress with the implementation of the Rouge River Watershed Plan.

CHAPTER

7

7.0 CONCLUSIONS

We embarked on this planning process with ambitious goals and objectives for the Rouge watershed. We wanted to make sure that the valuable resources and opportunities of the Rouge watershed would be protected, restored and enhanced for current and future generations of people, as well as for wildlife and their habitats. We especially wanted to find ways to reverse and prevent the deterioration of environmental quality and losses of natural and cultural heritage that were increasingly apparent in the watershed.

Before we could recommend strategies for future management of the watershed, we needed to improve our knowledge and understanding of the Rouge watershed ecosystem, assess the effects of human activities to date, consider potential future scenarios and analyze the likely effectiveness of a range of management approaches. This process resulted in some key findings.

Rouge River landscape (Photo credit: Lou Wise).

First, we concluded that the Rouge watershed is an extraordinary resource, especially given its location in the highly urbanized Greater Toronto Area. The Little Rouge River watershed is still relatively undeveloped with considerable natural cover and a water balance typical of a rural watershed. The aquatic systems in the upper Little Rouge and parts of the Main Rouge are healthy enough to support cold- and cool-water communities including species of concern such as redside dace and brook trout. Natural areas cover about 24% of the watershed and their habitats support a high diversity of plants and animals, including many that are rare or at risk (such as the nationally threatened Jefferson salamander, provincially significant Cooper's hawk and regionally rare one flower cancer-root). Major blocks of publicly owned lands have been reserved for conservation and greenspace purposes, most notably the 41 square km. Rouge Park. The Rouge watershed also has a rich cultural heritage, including many archaeological

A view south along Kennedy Road from atop the Oak Ridges Moraine

and historic sites, landscapes, stories and artifacts from earlier inhabitants as well as the diverse cultures of present day communities.

Second, we discovered that urban development has resulted in harmful changes to water balance, water quality, natural cover, aquatic and terrestrial communities, cultural heritage and air quality. These changes include increased surface runoff, more water pollution, greater annual flow volumes in rivers and streams, increased erosion and sedimentation, channel instability, reduced groundwater discharge, smog, and losses of cultural heritage and biodiversity. Rehabilitation of infrastructure and restoration of natural habitats to address these issues is underway, but is expensive and time consuming.

Third, we found that if future development proceeds with current approaches to community design and stormwater management, it will not be possible to maintain current conditions, let alone improve them. Instead, we can expect additional deterioration of environmental conditions and associated quality of life. Further, our analysis showed that even if the most innovative sustainable community measures are applied, this deterioration cannot be completely prevented. We also found that the anticipated effects of global climate change will exacerbate these concerns.

We recognize that urban growth is inevitable, at least within the current official plan boundaries. But it is clearly neither responsible nor sustainable to proceed without some significant changes to the design, pace and extent of new developments. Fortunately, we have identified many positive and practical opportunities to make these changes.

Rouge River Headwater Stream

We recommend that all development, in greenfield areas as well as intensification of existing urban areas, should include a full suite of sustainable community measures. Our report *Development of a Sustainable Community Scenario for the Rouge River watershed* (TRCA 2007) provides a starting point in describing sustainable community attributes and measures. It will be essential to facilitate adoption of new technologies, test their effectiveness in meeting our watershed objectives, and involve the public in evaluating the results, and make changes to improve performance when necessary.

We will need time to evaluate success, therefore we recommend that development should proceed with caution, and at a pace that allows opportunities to make any necessary adjustments, investigate new methods, and update the requirements for the next phases of development. With this approach in mind, we recommend a wide range of measures to protect and enhance valued resources, regenerate damaged systems, and build more sustainable communities. This will help to increase the resilience of natural systems to human activities and climate change. It will also create healthier places for people and wildlife and stronger support for economic activities. The emphasis in the relatively healthy Little Rouge watershed should be to protect and maintain its ecosystem functions and valued resources. In much of the Main Rouge and its tributaries, the priorities are to restore degraded conditions, prevent further deterioration, and bring about enhancements where possible.

Our recommended management strategies fall into three broad categories:

1. **Establish the targeted terrestrial natural heritage system:** Figure 5-2 illustrates an expanded natural heritage system that is designed to provide multiple benefits, including biodiversity and habitats, water balance maintenance and restoration, opportunities for nature-based recreation, improved quality of life, and greater resilience to urban growth and climate change. It can be accomplished by protecting existing valued assets, securing additional lands, regenerating degraded areas, and improving stewardship of public and private lands.

2. **Build sustainable communities:** We have identified more sustainable approaches to urban form, infrastructure, transportation and resource use that will contribute to overall improved quality of life. They should be applied to new communities, as well as to the intensification or redevelopment of existing ones. Some of the key features include reduced imperviousness, measures to maintain or restore water balance, design features to facilitate sustainable choices (e.g. energy conservation, reduced vehicle use, support for local agricultural products) and protection and adaptive re-use of cultural heritage features. Development where permitted, should be designed to proceed at a pace and extent that allows sufficient time to adopt, test and evaluate the effectiveness of new technologies and to make adjustments if the results do not meet our objectives and targets for the watershed.

3. **Recognize and enhance a regional open space system:** The Rouge watershed has the basis for a significant, inter-connected regional open space system including Rouge Park and regional trails, conservation areas and major municipal parks, heritage features and landscapes. We recommend greater collaboration among the various public and private operators to improve the linkages between these unique natural and cultural heritage destinations and experiences and facilitate management partnerships. We also recommend that this system be further developed to reach its potential to provide nature-based recreation experiences for a growing population, support for healthy communities, interpretation of natural and cultural heritage, linkages with local neighbourhoods and connections to surrounding watersheds and regions.

To accomplish these management strategies, we need a collaborative, integrated approach. This begins with increased awareness. We need to ensure that watershed residents, businesses, developers and agencies understand the importance of the watershed, its water cycles, natural systems and cultural heritage. This will require a long-term outreach program to provide information and understanding, explain how people can act on this knowledge, and inspire action. The results of our social marketing study, *Action Plan for Sustainable Practices*, are encouraging. The study shows that there is a modest basis of understanding and support for sustainability, but the public needs more specific information, marketing campaigns and assistance to inspire action. It also highlighted a number of barriers that reduce opportunities for businesses to adopt sustainable practices, so we plan to identify ways to remove barriers and provide incentives for the business community.

The coordinated efforts of government agencies and community leaders are also crucial to the success of this watershed plan. They have many complementary tools available, including plans and policies, permits and regulations, enforcement, infrastructure operations and maintenance, stewardship and regeneration programs, and education and awareness initiatives. We provide more details about how these existing tools can be used to help implement the watershed plan in the accompanying *Implementation Guide*.

We recognize that many challenges lie ahead on the road to a healthy, sustainable Rouge watershed. We are standing at a crossroads. In one direction lies a future modelled on the past, with continued losses of environmental quality, biodiversity and cultural heritage, along with considerable costs to address the health, social and economic consequences of degraded environmental conditions. In the other direction is a future with healthy natural systems and a rich natural and cultural heritage, supporting a higher quality of life for our communities. This plan outlines the key steps to achieve the best possible future for ourselves and our grandchildren. We hope you will support it and become a partner in its implementation.

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APPENDIX B - GLOSSARY

Adaptive management: The use of feedback from monitoring activities to make adjustments to policies, plans and programs to ensure that goals, objectives and targets are met.

Air Quality Index: An indicator of air quality based on hourly ambient concentrations of six key pollutants that are known to have adverse effects on human health and the environment: sulphur dioxide, ozone, nitrogen dioxide, total reduced sulphur compounds, carbon monoxide, and suspended particles.

Aquatic system: An ecological unit composed of living (e.g. fish, insects, amphibians, reptiles, plants) and nonliving (e.g., sediment, woody and rocky materials) elements, and related ecological processes that interact in an aqueous medium (e.g. river, lake, wetland).

Aquifer: A body of permeable rock saturated with water and through which groundwater moves.

Aquitard: A body of low permeability rock that inhibits the movement of groundwater.

Archaeological resources: Artifacts, archaeological sites, and marine archaeological sites.

Baseflow: The component of streamflow that comes from groundwater sources.

Baseline: Initial conditions from which deviations are assessed.

Benthic invertebrates: Organisms living near or at the bottom of streams or lakes for at least part of their life cycle; including crayfish, leeches, clams, snails and the larval stages of insects.

Biodiversity: Biodiversity (biological diversity) is the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems (Secretariat of the Convention on Biological Diversity, 2003).

Built heritage resources: Involving one or more significant buildings, structures, monuments, installations or remains associated with architectural, cultural, social, political, economic or military history and identified as being important to the community.

Carrying capacity: The ability of air, land, and water to absorb the impacts of human use.

Cultural heritage landscape: A defined geographical area of heritage significance which has been modified by human activities and is valued by a community. A landscape involves a grouping(s) of individual heritage features such as structures, spaces, archaeological sites and natural elements, which together form a *significant* type of heritage form, distinctive from that of its constituent elements or parts. Examples may include, but are not limited to, heritage conservation districts

designated under the Ontario Heritage Act; and villages, parks, gardens, battlefields, mainstreets and neighbourhoods, cemeteries, trailways and industrial complexes of cultural heritage value.

Ecological footprint: A resource management tool that measures how much land and water area a human population requires to produce the resources it consumes and to absorb its wastes under prevailing technology.

Ecosystem management: An approach that addresses natural environmental, social, cultural and economic issues and focuses on their linkages, relationships and dynamic nature.

End-of-pipe stormwater management: Constructed facilities such as ponds or wetlands that receive stormwater at the end point of a conveyance system such as a ditch or sewer and control its flow and quality before it reaches the stream or lake.

Eutrophic: Fresh waters that are highly productive and often display overgrowth of algal and/or aquatic plant growth as a result of an abundant supply of nutrients (e.g. phosphorus and nitrogen).

Evaporation: Water that leaves the surface water flow system and enters the atmosphere as water vapour.

Evapotranspiration: Water that leaves the soil zone and enters the atmosphere as water vapour through both evaporative and plant-based mechanisms (transpiration).

Fish Management Zone: An area of the watershed that exhibits or has relatively homogeneous hydrogeological characteristics and ecological functions and supports a characteristic fish community.

Flood vulnerable area: Represents any site where a structure or building is located within the regulatory floodline. Each structure, depending on its location, is associated with varying degrees of flood risk (i.e. 2 yr. 25 yr, 100 yr storm). Flood vulnerable roads – are sites where a road may be inundated with water under various storms.

Fluvial: Relating to a stream or river.

Fluvial Geomorphology: The study of landform evolution related to flowing watercourses and the physical forms and processes of rivers and streams.

Glaciation: The covering of an area or the action on that area, by an ice sheet or by glaciers.

Groundwater: Water that exists below the earth's surface in the spaces between soil grains or in open spaces in rock.

Groundwater Discharge: Water that flows from an aquifer into the surface water flow system.

Habitat patch: A contiguous (or unbroken) extent of one habitat type, either forest, wetland or meadow.

Heritage conservation districts: Any aggregate of buildings, structures and open spaces that as a group is a collective asset to the community and which may have architectural, historical, archaeological or scenic value. Districts may be found in urban and rural environments, and may comprise residential, commercial or industrial areas, landscapes or entire villages. Heritage Conservation Districts are designated by municipal by-law, under Part V of the Ontario Heritage Act.

