



Rouge River Watershed Fisheries Management Plan

DRAFT

December, 2010

*As per updates March, 2011

Prepared by:

Toronto and Region Conservation

Ontario Ministry of Natural Resources



Note to the Reader:

Various opportunities for public input and comment on this draft Rouge River Watershed Fisheries Management Plan have been previously provided through the plan preparation process. The Plan will be provided one final opportunity for input and comment through the Ontario Environmental Registry. Upon completion of this process, the Plan will be finalized and approved by the Ministry of Natural Resources. Although not yet finalized, the draft Rouge River Watershed Fisheries Management Plan does contain technical information and direction that users are encouraged to apply at this time.

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Acknowledgements

Funding for this project was supplied through Toronto and Region Conservation (TRCA) from the City of Toronto and York Region, and through the Toronto Remedial Action Plan (RAP) from Environment Canada and Ministry of the Environment.

This Plan was written by Christine Tu (TRCA), John Pisapio (Ontario Ministry of Natural Resources; OMNR) , David Lawrie (TRCA) and Tim Rance (TRCA) with technical advisory input from Steve Woolfenden (Fisheries and Oceans Canada; DFO), and Lewis Yeager (Rouge Park).

Numerous other groups or people who also provided input or technical support:

Department of Fisheries and Oceans, Sea Lamprey Control Centre

Metro East Anglers

Building Industry and Land Development

Deborah Martin-Downs (TRCA)

John Almond (OMNR)

Dena Lewis (TRCA)

Marion Daniels (Lake Ontario Management Unit)

Les Stranfield (OMNR)

Jody Willis (DFO)

Scott Jarvie (TRCA)

Sonya Meek (TRCA)

Bob Clay (TRCA)

Maria Papoulias (Rouge Park)

Ola McNeil (OMNR)

Maria Parish (TRCA)

John Nemeth (Town of Richmond Hill)

Trevor Parker (TRCA)

Patricia Dimond (editing services)

Appreciation is also extended to those people who attended the public meetings and who have provided comments on the Plan along the way.

List of Acronyms

AIS	Aquatic Invasive Species
ARA	Aquatic Resource Area
BILD	Building Industry and Land Development
BMP	Best Management Practice
CA	Conservation Authority
CCA	Canonical Correspondence Analysis
CCME	Canadian Council of Ministers of the Environment
CFIP	Community Fisheries Involvement Program
COSEWIC	Committee on the Status of Endangered Wildlife in Canada
COSSARO	Committee on the Status of Species at Risk in Ontario
CWS	Canadian Wildlife Service
DCWMP	Durham Coastal wetland Monitoring Project
DEM	Digital Elevation Model
DFO	Fisheries and Oceans Canada
EC	Environment Canada
ESA	<i>Endangered Species Act</i> (Ontario)
FMP	Fisheries Management Plan
FMZ	Fisheries Management Zone
FWIS	Flowing water Information System
GTA	Greater Toronto Area
IPO	Implementation Project Opportunity
LDI	Landscape Disturbance Index
LOMU	Lake Ontario Management Unit
LSAT	Landscape and Stream Assessment Tool
MDFMP	Maple District Fisheries Management Plan
MEA	Metro East Anglers
MESP	Master Environmental Servicing Plans

NGO	Non-Governmental Organization
OFAH	Ontario Federation of Anglers and Hunters
OMAFRA	Ontario Ministry of Agriculture and Rural Affairs
OMMAH	Ontario Ministry of Municipal Affairs and Housing
OMNR	Ontario Ministry of Natural Resources
OMOE	Ontario Ministry of the Environment
ORM	Oak Ridges Moraine
PIC	Percent Impervious Cover
PPS	Provincial Policy Statement
RMPM	Rouge Park Management Plan
RPA	Rouge Park Alliance
RRFMP	Rouge River Fisheries Management Plan (1992)
RDRT	Redside Dace Recovery Team
RWMP	Regional Watershed Monitoring Program
SNAP	Sustainable Neighbourhood Retrofit Action Plan
STEP	Sustainable Technologies Evaluation Program
STP	Sewage Treatment Plant
SWM	Stormwater Management
TFM	3-trifluoromethy-4-nitrophenol (lampricide)
TRCA	Toronto and Region Conservation
TSC	Technical Steering Committee
VHS	Viral Hemorrhagic Septicaemia
WBFMP	Watershed Based Fisheries Management Plan

Executive Summary

The original *Rouge River Fisheries Management Plan* (RRFMP) was written in 1992. This new *Rouge River Fisheries Management Plan* ("this FMP") provides important updates on existing watershed conditions, new legislation, watershed management approaches, and the assessment of fish communities and habitat. Also of primary importance in the new FMP is the identification and description of the linkages between land use changes and impacts to the form and function of streams. Accordingly, this FMP draws from the direction provided in the *The Rouge River Watershed Plan* (TRCA 2007a) which addresses more comprehensively the actions to improve watershed health, including improved management of water quantity, quality and water balance; metrics that define the flow regime and are critical links to aquatic system integrity.

Beginning in 2005, Toronto and Region Conservation (TRCA), in partnership with the Ontario Ministry of Natural Resources (OMNR), began data collection as the first step in support of the updated FMP. This FMP has subsequently been developed with leading edge technical understanding of the watershed, an ecosystem approach for addressing the challenges posed by urbanization and consideration of climate change. In conjunction with ongoing watershed planning and integration with the land use planning process, this FMP provides prioritized and substantially detailed guidance on how to effectively protect and manage the aquatic resources and features of the watershed. The unique character and variable conditions of the watershed have been captured within 10 geographically distinct fisheries management zones (FMZs) that effectively represent large subcatchment areas.

Fisheries management priorities were identified early in the development of this FMP and include aspects of native biodiversity that support conservation of genetic, species, and ecosystem diversity; and the sustainable management of ecological assets and watershed function. Other management priorities are maintaining or restoring natural hydrology, addressing cumulative effects through subwatershed planning, preventing new introductions and limiting further distribution of aquatic invasive species, assessing natural recruitment of Lake-based salmonids and climate change.

Portions of the Rouge River watershed continue to be urbanized. However, in comparison to most of the other watersheds in the Greater Toronto Area (GTA), the Rouge has experienced less development pressure to date. The northern portion of the watershed is primarily a rural landscape with some large natural areas and numerous stream corridors. It is within these relatively natural areas of the upper watershed that healthy and diverse aquatic ecosystems are supported, including a high concentration of Redside Dace (*Clinostomus elongatus*) populations, a provincially endangered species. Therefore, the northern portions of the Rouge watershed provide very substantial and important opportunities to maintain healthy aquatic conditions in support of native fish communities.

On the east side of the watershed is Rouge Park. It encompasses a large section of the Little Rouge River subwatershed within the City of Toronto and Town of Markham. Within the park boundaries, various additional land use designations have been applied that in some cases provide protection, or partial protection, for stream corridors and other natural areas.

In the middle and southern sections of the Rouge River there are existing impacts and habitat degradation, as these parts of the watershed have been developed with a mix of existing older and newer residential and commercial developments. There needs to be greater emphasis on connectivity to upstream reaches (e.g., through barrier mitigation) and continued improvement (retrofits) of stormwater management (SWM) controls at the landscape and lot level.

Adjacent watersheds, including the Don River and Highland Creek, which are two of the most urbanized in the GTA, offer a number of lessons relating to changes in landscape form, watershed function, and the associated degradation of aquatic features and ecosystems. The history of decline in the fisheries in these watersheds also provides insight as to which fish species and communities are most sensitive to land use changes and require focused management priority.

Given the documented decline, and in some cases the almost complete disappearance of sensitive species in the highly urban watersheds, some of these species have been selected as management target species for the Rouge FMP, including; Brook Trout (*Salvelinus fontinalis*), Redside Dace and Rainbow Darter (*Etheostoma caeruleum*). The effective protection and persistence of these sensitive species is such that the rest of the associated fish communities are expected to persist and hopefully thrive as well.

The key to achieving effective protection of target species and their habitat is to consider water management (i.e. hydrology) and cumulative effects in the context of fish habitat requirements and impact mitigation at the earliest possible stages of the land use planning process. In existing urbanized areas, remediation and retrofit of stormwater management facilities will also significantly contribute to this objective. Opportunities for improving aquatic habitat conditions are additionally provided through stream enhancement, restoration, rehabilitation, and stewardship initiatives directed at the FMZ level.

The main recommendations of this Rouge River FMP are summarized below:

Integrate water management with aquatic ecosystem health at early stages of the land use planning process.

A stronger link between water management (i.e., drainage) and aquatic resource protection needs to be established through source controls for stormwater and how they relate to both stream assimilative capacity (i.e., maintaining natural flow regimes) and ultimately fish habitat protection be identified and worked-out early in the planning process. It is too late to try and marry these needs at the detailed design and/or permit issuance stages. This is one of the fundamental lessons of past efforts to address aquatic resources and fisheries related matters. The Rouge River FMP further recommends that all land use planning frameworks, including:

Watershed Plans, Subwatershed Plans, Secondary Plans, and Master Environmental Servicing Plans (MESP) be informed by appropriately detailed watershed and subwatershed characterization. This speaks to comprehensive understanding of many physical and ecological watershed components, including: groundwater pathway determination, subwatershed water balance, pre-development surface water flow regime, fluvial geomorphic dynamics, cumulative effects assessment, stream thermal classification, fish communities, fish habitat identification, and water quality assessments in relation to fish and aquatic resources.

Maintain the flow regime of streams pre- to post-development.

Maintaining a flow regime that supports stream form and function as appropriate for target species (and associated fish communities) is required to achieve many of the priority objectives laid out in the FMP. With that, there are a number of additional recommendations pertaining to the direct and cumulative effects of SWM, water balance, and water taking, including:

- That the most effective designs for new SWM management ponds and other on site measures (e.g., cooling and infiltration trenches, evapotranspiration through vegetated swales, rain harvesting) are identified early in the land use planning process and applied in concert with cumulative effects assessments. Retrofit opportunities need equal consideration where appropriate.
- That the discharge from SWM facilities be recognized as having the potential to cause adverse or damaging impacts on target fish species and habitat; and that technical and design options focus on the achievement of effluents that are protective of fishes and fish habitat.
- That land use planning initiatives which spatially overlap with areas identified in this FMP as "very high, high, and medium" priorities for water balance are subject to appropriate flow regime investigations and characterization. There are no "low" priority areas in the Rouge River watershed with respect to water balance.
- That water takings in sensitive aquatic habitat areas (e.g., headwaters, Redside Dace reaches) continue to be screened by review agencies for site specific and cumulative effects on aquatic features

Protect Redside Dace and its habitat; an endangered species.

The Rouge River watershed currently provides a habitat stronghold for the endangered Redside Dace. This FMP identifies subcatchment areas where Redside Dace occurs, and provides construction timing windows, and an overview of the permitting and regulatory framework under the *Endangered Species Act* (2007). This FMP also provides recommendations and direction on restoration, rehabilitation, and stewardship opportunities in support of recovery planning for Redside Dace.

Increase the connectivity within the watershed to support native biodiversity and healthy fish communities.

In-stream barriers (e.g., online ponds, perched culverts, dams/weirs, etc.) are one of the main issues in the Rouge River from several perspectives: fragmentation of habitat in smaller tributaries, impacts to water quality and temperature, and barriers to fishes migrating up from Lake Ontario to the headwaters. However, there are also strategic barriers that are maintained to partition species for management purposes and to prevent the spread of aquatic invasive species (e.g., Sea Lamprey (*Petromyzon marinus*) and Round Goby (*Neogobius melanostomus*)). There are approximately 253 in-stream barriers that prevent or limit fishes from moving through the watershed. This FMP prioritizes these barriers for management (top 30) and from that list identifies those that require priority consideration within the next 5 – 10 years across the various FMZs.

Prevent the further establishment and expansion of aquatic invasive species in the Rouge watershed and undertake to reverse the abundance of established invasives.

There is a major focus on the protection of native fish communities with additional emphasis on actively managing for the prevention of further introductions of aquatic invasive species advancing into the watershed from Lake Ontario. Recommendations include targeted monitoring, development of a response strategy, increased stewardship/education, and maintenance of strategic barriers, such as the barrier in the lower reaches of the Little Rouge River, with the intent of preventing the potential further upstream movement of Round Goby. Under consideration by the Sea Lamprey Control Centre of Fisheries and Oceans Canada is the installation and operation of a seasonal/ removable barrier in the lower reaches of the Rouge River to control Sea Lamprey as a potential alternative to the use of lampricide.

Identify and undertake priority riparian planting opportunities to address and improve aquatic habitat quality and quantity.

This FMP provides recommendations on priority areas for the enhancement of riparian zones and wetland restoration. Certain types of riparian vegetation communities are recommended for planting, depending on location in the watershed and target species requirements (e.g., closed canopy/tree cover for headwater streams; more open grassy meadows in middle reaches; treed set-backs in the larger watercourses). Achieving the vegetation and wetland targets of the *Terrestrial Natural Heritage System Strategy* (2007d) (as referred in the *Rouge River Watershed Plan* (2007a) is supported, with due recognition for other such strategies and guidance playing important roles in directing terrestrial system linkages with the aquatic system.

Support ongoing assessment of Rainbow Trout stocking and potential naturalization.

Traditional support and recommendations focused on enhancing angling opportunities have been preserved in this FMP. The stocking of Rainbow Trout (*Oncorhynchus mykiss*) in support of Lake Ontario fisheries objectives is also supported. However, in recognition of potential

competitive and/or predatory effects of juvenile trout on native fish species, it is recommended that the stocking of Rainbow Trout (and all other salmonids) be discontinued within Rouge watershed streams occupied by Redside Dace. Streams occupied by native Brook Trout should also generally be partitioned from stocked salmonids. It is also recommended that assessments be continued to determine if Rainbow Trout are establishing a naturally self-sustaining population within the main Rouge, an objective of the original 1992 RRFMP. Brown Trout (*Salmo trutta*) stocking is recommended to continue only in the lower reaches close to Lake Ontario. Additional or new stocking of other non-native salmonid species in the Rouge River watershed is not recommended as the priority focus of this FMP is on native species.

Provide examples of implementation projects that could address the priority recommendations within the FMP and provide a means to measure FMP success.

Each Fish Management Zone has a series of recommendations and restorative project ideas referred to as **Implementation Project Opportunities** (IPOs). These projects and project concepts have been developed to provide a readily available list of opportunities for agencies and/or stakeholders to help maintain or restore and ultimately enhance the aquatic ecosystem. These projects are also intended to support community engagement through education and participation. Project descriptions are provided to assist in identifying priority locations and actions. The effectiveness and benefits of these projects are maximized only if impacts to flow regime are effectively mitigated.