Index of biotic integrity: An ecologically based index to measure "stream health" that uses fish community data and summarizes them as ecological metrics that can be classified into four categories: species richness, trophic composition, local indicator species and fish abundance.

Infill: Development on empty lots of land within an urban area rather than on new undeveloped land outside the city or town.

Infiltration: Water entering the pores of the earth's surface.

Interior forest: A forest area that is not influenced by edge effects.

Lacustrine: Pertaining to a lake (i.e., lacustrine silt, lacustrine ecosystem).

Lot level stormwater management: Controls that are applied at the individual residential, commercial, industrial or institutional lot level to detain, infiltrate, or evaporate stormwater. Sometimes referred to as *source controls,* these measures are intended to reduce peak runoff rates, provide water quality treatment, and/or maintain the pre-development water balance.

Matrix influence: The surrounding land use context for natural habitats is referred to as the matrix. It influences the value of the habitat to native species through such influences as predation, competition, disturbance and encroachment.

Meander: A loop-like bend in a stream or river that develops when a watercourse flows through level land and erodes its floodplain.

Naturalization: The conversion of urban or agricultural lands to natural cover (see also Restoration).

Precautionary principle: Taking a conservative approach and/or incorporating contingencies and backups on decisions involving uncertainty.

Precipitation: Water that leaves the atmosphere and enters the surface water system in the form of liquid (rain) or solid (snow, sleet, etc.).

Quadruple bottom line: An approach to reporting and accounting that considers social, economic, environmental and cultural performance, benefits and impacts.

Rain-harvesting: Collection of rainwater for beneficial uses; a form of water conservation.

Recharge: Precipitation that enters the groundwater flow system.

Regional storm: The maximum historical rainfall on record. Hurricane Hazel (1954) is the regional storm in the Toronto Region.

Restoration: The act of repairing or re-establishing functioning ecosystems, which may be a defined, native, historic ecosystem; or a specified ecosystem suited to the conditions. Passive restoration allows lands to recover on their own whereas active restoration is assisted by human management activities.

Retrofit: Installation of new stormwater management measures or upgrades to existing infrastructure at the lot level, conveyance system or at end-of-pipe, in order to improve the level of stormwater management.

Riparian (cover/habitat): Riparian vegetation provides habitat, food and shelter, assists in stabilizing soils and contributes to both the adjacent aquatic and terrestrial ecosystems. The riparian area is located immediately landward of watercourses or shorelines characterized by soils that exhibit signs of regular saturation and vegetation tolerant of periodic inundation.

Runoff: The portion of precipitation that enters the surface water flow system.

Salmonids: Fish of the fish family Salmonides; for example salmon, trout and chars.

Sediment load: Volume of sediment carried by the stream or river.

Special Policy Area (SPA): SPAs are portions of a community that have historically existed in the flood plain and are intended to provide for the continued viability of existing uses, provided there is compliance with site-specific flood hazard management policies such as flood-proofing, flood remediation and risk reduction measures.

Stormwater: Rain and snowmelt that runs off urban surfaces such as roads, roofs, and paved areas and that may be conveyed by engineered drainage systems to lakes and rivers.

Subwatershed: A sub-section of a watershed. A region or area bounded peripherally by a water parting and draining ultimately to a tributary of a larger watercourse or body of water.

Surface water: Precipitation which does not soak into the ground or return to the atmosphere by evaporation or transpiration and is stored in, and flows through, streams, lakes, wetlands and reservoirs.

Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their needs (WCED, 1987).

Target species: Species or assemblage of species which are primarily sought in a fishery. Species most sensitive to change such that management for their survival will also ensure the health of the rest of the community.

Targeted terrestrial natural heritage system: Consists of existing natural cover and potential natural cover delineated in our management strategy (Chapter 5), as a basis for supporting objectives for biodiversity.

Terrestrial: Living on or growing on land.

Transpiration: The process whereby water leaves plant tissues by evaporation through small openings called stoma.

Triple bottom line: An approach to reporting and accounting that incorporates performance in societal and environmental as well as economic terms, recognizing the interdependence of these three elements. See also quadruple bottom line.

Water budget: A summary of the quantity of water in the atmosphere, the surface water flow system and the groundwater flow system within a watershed. This can be examined on any time scale from hourly to annually.

Water balance: This term is often used interchangeably with water budget. More correctly, this term applies to the concept of maintaining the various water budget components after urban development. For example, if the baseline recharge for a site is 150 mm/yr, maintaining the water balance would require the post development recharge for the site to be 150 mm/yr.

Watershed: The total area of land that drains to a river or other large body of water.

APPENDIX C

ROUGE WATERSHED TASK FORCE MEMBERS

Chair: Bryan Buttigieg, resident, City of Pickering

Vice-Chair: Councillor Frank Scarpitti, Regional Municipality of York

Municipal Representatives:
Councillor Gay Cowbourne, City of Toronto
Chris Darling, (alternate member) Regional Municipality of Durham
Councillor Elio DiIorio, Town of Richmond Hill
Alex Georgieff, Regional Municipality of Durham
Councillor Jack Heath, (alternate member), Regional Municipality of York
Audrey Hollasch, (alternate member), Town of Richmond Hill
Councillor Rick Johnson, City of Pickering
Councillor George McKelvey, (alternate member), Town of Markham
Tom Melymuk, (alternate member), City of Pickering
Mayor David Ryan, Regional Municipality of Durham
Councillor Erin Shapero, Town of Markham
Mayor Sue Sherban, (alternate member), Town of Whitchurch-Stouffville
Councillor Clyde Smith, Town of Whitchurch-Stouffville
Tracey Steele, (alternate member), Town of Richmond Hill

Residents:
Virginia Jones, City of Toronto
Lionel Purcell, Town of Whitchurch-Stouffville
Lorne Smith, Town of Markham
David Tuley, Town of Richmond Hill

Stakeholders:
John Almond, Ministry of Natural Resources
Pauline Browes, Waterfront Regeneration Trust Corp.
Wendy Burgess, Club Link Corp., representing watershed golf courses
Christine Caroppo, The Ontario Archeaological Society
Tim Clarridge, (alternate member) Spring Lakes Golf Club
Del Fisher, (alternate member) Rouge Valley Foundation
Paul Harpley, Toronto Zoo
Natalie Helferty, Richmond Hill Naturalists
Murray Johnston, Rouge Valley Foundation
Rimi Kalinauskas, Environment Canada
Keith Laushway, (alternate member) Waterfront Regeneration Trust Corp.
Cindy Lee, (alternate member) Toronto Zoo
Dick O'Brien, Toronto and Region Conservation Authority

Kevin O'Connor, (alternate member) Friends of the Rouge Watershed
Terry O'Connor, Agricultural Sector
John Pisapio, Ministry of Natural Resources
Michael Price, Milne Park Conservation Association
Garry Pringle, Ontario Realty Corporation
Jake Riekstins, (alternate member) Station Creek/Club Link Corp., representing watershed golf courses
Jim Robb, Friends of the Rouge Watershed
Patricia Short-Galle, Transport Canada
Gord Weeden, Rouge Park Alliance
Tupper Wheatley, (alternate member) Milne Park Conservation Association
Peter White, Ontario Stone, Sand & Gravel Association
Anil Wijesooriya, (alternate member) Ontario Realty Corporation

Supporting Municipal Staff: Michael D'Andrea and Bill Snodgrass, City of Toronto
Barb Jeffrey and Laura Atkins-Paul, Regional Municipality of York
Wendy Kemp and Lina Ariza, Regional Municipality of York
Lilli Duoba, Town of Markham

Observers: David Charlton, Urban Development Institute
Andre Flys, Save the Rouge Valley System Inc.
Michael Scott, Oak Ridges Moraine Foundation
Victor Doyle, Ministry of Municipal Affairs & Housing
April Marton, Ministry of Transportation
John Van Voorst, Ministry of Transportation

Rouge Watershed Task Force at Bruce's Mill Conservation Area.

APPENDIX D

ROUGE WATERSHED GOALS, OBJECTIVES, INDICATORS AND TARGETS

Overall Goal: To achieve a healthy, sustainable Rouge watershed by protecting, restoring, and enhancing its ecological and cultural integrity within the context of a regional natural heritage system.

GROUNDWATER QUALITY AND QUANTITY

Goal: Groundwater of sufficient quantity and quality to support ecological functions, aquatic habitats, native fish communities, and sustainable human needs, including drinking water, agricultural, industrial, and commercial uses.

Objective: Protect, restore and enhance groundwater recharge1 and discharge.	
Indicator	**Targets**
Recharge/discharge	Maintain long term stable aquifer water levels [As evidenced by hydrographs for reference monitoring wells; baseline hydrographs as per Rouge River State of the Watershed Report, TRCA, 2007]
	Maintain stable average annual baseflow rates [As determined by baseflow separation of long term stream flow gauges]
Objective: Protect, restore and enhance groundwater quality.	
Indicator	**Targets**
Groundwater chemistry and bacteria.	The more stringent of MOE Ontario Drinking Water Standards or MOE Provincial Water Quality Objectives. Maintain or reduce baseline chloride levels [Baseline as per 2006 data in Table 4-1 of Rouge River State of the Watershed Report, TRCA, 2007].
Objective: Ensure sustainable rates of groundwater use.	
Indicator	**Target**
Water consumption	No restrictions in use arising from low aquifer water levels

1 “Enhance” does not include increasing recharge beyond natural background levels

SURFACE WATER QUANTITY

Goal: Surface waters of a quality, volume and naturally variable rate of flow to:

- protect aquatic and terrestrial life and ecological functions;
- protect human life and property from risks due to flooding;
- contribute to the protection of Lake Ontario as a domestic drinking water source;
- support sustainable agricultural, industrial, and commercial water supply needs;
- support swimming, fishing and the opportunity to safely consume fish; and
- contribute to the removal of Toronto from the Great Lakes list of Areas of Concern

Objective: Protect and restore the natural variability of annual and seasonal stream flow.	
Indicator	**Target**
Streamflow	Maintain existing annual and seasonal flow volumes [as per long term Water Survey of Canada gauge measurements and additional gauges recommended for installation; baseline as in Rouge River State of the Watershed Report, TRCA, 2007].
Objective: Maintain and restore natural levels of baseflow	
Indicator	**Target**
Baseflow	Maintain or enhance baseline seasonal and annual baseflows [Baseline as per Interim Reference: TRCA, 2003; Hinton, 1996/97 as reported in Rouge River State of the Watershed, TRCA, 2007].
Surface Water Withdrawals	All surface water users offline from watercourse
Objective: Eliminate or minimize risks to human life and property due to flooding and erosion.	
Indicator	**Target**
Peak flow	Maintain or reduce existing peak flows (2-100 year and Regional events) [Baseline as per Rouge River Hydrology Update, Marshall Macklin Monaghan, 2001].
Water level	Maintain existing regulatory flood levels [Baseline as per Rouge River Watershed Floodplain Mapping Updates, Clarifica, 2006; Burnside and Associates, 2007]
Flood vulnerable areas and roads	Maintain or reduce existing flood vulnerable areas and roads [Baseline as per TRCA Flood Vulnerable Area/Road Databases as reported in Rouge River State of the Watershed Report, TRCA, 2007].
Ice jams	Maintain the number of sites and frequency of ice jams [Baseline as reported in Rouge River State of the Watershed Report, TRCA, 2007].

SURFACE WATER QUALITY

Goal: Surface waters of a quality, volume and naturally variable rate of flow to:

- protect aquatic and terrestrial life and ecological functions;
- protect human life and property from risks due to flooding;
- contribute to the protection of Lake Ontario as a domestic drinking water source;
- support sustainable agricultural, industrial, and commercial water supply needs;
- support swimming, fishing and the opportunity to safely consume fish; and
- contribute to the removal of Toronto from the Great Lakes list of Areas of Concern.

Objective: Meet standards for body contact recreation at nearshore beaches and in the river.	
Indicator	**Target**
Swimming and body contact recreation	Greater than 75% of surface water samples meet the PWQO of 100 coliforms/100 mL. Rouge Beach is open for an average of at least 95% of the swimming season
Objective: Protect and restore surface water quality with respect to conventional pollutants, to ensure protection of aquatic life, ecological functions and water supply needs.	
Indicator	**Target**
Conventional pollutants	Concentrations of conventional pollutants meet available guidelines, as follows: · suspended solids: 30 mg/L (EIFAC, 1965); · phosphorus: 0.03 mg/L (Provincial Water Quality Objectives,OMOE, 1999b); · nitrate: 1.0 mg/L (eutrophication),(CAST, 1992); · nitrate: 2.5 mg/L (amphibians) (Rouse *et al*., 1999); · un-ionized ammonia: 0.02 mg/L (Provincial Water Quality Objectives, OMOE,1999b); · DO: 5.0 mg/L warm water biota 6.0 mg/L cold water biota (PWQO at 10 to 15 degrees Celsius); · chloride: 250 mg/L (EC & HC, 2001).
Objective: Protect and restore surface water quality with respect to toxic contaminants, to ensure protection of aquatic life, ecological functions, human health, and water supply needs.	
Indicator	**Target**
Heavy metals and organic contaminants	Concentrations of metals and organics meet PWQOs. Banned priority toxics are not detected in surface waters. Organic contaminant levels in young-of-the year fish meet IJC and CCME guidelines. Restrictions on sport fish consumption have not increased from 1999 levels.

FLUVIAL GEOMORPHOLOGY

Goal: Natural, stable stream channels and corridors that allow for natural stream flow patterns, support diverse aquatic habitat, limit sediment loadings and protect human life, property and infrastructure from risks due to erosion and slope instability.

Objective: Protect and restore natural channel morphology and stability.	
Indicator	**Target**
Channel morphology	Maintain or restore natural channel structure and rates of morphologic change [to be compiled as data becomes available from TRCA Regional Watershed Monitoring Network fluvial geomorphology database and additional sites recommended for installation].
Erosion indices and flow frequency	Maintain or restore pre-development flow regimes and erosion potential [as per long-term Water Survey of Canada gauge measurements and additional gauges recommended for installation; Baseline as per Rouge River State of the Watershed Report, TRCA, 2007].
Protected stream corridors	All stream corridors in public ownership or otherwise protected from interference.
Natural cover in stream corridors	Complete natural cover in stream corridors.
Risk to public and private property from channel erosion and evolution	Reduce or eliminate buildings, infrastructure and private property at risk from channel evolution [database of sites at risk to be developed as recommended].

AQUATIC SYSTEM

Goal: A healthy aquatic system that supports a diversity of native habitats and communities and provides sustainable public use opportunities

Objective: Protect, restore and enhance the health and diversity of native aquatic habitats, communities and species.	
Indicator	**Targets**
Fish	Monitoring stations upstream of urban development should reflect healthy aquatic habitats and be reflected in the IBI Score. Stations within the urban boundary should maintain or improve existing conditions [Baseline as per Rouge River State of the Watershed Report, TRCA, 2007].
Aquatic Habitat Features	Only strategic barriers remain; barriers removed/mitigated in *priority* sequence as identified in FMP [OMNR and TRCA in progress].
	Increase wetland cover to 10% of total watershed area (all watersheds).
	High IC = 30% of RZ treed; 70% of RZ other NC Mod IC = 50% of RZ treed; 50% of RZ other NC Low IC = 80% of RZ treed; 20% of RZ other NC (IC = Impervious Cover; RZ = Riparian Zone; NC = Natural Cover)
	No additional loss of stream length [Baseline as per Rouge River State of the Watershed Report, TRCA, 2007]..

Objective: Protect, restore and enhance the health and diversity of native aquatic habitats, communities and species.	
Indicator	**Targets**
Invasive and exotic species	Prevent the introduction of any invasive or exotic species as identified in the Watershed Based Fisheries Management Plan (WBFiMP) [OMNR and TRCA in progress].
Habitat Feature	Increase wetland cover to 10% of total watershed riparian area.
	50% of Riparian Zone treed 50% of Riparian Zone other natural cover
	No additional loss of stream length [Baseline as per Rouge River State of the Watershed Report, TRCA, 2007].
Fish Passage	Only strategic barriers remain; barriers removed/mitigated in *priority* sequence as identified in FMP [OMNR and TRCA in progress].
Invasive and exotic species	Prevent the introduction of any invasive or exotic species as identified in the WBFiMP.
Objective: Provide for sustainable fishing opportunities and the safe consumption of fish	
Indicator	**Target**
Consumption advisories	No consumption advisories beyond the monthly maximum of no more than 8 meals per month.
Angling opportunities	Increased angling opportunities at a limited number of selected locations; specific target to urban angling [Baseline as per Rouge River State of the Watershed Report, TRCA, 2007]..
Baitfish harvest	TBD

TERRESTRIAL SYSTEM

Goal: A healthy terrestrial system that supports a diversity of native habitats and communities, a more natural watershed hydrology, cleaner air and sustainable public use opportunities.

Objective: Protect, restore and enhance natural cover to improve connectivity, biodiversity and ecological function.	
Indicator	**Target**
Quantity of natural cover	Increase natural cover to at least 31% of the watershed which is the minimum target defined for the Rouge River watershed using the Terrestrial Natural Heritage System methodology.
Objective:Protect, restore and enhance terrestrial natural heritage system quality and function to minimize the negative influences of surrounding land use.	
Indicator	**Target**
Quality of Natural Cover	Average total quality score of 10.8 for the Rouge River watershed.

<table>
<tr><th colspan="2">Objective: Protect, restore and enhance natural cover to improve connectivity, biodiversity and ecological function.</th></tr>
<tr><th>Indicator</th><th>Target</th></tr>
<tr><td>Distribution of Quality</td><td>Improve the distribution of “good” quality habitat patches across subwatersheds in accordance with the targeted terrestrial natural heritage system for the Rouge River watershed.

Subwatersheds:<table><tr><td>Lower Rouge</td><td>10.5 (fair)</td></tr><tr><td>Morningside Crk.</td><td>9.1 (fair)</td></tr><tr><td>Middle Trib.</td><td>10.2 (fair)</td></tr><tr><td>Little Rouge</td><td>11.6 (good)</td></tr><tr><td>Upper Rouge/Beaver Crk</td><td>9.9 (fair)</td></tr></table></td></tr>
<tr><td>Disturbances in natural areas</td><td>Maintain or reduce the ratio of severely disturbed area to total ELC area [Baseline as per Rouge River State of the Watershed Report, TRCA, 2007].</td></tr>
<tr><th colspan="2">Objective: Increase native terrestrial biodiversity.</th></tr>
<tr><th>Indicator</th><th>Target</th></tr>
<tr><td>Biodiversity (This indicator is in development)</td><td>Enhance and expanded native habitat and species type representation in the terrestrial system [Baseline as per Rouge River State of the Watershed Report, TRCA, 2007]..</td></tr>
</table>

AIR QUALITY

Goal: Air of a quality that protects human health, natural ecosystems and crops, and contributes to the reduction of global climate change.

Objective:Protect and restore air quality.	
Indicator	**Target**
Air Chemistry	Air Quality Index (AQI) of “Very Good” (AQI does not exceed 15).
Smog	0 smog days and smog advisories issued per year.
Lichen (TBD)	Index of Atmospheric Purity (IAP) values (TBD).

CULTURAL HERITAGE

Goal: Recognition, preservation, and celebration of cultural heritage in the Rouge River watershed to increase awareness and understanding of past human relationships with the environment.

Objective: Identify, document, protect and celebrate cultural heritage resources.	
Indicator	**Target**
Cultural heritage resources	Increase the database of known archaeological, historic and burial sites, and built structures [Baseline as per Rouge River State of the Watershed Report, TRCA, 2007]..

NATURE-BASED RECREATION

Goal: Opportunities for public enjoyment that are compatible with, and raise awareness of, the watershed's natural and cultural heritage.

Objective: Ensure that recreation activities in the watershed are compatible with ecological and cultural integrity.	
Indicator	**Target**
Disturbance in natural areas.	Maintain or reduce the ratio of severely disturbed area to total ELC area [Baseline as per Rouge River State of the Watershed Report, TRCA, 2007]..
Objective: Provide opportunities for a variety of appropriate public uses and experiences in representative natural and cultural landscapes.	
Indicator	**Target**
Variety of uses and experiences	Protect and enhance key uses and experiences in representative areas: *Rouge Park/Urban Wilderness* • Non-motorized boating, swimming • Bird watching • Hiking, cross-country skiing & snowshoeing *Kettle Lakes/Countryside* • Agri-tourism, farm drives • Horseback riding • Cycling • Hiking, cross-country skiing & snowshoeing *Major Urban Parks* • Picnicking • Camping • Hiking, cross-country skiing & snowshoeing
Access to greenspace	Greenspace located within 2 km of all homes.
	Maintain or increase the number of ha of greenspace per 1000 residents [Baseline as per Rouge River State of the Watershed Report, TRCA, 2007].

Objective: Develop a continuous trail network linking Lake Ontario to the Oak Ridges Moraine, with connections to local communities, neighbouring watershed trail systems and natural and cultural heritage features.	
Indicator	**Target**
Trails	100% completion of planned trail systems [as per Figure 5-3 Rouge River Watershed Plan, TRCA, 2007]. All trails to be surveyed and posted by Universal Trail Assessment Process.
Connectivity	100% of planned trail linkages [as per Figure 5-3 Rouge River Watershed Plan, TRCA, 2007].

LAND AND RESOURCE USE

Goal: A healthy watershed with a mosaic of land and resource uses (at watershed and community scales) that are compatible with the protection and improvement of ecological health. Land and resource uses include: Rouge Park, urban and rural settlements, agriculture, golf courses, aggregate extraction, and transportation and utility corridors.