1 INTRODUCTION

Throughout Ontario, there is increased recognition of the need to focus the protection and management of fisheries and other aquatic resources on an ecosystem or watershed basis. This *Rouge River Fisheries Management Plan* (“The Plan” or “This Plan” or “This FMP”) is an updated version of the fisheries management plan written in 1992 and provides a framework to guide the protection, rehabilitation, and enhancement of the fisheries resources in the watershed.

This Plan acknowledges the strong connection between fishes and the broader aquatic community, landscape characteristics, and the resultant habitat quality. Accordingly, this Plan focuses on actions related to fishes while *The Rouge River Watershed Plan* (TRCA 2007a) addresses more comprehensively the actions to improve watershed health, including improved management of water quantity, quality and water balance; metrics that define the flow regime and are critical links to aquatic system integrity. The key messages coming from the *Rouge River Watershed Plan* are:

- Expand terrestrial natural cover;
- Build more sustainable new communities and retrofit older ones to improve their sustainability by improving water management and promoting more sustainable practices overall;
- Recognize and develop a regional open space system.

The above direction comes with the context of recognizing the historic progression of land development and planning adaptations. Largely forested watersheds were vastly cleared for agriculture well over a century ago affecting terrestrial and aquatic ecosystems alike. As European settlement began near the lakefront, city planning included only limited consideration for sewage treatment and garbage disposal; the filling in of coastal wetlands and burying streams were common, unquestioned practices. As urbanization began in earnest in the 50s, 60s and 70s, major issues concerning human health were far better addressed but practices like stormwater management or bioengineering of streams to control flooding or erosion were not yet in effect.

The way we used to develop took a toll of the natural habitats of streams and the organisms that lived there. In more recent decades, development practices became more environmentally sound with advances in stormwater management that took into account water quality and fisheries in addition to quantity and erosion. Today we are doing better but recognize we must continue to improve how we develop the landscape, particularly around the issue of stormwater.

Therefore, this fisheries management plan should be read in conjunction with the *Rouge River Watershed Plan* (TRCA 2007a) for maximum benefits in the watershed. Both plans acknowledge the challenges of land development while protecting, and indeed improving, the

environmental functions and the quality of existing habitats. Moving forward with a clear expectation that successful mitigation of the major impacts to urban stream integrity is achievable; the goals of biodiversity and ecosystem health stated in this Plan are attainable. Adherence to the protective management framework laid out in this Plan, together with the application of protective legislation, give further basis to conclude that “good” planning can produce a healthy mosaic of stream form and function within the urban landscape.

1.1 Plan Development and Use

The Ontario Ministry of Natural Resources (OMNR) is developing draft watershed based fisheries management plan (WBFMP) guidelines to support consistency in Fisheries Management Plans (FMP) across Ontario. The Rouge River FMP meets the primary components of the framework, which include:

- explanation of the ecological processes in need of management;
- existing conditions of Rouge River aquatic ecosystem;
- provision of management tools;
- identification of resource issues;
- recommended management strategies (prioritized) to achieve objectives of the updated Rouge River FMP;
- recommended projects (prioritized) to measure the implementation success of Rouge River FMP over five to tens years;
- technical steering committee guidance; and,
- public consultation.

1.1.1 Fisheries Technical Steering Committee

As part of the WBFMP framework, a Technical Steering Committee (TSC) was developed. The TSC members were selected to represent a cross-section of government agencies involved in fisheries management and included staff from Ontario Ministry of Natural Resources, Toronto and Region of Conservation Authority (TRCA), Fisheries and Oceans Canada (DFO) and Rouge Park. The TSC met regularly in the early planning stages and were responsible for preparing this FMP for posting on the Ontario Environmental Registry with final approval by the Ontario Ministry of Natural Resources. TSC members from TRCA worked simultaneously on the *Rouge River Watershed Plan* (TRCA 2007a) to ensure consistency in aquatic system management direction with this Plan.

1.1.2 Stakeholder Consultation

Initial public consultation occurred in September of 2006. Two open house meetings informed the public about the purpose and scope of the project, of existing aquatic conditions, and of the development of new management, monitoring data, and assessment tools to be considered as part of the plan. These meetings also provided the opportunity for the TSC to receive comments from stakeholders and identify additional issues related to the fisheries and

aquatic resources in the watershed. Following these open houses, members of the TSC presented material from the public consultation the December 2006 annual meeting of the Metro East Anglers (MEA). The feedback from these sessions was valuable for the development of management recommendations.

In February, 2008, draft management recommendations were shared and discussed, in separate meetings, with the following stakeholders: Metro East Anglers (MEA), Building Industry and Land Development (BILD) and the Lake Ontario Management Unit (LOMU). In March, 2008, the second general public consultation event was held to describe the management recommendations and priorities and receive comment. Development of the Plan extended into 2010 coinciding with the up-listing of Redside Dace (*Clinostomus elongatus*) from threatened to endangered in 2009, and associated new protection requirements for this species and its habitat under the provincial Endangered *Species Act* (OMNR 2007). This species is locally common and well distributed in the Rouge River watershed. This FMP has been written to be consistent with the direction and requirements of the Endangered *Species Act* (OMNR, 2007).

1.1.3 Using the Plan

In the past, fisheries management in the Rouge River watershed was guided by *the Maple District Fisheries Management Plan* (MDFMP) (OMNR 1988). In 1990, staff from OMNR Maple District, (now Aurora District), and TRCA worked together to develop the first *Rouge River Fisheries Management Plan* (RRFMP) (OMNR 1992). This plan was a resource document, completed in 1992, and consisted of two parts: Part I, Management Strategy, and Part II, Assessment and Rehabilitation. The RRFMP was to provide management direction for 10 years at which time an updated plan was to be written.

This updated *Rouge River Fisheries Management Plan* is a resource document and not policy. It is written for a broad user base that goes beyond just government agencies to include citizens, angler organizations, non-governmental organizations (NGOs), developers, and municipalities of the Rouge River watershed. Resource management decisions within this Plan have been based on the most recent scientific and ecological information as well as on the available relevant social, cultural, and economic information for the Rouge River watershed.

This Plan can be consulted for various purposes, including:

- Understanding what regulations, policies, restrictions or management apply for certain areas;
- Deciding project options for mitigation or enhancement works;
- Identifying sensitive stream areas that should be referenced in Environmental Impact Studies and Environmental Assessments;
- Understanding the technical basis for recommended improvements in water management and protection of aquatic resources;
- Identifying stewardship opportunities.

1.2 Context of the Plan

In past FMPs, the term “fisheries management” traditionally meant providing a characterization of existing conditions at the watershed or subwatershed level and recommendations around a fairly standard set of issues, including: fish stocking, baitfish harvest, angling opportunities, fish passage and stream rehabilitation goals. Consistent with this framework, this Plan includes 10 fish management zones based on subwatershed characteristics and fish communities. Each zone has specific target species to guide management considerations. Different from past FMPs, this Plan is based more broadly on the need to achieve improved management of aquatic ecosystems and stream form and function in the watershed. As such, in addition to providing the above types of information, this plan also profiles various legislative and policy direction affecting land use planning. In some cases, agency regulatory requirements and/or policies are distinguished from recommendations on fisheries management strategies or actions.

Table 1-1 lists the various pieces of legislation relevant to aspects of managing fishes and/or fish habitat. From this list, the legislation that address fisheries most directly are: the federal *Fisheries Act* (DFO 1985a), the federal *Species at Risk Act* (EC 2002), the provincial *Fish and Wildlife Conservation Act* (OMNR, 1997), and the provincial *Endangered Species Act* (OMNR 2007). However, the land use planning process is coordinated in accordance with the *Ontario Planning Act* (OMMAH 1994) and provisions within the *Provincial Policy Statement* (PPS) (OMMAH 2005a). Nevertheless, there are links between the different legislation and policies that exist based on aquatic habitat or species protection.

Table 1-1: Legislation Relevant to Fisheries Management in Ontario

Legislation	Agency	Provisions Dealing with Fishes and Fish Habitat
<i>Canadian Environmental Assessment Act (1992)</i>	Environment Canada (EC)	Regulates the process to predict the environmental effects of proposed initiatives before they are carried out
<i>Species at Risk Act (2002)</i>	Environment Canada (EC)	Protects species at risk and the habitat critical for their survival
<i>Fisheries Act (1985)</i>	Fisheries and Oceans Canada (DFO)	Regulates works and undertakings affecting fish and fish habitat
<i>Navigable Waters Protection Act (1985)</i>	Fisheries and Oceans Canada (DFO)	Regulates works built or placed in, on, over, under, through or across any navigable water
<i>Drainage Act (1990)</i>	Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)	Permits individuals and municipalities to initiate and maintain drainage works
<i>Greenbelt Act (2005)</i>	Ontario Ministry of Municipal Affairs and Housing (OMMHA)	Hydrological planning within the Protected Countryside should follow watershed-based management approaches

Legislation	Agency	Provisions Dealing with Fishes and Fish Habitat
<i>Oak Ridges Moraine Conservation Act *</i> (2001a)	Ontario Ministry of Municipal Affairs and Housing (OMMHA)	Provides protection of the ecological and hydrological integrity of the Oak Ridges Moraine area
<i>Municipal Act (2001b)</i>	Ontario Ministry of Municipal Affairs and Housing (OMMHA) Municipalities	Regulates approvals for construction over public shores and waters
<i>Ontario Planning Act (1994)</i>	Ontario Ministry of Municipal Affairs and Housing (OMMHA)	Provides policies and guidance for land use planning
<i>Beds of Navigable Waters Act (1990)</i>	Ontario Ministry of Natural Resources (OMNR)	The beds of most navigable waters are Crown Land
<i>Endangered Species Act (2007)</i>	Ontario Ministry of Natural Resources (OMNR)	Regulates the protection of species at risk and their habitat in Ontario
<i>Fish and Wildlife Conservation Act (1997)</i> (formerly the <i>Game and Fish Act</i> – repealed 1999)	Ontario Ministry of Natural Resources (OMNR)	Laws and regulations relating to angling, hunting and the protection and management of fishes and wildlife. Regulates the capture, sale and possession of fish
<i>Lake and Rivers Improvement Act (1990)</i>	Ontario Ministry of Natural Resources (OMNR)	Regulates activities affecting lakes and rivers
Ontario Fisheries Regulations (1985) (updated annually)	Ontario Ministry of Natural Resources (OMNR)	Regulations on angling and commercial fishing
<i>Public Lands Act (1990)</i>	Ontario Ministry of Natural Resources (OMNR)	Regulates the removal of sand and gravel from beaches
<i>Environmental Assessment Act (1990)</i>	Ontario Ministry of the Environment (OMOE)	Provides for assessment of the effects on the environment of public and private projects
<i>Ontario Water Resources Act (1990)</i>	Ontario Ministry of the Environment (OMOE)	Regulates discharge into water bodies and withdrawal of water
<i>Conservation Authorities Act (1990)</i>	Ontario Ministry of Natural Resources (OMNR) Conservation Authorities (CAs)	Provides for regulation of valley and stream corridors

* *Oak Ridges Moraine Conservation Act* is only relevant to watersheds within the defined area, which includes the Rouge River Watershed.

While fisheries management is the legislated responsibility of the OMNR, many of the goals and objectives of fisheries management laid out in this FMP are related to the initiatives and responsibilities of other agencies and organizations. For example, watershed management planning is the responsibility of Conservation Authorities. However, many of the development and restoration activities in the watershed have a direct impact on fishes and fish habitat. Therefore, this plan reflects the joint effort of multiple agencies in consultation with stakeholders working together to protect, maintain, and enhance fisheries resources in the Rouge River watershed.

The main agencies with direct legislative responsibility for fishes and/or fish habitat are recognized as: Fisheries and Oceans Canada (DFO), Environment Canada (EC) and Ontario Ministry of Natural Resources. The roles of these agencies are discussed in detail together with municipal, Conservation Authority, and Rouge Park context.

1.2.1 Federal Level

Fisheries and Oceans Canada

Fisheries and Oceans Canada (DFO) has ultimate responsibility for the management of fisheries resources in Canada, pursuant to the *Fisheries Act* (DFO 1985a). In Ontario, the provisions in the *Fisheries Act* are delivered by DFO and through partnership agreements with other government agencies (Environment Canada, Parks Canada, the Ontario Ministry of Natural Resources, and Conservation Authorities). DFO retains, in Ontario, responsibility for administering the fish habitat provisions of the *Fisheries Act* (Section 35) and shares responsibility with Environment Canada for the administration of Section 36 of the *Fisheries Act* (the entry of substances deleterious to fish into fish habitat). Decisions related to the management of fish populations in Ontario, including determining fishing seasons, catch limits, stocking of inland waters and area fish management priorities are administered by the Ontario Ministry of Natural Resources, on behalf of DFO.

Section 2 of the federal *Fisheries Act* defines fish to include:

"parts of fish, shellfish, crustaceans, marine animals and any parts of shellfish, crustaceans or marine animals, and the eggs, sperm, spawn, larvae, spat and juvenile stages of fish, shellfish, crustaceans and marine animals."

Section 34(1) of the federal *Fisheries Act* defines fish habitat as:

"spawning grounds and nursery, rearing, food supply and migration areas on which fish depend directly or indirectly in order to carry out their life processes."

The essential ecosystem components required for healthy fish habitat include adequate food, cover, spawning and nursery habitats and access for migration.

Section 35 is the primary section pertaining to the protection of fish habitat and Subsection 35(1) states that:

“No person shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat.”

Subsection 35(2) qualifies that prohibition by stating that:

“No person contravenes Subsection 35(1) by causing the alteration, disruption or destruction of fish habitat by any means or under any condition unless authorized by the Minister or under regulations made by the Governor of Council under this Act.”

Based on the “No Net Loss” Guiding Principle, DFO has developed a variety of review guidelines, operational statements, fact sheets, and outreach materials outlining the general principles used by DFO staff to conserve and protect fish habitat. DFO’s delivery of the fish habitat management program in Ontario is accomplished through both proactive means, such as educational outreach and the pre-development review of proposals potentially impacting fish habitat and the enforcement of Section 35 of the *Fisheries Act* through DFO’s Conservation and Protection Branch.

In addition to the above functions, DFO has been given the responsibility for the administration of the *Species at Risk Act* (SARA) (EC 2002), as it relates to aquatic species.

Section 32 of SARA protects the residences and individuals of Schedule 1 extirpated, endangered, or threatened SARA species from negative impacts resulting from man-made activities or works.

Environment Canada

Environment Canada (EC) has shared responsibility for the enforcement of the pollution prevention provisions of the *Fisheries Act*.

In many cases (e.g., non-federal lands or non-federally regulated industries), EC refers potential occurrences to the Ontario Ministry of the Environment (OMOE). OMOE often is the lead agency responding to occurrences although, if the deleterious discharge is physical in nature (e.g., sediment), it will be referred to DFO as per the 2007 inter-jurisdictional compliance protocol for fish habitat and associated water quality.