Objective: Practice sustainable resource use by individuals, households, businesses, institutions and governments.	
Indicator	**Target**
Water demand	Meet municipal targets for reduction in water demand: Reduce peak and average day demand by at least 10% of projected levels (City of Toronto, 2002; Resource Management Strategies Inc., 2007) [As per Municipal Performance Measurement Programs; Baseline as reported in Rouge River State of the Watershed Report, TRCA, 2007].
Solid waste diversion	Meet municipal targets for residential waste diversion: • 60-75% diversion of household wastes in York Region (MacViro Consultants and Jacques Whitford Limited, 2006). • 100 % diversion of household wastes by 2010 in the City of Toronto (Waste Diversion Task Force 2010, 2001). [As per Municipal Performance Measurement Programs; Baseline as reported in Rouge River State of the Watershed Report, TRCA, 2007].
Energy sources and demand	Meet Province of Ontario target of 10% of energy demand from renewable power sources where drawn from grid (Province of Ontario, 2006). Reduce energy demand by 15% per capita per year.
Objective: Improve sustainability in urban form at building site, community and watershed scales.	
Indicator	**Target**
Community design	TBD
Transportation	Increase the annual # of transit trips per person [As per Municipal Annual Reports; Baseline as reported in Rouge River State of the Watershed Report, TRCA, 2007].
	Decrease the % of "car, truck, van as driver" mode [As per Municipal Annual Reports; Baseline as reported in Rouge River State of the Watershed Report, TRCA, 2007].
Green buildings	100% of new or retrofit public buildings achieve green building certification.

Objective: Protect agricultural lands for food and crop production and as a vital component of the watershed landscape, by sustaining a viable agricultural industry.	
Indicator	**Target**
Local food purchasing	Public facilities, including schools, meet 20% of their food needs with production from Ontario farms and community gardens.
Agricultural industry vitality	Maintain or increase net farm income [Baseline is 2001 census]

Note: Public sector may achieve higher targets (e.g. City of Toronto aims to meet 25% of its demand with renewable power sources)

APPENDIX E

ROUGE WATERSHED SCENARIOS SELECTED FOR ANALYSIS

No.	Name	Description	Rationale
1	Baseline conditions (2002).	Watershed conditions that existed in 2002.	Baseline for comparison.
2	Official plan (OP) build-out.	Official plans completed with current stormwater management practices and Ontario Realty Corporation (ORC) land transferred to TRCA to be managed as part of Rouge Park.	Evaluate the effect of approved and adopted OP completion.
3	End-of-pipe stormwater retrofit.	Scenario 2 plus implementation of >905' municipalities= end-of-pipe stormwater retrofit plans.	Evaluate the effect of end-of-pipe stormwater retrofit on approved and adopted OP completion.
4	Expanded natural cover.	Scenario 2 plus implementation of the (1) TRCA Terrestrial Natural Heritage Strategy and (2) the draft ecological corridor for the Little Rouge Management Plan for the Ontario Realty Corporation lands north of Steeles Avenue.	Evaluate the effect of increased natural cover on approved and adopted OP completion.
5	End-of-pipe stormwater retrofit and expanded natural cover.	Scenarios 2, 3 and 4 combined.	Evaluate the effect of end-of-pipe stormwater retrofit and increased natural cover on approved and adopted OP completion.
6	Full build-out.	Scenario 2 (OP build out) plus development of all available areas to boundaries of the Oak Ridges Moraine Protection and Greenbelt Plan Areas, current stormwater management practices in developing areas.	Evaluate effect of full development of the Rouge Watershed.
7	Sustainable community programs in new and existing developments.	Scenarios 5 and 6 plus more intensive implementation of sustainable community initiatives, including expanded natural cover, more sustainable designs in new developments, delineation and protection of Rouge Park North corridors and improved stormwater management practices in new and existing developments with emphasis on lot level measures.	Evaluate the effect of sustainable community design and enhanced stormwater management on complete development.
8a	Climate change: Full build-out with warmer wetter climate.	Scenario 6 with a predicted 2080 period climate (CGCM), which is 5EC warmer and 6% wetter than recent average annual conditions.	Evaluate impact of climate change on complete development.
8b	Climate change: Full build-out with warmer much wetter climate.	Scenario 6 with a predicted 2080 period climate (Hadley) which is 7EC warmer and 19% wetter than recent average annual conditions.	Evaluate impact of climate change on complete development.

No.	Name	Description	Rationale
8c	Climate change: Sustainable community with warmer wetter climate.	Scenario 7 with a predicted 2080 period climate (CGCM) which is 5EC warmer and 6% wetter than recent average annual conditions.	Evaluate impact of climate change on complete development with sustainable communities programs implemented.
8d	Climate change: Sustainable community with warmer much wetter climate.	Scenario 7 with a predicted 2080 period climate (Hadley) which is 7EC warmer and 19% wetter than recent average annual conditions.	Evaluate impact of climate change on complete development with sustainable communities programs implemented.

APPENDIX F

SUMMARY OF RECOMMENDATIONS

See Chapter 5 for rationale, background and more details. Key recommendations are highlighted in bold, with supporting recommendations in normal text. Lead responsibility refers to the partner(s) who would have the mandate and/or be in the best position to lead action on the recommendation. We understand that a number of other partners may be involved to ensure a successful outcome, and the suggested lead role does not preclude other partners from initiating action on any aspect of the recommendation. More details about how to implement these recommendations can be found in the Rouge River Watershed Plan Implementation Guide.

No.		Recommendation	Lead responsibility
WATER (Section 5.3)			
1	**Protect recharge**	**Identify and protect key recharge and discharge as well as subsurface flow direction through municipal plans, policies and regulations** (see Figure 3.4).	**Municipalities**
2		Protect or enhance infiltration, a key element in managing water balance: · Municipal plans, policies and regulations should identify and protect key recharge and discharge as well as subsurface flow directions. · Protect local recharge areas for those reaches (Robinson Creek, Morningside Creek and upper Main Rouge River) that are heavily reliant on local sources. · Protect regional recharge in those high volume recharge areas. These include two notable areas that lie outside the Rouge Watershed boundary (in north-east Humber Watershed and East Holland Watershed in Lake Simcoe Region). · Review opportunities early in the development planning process to set aside key recharge areas for inclusion in the natural heritage system. Undertake this broad site planning and optimization of site design through larger scale studies, for example at a sub-watershed scale.	Province (ORM Conservation Plan), TRCA, Lake Simcoe Region Conservation Authority, Town of Whitchurch Stouffville, Town of Richmond Hill, Town of Markham and Region of York.
3	**Increase natural cover**	**Implement the targeted terrestrial natural heritage system identified in Section 5.4.2**	**TRCA, Rouge Park, municipalities**
4		Implement natural cover improvements as quickly as possible in the upper Main Rouge and middle tributaries in advance of future urbanization. In the Little Rouge subwatershed, begin with the headwaters of the tributary that flows through the Town of Whitchurch-Stouffville and in Rouge Park along the Little Rouge River.	TRCA, Rouge Park, municipalities
5		Support the Town of Markham's OPA 140 to implement the Rouge North Management Plan and the Rouge North Implementation Manual's "ecological criteria" in the middle reaches of the watershed, outside the Greenbelt Plan's protected countryside.	Province
6		Support the principle of the Markham Small Streams Study and undertake further work to simplify its implementation through development planning.	Town of Markham

No.		Recommendation	Lead responsibility
7	**Improve sustainability of development design**	**Encourage behavioural shifts and innovative urban design forms that minimize impervious areas and aim to maintain pre-development rates of infiltration, evapotranspiration and surface run-off**	**Province, Association of Municipalities of Ontario, Conservation Ontario, TRCA, municipalities**
8		Consider a policy for "no net loss of topsoil", as a means of reducing loss of soil moisture storage capacity.	Municipalities
9		Prepare development standards for sustainable community design and updated stormwater management guidelines.	Province, with Association of Municipalities of Ontario and Conservation Ontario and TRCA
10		Stormwater management strategies for future urban expansions should consider the sub-watershed scale, in addition to impacts to receiving tributaries.	Municipalities
11	**Improve erosion and sediment control and site restoration**	**Adopt policies that phase top soil stripping to smaller geographic areas and require site stabilization as soon as possible.**	**Municipalities**
12		Improve control of land disturbance: · Review and strengthen where necessary bylaws regulating land disturbance. · Restrict topsoil stripping until draft plan approval. · Increase inspection and enforcement of bylaws regulating land disturbance.	Municipalities
13		Adopt the *GTA Erosion and Sediment Control Guidelines for Urban Construction.*	Province, municipalities
14		Conduct regular training seminars for municipal and CA staff, consultants, and contractors to promote awareness of best practices and application and testing of innovative, environmentally-friendly products for erosion control and site restoration.	Municipalities and TRCA
15		Develop new provincial standards for technologies and practices to encourage product manufacturers to improve them (e.g. filtering capacity of sediment fences).	Province
16		Improve site maintenance and restoration during and following construction.	Developers, municipalities
17		Adopt a policy requiring replacement of topsoil and subsoil and reduce on-site compaction, to ensure the site is amenable to restoration.	Municipalities
18		Require use of native species in site restoration planting plan and require sign-off by qualified professional on "as-installed" site.	Municipalities
19		Review and identify mechanisms for requiring long-term monitoring and replacement of stabilization measures until sites are restored as planned.	Municipalities and TRCA

No.		Recommendation	Lead responsibility
20	**Implement stormwater retrofits**	**Retrofit existing urban areas (lot level, conveyance and end-of-pipe) where possible:** · Emphasize infiltration over evapotranspiration, especially in sub-watersheds of upper Main Rouge, Robinson Creek and Morningside Creek. · Develop and adopt innovative technologies to accomplish infiltration in areas of low permeable soils. · Apply other, non-infiltration strategies including naturalization of residential properties, rain gardens, rain harvesting and green roofs on commercial /industrial / institutional properties with extensive impervious surfaces. · Municipalities should formalize programs to monitor the performance of existing stormwater management ponds and identify "recommissioning opportunities" through minor modifications that could optimize their performance with respect to water quality and erosion control. · Review and confirm the effectiveness of end-of-pipe retrofits for the Beaver Creek subwatershed. In five years following verification of the benefits of all potential retrofit and recommissioning initiatives on Beaver Creek and other subwatersheds, based on additional flow data and new calibrated hydrologic models. Undertake a subwatershed based detailed design study for end-of-pipe retrofits and improved stormwater management. · Implement other end-of-pipe retrofits as identified in the *City of Toronto Wet Weather Flow Management Plan* and stormwater retrofit studies of the Towns of Markham and Richmond Hill, as opportunities arise, such as during maintenance projects.	**Municipalities, property owners**
21		Review municipal engineering standards and make revisions and upgrades where possible to ensure that they allow adequate flexibility to meet stormwater management objectives (e.g. road drainage measures, plumbing code changes to encourage rain water harvesting and grey water use).	Municipalities, Municipal Engineers Association
22		Implement the *Action Plan for Sustainable Practices*, Freeman Associates, 2006. <u>Residential landowners:</u> · A multi-pronged marketing campaign in the GTA. · Partners include municipalities, NGOs and retailers. · Components of the campaign could include a poster campaign, advertising in community newspapers, direct mailings, point of purchase displays, workshops, demonstration projects, tours and garden competitions. · Builders should be encouraged to include low maintenance landscaping with native plant species as an option available for new homes. Businesses: · Streamlined approvals process for projects that go beyond regulatory requirements. · Regulatory changes. · Financial incentives such as no-interest loans and grant programs. · Information tools such as a guide book, workshop, demonstration projects and email advice ("ask an expert"). · Awards program to provide visibility and profile. · Corporate leaders program.	Municipalities and TRCA