In addition to their *Fisheries Act* responsibilities, EC also has a regulatory function with respect to administering requirements of the *Migratory Birds Convention Act* (EC 1994) and the *Species at Risk Act* (except aquatic species at risk). Both of these acts could influence the potential to proceed with proposed works in a variety of habitats, including aquatic ecosystems. Federal agreements and bi-national agreements also help to guide the management of Lake Ontario tributaries. These include:

- *Policy for the Management of Fish Habitat* (DFO 1986)

- *A Joint Strategic Plan for Management of Great Lakes Fisheries* (GLFC (Great Lakes Fisheries Commission 1997)
- *Fish Community Objectives for Lake Ontario* (GLFC 1999)

1.2.2 Provincial Level

Ontario Ministry of Natural Resources

The Ontario Ministry of Natural Resources is the provincial agency responsible for the protection and management of Ontario's natural resources, including fisheries management. The *Fish and Wildlife Conservation Act* (OMNR 1997), the *Lakes and Rivers Improvement Act* (OMNR 1990b), Ontario Water Resources Act (OMOE, 1990), and the *Endangered Species Act* (OMNR 2007) are the primary pieces of legislation affecting fisheries and aquatic resources. The Oak Ridges Moraine Conservation Plan (OMMAH 2002) and the Greenbelt Plan (OMMAH 2005b) are provincial plans that provide additional direction on land use affecting natural heritage features, including streams and other aquatic habitats.

Under the *Fish and Wildlife Conservation Act*, OMNR has management authority over decisions pertaining to fisheries regulations, species partitioning, species reintroductions, invasive species, bait harvest, stocking and authorizations for research and monitoring activities. A number of the fisheries management decisions and recommendations included in this FMP are based on support or approval from OMNR under the auspices of the *Fish and Wildlife Conservation Act* or the *Lakes and Rivers Improvement Act* - for example, requirements for in-stream construction timing windows (administered by TRCA), decisions on species partitioning, and decisions on the management of exotic species.

Enacted in 2007 and implemented in 2008, Ontario's *Endangered Species Act* is administered by OMNR. The *Act* provides legal protection for endangered and threatened species and their habitat. Section 9 of the *Act* includes prohibitions against killing, harming, harassing, possession and purchase. Section 10 of the *Act* prohibits activities that damage or destroy habitat. Species specific habitat regulations will eventually be passed for many endangered and threatened species. Prior to the development of a regulation, a species may be afforded general habitat protection under Section 2 of the *Endangered Species Act* (ESA) until such time as a habitat regulation is passed. The ESA defines habitat for endangered and threatened species to be that upon which a species depends, directly or indirectly, to carry out all aspects of its life cycle and ecology. The ESA allows for the possible issuance of permits to conduct certain activities that may impact endangered and threatened species and their habitat, provided effective mitigation and additional actions are taken that result in an overall benefit to species. Further details on ESA and its application to Redside Dace, including permits, are provided in Chapter 3 of this Plan.

In Ontario, species at risk are assigned their conservation status by the Committee on the Status of Species at Risk in Ontario (COSSARO). At the federal level it is the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Each of these committees is an

independent scientific advisory body. In February 2009, citing continued declines of populations and loss and impairment of habitat, COSSARO up-listed Redside Dace from the status of threatened to endangered. Species that are listed as threatened are those that are vulnerable to continuing population declines and range reduction and are expected to slide into the endangered status unless existing threats to the species and its habitat are reversed. Species assigned a status of endangered are in imminent threat of becoming extirpated (lost from/ extinct from Ontario) unless threats to the species and its habitat are reversed. The provincial *Recovery Strategy for Redside Dace* (OMNR 2010a) provides a full description of status, threats to the species, habitat protection recommendations and recovery actions. The OMNR reviews and provides a government response statement to all Recovery Strategies – this includes the *Redside Dace Ontario Government Response Statement for Redside Dace* (OMNR 2010b).

For additional information on all aspects of the *Endangered Species Act*, contact the OMNR Aurora District Species at Risk Biologist.

In 1976, OMNR developed a long-term plan for managing Ontario's fisheries resources (*Strategic Plan for Ontario Fisheries - SPOF I* (OMNR 1976)). With public consultation, OMNR designed a new strategy (*SPOF II* (OMNR 1992b)) which identifies ecological, economic, and social values placed on our fisheries, and maps out a course of action to sustain aquatic ecosystems for the future. SPOF II consists of four parts (outlined below) and provides a basis for actions involving the public and private sectors (Table 1-2).

Table 1-2: SPOF II Outline

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

In addition to legislation, there are a number of key concepts and principals from OMNR strategic documents that help to guide fisheries management. These documents include:

- *Protecting What Sustains Us: Ontario's Biodiversity Strategy* (OMNR 2005a)
- *Our Sustainable Future – Ministry of Natural Resources – Strategic Directions* (OMNR 2005b)
- *Strategic Plan for Ontario Fisheries (SPOF II)* – an aquatic ecosystem approach to managing fisheries (OMNR 1992b)
- *Oak Ridges Moraine Conservation Plan* (OMMAH 2002)

These policy documents, however, are only one component of protecting the resource. Also important are approaches that support and foster stewardship, education and outreach. Many of the actions outlined in this plan are, therefore, based on this approach.

1.2.3 Municipal and Conservation Authority Level

At the municipal level, fish habitat often receives environmental protection indirectly through Official Plan designation of Green Space or Open Space and through development of setbacks. As per a provision laid out in the *Rouge North Management Plan* (RPA 2001), the Town of Markham is positioned to become the future owner of lands adjacent to tributaries in their jurisdiction that are currently managed by Rouge Park. Municipalities also work closely with Conservation Authorities through watershed planning, the development of watershed-based FMPs, and the plan review process and through support of authority policies and programs. These include:

- Ontario Regulation 28 of the *Conservation Authorities Act* (OMNR 1990a)
- *Valley and Stream Corridor Management Program* (TRCA 1994)
- *Rouge River Watershed Plan* (TRCA 2007a)
- *Terrestrial Natural Heritage System Strategy* (TRCA 2007d)
- *Low Impact Development Stormwater Management Planning and Design Guide* (CVC and TRCA, 2010)
- *Stormwater Management Criteria Document* (TRCA, currently under development)

1.2.4 Rouge Park

Rouge Park protects over 40 km² within the Rouge River, Petticoat Creek and Duffins Creek watersheds. The Park is part of Ontario's Greenbelt, and it represents Canada's largest natural environment park in an urban setting. Rouge Park was formally established in 1994 by the Province of Ontario, following years of citizen support for the preservation of the Rouge River valley. The initial land dedication for Rouge Park comprised extensive lands south of Steeles Avenue, in the Cities of Toronto and Pickering. In subsequent years, lands north of Steeles Avenue, including the Little Rouge Corridor, Bob Hunter Memorial Park and most recently, the Markham East Lands, were dedicated to Rouge Park by the Province (**Figure 1-1**).

The Park is managed as a partnership, with land and funds from the Province of Ontario, the Government of Canada, Toronto and Region Conservation Authority, municipal governments and other agencies. The Rouge Park Alliance directs the planning and management of Rouge Park.

Since its inception, Rouge Park has increased in size through land acquisition and many significant restoration projects have been implemented. Through planning there has been a strong vision on establishing a protected nature reserve stretching from Lake Ontario north to the Oak Ridges Moraine, including a continuous trail system and areas dedicated to the preservation of near-urban agriculture.

Numerous plans have been compiled to guide the acquisition and management of Rouge Park lands, including the *Rouge Park Management Plan* (Province of Ontario 1994), *Rouge North Management Plan* (RPA 2001), *Bob Hunter Memorial Park Master Plan* (RPA 2007), *Little Rouge Corridor Management Plan* (RPA 2007) and *We're Building Rouge Park – Natural Heritage Actions for the 21st Century* (RPA 2008). Rouge Park management plans are supported by the *Greenbelt Plan* (OMMAH 2005b), section 3.2.6., and the *Rouge North Management Plan* (RPA 2001) is embedded in planning policy within the Town of Markham's Official Plan Amendment 140 (Rouge North Management Area / Greenbelt – 2005).

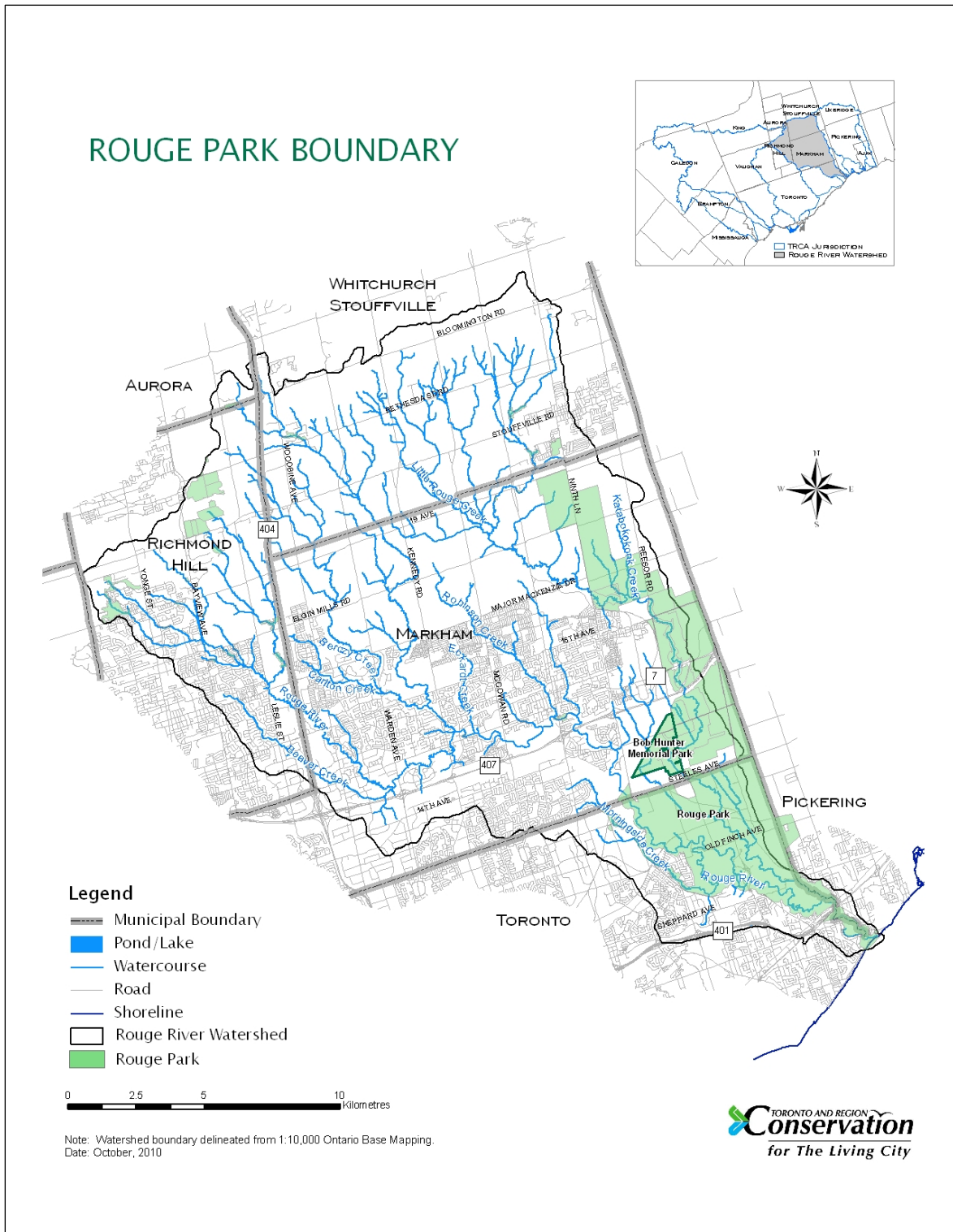


Figure 1-1: Rouge Park Boundary within the Rouge River Watershed

1.3 Fisheries Management Priorities

1.3.1 Biodiversity

Biodiversity generally refers to the variety of life shaped through ecological and evolutionary processes. This diversity is expressed at different levels of organization: the genetic diversity within species, the diversity between species, and the diversity among entire ecosystems. The principles of biodiversity embrace the intrinsic values of the natural world, sustainable use of resources, ecosystem approaches to resource management, biodiversity, conservation and the “precautionary principle” (United Nations *Convention on Biological Diversity* (United Nations 1992); *Canadian Biodiversity Strategy* (Government of Canada 1995); *Ontario’s Biodiversity Strategy* (OMNR 2005a). Within the scope of this FMP, two of the main goals relating to biodiversity are the protection and conservation of genetic, species, and ecosystem diversity; and the sustainable management of ecological assets and watershed functions. This FMP encompasses all aquatic species and their habitats as a fundamental measure of environmental health, aquatic ecosystem function, and sustainable watershed development. Chapters 3 and 4 contain many management recommendations geared towards the protection and enhancement of native aquatic communities and their biodiversity.

1.3.2 Cumulative Effects

The cumulative effects of urbanization, mostly associated with increasing impervious cover leading to changes in drainage, impart substantial adverse effects on watershed and aquatic ecosystem function. Individual development or resource use activities, assessed in isolation, may not cause substantial impact but added together can result in measurable changes not easily teased out to the source. The *Rouge River Watershed Plan* (TRCA 2007a) emphasizes the need for cumulative effects assessment and action at the watershed and subwatershed level. The *Redside Dace Recovery Strategy* (OMNR 2010a) identifies cumulative impacts as a key threat to the persistence of this endangered species. Impacts include altered water volumes and timing, flow regime, increasing sediment discharges, elevating water temperature, and fragmenting habitat. Chapter 3 provides recommendations on how to effectively address cumulative effects.

1.3.3 Water Management: Stormwater and Water Balance

Stormwater, and its management, influence three fundamental ecological and geo-fluvial processes that help shape the aquatic ecosystem: flow regime (surface and groundwater); erosion potential and water chemistry. All of these parameters are considered to be the drivers of aquatic habitat health, form, and function. Water balance is about achieving both infiltration and flow volume control (using low impact development, evapotranspiration, storage, etc.) when landscapes are developed and stormwater has to be managed using more than traditional practices (i.e., ponds). Chapter 3 provides direction for improving stormwater management and water balance, planning for both new and retrofit developments.

1.3.4 Aquatic Invasive Species

Aquatic invasive species (AIS) are non-native and non-introduced species that are often able to out-compete indigenous species for food or refuge resources and thus unbalance the native ecosystem. Such species have been identified as one of the greatest threats to biodiversity, posing direct impacts to native species and their habitat (EC 2004a; Hecky et al. 2004; OMNR 2005a). Mitigation strategies for invasive species include prevention; early detection and response; control (chemical, mechanical or biological) including eradication if feasible; and require sufficient economic resources and multi-agency and public support. Of these strategies, emphasis should be placed on prevention and early intervention, proven to be most effective and cost efficient (Wittenberg and Cock 2001). Chapter 3 provides information on existing conditions and current management of AIS.