No.		Recommendation	Lead responsibility
23	**Maintain stormwater infrastructure**	**Continue to develop and implement operation and maintenance plans for stormwater management infrastructure (ponds, catchbasins, swales, oil/grit separators and retrofit programs)**	**Municipalities**
24		Investigate innovative financing mechanisms for stormwater infrastructure maintenance and upgrades/retrofits, such as: · Stormwater management fees associated with municipal water and sewer bill. · Credits for property owners who undertake good stormwater management practices.	Municipalities
25	**Prevent pollution**	**Prevent and reduce the release of pollutants in urban and rural areas**	**Province, municipalities, landowners**
26		The Province should: · Develop guidelines for inland fill operations to ensure acceptable fill quality and location. · Adopt ecological policy, criteria and guidelines that address water temperatures and chloride. · Continue to develop and implement a rural water quality stewardship program to address priority contaminant sources and support nutrient management standards under the Nutrient Management Act.	Province
27		Link stewardship agreements to leases for publicly owned farmlands in the Rouge Watershed	Federal and Provincial governments, Rouge Park, TRCA
28		Municipalities should: · Develop monitoring programs to track the amount, timing and distribution of road salt applications · Review and implement snow disposal and road salt management plans. · Provide routine staff training for spills prevention and control programs. · Adopt bylaws limiting the cosmetic use of pesticides (City of Toronto and Markham already done this). · Encourage programs to control, minimize and treat run-off (e.g. green roofs). · Promote education and awareness programs, such as Yellow Fish Road, Healthy Yards etc in cooperation with TRCA, Rouge Park and other community partner groups. · Naturalize stormwater ponds to discourage use by Canada geese and provide educational signage advising the public not to feed the geese · Retrofit existing stormwater management facilities to incorporate water quality and erosion control as opportunities arise. · Ensure that sewer use by-laws are up to date including application to storm sewers and regional roads, requirements for the preparation of pollution prevention plans, and provisions for the establishment of an inspection program. · Establish award incentives for each target audience (i.e. residents, businesses, government), such as “Most Environmentally-Friendly Design”. · Establish an Integrated Pesticide Management (IPM) Program for golf courses and cemeteries.	Municipalities

No.		Recommendation	Lead responsibility
29	**Manage flood risks**	**Continue to be consistent with the Provincial Policy Statement regarding public health and safety (natural hazards). Undertake comprehensive risk assessment plans to define how additional flood risk created through land changes in Special Policy Areas can be managed.**	**Municipalities**
30		Undertake an updated hydrologic study evaluate the effects on flooding of proposed development and to confirm the level of stormwater management control before expanding urban land use boundaries beyond those reflected in the existing Official Plans.	Municipalities, TRCA
31		Work with municipalities, the Province and developers to reconcile the conflict inherent in intensifying development in flood prone areas, through appropriate flood studies, flood remediation and flood proofing measures, and seeking opportunities for intensification outside the floodplain.	TRCA
32		Undertake a flood risk reduction study to improve hydraulic capacity of road and rail crossings in the Markham SPA.	Town of Markham, TRCA
33		TRCA should: · Track advances in the prediction of regional and local climate change and re-assess local flood risks and management measures. · Continue to operate the flood forecasting and warning program. · Continue to develop and enhance the real time precipitation and stream gauge network. · Continue to maintain and upgrade the flood vulnerable site database response model to assist municipal emergency response. · Educate homeowners regarding flood risks associated with improper practices such as backyard dumping and impediments to water movement · Implement active and passive re-vegetation programs to promote attenuation of flood flows.	TRCA
34		· Develop flood emergency response plans at the municipal level	Municipalities
35	**Protect stream form**	**Protect natural stream form, using the Rouge Park Management Plan, Rouge Park North Management Plan, TRCA's Valley and Stream Corridor Management Program, and Markham's Small Streams Study (where policy areas overlap, the more restrictive policy shall apply)**	**Municipalities**
36		Opportunities should be investigated to acquire lands in strategic locations to allow stream corridors to evolve naturally, without impacting property or infrastructure.	Municipalities, TRCA, Rouge Park
37		Road crossings over watercourses should be sited at appropriate locations to minimize potential for alterations to channel form and allow for natural movement of the channel within the floodplain (for example, not on a meander), avoid or reduce channel lowering, relocate to maintain channel forms, monitor channel stability and guide restoration of channels using bioengineering.	Municipalities, utilities

No.		Recommendation	Lead responsibility
38		Planning for new infrastructure should avoid placing infrastructure in valleys in order to allow room for natural movement of the channel across the floodplain.	Municipalities
39		Maintain an inventory of "at-risk" infrastructure, conduct regular monitoring, and undertake proactive planning for remediation projects incorporating opportunities for net gain in achieving objectives of this watershed plan.	Municipalities
40	**Monitor, evaluate and adjust**	**Review and update existing monitoring programs to provide feedback on implementation of the Rouge River Watershed Plan and inform adaptive management**	**TRCA**
41		Promote, test and evaluate innovative approaches and technologies: · Commit long term support to the TRCA's Sustainable Technologies Evaluation Program (STEP) as a forum for coordinated performance monitoring and evaluation among a number of agencies and private partners · Develop policies and design guidelines for new technologies such as green roofs and permeable pavement, and assess barriers to implementation · Arrange for third-party verification of technology performance · Implement and evaluate pilot projects using innovative technologies · Communicate results through web seminars and publications	TRCA
42		Monitor the effects of new and retrofitted urban development design and stormwater management practices and implement adaptive management where necessary: · Require developers to undertake or contribute to compliance monitoring and enforcement to ensure the designed stormwater management facility performance targets are met · Conduct monitoring studies at the technology scale and subwatershed scale to determine the extent to which community design standards and innovative stormwater management practices mitigate the cumulative effects of urban development on the water balance and aquatic systems · Develop targets for identifying and monitoring the maintenance of a natural range in variation of flow regime (e.g. ratio of baseflow to average annual flow). Review and update targets periodically, based on long term monitoring data · Monitor on a long-term basis baseflow, stream flows, groundwater levels, and precipitation in the Rouge watershed, as part of the Regional Watershed Monitoring Network · Evaluate all impacts of environmental change (including climate change) on baseflows and revise the management recommendations and criteria of this watershed plan as necessary · Adopt modified management strategies, criteria and guidelines, as necessary	TRCA

No.		Recommendation	Lead responsibility
43		Continue data collection in the Rouge Watershed to track changes resulting from global climate change and undertake additional watershed-based hydrologic modeling when data become available from the regional scale climate models that are currently being developed for the Region	TRCA
NATURE (Section 5.4)			
Aquatic System (5.4.1)			
44	**Protect habitat and maintain flow conditions**	**Protect headwater streams from landform alterations and from changes to the amount and seasonal distribution of groundwater contributions.**	**MNR, TRCA, municipalities**
45		Implement lot level stormwater management during new development and retrofit existing developed areas	Municipalities
46		Increase and improve natural cover along stream corridors and on tableland	MNR, TRCA, Rouge Park, municipalities
47		Enhance aquatic habitats using natural channel design principles	MNR, TRCA, Rouge Park, municipalities
48		Increase management attention to non-fish components of aquatic ecosystems, including benthic invertebrates and breeding areas for resident insects, amphibians and reptiles. Use this information to inform aquatic management decisions and for interpretive purposes for Rouge Park.	MNR, TRCA, Rouge Park
49	**Optimize fish passage for native fish species**	**Mitigate barriers identified in the Rouge River Fisheries Management Plan**	**MNR, TRCA**
50	**Install/maintain barriers to partition species or exclude invasive species**	**Install/maintain barriers identified in the Rouge River Fisheries Management Plan**	**MNR, TRCA**
51		Identify areas of unexploited native fish communities, such as those reaches that have been isolated by barriers, for interpretive and research benefits.	MNR, TRCA, Rouge Park, Universities
52	**Improve recreational fishing opportunities**	**Implement recommendations of the Rouge River Fisheries Management Plan regarding stocking, regulations, access and facilities, including:** · Conduct a thorough creel survey to define the fishery and assess fishing pressure throughout the watershed. · Promote viewing opportunities for fish. · Prohibit private stocking in the watershed · Work toward a native gene pool for key Rouge River native species.	**MNR, TRCA, Rouge Park**
53	**Continue and improve monitoring**	**To address current data gaps, consider additional aquatic monitoring stations in Fish Management Zones 3 (Bruce Creek), 5 (Main Rouge through Markham including Eckhardt Creek), and 10 (Beaver Creek and Upper Main Rouge).**	**MNR, TRCA**

No.		Recommendation	Lead responsibility
Terrestrial System (5.4.2)			
54	**Secure the targeted system**	**Increase protected natural cover from 24% to 31% of the watershed with the following priorities as illustrated on Figure 5.2:** 1. Locations in potential urban growth areas. 2. Locations in the Greenbelt. 3. Natural core and linkage areas designated in the ORM Plan. 4. Areas of redevelopment in existing urban areas. 5. Consolidation of Rouge Park lands. Additional emphasis should be placed on areas where natural cover will achieve multiple watershed benefits, as identified in other sections of this plan (e.g. reduced erosion, aquatic habitat etc.).	**TRCA, Rouge Park, municipalities, Transport Canada, Province, NGOs, private landowners**
55		Identify in official plans a targeted natural heritage system for the Rouge Watershed based on the one recommended in the watershed plan and adopt policies to protect and restore natural cover	Municipalities
56		Apply the principle of "net gain" to provide compensatory habitats to replace features and habitats that cannot be retained during private development as well as infrastructure and other public sector projects.	All levels of government
57		Adapt existing natural heritage policies and strategies to reflect priorities of the Rouge River Watershed Plan	All government agencies and NGOs
58		Apply the Rouge Park ecological criteria and define the Rouge Park and Greenbelt boundary to inform and provide a foundation for growth planning exercises.	Municipalities, Province, TRCA, Rouge Park
59		Continue monitoring, including: · The Regional Watershed Monitoring Network including remote sensing, biological field inventories and community volunteer-based monitoring. · Rouge Park plant and animal monitoring such as the winter bird survey and breeding bird surveys. · Ecological restoration success.	TRCA, Rouge Park
60	**Restore and enhance natural cover**	**Restore existing public and private lands to increase the quality of natural cover** · Within each of the priority areas for securement noted above, further priority should be assigned to restoring targeted areas where natural cover expansion will also achieve other watershed benefits as identified in the strategies for water and aquatic systems (e.g. riparian zones, groundwater recharge areas, and subwatersheds where reductions in surface runoff are required to improve water balance and reduce erosive flows). · Restoration activities should focus on the most vulnerable areas (for example the woodlot near Warden and 16th that has high species diversity but has recently become fragmented). · Assignment of restoration priorities should consider the importance of maintaining agricultural land use in the watershed (see Section 5.5.2).	**All government agencies, Rouge Park, NGOs, property owners**

No.		Recommendation	Lead responsibility
61		Encourage and provide resources for Rouge Park to accelerate its restoration plans.	Rouge Park partners
62		Investigate opportunities to develop a stewardship priorities map for private lands in the Greenbelt	TRCA, Rouge Park
63		Provide education, information, incentives and awards for private landowners	TRCA, Rouge Park, NGOs
64		Investigate incentive opportunities for rural areas including: · Grant programs (especially for the targeted system on rural lands outside the ORM and Greenbelt as they are subject to a greater range of alternative uses that compete with natural cover). · Stronger penalties for non-compliance with municipal tree preservation or natural heritage protection by-laws and policies. · Tax incentives, such as the Managed Forest Tax Incentive Program and Conservation Land Tax Incentive Program. · Land donations and conservation easements with associated tax relief and other financial benefits.	TRCA, Rouge Park, municipalities
65		Public landowners, such as Rouge Park, TRCA, all three levels of government, school boards and other agencies should continue to set an example and provide or obtain adequate resources for natural heritage protection, stewardship and restoration on their lands. This should include: · Aggressive planting programs to increase natural cover. · Provision of at least 7 metres buffer between mown areas and watercourses.	Public landowners
66	**Manage the matrix**	**Improve stewardship of public and private lands**	**TRCA, Rouge Park, municipalities**
67		Incorporate elements in developments and infrastructure to support natural heritage: · New urban areas and infill developments should incorporate design elements, such as buffers and barrier plantings, which improve the interface with existing natural areas. · Naturalization should be included in the landscape design of larger public and private properties such as industries, institutions, golf courses, transportation corridors and large residential lots. · Smaller properties, commercial areas and streetscapes can emphasize the use of native plants and environmentally friendly gardening practices.	Municipalities, TRCA
68		Educate pet owners to control the movement of pet cats and dogs to reduce access to wildlife and their habitats.	Residents, municipalities

No.		Recommendation	Lead responsibility
69		Reduce the occurrence of invasive alien species through: · Public education and greater involvement of groups (e.g. scouts and guides) in removal projects. · Development of educational materials about invasive alien species for horticultural and nursery industries and retail outlets. · Partnerships among municipal parks departments and other experts to facilitate information sharing about research and effectiveness of control and removal methods.	Municipalities, TRCA, Rouge Park, NGO's
70		Promote stewardship of public and private lands with a variety of existing and new tools, including: · Rouge Park Stewardship Program · Public awareness and marketing programs (see summary of *The Action Plan for Sustainable Practices* in the Water Strategy, section 5.3). · Public awareness and marketing programs, including backyard certification and awards. · Increased enforcement of regulations regarding tree cutting, floodplain filling, dumping etc · Municipal policies to promote improved soil, water and air quality in urban environments to improve the success of native species and green infrastructure. · Outreach and education programs for the horticultural industry regarding native plant materials and invasive species.	TRCA, municipalities, Rouge Park
PEOPLE (Section 5.5)			
Urban land use (5.5.1)			
71	**Implement sustainable urban form**	**Apply sustainability principles and measures to urban form at all scales – watershed, community and building site – as detailed in *Development of a Sustainable Community Scenario for the Rouge River Watershed* (TRCA 2007).**	**TRCA, Rouge Park, municipalities**
72		At the watershed scale: · Implement the targeted natural heritage system for the Rouge Watershed Continue policy protection for natural heritage and agricultural lands afforded by the Provincial Policy Statement, Greenbelt and Oak Ridges Moraine legislation, TRCA's Valley and Stream Corridor Program, as well as Rouge Park's Management Plans.	TRCA, Rouge Park, Province, municipalities

No.		Recommendation	Lead responsibility
73		At the community scale, apply innovative design to achieve pedestrian-oriented, ecologically sustainable, mixed use communities: · Protection and enhancement of natural systems (see water and nature strategies) · Protection and interpretation of cultural heritage (see cultural heritage strategies) · Securement of additional public sector lands for infiltration and stormwater management to complement the lot level practices (e.g. along road rights of way, along trails, in parks, on municipal properties) · Re-use of stormwater, for example for irrigation of landscapes · Renewable energy sources and district energy schemes · Smaller lot sizes and increased building density · Mixed use development to reduce travel needs · Sustainable transportation (e.g. transit, cycling and walking) · Pedestrian scale streetscapes that promote walking and social interaction · Retrofitting of existing urban areas and design of new ones to increase ecological values and reduce resource use · Certification programs such as LEED for neighbourhoods or Green Globes	Municipalities
74		At the building site scale, minimize resource use, maintain water budget and improve environmental quality with: · Lot level stormwater management (see water strategies) · Minimal impacts on adjacent natural heritage system · Policies to ensure that all new public buildings are designed to achieve LEED (Leadership in Energy and Environmental Design) or similar certification and that all existing buildings are retrofitted to improve performance (e.g. public buildings should achieve LEED Gold or higher) · Incentives for builders to promote green building design · Building orientation to maximize sunlight, passive solar energy, wind shelter and natural ventilation · Landscaping to reduce energy needs · Dual plumbing to use recycled water for toilet flushing or irrigation. · Building design for multiple uses and diverse densities to increase life span and maximize land use efficiency	Municipalities
75		Implementation of sustainable urban form should include: · Strategies to ensure review and approval processes accommodate non traditional innovative design components · Increased awareness among developers and builders of new approaches and successful experiences from other jurisdictions · Increased awareness and information for homebuyers to help them make sustainable purchasing decisions. · Encouragement for residents to make sustainable choices in all aspects of their lifestyles. · Recognition, celebration and promotion of sustainable practices through recognition awards for residents, businesses, agencies and institutions.	TRCA, Rouge Park, municipalities, GTHA-UDI, NGOs

No.		Recommendation	Lead responsibility
76	**Implement sustainable infrastructure**	**Establish baseline environmental conditions early in the planning stages and make informed choices among alternatives to avoid or minimize impacts to natural systems and achieve net gain wherever possible through innovative design**	**All government agencies**
77		Specific recommendations: 1. an Environmental Assessment (EA) be undertaken for the possible complete project so that the public and approving agencies see the possible overall and cumulative impacts; 2. the construction of any underground service should strive to minimize or avoid groundwater and surface water withdrawals and transfer of water across watersheds; 3. carrying capacity, need (sizing) and "alternatives to" the undertaking must be fully assessed to avoid impacts wherever possible through demand management and innovative alternatives and application of precautionary principle; 4. all options for different horizontal and vertical alignments be considered for their cumulative impact(s) on underground aquifers; 5. all construction options be explored to demonstrate to the public and agencies that the proponent has considered viable alternatives; 6. the decision making matrix be clearly defined to balance the needs of the various stakeholders and ensure the principle of the 'Quadruple Bottom Line'; 7. the preferred solution clearly identify the impacts on the underground water regime and that the construction tender documents include the requirements; 8. any changes in undertaking design or construction technique should require further public and agency notice and consultation and an addendum to the EA; 9. the construction method be monitored to ensure that the predicted impacts are not exceeded by the actual impacts; 10. the proponent adjust the construction phase if the monitoring determines that any predicted negative impacts have been exceeded; 11. after construction is completed the proponent verify that environmental conditions have been restored, or improved, to those that existed before construction started; and 12. a performance bond of sufficient magnitude be held by the MOE and/or TRCA or other appropriate public body to ensure that conditions are restored or improved, if the proponent fails in their obligations.	All government agencies
78		Ensure that groundwater is not diverted to surface water via such mechanisms as foundation drains connected to stormwater ponds or groundwater-based water supplies connected to Lake Ontario-based sewage treatment systems.	**All government agencies**
79		Environmental agencies, including DFO, MOE, MNR and TRCA, should continue to work with York Region to monitor aquifer water levels over the long term and ensure that the aquifer recovers from the dewatering undertaken to facilitate construction of the York Durham Sewer System.	**Region of York, DFO, MOE, MNR, TRCA**

No.		Recommendation	Lead responsibility
80	**Implement sustainable ttransportation**	**Implement transportation strategies of York Region, Durham Region and City of Toronto, with emphasis on transit, cycling and pedestrian components, including:** · strategic transportation corridor and network planning studies and systems planning before environmental assessments are undertaken for specific projects, · comprehensive transportation planning and coordination among jurisdictions, · planning for transportation early in the growth planning process so that all opportunities can be taken to reduce the number of crossings of stream and other natural heritage corridors, and · application of the recommendations listed under "sustainable infrastructure" for the planning of transportation infrastructure.	**Municipalities, Province**
81	**Agriculture (5.5.2)**	**Implement the GTA Agricultural Action Plan**	**Municipalities, regional federations of agriculture**
82	**Provide GTA-wide services for local farm businesses**	**These services should include:** · Develop new products for local niche markets (e.g. new Canadians, specialty and gourmet restaurants) · Promote best management practices, awareness of resource materials and grant opportunities · Assist farmers to address requirements for nutrient management, source water protection, environmental farm plans, natural heritage stewardship etc. · Facilitate complementary activities based on agriculture, such as farm vacations, bed and breakfast, tours, recreation/entertainment ventures, farm markets etc.	**GTA Agricultural Action Plan implementation committee**
83	**Support local food and increase public awareness**	**Support local food production and purchase and increase public awareness about sustainable agriculture:** · Watershed stakeholders, particularly institutions and businesses with significant buying power (e.g. schools, colleges, universities, hospitals, hotels and restaurants) should participate in "local food first" programs · Provide recognition and profile for institutions, restaurants and businesses that feature local food selections · Educate the public and food industry about: – Values of maintaining viable farms in the Watershed – Importance of respecting the business needs of agricultural enterprises – Links between local foods and their contribution to health – Translate education, awareness and marketing materials into languages spoken in Toronto Region watersheds	**Municipalities, regional federations of agriculture, restaurant associations, TRCA**
84	**Implement land use policies to support agriculture**	These policies should: · Encourage compact urban development, infill and re-development · Maintain firm urban/rural boundaries · Improve transit and travel demand management	**Province, municipalities**

No.		Recommendation	Lead responsibility
85	**Support agricultural vitality on public lands**	This support should include: · Continue the Rouge Park policy of identifying and preserving working farms through agricultural heritage zoning in its management plans. · Provide longer term leases (e.g. at least 10 years) · Demonstrate cultivation of new products for local niche markets, with appropriate research partners · Demonstrate best management practices · Establish community gardens for urban residents · Provide sites for farm markets · Coordinate farmland initiatives with other publicly owned agricultural lands in the GTA	Public landowners
86	**Resource use (5.5.3)**	**Increase resource conservation, sustainable sources and responsible waste management**	**All levels of government**
87	**Increase water efficiency and conservation**	Region of York, Region of Durham and City of Toronto should continue their water efficiency programs with targets for water conservation. The targets and other information provided in this watershed plan should be used as a guide in any future updates of the water supply and water efficiency strategies.	Region of York, Region of Durham and City of Toronto
88		Support the continued implementation of the Region of York's *Water for Tomorrow* program, Durham Region's *Water Efficient Durham* and the City of Toronto's *Water Efficiency Program*: · Consider the role of rain-harvesting as a water conservation mechanism. · Monitor indoor and outdoor water use over time. · Monitor rates of water use by local service area and evaluate trends over time. · Consider pricing incentives as a potential component in future updates to water efficiency plans. · Incorporate relevant findings and recommendations from the Action Plan for Sustainable Practices to improve rates of participation in water conservation programs by residents and businesses. · Raise awareness of water conservation practices and technologies through partnerships with schools and community groups (e.g. ultra low flush toilets, low flow shower heads, rain sensor switches for automated irrigation systems). · Adopt policies that allow rainharvesting and use within buildings for non-potable uses. · Improve public confidence in the public water supply to reduce demand for bottled water. · Investigate water pricing in combination with stormwater management fees as tools to provide incentives for more efficient water use (e.g. use of rainwater on site as a resource to offset potable water needs). · Renaturalize lawns and parks with use of native species that are more drought tolerant.	Municipalities, MMAH, GTHA-UDI
89		Ensure that all required water users have a valid permit to take water and monitor their withdrawals, and that applications for permit renewals are reviewed regularly for consistency with the directions of this watershed plan.	MOE