1.3.5 Lake-Based Fisheries

Watersheds and river systems provide essential productive capacity for lake-based fisheries objectives. Salmonid fisheries are the main focus in Lake Ontario as directed by the OMNR. The Rouge watershed supports Rainbow Trout (*Oncorhynchus mykiss*) production and some limited production of Brown Trout (*Salmo trutta*). The Rouge has not been identified for Atlantic Salmon (*Salmo salar*) reintroduction. Additional descriptions and information on the Rainbow Trout fishery are found in Chapter 3.

1.3.6 Climate Change

Climate change is the result of the cumulative use of fossil fuels resulting in greenhouse gas emissions (e.g., carbon dioxide and methane) into the atmosphere, and the conversion of vegetated land cover (e.g., forest, grassland and wetlands) into non-vegetated or less vegetated carbon source areas (e.g., urban development or agriculture). The changing climate, specifically global warming and increased occurrence of extreme weather events (e.g., more frequent and intensive storms) may have dramatic effects on fisheries. It is predicted that the warming of surface waters will result in the northern retreat and expansion of coldwater and warmwater fish distribution respectively, and a decrease or relocation of spawning and nursery habitat (Gucinski et al. 1990). In addition to the changing distribution of species adapting to this altered climate, there is a potential for increased disease outbreaks (Novacek and Cleland 2001). Other variables expected to impact fisheries include changes in the hydrologic and nutrient cycles. Chapter 2 identifies TRCA direction for managing risk to natural heritage systems due to climate change. Chapter 3 provides management recommendations that also address climate change issues.

1.4 Vision, Goal, Objectives and Measures of Success

The vision, goal and objectives for the Rouge River FMP are based upon an aquatic ecosystem approach to managing fisheries in a watershed that is undergoing urbanization and reflect policy and guidance provided by the OMNR.

1.4.1 Vision

A collaboration of public agencies and private interests working together to ensure progressive watershed based planning and effective protection of the rivers, streams and aquifers that define the Rouge River Watershed and provide a sustainable aquatic ecosystem for future generations.

1.4.2 Goal

“Healthy aquatic ecosystems that provide sustainable benefits, contributing to society’s present and future requirements for a high-quality environment, wholesome food, employment and income, recreational activity, and cultural heritage.” (Strategic Plan for Ontario Fisheries II (OMNR 1992))

1.4.3 Objectives - Watershed Wide

- I. **Biodiversity of Native Fish Species and Species at Risk:** To support existing federal and provincial legislation, policy and/or strategies to protect and improve biodiversity, abundance, distribution, and habitat health and suitability for all native fish species, with a priority concern for the endangered species Redside Dace.
- II. **Hydrology:** To recognize/respect the integral relationship between hydrology, land use change, and healthy aquatic ecosystems through the use of substantial baseline conditions as the basis for all planning decisions (new and retrofit) that are meant to maintain the ecological and hydrological function of streams through effective management of stormwater, and achieving water balance between the groundwater and surface water regimes (i.e. infiltration and flow volume control).
- III. **Fish Stocking:** To address concerns relating to predation on and/or resource competition with species at risk by assessing stocking of non-native salmonid species, including Rainbow Trout, Brown Trout, Chinook Salmon (*Oncorhynchus tshawytscha*) and Coho Salmon (*Oncorhynchus kisutch*), within streams currently occupied by or managed for recovery of species at risk within the Rouge River watershed.
- IV. **Education, Interpretation and Stewardship:** To ensure that watershed residents are well informed about the relationship of the terrestrial and aquatic components of the Rouge River ecosystem and the effects of human actions on the aquatic environment.
- V. **Implementation:** To establish an informal Advisory Group, led by agency staff, to provide guidance and facilitation to stakeholders interested in undertaking projects that address recommendations contained within this FMP.

1.4.4 Objectives - Specific Fish Management Zones

A total of 10 Fisheries Management Zones (FMZ) were developed for the Rouge River FMP (**Figure 1-2**). There are common physiographic elements among the FMZs but there are also unique habitat features, functions, fish communities, and land use influences between FMZs. The response of each FMZ to land use pressures and cumulative effects depends on:

- land use (urban, agricultural, natural), and
- relative position within the watershed.

The following subset of objectives is meant to reflect considerations and conditions at the more local FMZ scale:

- i. To develop a management framework at the Fisheries Management Zone, reach, or site level such that the fish community and in-stream habitat is defined.
- ii. To prioritize the habitat requirements of key target species, as identified in this FMP, and their associated communities for management actions.
- iii. To protect the populations and habitats of locally rare, sensitive, threatened, or endangered species found in each Fisheries Management Zone.
- iv. To improve floodplain, riparian zone, and wetland habitats to benefit aquatic species.
- v. To optimize fish passage throughout the river system for all species.
- vi. To establish 1 – 3 years baseline conditions of the biophysical and hydrogeological conditions that support desired fish communities in each Fisheries Management Zone.
- vii. To develop greater knowledge and understanding of individual fish species and populations, fish habitat, and aquatic ecosystem structure and function through science, modelling, monitoring of mitigation/restoration measures and responses to effects of urbanization and climate change.
- viii. To seek increased controls and improved public cooperation on reducing aquatic invasive species and diseases.
- ix. To provide for sustainable fishing opportunities and use of the resource.

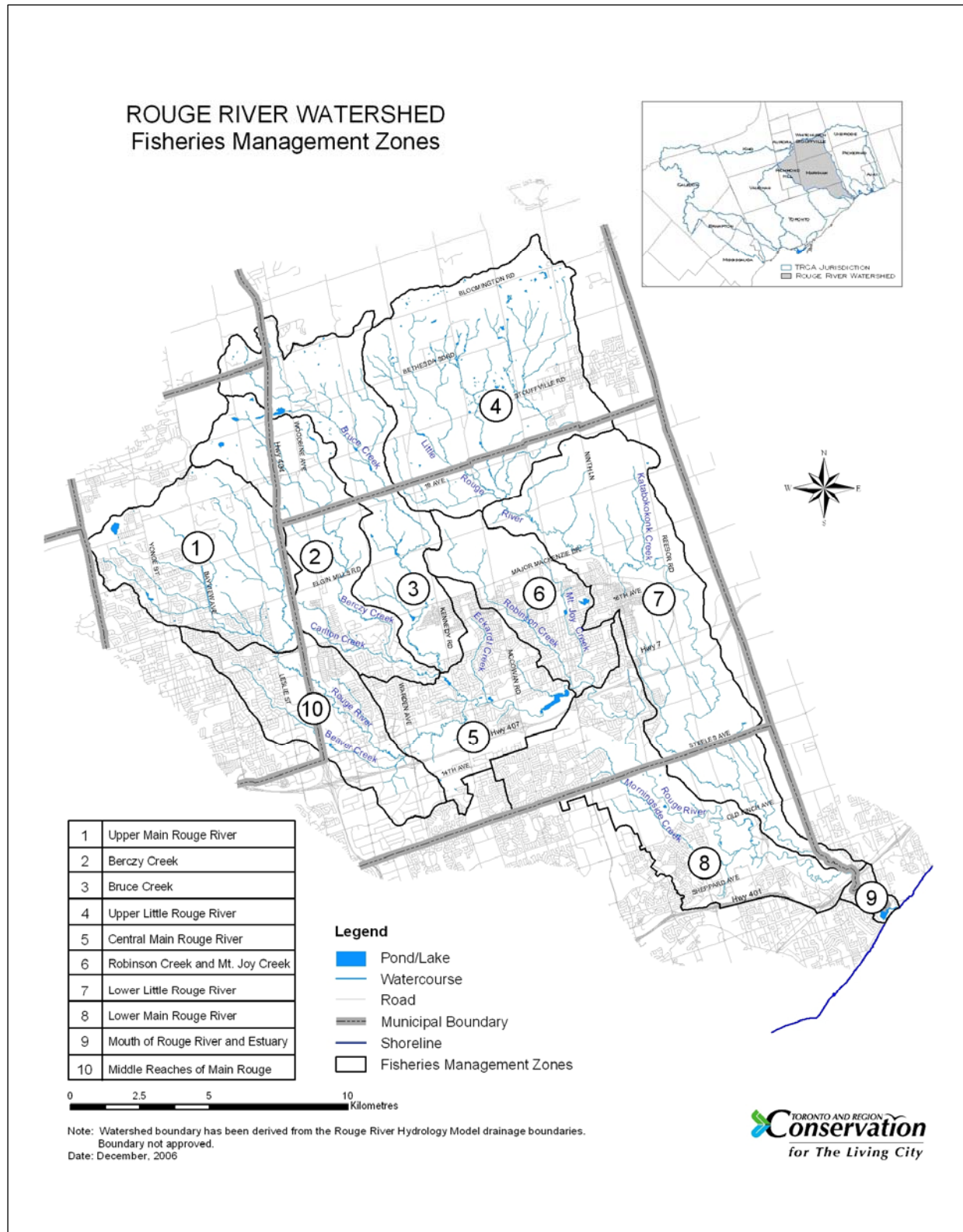


Figure 1-2: Fisheries Management Zones in the Rouge River

1.4.5 Measures of Success

It is important that the implementation of this FMP be assessed incrementally (every 5 years) using measurable and realistic targets. Formal reporting on the progress of this FMP and providing updates to management direction, if required, will be done every 10 years by the Ontario Ministry of Natural Resources.

Ways of measuring implementation of this FMP include tracking/documenting a substantially stronger linkage between land use planning and aquatic ecosystem health/function as well as implementing recommended priority projects. Chapter 4 of this FMP provides examples of Implementation Project Opportunities (IPOs) that can address priority recommendations. The IPOs are not an exhaustive list of potential restoration or mitigative actions, but either addresses the main issues identified as limiting the health of fish and fish habitat within a given Fish Management Zone or fill knowledge gaps that would improve management decisions for target species and system integrity.

The criteria for selecting which projects would be recommended for measuring implementation success of the FMP were:

- Obtain maximum system benefit by undertaking projects that are in close proximity to each other and address multiple issues.
- Support the principle that healthy headwaters or upstream reaches will greatly mitigate cumulative impacts to downstream portions of the whole system.
- Fill knowledge gaps that can affect planning or regulatory decisions for target species.
- Have a reasonable expectation for project completion within 5 years (not including post-monitoring activities).

In conclusion, Rouge River FMP measures of implementation success are defined as:

- i. Documented usage and/or demonstrated uptake of Rouge River FMP requirements and recommendations early in and appropriately throughout the land use planning process (new development and retrofits) and/or during the construction phase of all near or in-water works.
- ii. New development projects, such as the North Leslie Lands in FMZ 1, proceed with early planning that links water management and fisheries concerns such that the built-out scenario achieves a water balance condition that supports aquatic ecosystem function across the fish management zone.
- iii. Within the next 5 years, initiate and complete the following four Implementation Project Opportunities within the Upper Main Rouge River (see section 4.1.1.2 of this Plan):
 - Leslie Tributary Stewardship and Riparian Enhancement (IPO 1.1)
 - Community Riparian and Upland Habitat Creation Project (IPO 1.2)

- Management of Priority Barrier 1.1 (IPO 1.3)
- Baseline Flow Regime Characterization (IPO 1.4)

DRAFT

2 FISHERIES MANAGEMENT TOOLS

This FMP is intended to provide guidance to a wide audience (i.e., aquatic resource managers, planners, politicians, stakeholders, and non-profit groups) in order to implement a systematic and holistic approach to managing the aquatic ecosystem. Accomplishing this will require stakeholders to address the management recommendations in this FMP within the various regulatory frameworks and land use planning processes. The recommendations are presented in Chapters 3 and 4. The following information is presented below as ‘tools’ to ensure consistency with Rouge River FMP objectives:

1. Target species: what and where fish species and communities are being managed (e.g., FMZs, target species);
2. Timing windows and Reside Dace screening map: when construction activities can occur (i.e., timing windows) and where projects might require a permit under the ESA (screening);
3. Fish monitoring and data management: What types of data are currently available (e.g., monitoring, survey, percent impervious cover, etc.);
4. Land use and percent impervious cover: how close are current and future percent impervious cover values to thresholds that predict decline in the health of fish and fish habitat.
5. Climate Change Risk Assessment: what tools are currently available for assessing risk to natural heritage components due to climate change stress.

2.1 Target Species

As identified in Chapter 1, ten FMZs have been determined for the Rouge River watershed (**Figure 1-2**). FMZs are reasonably consistent with subcatchment drainage areas and are considered relatively homogeneous in hydrologic, geologic and thermal regimes. The purpose and advantage of these zones are to focus management on system function that supports the fisheries as opposed to just considering the response of the in-stream environment.

Target fish species for the Rouge River FMP have been identified for each FMZ and are illustrated on **Figure 2-1**. The habitat requirements for these species have guided the specific management requirements, recommendations, and implementation detailed in this FMP. Target species were selected based on ecological sensitivities and top trophic status in the food chain. In particular, Brook Trout (*Salvelinus fontinalis*), Redside Dace and Rainbow Darter (*Etheostoma caeruleum*), are being treated as “key” target species for their more specialist habitat requirements, high sensitivity to urban impacts and, for Redside Dace, the endangered species status.

Through sound management for habitat conditions that support the key species, the other target species and remaining fish community are also being “cared for”. The reason for identifying the other target species is a function of a desire to: promote biodiversity, and to protect all species that have specific sensitivities to changes in the aquatic ecosystem.

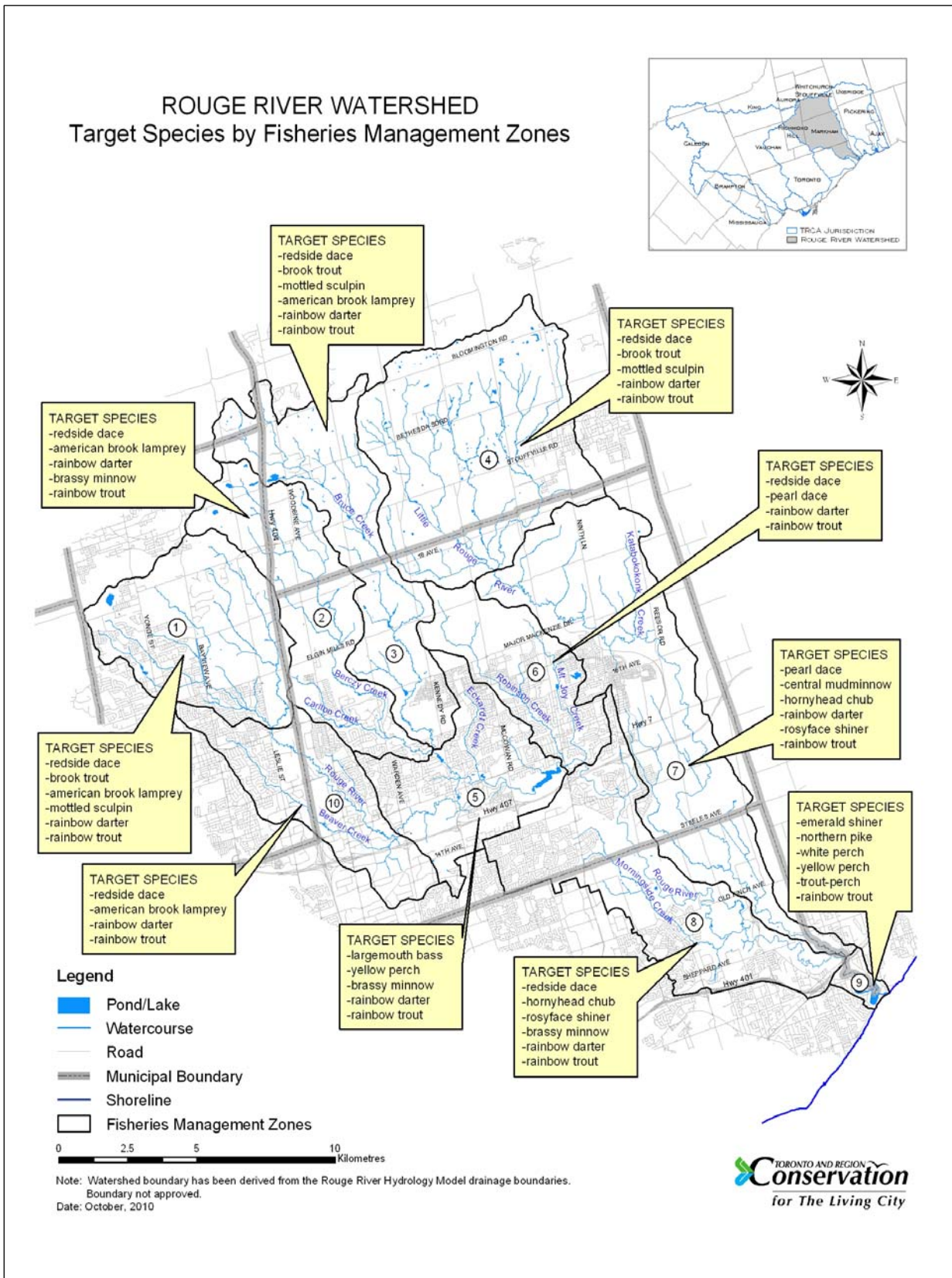


Figure 2-1: Target Species by FMZ for the Rouge River

2.2 Timing Windows for Construction

Construction timing windows are applied for works conducted within or near water. There are three categories that apply in the Rouge: coldwater, warmwater and Redside Dace (**Table 2-1, Figure 2-2**). The main purpose of these “windows” is to limit construction and development activities to periods of the year that pose the least damage or risk of damage to aquatic ecosystems. For this reason, cold and warmwater timing windows are intended to limit development activities from periods of the year coinciding with fish spawning and nursery periods. The Redside Dace window provides this same protection but is also intended to restrict development activities during seasons where the stability of stream channels and the prevention of sedimentation and erosion cannot be ensured (i.e., late fall, winter, and spring).

Where coldwater habitat is found above Redside Dace occupied reaches and in-water works are proximal and/or substantial enough to raise concerns about downstream fishes and habitat protection, then the more conservative Redside Dace window may be applied. The Redside Dace screening zones capture where in the watershed this broader consideration for downstream protection could be applied. The decision to apply the Redside Dace window starts with OMNR reviewing the proposed works. Discussions with TRCA staff and/or new information can be part of this review process that help decide what the final designation will be for occupied reaches and upstream contributing habitat. OMNR will normally determine the Redside Dace timing window for occupied stream reaches. Where spring migratory species are present, cold-water timing windows may apply to ensure passage and unimpacted spawning habitat conditions.

Depending on the type of development activity and the risk to the stream, the responsible agencies that apply the timing windows may allow for some flexibility in terms of extensions. However, such extensions will normally only be granted based on ecological considerations and type of work. Matters relating to contractors and other scheduling or planning problems will not normally be deemed as acceptable reasons for receiving timing window extensions.

It is acknowledged that the Redside Dace and coldwater timing windows provide for only a relatively short construction season (for works impacting streams). It is therefore imperative that project proponents recognize timing windows as an important component of the land use planning and approvals process, and ensure that works are scheduled accordingly.

Table 2-1: Construction Timing Windows

Habitat Category	Timing Window for Construction
Coldwater	June 15 th to September 15 th
Redside Dace	July 1 st to September 15 th
Warmwater	July 1 st to March 31 st

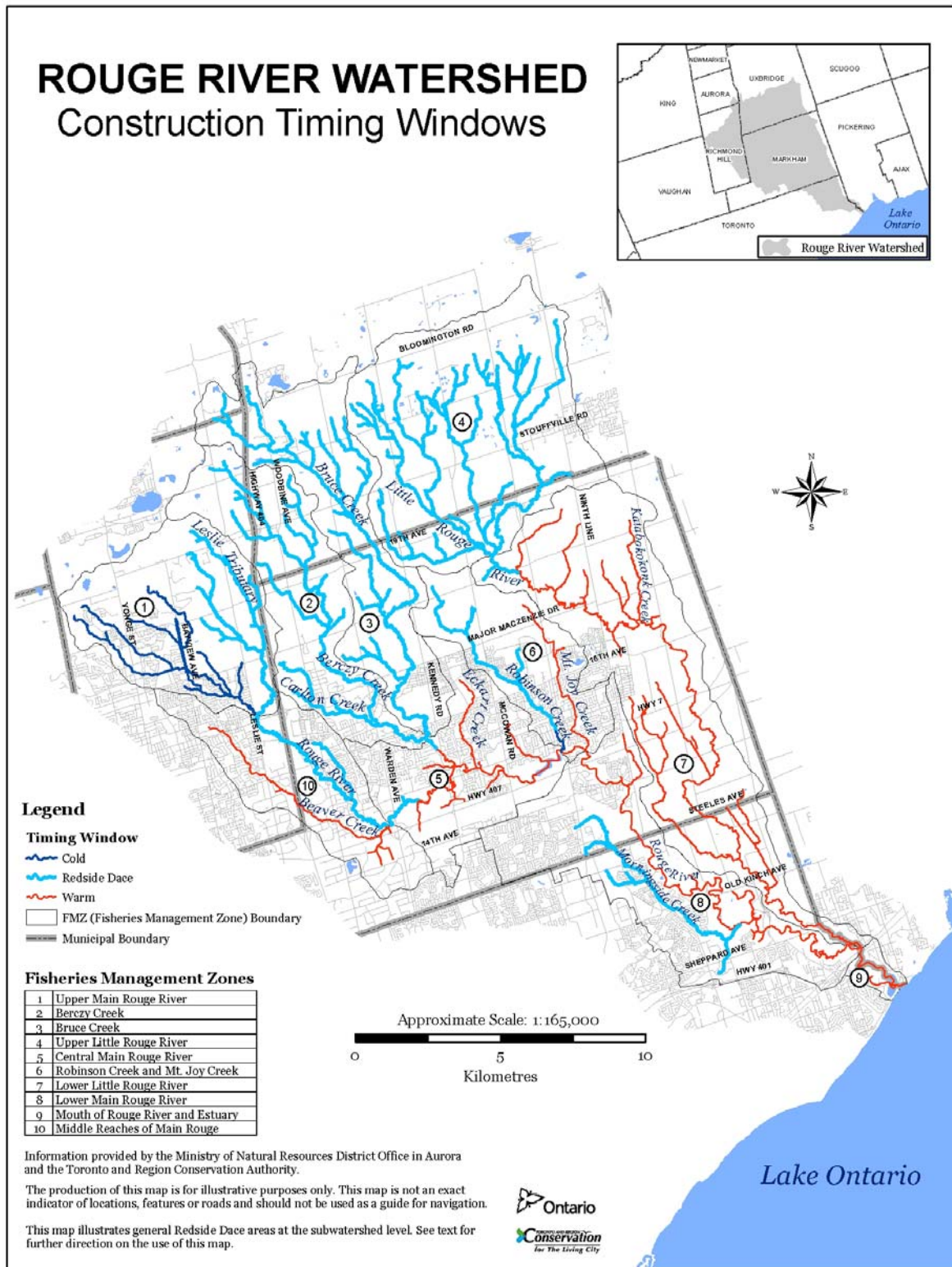


Figure 2-2: Timing Windows for Construction for the Rouge River and Redside Dace Screening Zones.

2.3 Fish Monitoring and Data Management

The current and historic fisheries data set has been and continues to be assembled by the OMNR. These data are recorded on scientific collector's permits and are an informative and critical management tool for the watershed. These fisheries data have been gathered for decades and currently exist electronically through TRCA. The e-database is periodically updated to better inform fisheries management decisions. The summaries of these fisheries community data, for the watershed and each FMZ, are presented in Chapters 3 and 4, respectively, of this document.

The fisheries data set allows for the examination and interpretation of fish communities from across the watershed and through time, allowing trends and patterns to be analyzed. Managers can identify where unique, rare, or endangered fish species exist, allowing for the development of improved or specific management strategies that will protect those species and their habitats. Managers can also use this information to target monitoring or restoration efforts (e.g., endangered species habitats and AIS invasion pathways). In this Plan, fisheries data have been used extensively, and will continue to be relied upon in the future.

2.3.1 Regional Watershed Monitoring

The TRCA's Regional Watershed Monitoring Program (RWMP) is designed to provide a general picture or trend of changes to the fish community's "health" by sampling multiple years at the same locations. A total of 26 fixed sampling sites have been established in the Rouge River watershed (**Figure 2-3**). Fisheries and habitat surveys are currently conducted on a 3 year cycle in the Rouge River Watershed and data exists for 2003, 2006, and 2009.

2.3.2 Special Project Monitoring

Based on the broader regional understanding, site specific studies can and are undertaken to address very specific questions about localized issues or opportunities. For example, TRCA undertook additional sampling beyond the RWMP to capture more specialized habitat. These stations are referred to as FMP sites as the data were used specifically in the development of this Plan (**Figure 2-3**). This local information can lead to improved management decisions and further refines the understanding of the aquatic resource. It is hoped that future survey and monitoring work will be coordinated or communicated with the Advisory Group to ensure the continuity of these invaluable data sets and improve fisheries management planning.

2.3.3 Flowing Water Information System (FWIS)

OMNR is currently developing a web-based program titled *Flowing Water Information Systems* (FWIS) which is intended to integrate fish community data with other stream metrics across Southern Ontario. Such programs may serve to help further refine the characterization of streams and their function within or amongst watersheds.

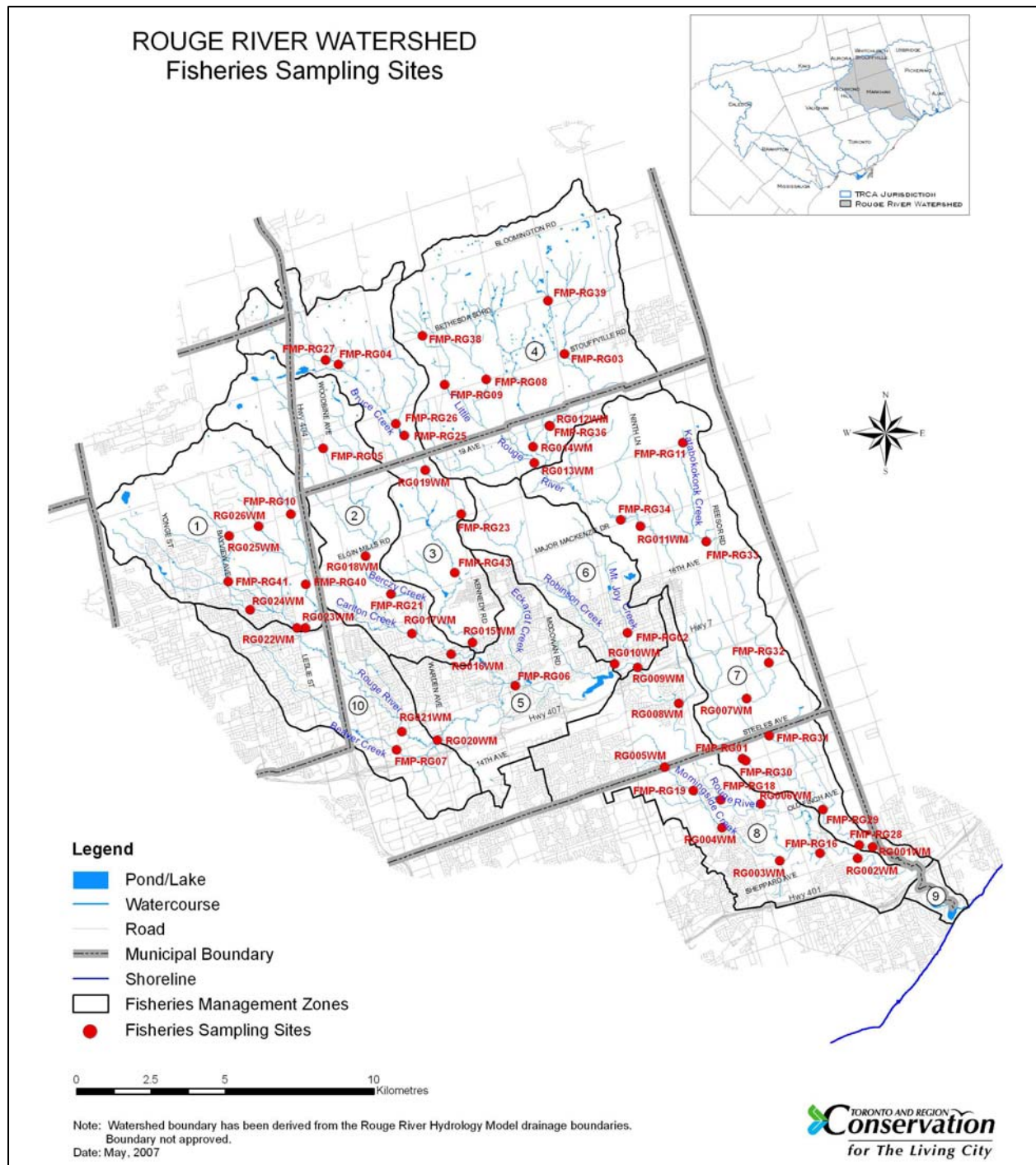


Figure 2-3: Fisheries Sampling Sites (RWMP and FMP sites)

2.4 Land Use and Percent Impervious Cover

The Landscape and Stream Assessment Tool (LSAT) is a GIS application that runs the modeled relationships between fish community and Landscape Disturbance Index (LDI), geology, slope and the area of a subcatchment (e.g., Fish Management Zone). LDI is a similar variable to percent impervious cover (PIC). The output parameter is referred to as a Fish Canonical Correspondence Analysis (CCA) Score and represents species that “typically” inhabit a certain range of habitat from “coldwater” to “cool” to “warm” to “warm water tolerant” (or degraded). This model does require specific software, sufficient fish data, and detailed understanding of land use and land cover attributes. The existing land use (2005) and associated PIC for the Rouge River watershed are shown on **Figure 2-4**. The areas that urbanized between the years 2002 and 2005 are shown in red. The Fish CCA scores for the Rouge fish management zones were based only in the 2002 land use data and are provided in Chapter 3, section 3.2.3 of this document.