No.		Recommendation	Lead responsibility
90		Use baseline baseflows defined in this watershed plan to determine the baseflow threshold below which no surface water may be drawn from a watercourse unless detailed studies are undertaken to support other withdrawal volumes.	TRCA, MOE
91	**Reduce energy use and increase non-fossil fuel alternatives**	Reduce energy use and increase reliance on non-fossil fuel, green power sources. · Promote partnerships between utilities and municipalities to facilitate the use of district energy schemes and renewable energy sources as part of the community design. · Encourage public transit use, walking, cycling and other alternatives to the private vehicle. · Provide incentives for use of hybrid or non-fossil fuel powered vehicles. · Continue the GTA Mayors' Megawatt Challenge · Provide incentives for building retrofits to improve energy efficiency to 30% or more energy efficient than the model National Energy Code for Buildings. · Require new homes to meet standards such as EnergyStar Certification requirements or an EnerGuide rating greater than 80. · Increase application of energy conservation practices (e.g. visual monitoring systems that allow users to see energy use; discontinue bulk metering, photosensor and motion sensor controls; lower speed limits for commercial vehicles and transit). · Promote in house, grid-tied energy generation capacity using renewable energy sources, with surplus energy purchased by the utility at the market rate.	Municipalities, utilities, GTHA-UDI
92	**Reduce waste**	Reduce the amount of waste generated and re-use "waste" as a resource: · Reduce, recycle and re-use. · Reduce packaging. · Foster partnerships between waste generators and waste re-users. · Re-use or recycle construction and demolition waste to meet or exceed the Canadian Green Building Council's target for 20% or less construction waste to landfills (currently 35% goes to landfills). · Establish programs to test the performance of products made with re-used materials. · Incorporate recycling areas throughout buildings with a central collection area to make source-separation convenient. · Standardize requirements for minimum recycled aggregate material.	Municipalities, GTHA-UDI
	Air quality and climate change (5.5.4)		
93	**Undertake a vegetation impacts study**	We recommend a GTA-wide study to determine the economic and ecological impacts of poor air quality on local agricultural crops, urban forests and natural heritage.	Universities

No.		Recommendation	Lead responsibility
94	**Reduce vehicle use and other emissions**	As described in Section 5.5.1 on Urban Land Use, we recommend more sustainable approaches to urban form and transportation that include measures to reduce vehicle use and to encourage clean, renewable forms of energy generation and district energy schemes.	Municipalities
95	**Enhance natural vegetation sinks**	As described in Section 5.4.2, we recommend strategies to secure, restore and enhance natural cover. These would result in a significant increase in the amount of vegetation in the watershed with corresponding benefits in terms of the uptake of carbon and air pollutants.	Municipalities, TRCA, Rouge Park
96	**Nature-based recreation (5.5.5)**	**Increase opportunities for public enjoyment that are compatible with, and raise awareness of, the watershed's natural and cultural heritage**	**TRCA, Rouge Park, municipalities**
97		Recognize the regional system for nature-based recreation and establish a multi-partner program with long term funding commitments and a funding formula to support integrated planning for the system, maintenance and reinvestment in existing properties as well as further expansion and enhancement of the system.	Region of York, local municipalities, TRCA, and Rouge Park
98	**Implement inter-regional trail network**	Implement an inter-regional trail network, as proposed on the *Rouge River Watershed Trails Plan* (Figure 5.3). It should include: · Integration of local community trail plans with the inter-regional trail system. · Completion of community trail plans early in the planning process for greenfield development areas. Funding for implementation should be allocated from development charges. · Cooperation with neighbouring jurisdictions to establish greenspace and trail connections to adjacent watersheds. · Collaboration with golf course operators, farmers and other private landowners to ensure compatibility of public uses on or adjacent to their properties and to secure trail easements where appropriate. · Public consultation on trail alignment and design. · Funding mechanisms for trail development and long term maintenance.	TRCA, Rouge Park, Town of Markham, Town of Whitchurch-Stouffville
99	**Develop recreation strategy for Northern Countryside**	Develop a recreation strategy for the Northern Countryside including: · Delineation of trail routes as part of the inter-regional trail network. · Definition of unique public use experiences and opportunities. · Assess the road system to identify opportunities for scenic corridors and heritage landscapes. · Identification of opportunities to interpret natural and cultural heritage. · Management approaches to optimize user experience and avoid problems associated with over use or inappropriate use. · Integration with the broader regional open space system.	Rouge Park, TRCA, Town of Whitchurch-Stouffville

No.		Recommendation	Lead responsibility
100	**Protect urban wilderness experience of Rouge Park**	Protect the urban wilderness experience of Rouge Park: · Educate park users and local decision-makers about natural and cultural resources, watershed functions and the impacts of human activities · Intensify Rouge Park's efforts to control impacts of public use before the Inter-regional Trail system is completed. · Develop education, awareness and interpretive materials for the lower Rouge Watershed and Rouge Marsh complex before connections are made with the Waterfront Trail.	Rouge Park, TRCA, municipalities
101	**Balance public access and resource protection**	Develop a plan to achieve a balance between public access and protection of sensitive ecological and cultural heritage resources including: · Policies and guidelines for the phasing out or relocation of public uses that are incompatible with the objectives of this watershed plan and Rouge Park's management plans. · Decommissioning of unauthorized trails. · Development of policies and enforcement of regulations for unauthorized or incompatible uses and harmonization of appropriate by-laws among municipalities. · Standards of practice for public use operators, such as environmental management systems for public agencies, Audubon Program or equivalent for golf courses, and Environmental Farm Plans for agri-tourism businesses. · Monitoring of trail use and participation rates in other activities such as bird-watching, boating, fishing and picnicking to assist in planning and regulating public activities.	TRCA, municipalities
102	**Interpret natural and cultural heritage**	Heritage interpretation: · The Rouge Park Management Plan (1994), Rouge North Management Plan (2001) and Little Rouge Corridor Management Plan (2006) should be consolidated to provide one comprehensive planning document for Rouge Park. · Public use strategies should be incorporated into the Master Plan for Transport Canada's Green Space lands where appropriate and compatible with Rouge Park and other adjacent lands. · TRCA should complete and implement the master plans for Bruce's Mill Conservation Area and the Oak Ridges Corridor Park. · Municipalities should provide adequate lands for sportsfields and other active recreation facilities outside Rouge Park, without negatively impacting other natural and cultural heritage landscapes.	TRCA, Rouge Park, municipalities
103	**Establish management and operational agreements**	Establish management and operational agreements for Rouge Park and other public lands in York Region including: · Clear maintenance and enforcement responsibilities. · Sufficient financial and other resources among Rouge Park, TRCA, York Region and local municipalities.	York Region, local municipalities, Rouge Park, TRCA
104	**Form community partnerships**	Form community partnerships for implementation: · To assist with raising public awareness, creating a trail association, special events, fundraising, recruiting volunteers for restoration projects and ecological monitoring · Include NGOs, user groups (e.g. trails, fishing, heritage etc), organized First Nations representatives, residents and ratepayers associations.	TRCA, Rouge Park, municipalities

No.		Recommendation	Lead responsibility
105	**Cultural heritage (5.5.6)**	Improve recognition, preservation and celebration of cultural heritage	TRCA, Rouge Park, municipalities
106	**Investigate and conserve cultural heritage prior to land use change**	Investigate and conserve cultural heritage prior to changes in land use, including development, trail creation and reforestation, in accordance with the requirements of the Ontario Heritage Act (2005). This should include: · Preparation of archaeological master plans and identification of processes and protocols to identify, protect and conserve archaeological resources. · Incorporation of heritage buildings and their contextual surroundings into proposed developments rather than being demolished. · Recognition of cultural heritage landscapes (eg countryside roads such as 14th Avenue, Reesor Road and Twyn Rivers Drive, agricultural communities, clusters of century homes and 20th century ethnic architecture) in municipal plans. · Protection of Aboriginal archaeological sites as green spaces, where possible, with limited investigative excavations. · Encouragement of Ontario Heritage Trust to investigate properties with both cultural and natural heritage values for their Natural Spaces Land Acquisition and Stewardship Program. · Storage of oral and archival histories and other reference materials about the Rouge Watershed in the Rouge Park office or another centralized location.	Rouge Park, municipalities
107	**Establish a comprehensive communication plan with Aboriginal groups**	Develop a communications plan including: · Identification of key groups and contacts · Partnership opportunities for interpretation and awareness programs, viewing of artifacts, program development, education and events. · A protocol for consultation with recognized Aboriginal groups. · Encouraging the Ontario Ministry of Culture to establish a system of Nation- to-Nation two-way meaningful consultation, that individual archaeologists and First Nations and Métis communities can follow to share information with each other.	Aboriginal community, Ministry of Culture, TRCA, Rouge Park, municipalities
108	**Fill gaps in archaeological knowledge**	Develop a program to fill gaps in our archaeological knowledge and improve our understanding of early human cultures.	TRCA
109		Establish a permanent repository for the storage of archaeological artifacts, with participation by Aboriginal representatives: · Include secure artifact storage and community-friendly spaces, including places for researchers to work, artifact layout space, and flexible areas for public use. · Funding strategies could include box levies on the remover (e.g. landowner or project proponent) of the artifact. · Encourage a trustee approach if ownership (e.g. of Aboriginal artifacts) is an issue.	Province, TRCA, Aboriginal Community, Markham Museum

No.		Recommendation	Lead responsibility
110	**Develop active and participatory programs to increase awareness**	Develop active and participatory programs to provide learning opportunities and increase awareness of cultural heritage, including: · Special attention to reaching out to new Canadians. · Incorporation of living culture, such as photography, drawing, painting and performance arts. · User-pay approaches to support these programs.	Schools, TRCA, Rouge Park, Markham Museum and other local museums
111		Develop community-based projects to incorporate cultural heritage values and themes into the local community fabric, including the following priorities: · Determine appropriate teaching sites for archaeological field schools at a Pre-Contact site, with Aboriginal consultation and approval, and on a Post-Contact site, with community consultation and approval, partnered with the TRCA Archaeology Program, the Ontario Heritage Trust, the Ontario Archaeological Society, local school boards, and other stakeholder organizations. · Designation of cultural heritage landscapes and multiple properties that share cultural heritage significance as Heritage Conservation Districts under the Ontario Heritage Act. · Provide expertise and resources to local ethnic groups to establish forms of public recognition of their culture in the watershed, including First Nations Métis, and the Mennonite community as well as other 19th - 21st century ethnic communities and influences. Other recommended initiatives include: · Recognition of the eastern Carrying Place Trail with interpretive signage on contemporary trails. · Promotion of links between human and natural heritage, for example with interpretive signs about the influences of human activities on historic and current environments. · Signage for communities, streets and public buildings with historic names, trail guides/maps and public art. · Protection and interpretation of cultural features that also serve as wildlife habitat (eg barn owls shelter in active farm buildings, turkey vultures nest in old silos or barns). · Celebration of agriculture and community gardens as an expression of culture, in addition to their roles in food production and land/water stewardship. · Involvement of existing programs such as the Stouffville Public Library's lecture series.	Municipalities, TRCA, Aboriginal Community
112		The heritage character of Cedar Grove and Locust Hill should be maintained through designation as a historic area and development of interpretive programs. · Existing heritage buildings could be restored for adaptive re-use. · New lease arrangements or ownership models should be considered to foster a sense of community.	Town of Markham