As a tool for future planning, the PIC for each fish management zone under approved Official Plans for the Rouge River watershed is provided on **Figure 2-5**. The calculated PIC is approximately what it will be after the approved development plans are implemented. The hatched lines on **Figure 2-5** show the areas in the watershed still open for potential growth planning. Depending on what type of land use, where it is, and how much occurs in these potential urban areas, the PIC could cross thresholds that are predicted to result in complete loss of sensitive taxa (above 10%) and measurable stream degradation (above 20%)(Maude and Di Maio 1999; Center for Watershed Protection 2003; EC 2004b).

Using PIC scores, managers can immediately obtain a sense of which FMZs in the Rouge watershed are more influenced by urban considerations as compared to relatively natural or undeveloped areas. This can be a first line assessment for more integrated growth planning or identifying restoration/enhancement projects that focus on infiltration.

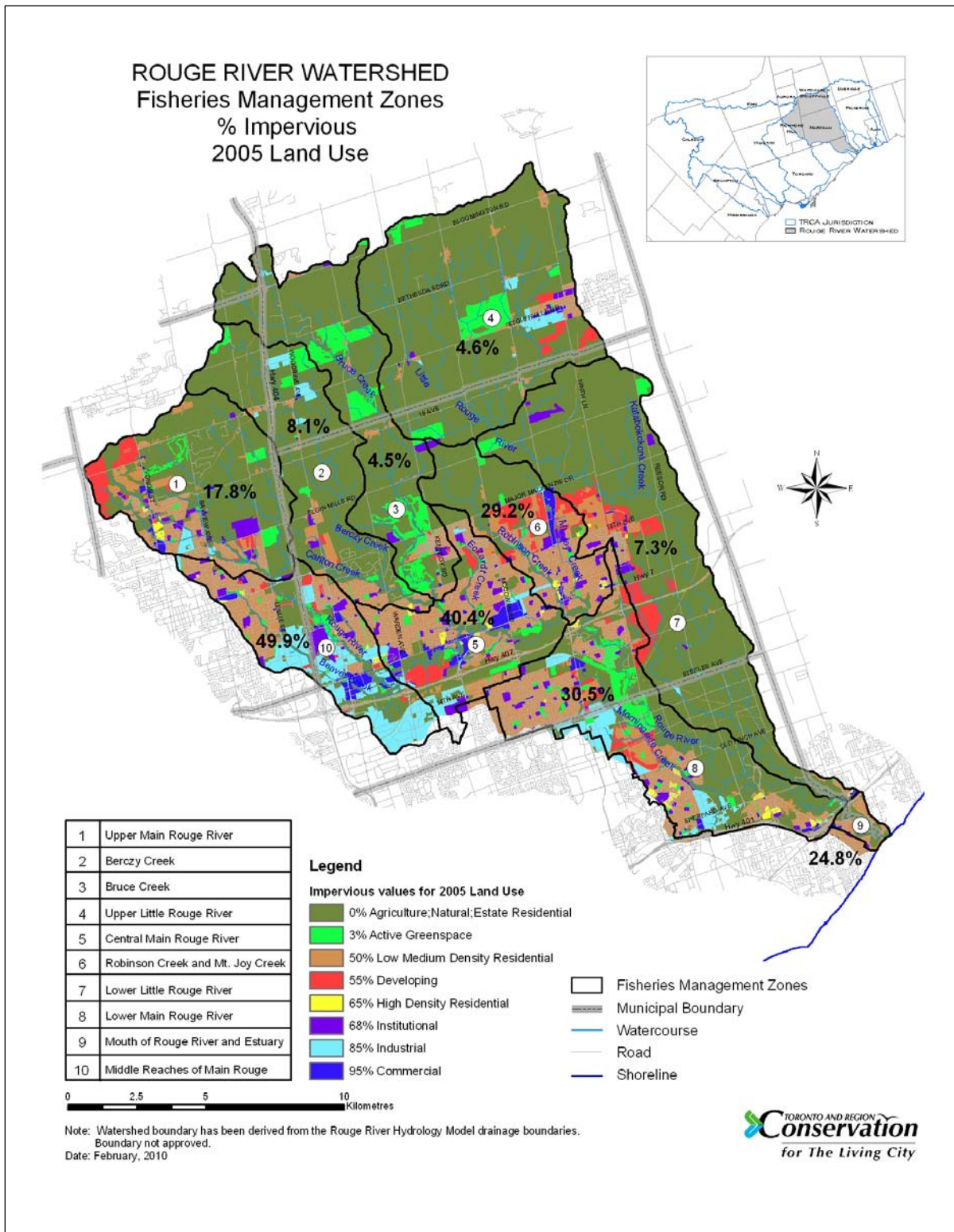


Figure 2-4: Existing Percent Impervious Cover in Rouge River by Fish Management Zone

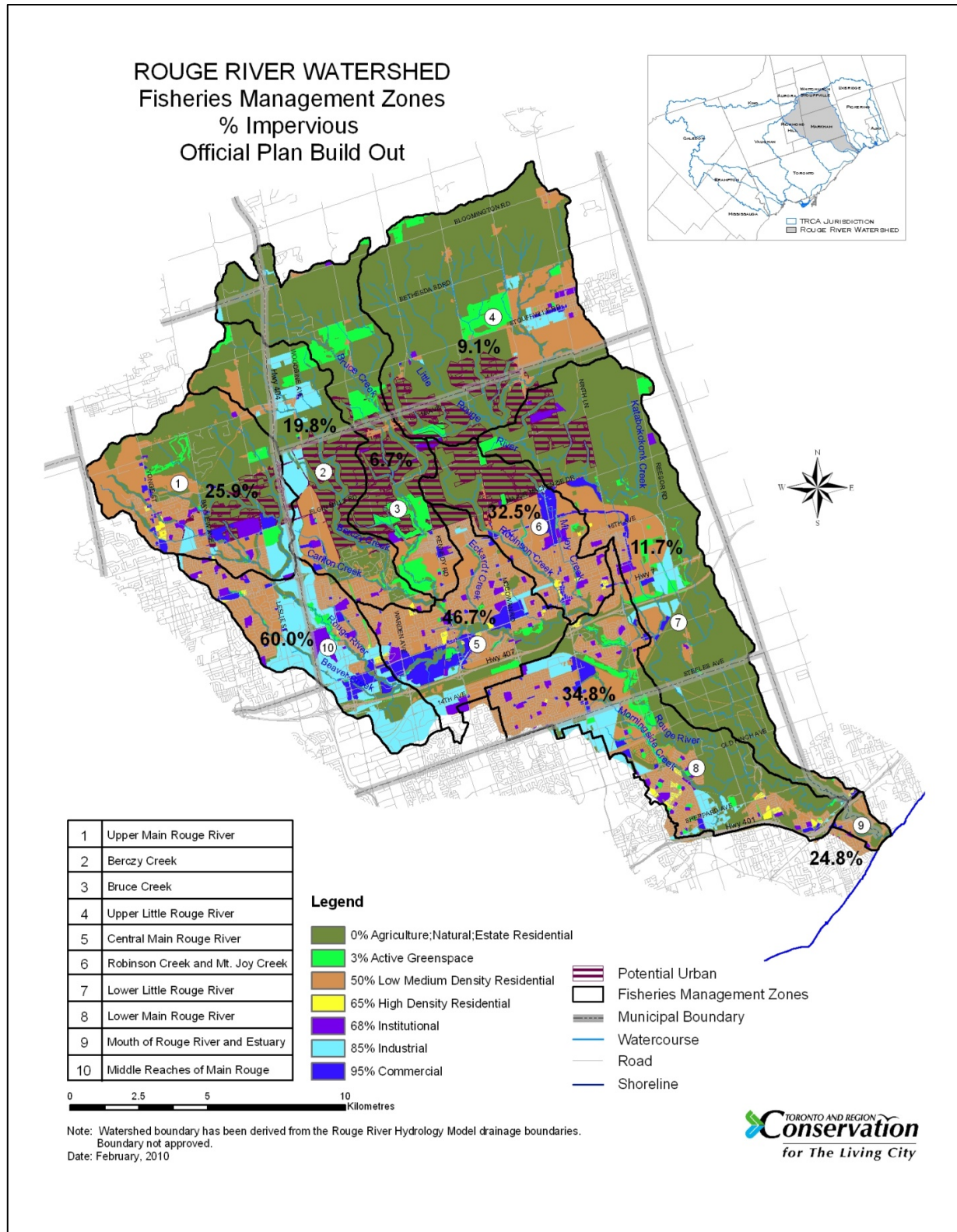


Figure 2-5: Future Percent Impervious Cover in Rouge River by Fish Management Zone

2.5 Climate Change Risk Assessment

The development of adaptive management tools aimed at building resilience into the natural system as a means of addressing climate change is a fast growing area of interest for resource managers and many other groups. The TRCA, in partnership with Beacon Environmental, has proposed one such tool, an assessment framework that can be used to help identify, prioritize, manage and monitor risks to natural systems associated with climate change. The tool is presented in a working draft copy of *Climate Change: Implications for Natural Systems and Biodiversity* (Beacon Environmental 2010) and is available upon request from TRCA. Future revised versions of this living document will be available on the TRCA website. Other climate change management strategies may also provide relevant and alternative approaches that may allow for a more comprehensive consideration of the complex issues facing aquatic resource managers.

3 EXISTING CONDITIONS, ISSUES, AND MANAGEMENT RECOMMENDATIONS ACROSS THE WATERSHED

This chapter is organized into 2 main sections. The first section (3.1) provides a summary of the ecological processes that, combined, produce the resultant aquatic habitat condition within the Rouge River at both the watershed scale and at the subcatchment level. Following the ecological discussion are watershed-wide recommendations that address the larger issues associated with landscape change that have influence over the state of aquatic health.

The second section (3.2) focuses on the fish community across the watershed and in-stream or valley corridor habitat conditions (i.e., in-stream barriers, stocking, and riparian vegetation) with each topic having a set of recommendations.

The following management approaches were used to help prioritize and organize all recommendations:

- Use watershed and subwatershed planning as a requirement for effective protection of aquatic resources and functions.
- Maintain healthy rivers and streams by considering ecosystem functions and relationships.
- Employ effective protection of headwater ecosystems.
- Maintain pre-development water balance in streams where fish species have direct or significant reliance on groundwater contributions to provide required habitat conditions.
- Apply innovative and evolving practices and technologies for stormwater management in urban or urbanizing areas to address flow regime alteration.
- Consider and define the cumulative effects of urbanization on stream quality and fish communities.
- Target activities that support healthy ecological processes and address factors that limit target species maintenance, enhancement, and distribution.
- Use a timeframe to organize short-term (5 years) and long-term (10 years) enhancement, rehabilitation or maintenance efforts.
- Use spatial scales to organize recommendations that can be applied across the watershed versus more refined recommendations that take into account the specific conditions and issues present at the fish management zone level.

3.1 Factors Affecting Aquatic Ecosystem Health

There are key ecological processes that essentially define the form and functional attributes of the aquatic system. They include the flow regime (groundwater and surface water), the terrestrial natural heritage system (land cover) and geology. Anthropogenic practices (e.g., land use, stormwater drainage, water taking) greatly influence the first two processes and in-turn have a cascade effect on fishes and fish habitat. For the most part, these driving forces operate at the watershed or regional scales. Management direction needs to recognize that changes to these processes will have a cumulative effect through the watershed as well as local influences on in-stream conditions. The in-stream conditions shift from the headwaters to the mouth and are ecological processes as well, just at a smaller scale. They include water temperature, water chemistry, and sedimentation.

The following is a summary of existing conditions within the Rouge River that sets the stage for understanding how the larger over-land, under-land and in-stream processes are linked and affected by land use and other human practices. Detailed background data, analyses and discussion can be found in the *Rouge River Scenario and Modelling and Analysis Report* (TRCA 2007b) and/or the *Rouge River State of the Watershed Report* (TRCA 2007c).

The urban areas in the Rouge watershed have steadily built out over the years such that percent impervious cover (PIC) has increased across all the FMZs. Based on 2005 land use, the FMZs containing urban centres are now well past the 10% -15% PIC above which stream degradation and decline or loss of sensitive species can be measured (FMZ1, FMZ 5, FMZ 6, FMZ 8, FMZ 9 and FMZ 10; See **Figure 2-4**). The next wave of growth planning is already underway across York Region and will mostly affect the headwaters in FMZ 1, FMZ 2, FMZ 4 and to a lesser degree, FMZ 7 and FMZ 10. See **Figure 2-5**.

With higher PIC comes increased overland drainage during storm events. Much of the earlier development in the Rouge (approximately 22%) was constructed without the benefit of stormwater management, followed by 18% constructed with older end-of-pipe stormwater management (i.e., ponds) that only provided flood control. The remaining 60% is comprised of more recent development that employed stormwater management ponds to control flooding and erosion and improve water quality. Currently there are a total of nearly 200 stormwater management ponds existing or proposed for the watershed. However, traditional stormwater management practices and designs (i.e. ponds) are not enough to properly protect the flow regime, and that they poorly address the low assimilation capacity of small streams to receive increased quantities of flow (TRCA 2007e).

The increase in drainage is reflected in the measured increase (55%) in total stream flow in the Main Rouge since 1962 to present (TRCA 2007a). By comparison, little change (<10%) in total flow has occurred in the Little Rouge subwatershed. Changes in the Main Rouge are largely due to the effects of past urbanization in and around Richmond Hill, Town of Markham and City of Toronto. The Main Rouge has sustained changes consistent with development impacts but

not to the same extent as more highly urbanized watersheds such as Highland Creek and the Don River.

The highest groundwater recharge areas in the Rouge are located in the northeast and northwest corners of the watershed, where the Oak Ridges Aquifer sand and gravel outcrop at the surface. Where impervious cover overlaps these areas, local streams experience higher flow volumes and consequently higher erosion potential as overland drainage increases. The two highest groundwater discharge zones are generally located along the middle reaches near Elgin Mills and 19th Avenue, sourced by the Oak Ridges Aquifer (lower reaches of FMZ 1, 2, 3, 4) and around Finch Avenue, sourced by the Thorncliffe Aquifer (Lower reaches of FMZ 8 and FMZ 9). The groundwater model suggests that approximately 2/3 of groundwater discharge enters the system via small, low order streams. When integrated with the fisheries data, it is in these small streams that healthy populations of Brook Trout and Redside Dace are predominately found (e.g., along Elgin Mills Rd.).

The cool water reaches appear more reliant on local groundwater recharge/discharge pathways, particularly Robinson Creek and Morningside Creek. Although the mid to lower reaches of the Little Rouge River are largely warmwater, there are two first-order cold –cool water tributaries that appear to have local groundwater sources (Katabokokonk Creek and an unnamed tributary that both flow into the main branch of the Little Rouge).

Groundwater pathway diversion is one way to alter stream hydrology another is direct water taking either from the stream (surface water) or groundwater sources. There are 116 individual registered and 57 un-registered water users in the Rouge River watershed. Only if a water user plans to take more than 50,000 L/day do they require a water taking permit from the Ontario Ministry of the Environment (OMOE). Approximately 34% of the permits are for surface water withdrawal, 37% groundwater, 12% both and 16% unknown. Surface water taking is likely the most stressful to fishes when baseflows are low. The most common purposes for water taking in the Rouge are for aesthetics (e.g., lawns), golf course irrigation, and livestock watering. However, the largest amount of water is removed for aquaculture, followed by golf course irrigation, and aggregate washing.

Stream temperature is affected by many factors but relative contributions of groundwater and surface water are key factors. Following from the discussion above, many streams in the Rouge River watershed run cold through the upper reaches of FMZ 1, 3 and 4 where groundwater discharge contributions are high as well as in a few tributaries lower down (see TRCA 2007c for thermal regime map of entire watershed or specific FMZ mapping in Chapter 4 of this FMP). Temperatures are generally cool through Berczy Creek (FMZ 2) and transition to cool in the middle reaches across the watershed before becoming warm water below Steeles Avenue in the Main Rouge. The lower half of the Little Rouge (FMZ 7) transitions to warm water habitat at Major Mackenzie Drive with a couple of small, cool water tributaries contributing lower down.

Several areas in the Rouge experience more localized effects on temperature due to on-line ponds, water taking, loss of riparian vegetation, and shifts to more surface water contributions in urban zones (via SWM ponds). Impacted areas are identified for each FMZ in Chapter 4.

Over all, the water chemistry in the Rouge River is relatively unimpacted, with the main exception being chlorides and *Escherichia coli* (*E. coli*). An examination of water quality data in the Rouge River has shown an upward trend in both of these parameters associated with urbanization (TRCA 2007c). As bacteria are not specifically harmful to fishes, this parameter will not be discussed further. However, chloride levels may be stressful to aquatic life in the Main Rouge River and to a lesser degree in the Little Rouge River during certain times of the year and linked to current road salting practices. This is likely to be an increasing trend as more roads and impervious surfaces are constructed within the watershed.

OMOE fish consumption advisories are in effect for salmonids that enter the watershed from Lake Ontario, where fish are known to accumulate contaminants. Several different species caught in Milne Reservoir and in the Rouge River Marsh also have consumption guidelines according to the size of the individual fish (OMOE, 2009).

The flow regime is a major factor affecting erosion and sedimentation within the stream. Increases in surface flow volume generally lead to higher in-stream erosive forces and subsequent shifts in the sedimentation process. Within and downstream of developed areas, the Main Rouge River and its tributaries are experiencing unnatural and impacting rates of erosion associated with the conversion of rural to urban land uses. Stream response (i.e., instability and adjustment processes) will continue for a period of time even after landuse changes are complete. The Little Rouge River catchment has relatively little urban development but recent (2010) evidence of severe bank erosion (i.e., large mature trees observed washed into the stream in Rouge Park) and observed lateral widening of the channel in the lowest reaches may not be within the natural variation for this system.

3.1.1 Watershed Wide Management Recommendations

The goals and objectives of this FMP are directly tied to the ecological and geo-fluvial processes and functions of the watershed. Maintenance of these functions requires comprehensive treatment through planning; best management practices (BMPs), and stewardship. Management recommendations at this landscape level overlap in practice and work to achieve multiple benefits for the larger aquatic system. They have been organized into eight categories:

1. Watershed and Subwatershed Characterization
2. Watershed and Subwatershed Studies and Plans
3. Cumulative Effects
4. Stormwater Management
5. Water Balance
6. Water Taking
7. Infrastructure

8. FMP Implementation

3.1.1.1 Watershed and Subwatershed Characterization

A fundamental tenet of good planning is to base decision making on an accurate characterization of watershed conditions and functions. This chapter and supporting TRCA documents (TRCA 2007b and TRCA 2007c) provide the existing conditions of metrics that affect pertinent stream processes and the resultant biotic communities. This information is accurate and complete for understanding the larger fish community components (species, trophic structure, abundance and distribution); thermal stream classification; land cover (form and function of riparian and table land vegetation); and land use at the watershed and subwatershed scale. Significant updates to these findings or new information may be considered on a project basis to refine planning decisions.

This current understanding has been used to define some of the management tools available as described in Chapter 2 of this FMP (e.g., fish management zones, target species, timing windows). More detailed characterization of the flow regime, water quality and quantity and pathways of effects of land use on stream health would still be needed to best plan urban development projects.

Recommendation(s):

- (i) That all land use planning including: watershed plans, subwatershed plans, secondary plans, and master environmental servicing plans (MESP) should be informed by appropriate characterization including: groundwater pathway determination, subwatershed water balance, pre-development surface water flow regime, current water taking activity, fluvial-geomorphic dynamics, cumulative effects inventory, stream thermal classification, fish community characterization, fish habitat identification, and water quality assessments in relation to fishes and aquatic resources.

3.1.1.2 Watershed and Subwatershed Studies and Plans

As emphasized in this FMP, the effective protection and maintenance of fisheries and other aquatic resources within the Rouge watershed requires planning, cumulative impact assessment, and effective impact mitigation at the subwatershed level (can be equivalent to the fisheries management zone scale). A Rouge River watershed plan already exists. Within the broader context of the watershed plan, subwatershed studies and plans will further refine our understanding of the local system and provide necessary basis for more specific designs and decisions including the cumulative potential of mitigative measures to maintain the desired condition.

Recommendation(s):

- (i) That subwatershed studies and plans should be required for all remaining portions of the Rouge watershed that are proposed for urbanization.
- (ii) That the existing *Rouge River Watershed Plan* (TRCA 2007a) be used as a resource to help inform land use planning, impact assessment and mitigation.
- (iii) The recommendations in the *Rouge River Watershed Plan* (TRCA 2007a) for sustainable community retrofits be implemented, including, improved effectiveness of design to achieve pre-development rates of infiltration, evapotranspiration and runoff;
- (iv) That guidance provided through the TRCA Sustainable Technologies Evaluation Program (STEP; www.sustainabletechnologies.ca) and the *Low Impact Development Stormwater Management Planning and Design Guide* (CVC and TRCA 2010; available through the STEP website) and the *(Draft) Guidelines for Development Activities in Redside Dace Protected Habitat* (OMNR 2011b) be consulted when planning and implementing sustainable community design.

3.1.1.3 Cumulative Effects

This FMP underscores the need to focus on cumulative effects at the subwatershed, catchment and/or fisheries management zone levels. As such, the cumulative effects of some development activities including, but not limited to, stormwater management (outfalls), water taking, and infrastructure development can be identified, measured, and mitigated through the use of larger scale planning studies.

Recommendation(s):

- (i) That the assessment and effective mitigation of cumulative effects relating to development impacts and stormwater management on: groundwater, surface water, pre- to post-development flow regime (specifically the effects on stream form and erosion potential), thermal and water quality contributions (contaminants and total suspended solids) be included as a requirement for all subwatershed plans, secondary plans, and MESPs.

3.1.1.4 Stormwater Management

Improved effectiveness of stormwater management is a priority for healthy aquatic systems as shown by the watershed planning process led by TRCA and as described in the *Rouge River Watershed Plan* (TRCA 2007a). The watershed plan is positioned to guide municipal development activity. Municipalities, by and large, are or become the long term managers of stormwater facilities and thus are charged with the responsibility of ensuring maintenance and performance standards. *The Rouge River Watershed Plan* (TRCA 2007a) contains detailed recommendations, implementation and policy directions specific to achieving stormwater improvements and outflows that are consistent with high quality aquatic habitat and maintenance of target fish species and/or communities as identified in this FMP. The success of many of this FMP's recommendations is based in part on the expectation for improved

stormwater management (e.g., temperature, flow rates, peak volumes, seasonal distribution, and water quality).

Stormwater management is required in order to delay and provide detention of stormwater flowing off impervious urban surfaces and also to capture sediment before entering watercourses. Stormwater ponds are most often used for stormwater management. To date, stormwater ponds have typically been designed to capture 80% of sediment loads exclusive of absolute thresholds of sediment entering fish habitat. What this means is that ponds are not typically designed to be effectively protective of sensitive fishes or other aquatic organisms and their performance gradually declines over time as ponds fill with trapped sediment.

In addition to sediment loading, storm ponds can also impart negative thermal impacts on receiving watercourses as a consequence of surface water heating. In recent years, there have been some substantial efforts directed towards improved storm pond function through the use of new and innovative designs and technologies. This FMP encourages continued innovation and design contributions. However, such efforts must be conducted in concert with rigorous cumulative effects assessment, mitigation, and maintenance of pond function through scheduled removal of accumulated sediment.

In terms of specifically identifying the cumulative effects of stormwater outfalls, temperature and sediment are two storm pond parameters measurable at the subwatershed level. The cumulative effects can generally be calculated by considering the total developed area, the total stormwater pond area and volume, and the expected sediment and temperature contributions of all individual storm ponds proposed within a given subwatershed or subwatershed study area.

Recommendation(s):

- (i) That the identification, assessment and effective mitigation of the cumulative effects of temperature and total suspended solids from stormwater outfalls entering watercourses and fish habitat be included as a principle component of all subwatershed plans, secondary plans and MESPs for all urbanizing areas of the watershed.**
- (ii) That the most effective designs for stormwater ponds and other stormwater infiltration designs/technologies are used in concert with conducting cumulative effects assessments.**
- (iii) That new and innovative approaches for stormwater management (future and retrofit) geared towards the protection of fishes and aquatic ecosystems be encouraged and supported such that discharge meets ambient stream temperature, water clarity, and chemistry or is within the acceptable range for target species, to be determined by the appropriate regulatory agency.**
- (iv) That stormwater retrofits be used in existing urban areas to incorporate water quality and erosion control.**

- (v) That in areas of sensitive environmental receptors (e.g., stream habitat of Species at Risk, headwaters, and wetlands) elevated standards of stormwater treatment resulting in effluents that are effectively protective of those receptors and the aquatic communities they support, be required.

3.1.1.5 Water Balance

All watercourses in the Rouge River watershed and their related ecosystem function have a degree of sensitivity to the alteration of the surface and groundwater regime often associated with land use change. Three priority designations are defined below and recommended to provide guidance as to where water balance decisions are most critical to the land planning process. There may be cases where the detailed biological and/or hydrogeological and/or permitted water taking information suggest greater sensitivity to changes in water balance than identified in this FMP. As such, project-specific assessments should be undertaken to accurately define a water balance condition that would allow for the maintenance of aquatic ecosystem integrity should urban development proceed within the catchment.

Recommendation(s):

- (i) That urban land uses in new or re-development areas, which spatially overlap with areas identified in this Plan (very high, high, and medium), be supported by flow regime investigations (e.g., stream gauge installation and/or monitoring that could also support an appropriate flow model).

Very High Priority Areas

- Small watercourses (third order or lower) which are reliant on groundwater contributions to maintain critical ecological functions - alterations to the flow regime, resulting in increased surface flow contributions, can shift the thermal regime and baseflow, negatively affecting watercourse structure and functions.
- Presence of sensitive and/or Species at Risk which rely on, or greatly benefit from the supply of groundwater to the watercourse for life functions and the maintenance of cold or cool water aquatic habitat conditions.
- Presence of a sensitive aquatic species that relies on direct groundwater discharge to the watercourse for successful reproduction.

High Priority Areas

- Small watercourses (third order or lower) which are reliant on groundwater contributions to maintain critical ecological functions - alterations to the flow regime, resulting in increased surface flow contributions, can shift the thermal regime and baseflow , negatively affecting watercourse structure and functions.
- Presence of sensitive aquatic species (non species at risk, e.g. Brook Trout) which rely on direct groundwater discharge to the watercourse for successful reproduction and the maintenance of coldwater habitat.

Medium Priority Areas

- Larger watercourses (fourth order or higher) where there is higher capacity to buffer the negative effects of changes in flow regime on aquatic habitats.
 - Resident fish species are not reliant on groundwater discharge to complete critical life stages.
 - Cumulative benefits of maintaining water balance in upstream, higher priority areas will protect these habitats significantly.
- (ii) That flow regime investigations provide the comprehensive baseline data (e.g., water taking activity) needed to inform planning decisions to achieve water balance objectives that maintain aquatic ecosystem function.

3.1.1.6 Water Taking

Water taking (surface and groundwater) is regulated by the Ontario Ministry of Environment. Permits are required for any water taking from watercourses or aquifers in excess of 50,000 litres per day. Cumulative and/or direct water takings have the potential to result in negative impacts to stream condition and aquatic communities. Water taking can also affect the outcomes of water balance assessments.

Recommendation(s):

- (i) That longer term dewatering of significant volume and water takings (surface and groundwater) in sensitive aquatic habitat areas (e.g., headwater areas, Redside Dace reaches) continue to be screened by review agencies for studies to be carried out to determine site specific and cumulative effects on aquatic features.
- (ii) That relevant water taking data (i.e., quantity on permit and actual timing and location) be used to inform water balance assessments.

3.1.1.7 Infrastructure

Infrastructure and capital works projects (e.g., watercourse crossings for roads and utilities, parks and trails; dewatering for sub-surface infrastructure such as sewers) can impact aquatic resources and watershed function. Therefore, these should be sufficient detail and analysis of potential environmental effects from infrastructure projects at all stages of planning and design (e.g., master planning, environmental assessment, and detailed design, or in the planning and development process through a MESP, draft plan of subdivision, and detailed design). When upgrading infrastructure, opportunities exist to correct issues of past design or infrastructure failure (e.g., fish barriers due to perched culverts).