No.		Recommendation	Lead responsibility
113		Assist schools with program opportunities and materials to implement the new (2006) Ontario school curriculum on Aboriginal and pioneer life. · Explore opportunities for TRCA's archaeological field school to contribute to the new curriculum and develop a sustainable funding plan.	TRCA
114		Conduct a feasibility study for continuing education courses for adults to learn practical skills such as archaeological fieldwork, artifact analysis and site interpretation, and archival research.	TRCA
115	**Develop a living cultural heritage program**	A living cultural heritage program should be developed to enhance interpretive and tourism opportunities in the watershed. It should: · Draw upon the databases and inventories of cultural heritage, including built structures and landscapes. · Identify architectural assets in need of restoration and look for opportunities to revitalize heritage properties by forming partnerships to increase revenue and find adaptive re-use, such as pubs, restaurants, community centres, and art centres.	Municipalities, Rouge Park
IMPLEMENTATION (Chapter 6)			
116	**Existing policies and programs**	**Use the information and recommendations of the watershed plan to inform their ongoing programs and decision making.** The ten year workplan (*see Implementation Guide*) will provide an opportunity to set priorities and coordinate actions.	**All Watershed partners**
117	**Provincial initiatives**	**Use the watershed plan to support and provide more specific guidance to implement Provincial initiatives**	**All Watershed partners**
118		As per section 3.2.6 of the *Greenbelt Plan*, recognize the *Rouge River Watershed Plan* as a guiding document that builds on and supports the *Rouge North Management Plan* and *Rouge North Implementation Manual*.	Province, municipalities, TRCA, Rouge Park
119		Ministry of Public Infrastructure and Renewal and other relevant agencies should address the R*ouge River Watershed Plan's* recommendations through Implementation Analysis & Sub-Area Assessment (s.5.3/p. 35 of *Growth Plan for the Greater Golden Horseshoe*), in keeping with special status accorded the Rouge lands through the *Greenbelt Plan's* section 3.2.6	Ministry of Public Infrastructure and Renewal
120		Recognize and act on the *Rouge River Watershed Plan's* recommendations as per section 24 of the *Oak Ridges Moraine Conservation Plan*, which states: "The objectives and requirements of each watershed plan are to be incorporated into the municipality's official plan, and major development commenced after April 23, 2007 is prohibited unless it conforms with the watershed plan."	Region of York, Town of Whitchurch-Stouffville, Town of Richmond Hill, and Town of Markham
121		Address the Rouge River Watershed Plan's recommendations in the fulfillment of source water protection planning requirements of the Clean Water Act	TRCA

No.		Recommendation	Lead responsibility
122	**Stewardship and regeneration**	**Develop a coordinated program among various partners to accelerate securement and expansion of the terrestrial natural heritage system** with a focus on: · securing the 14 % (1400 ha) of the targeted system that is currently not protected by other policy mechanisms within 5 years, and · achieving an increase in natural cover by 10% (net 2.4% of watershed or about 270 ha) over 2002 levels within 5 years	**TRCA**
123		Develop a coordinated program among various partners to accelerate implementation of lot level stormwater management retrofits, in conjunction with a social marketing pilot project focusing on residential and business sectors in the Rouge Watershed.	TRCA, Municipalities
124	**Education**	**Coordinate partners' educational activities to ensure consistent messaging, avoid duplication and facilitate integration of funds and other resources.**	**TRCA, Rouge Park**
125	**Enforcement**	**Increase enforcement capacity among responsible agencies (e.g. TRCA, municipalities, MNR, MOE, DFO) including:** · identify and secure necessary resources, · investigate means to improved partnering among relevant agencies, · post signage using universal symbols and/or in multiple languages about permitted and non-permitted activities, · promote public awareness of who to call and facilitate referrals of mis-directed calls, · adopt protocols for feedback to the public on actions taken.	**TRCA, municipalities, MNR, MOE, DFO**
126	**Operations and Maintenance**	Property managers should consider ways they can incorporate the watershed plan's directions into their ongoing practices and programs. For example, naturalization schemes could be adopted as part of landscaping practices.	Municipalities, Province, Golf courses, cemeteries
127		Continue to develop and implement operations and maintenance programs for stormwater management infrastructure	Municipalities
128		Establish management and operations agreements for Rouge Park and other public lands in York Region including clear maintenance and enforcement responsibilities (see Nature based recreation above).	York Region, local municipalities, Rouge Park, TRCA
Monitoring			
129		**Ambient watershed conditions and long-term trends: Enhance the Regional Watershed Monitoring Network (RWMN)**	**TRCA**
130		Improve monitoring of precipitation: · Install additional rain gauges in the northeast, middle and southern parts of the watershed to supplement the data from the Buttonville Airport gauge and address the need for subwatershed-level data for calibration of hydrologic models. · Coordinate with similar efforts to augment the rain gauge network in neighbouring watersheds.	TRCA

No.		Recommendation	Lead responsibility
see Rec. 33		Track advances in the prediction of climate change.	
131		Additional funding partnerships should be sought to install nests of groundwater monitoring (water level and groundwater quality) wells at additional sites in the watershed to improve spatial coverage and at various depths to improve knowledge of each of the three major aquifers. There are currently only three groundwater monitoring wells within the Provincial Groundwater Monitoring Network in the Rouge and we recommend adding three new locations with nests of 2-3 wells at each location. They should be located to assess water level changes in aquifers that discharge at surface water flow gauge locations as well as to facilitate the assessment of both regional and local effects of urban development and land conservation. Potential locations include: · North-east corner of the watershed on the Oak Ridges Moraine (3 wells) · Near Major Mackenzie Drive and McCowan (3 wells); Assume York Region's wells as part of the RWMN, once their project monitoring is complete. · Lower Rouge south of the Iroquois shoreline (2 wells)	Province, TRCA
132		Implement additional stream flow gauges at the following locations to improve hydrologic modeling capability, floodplain mapping and flood flow prediction, as well as for tracking the hydrologic impact of any new upstream development: · Install one additional stream flow gauge on the Main Rouge River downstream of the Morningside Creek confluence and the Little Rouge River south of Finch Avenue to facilitate watershed-scale calibration of models. · Install one additional stream flow gauge on each of the major headwater tributaries ("Middle Tributaries") to assist in subwatershed-scale calibration and analysis. Gauges should be located on Beaver Creek, Upper Rouge River upstream of the Beaver Creek Confluence, Berczy Creek, Bruce Creek, and Robinson Creek as close to the confluences with the Main Rouge as possible. There may also be opportunities to restore decommissioned WSC gauges on the Main Rouge and to formalize temporary gauges established for the YDSS and North Leslie projects.	TRCA

No.		Recommendation	Lead responsibility
133		Implement the following improvements to monitoring of stream form: · Establish additional fluvial geomorphology monitoring sites just downstream of the area of future urban expansion in order to track the effects of development on erosion and channel form at a local and subwatershed scale. These should be established as soon as possible to determine an existing conditions baseline and should be monitored annually, probably for at least 20 years. · Establish reference sites upstream of the developing areas. Locations to consider include Bruce Creek, Berczy Creek, Robinson Creek, and the Little Rouge River just upstream of Major Mackenzie Drive, plus corresponding reference sites for all of these upstream of the areas of potential future development. · Enhance the current monitoring protocol applied at the established fluvial geomorphic monitoring sites (i.e. additional cross-sectional surveys, greater frequency).	TRCA
See Rec. 129		· Continue monitoring of water quality	
See Rec. 53		· Continue and improve monitoring of the aquatic system	
134		Increase terrestrial natural heritage monitoring including: · expanded winter bird and breeding bird surveys and; · additional monitoring of ecological restoration success.	TRCA, community volunteers
See Rec. 101		Improve monitoring of participation rates for nature-based recreation: · monitor trail use; and · track participation rates in other related recreational activities, such as fishing, picnicking etc.	Municipalities, TRCA, community groups
		Evaluation of innovative technologies: **See strategies for water (Section 5.3; Rec. 41) regarding the Sustainable Technologies Evaluation Program (STEP)**	**TRCA**

No.		Recommendation	Lead responsibility
135		Adaptive management: Develop an adaptive management program for the Rouge Watershed that will use feedback from monitoring activities to make adjustments to policies, plans and programs to ensure that our goals, objectives and targets are met. It should include: · A review of the adequacy of existing and enhanced monitoring mechanisms (e.g. RWMN and requirements for compliance monitoring by proponents · Definition of analytical, assessment and reporting protocols · Definition of triggers for initiating policy or planning adjustments · Identification of the mechanisms and procedures for engaging watershed partners in a process for amending the watershed plan	TRCA
136	Implementation Oversight	Implement a Rouge River Watershed Plan Implementation Committee - with representation from all key stakeholders in the Watershed - to guide implementation of the Plan. The Committee should: · Report to the TRCA Board and the Rouge Park Alliance · Be given a terms of reference, mandate and duration of term at which time the membership and terms of reference would be confirmed and updated; · Report regularly on progress with the implementation of the Rouge River Watershed Plan.	TRCA, Rouge Park

APPENDIX G

TECHNICAL SUPPORT

Technical support in undertaking the Rouge River Watershed Planning Study was provided by the following team of staff and consultants:

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List of Supporting Documents

Watershed Plan

Rouge River Watershed Plan – Towards a Healthy and Sustainable Future. Report of the Rouge Watershed Task Force. Toronto and Region Conservation Authority. 2007.

Supporting Documents

2006 New Home Builder Customer Satisfaction Study – TRCA Supplemental Study. J.D. Power and Associates. 2006.

Action Plan for Sustainable Practices – Implementation Strategies for the Residential and Business Sectors in the Greater Toronto Area. Freeman Associates. 2006.

Development of a Sustainable Community Scenario for the Rouge River Watershed. Toronto and Region Conservation Authority. 2007.

Rouge River State of the Watershed Report. Toronto and Region Conservation Authority. 2007.

Rouge River Watershed Based Fisheries Management Plan (in progress, 2007)

Rouge River Watershed Plan Implementation Guide. TRCA. 2008.

Rouge River Watershed HSP-F Update and Future Scenarios Modelling. EBNFLO Environmental in association with Aquafor Beech Ltd. 2006.

Rouge River Watershed Scenario Modelling and Analysis Report. TRCA. 2007.




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