Recommendation(s)

- (i) That review agencies work with municipalities and developers throughout all stages of the infrastructure planning processes to assess individual and cumulative impacts of infrastructure on fisheries, other aquatic resources, and watershed functions, and to identify opportunities for avoidance, mitigation, compensation, and/or overall benefit.

3.1.1.8 FMP Implementation

The authoring agencies will seek to facilitate the implementation of recommendations and projects contained within this Plan. Contributions may include technical advice for projects, explanation of the planning and/or permitting process, identification of funding opportunities, and assistance with co-ordinating partnerships. Although a formal implementation committee will not be specifically developed, for practical reference, agency staff (i.e., designated OMNR Management Biologist, and TRCA Aquatic Systems Supervisor or Biologist) may be referred to as the Rouge FMP Advisory Group.

Recommendation(s)

- (i) That an informal Rouge River FMP Advisory Group be initiated jointly by TRCA and OMNR and invite participation of Rouge Park, DFO and other interested groups and individuals as appropriate.

3.2 Fish Community and Habitat

As with most living things, fishes have some basic chemical, physical, and biological needs. These needs are summarized in **Table 3-1**. Although the basic needs of fishes are common across the group classification of “fishes” (phylogeny), it is important to note that different families and species of fish differ with regard to their specialized needs, sensitivities and tolerances to environmental conditions. For example, salmonids (e.g., trout and salmon) are highly sensitive in terms of water temperature, dissolved oxygen, substrate type, groundwater discharge, and pollution levels, meaning they can only live within a given narrow range of these parameters. Centrarchids (e.g., sunfish and bass) and percids (e.g., darters) are more tolerant than salmonids and can withstand a broader range of habitat conditions. Some forage minnows such as Longnose Dace (*Rhinichthys cataractae*) and Blacknose Dace (*Rhinichthys atratulus*) are very tolerant and can persist within an even broader range.

Table 3-1: The Basic Needs of Fish.

Parameter Type	General Description	Example
Physicochemical	Water Quality and Quantity	A healthy medium in which to live: water quality, water temperature, water depth, natural flow regime, baseflow, etc.
Physical	Habitat Quality and Quantity	Appropriate physical habitat to complete life cycle: channel morphology, substrate, cover, riparian vegetation, connectivity, etc.
Biological	Ecological Integrity of Aquatic Community	Community Structure: a balance of other native fishes and organisms (benthic invertebrates, plants, algae, detritus, etc.) to sustain a healthy food web and genetic pool.

There is a natural shift in habitat conditions along a river's continuum from headwaters to mouth, giving rise to multiple habitats and predictable fish assemblages (Vannote et al. 1980). Beginning at a river's source, small order streams are highly influenced and dependent upon their catchment area for allochthonous (material formed outside of the stream but washed in from adjacent lands) sources of carbon. This carbon, in the form of leaf litter, twigs, and other debris, provides food for bacteria and other small organisms such as invertebrates, which kick-start the food chain. These are low productivity streams, often groundwater fed, cold and support a defined set of more specialized, sensitive fishes (e.g., Brook Trout, American Brook Lamprey (*Lampetra appendix*)).

As the water flows continuously down through the watershed, it comes together and creates ever larger streams, the energy of the system transports sediments and nutrients from above, carving new niches and supporting the transition to yet another suite of species (e.g., Redside Dace and other minnows, darters, sculpin). Diversity in habitat and, in response, fish communities, is usually the highest through these middle reaches.

Moving lower down in the system, habitat conditions tend to become more homogenous as stream size increases, energy (stream gradient) is lower, water temperatures generally rise and the influences of land on water lessen. The lowest portions of a watershed are characterized more by habitat generalists and guilds of cool or warmwater fishes with a wider range of tolerances (e.g., White Sucker (*Catostomus commersoni*), Blacknose Dace, Longnose Dace, Creek Chub (*Semotilus atromaculatus*), Smallmouth Bass (*Micropterus dolomieu*), Johnny Darter (*Etheostoma nigrum*), catfish). This dynamic process of a natural river system culminates as the widest, deepest branch meets the lake and a new set of forces (lake influenced) and complex biotic relationships are established.

In general, biodiversity (sometimes represented by species richness) can stabilize a community in the face of disruptive events and system pressures over an extended period of time (Vannote et al. 1980). The theory holds that "something" will survive and populate impoverished habitats that have been altered or stressed.

3.2.1 Fish Community in the Rouge River

Over the last 30 years 69 species have been recorded in the Rouge River of which there are 8 coldwater species, 26 coolwater species and 35 warmwater species (Table 3-2). Included in these thermal guilds are 2 endangered species, 4 stocked (either in the Rouge or in neighbouring watersheds), and 4 invasive species. The most diversity is found within in the upper reaches (1/3) of the watershed. The communities occupying these upper reaches span true coldwater species (e.g., Brook Trout) to warmwater species more typical of larger order streams (e.g., Largemouth Bass (*Micropterus salmoides*), and Yellow Perch (*Morone flavescens*). Moving further down the system to the middle reaches the diversity is actually the lowest and largely made up of coolwater species that are not habitat specialists, with a notable exception being Redside Dace. Diversity begins to rise through the lower watershed to the mouth of the main branch as it is influenced by lake-based species. Details of target species, fish community structure, and shifts over time are provided for each FMZ in Chapter 4.

Table 3-2: Fish Community of the Rouge River Watershed

Species Name	Scientific Name	Thermal Guild	Last Record
Alewife	<i>Alosa pseudoharengus</i>	Cool	01/06/2002
American Brook Lamprey	<i>Lampetra appendix</i>	Cold	13/07/2009
American Eel	<i>Anguilla rostrata</i>	Warm	14/05/2010
Atlantic Salmon	<i>Salmo salar</i>	Cold	28/07/2005
Banded Killifish	<i>Fundulus diaphanus</i>	Warm	04/07/1980
Blackchin Shiner	<i>Notropis heterodon</i>	Warm	15/05/2010
Black Crappie	<i>Pomoxis nigromaculatus</i>	Warm	07/08/2009
Blacknose Dace	<i>Rhinichthys atratulus</i>	Cool	15/05/2010
Bluegill	<i>Lepomis macrochirus</i>	Warm	12/05/2010
Bluntnose Minnow	<i>Pimephales notatus</i>	Warm	15/05/2010
Bowfin	<i>Amia calva</i>	Wrm	07/06/2000
Brassy Minnow	<i>Hybognathus hankinsoni</i>	Cool	14/05/2010
Brook Stickleback	<i>Culaea inconstans</i>	Cool	16/05/2010
Brook Trout	<i>Salvelinus fontinalis</i>	Cold	01/10/2009
Brown Bullhead	<i>Ameiurus nebulosus</i>	Warm	16/05/2010
Brown Trout	<i>Salmo trutta</i>	Cold	20/09/2005
Central Mudminnow	<i>Umbra limi</i>	Cool	14/09/2009
Central Stoneroller	<i>Campostoma anomalum</i>	Cool	16/05/2010
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	Cold	13/05/2010
Coho Salmon	<i>Oncorhynchus kisutch</i>	Cold	17/08/1989
Common Carp/ Koi	<i>Cyprinus carpio</i>	Warm	16/07/2009
Common Shiner	<i>Luxilus cornutus</i>	Cool	16/05/2010
Creek Chub	<i>Semotilus atromaculatus</i>	Cool	16/05/2010
Emerald Shiner	<i>Notropis atherinoides</i>	Warm	15/05/2010
Fantail Darter	<i>Etheostoma flabellare</i>	Warm	04/06/2002
Fathead Minnow	<i>Pimephales promelas</i>	Warm	16/05/2010
Finescale Dace	<i>Phoxinus neogaeus</i>	Warm	12/07/1999
Freshwater Drum	<i>Aplodinotus grunniens</i>	Warm	20/05/2004
Gizzard Shad	<i>Dorosoma cepedianum</i>	Warm	08/08/2005
Golden Shiner	<i>Notemigonus crysoleucas</i>	Warm	20/07/2005

Species Name	Scientific Name	Thermal Guild	Last Record
Goldfish	<i>Carassius auratus</i>	Warm	07/08/2009
Hornyhead Chub	<i>Nocomis biguttatus</i>	Warm	16/05/2010
Iowa Darter	<i>Etheostoma exile</i>	Cool	16/05/2010
Johnny Darter	<i>Etheostoma nigrum</i>	Warm	16/05/2010
Lake Chub	<i>Couesius plumbeus</i>	Cold	15/05/2010
Largemouth Bass	<i>Micropterus salmoides</i>	Warm	10/09/2007
Logperch	<i>Percina caprodes</i>	Warm	15/05/2010
Longnose Dace	<i>Rhinichthys cataractae</i>	Cool	16/05/2010
Mimic Shiner	<i>Notropis volucellus</i>	warm	04/04/2000
Mooneye	<i>Hiodon tergisus</i>	Cool	02/06/2000
Mottled Sculpin	<i>Cottus bairdii</i>	Cold	01/10/2009
Northern Hog Sucker	<i>Hypentelium nigricans</i>	Warm	21/09/1998
Northern Pike	<i>Esox lucius</i>	Cool	20/05/2004
Northern Redbelly Dace	<i>Chrosomus eos</i>	Cool	12/05/2010
Pearl Dace	<i>Margariscus margarita</i>	Cool	02/11/2006
Pumpkinseed	<i>Lepomis gibbosus</i>	Warm	16/05/2010
Rainbow Darter	<i>Etheostoma caeruleum</i>	Warm	16/05/2010
Rainbow Trout	<i>Oncorhynchus mykiss</i>	Cold	16/05/2010
Redside Dace	<i>Clinostomus elongatus</i>	Cool	24/09/2009
River Chub	<i>Nocomis micropogon</i>	Cool	22/08/2005
Rock Bass	<i>Ambloplites rupestris</i>	Warm	16/05/2010
Rosyface Shiner	<i>Notropis rubellus</i>	Warm	15/05/2010
Round Goby	<i>Neogobius melanostomus</i>	Cool	16/05/2010
Sand Shiner	<i>Notropis stramineus</i>	Warm	15/05/2010
Sea Lamprey	<i>Petromyzon marinus</i>	Cool	16/05/2010
Smallmouth Bass	<i>Micropterus dolomieu</i>	Cool	16/05/2010
Spotfin Shiner	<i>Cyprinella spiloptera</i>	Warm	08/08/2005
Spottail Shiner	<i>Notropis hudsonius</i>	Warm	09/09/2005
Stonecat	<i>Noturus flavus</i>	Warm	15/05/2010
Tadpole Madtom	<i>Noturus gyrinus</i>	Warm	16/06/1992
Threespine Stickleback	<i>Gasterosteus aculeatus</i>	Cool	04/06/2002
Trout-perch	<i>Percopsis omiscomaycus</i>	Cool	17/10/1989
Walleye	<i>Sander vitreus</i>	Cool	20/05/2004
White Bass	<i>Morone chrysops</i>	Warm	03/07/1984
White Crappie	<i>Pomoxis annularis</i>	Warm	08/08/2002
White Perch	<i>Morone americana</i>	Cool	14/07/1983
White Sucker	<i>Catostomus commersonii</i>	Cool	16/05/2010
Yellow Bullhead	<i>Ameiurus natalis</i>	Warm	06/07/2001
Yellow Perch	<i>Perca flavescens</i>	Cool	14/05/2010

2009/2010 Surveys by Fisheries and Oceans Canada, Sea Lamprey Control

2009, 2006, 2003, and 2000 surveys by TRCA's Regional Watershed Monitoring Program

2005 survey by TRCA Aquatic Group

Pre 2000 data from MNR collection records

Thermal Guild reference www.afs-soc.org/fishdb/fish_detail.php?FID=144

Endangered

Stocked

4 Aquatic Invasive

3.2.1.1 Core Fish and Fish Habitat Recommendations

The following recommendations are at the core of fish management and should be applied to help manage all native fish species within the Rouge River. Target species specific recommendations appear in later sections of this chapter.

Recommendation(s)

- (i) That native fish biodiversity increase or be maintained.
- (ii) That populations and habitats of threatened or endangered fish species be protected.
- (iii) That floodplain, riparian, and wetland habitat for fish be improved.
- (iv) That aquatic habitat is maximized/enhanced in ways that do not promote physical intervention or alteration to natural stream processes.
 - Channel realignments should only be considered by approval agencies when there is clear and substantial indication that a realigned channel will result in an improved stream condition.
- (v) That water chemistry and stream temperatures be, at a minimum maintained and where possible improved.

3.2.2 Fish Index of Biotic Integrity and Cumulative Impacts

The broad health of the stream and fish community can be assessed by calculating the Index of Biotic Integrity (IBI). The IBI uses a series of metrics, including species richness, local indicator species, trophic structure, abundance, and fish health. The interpretation of these metrics provides an evaluation of the habitat features and resources available for use, fish productivity and condition (Steedman 1988). TRCA uses a modified version of the IBI developed by Steedman (1987). Modifications were: 1) the removal of the metric that considers “black spot” an indicator of poor fish health (this condition can be prevalent in healthy fish populations within TRCA streams); and 2) presence of Brook Trout was only applied to coldwater streams, even if existing habitat was less than optimal. The metrics are essentially scored according to the value observed versus the expected value for a “healthy” stream of similar size and physiographic region. The IBI stream health categories are: “poor”, “fair”, “good”, and “very good”.

IBI Results for the Rouge River

Fish data for calculating IBI scores are supplied through the TRCA RWMP which sampled the Rouge at fixed sites in 2003, 2006, and 2009. The IBI scores for the Rouge in 2003, 2006, and 2009 are illustrated on **Figure 3-1**. Scores are largely “good” in the headwaters (FMZ 2, FMZ 3, and FMZ 4) and “good-fair” through the upper-middle reaches of the main Rouge and lower reaches of the Little Rouge (FMZ 1, FMZ 10, FMZ 6, and FMZ 7). Scores reflecting more relatively “poor” conditions are measured in the lower reaches of both the main Rouge River and Morningside Creek (FMZ 8). There are no RWMP sites in FMZ 5 or FMZ 9. Morningside Creek is a very flashy system, with multiple in-stream barriers and is heavily influenced by

urbanization; even though Redside Dace still persist in the upper reaches, the consistently 'poor' IBI score at the bottom of the catchment is not surprising and reflects cumulative impacts at the catchment level. Similarly, the RWMP station measuring 'poor' in the bottom of Main Rouge is reflective of cumulative impacts across the watershed.

As part of a 10 year summary of the RWMP, analysis of IBI scores across the TRCA jurisdiction was undertaken. Results from that exercise are used here to describe stream health conditions in the Rouge. The mean IBI score for the Rouge watershed was calculated for each sampling year (2003, 2006, and 2009) and compared to each other using the non-parametric Wilcoxon test (**Figure 3-2**). From this analysis, there was no significant difference found between the three sampling years (p value = 0.33). This suggests that there have not been any major shifts in stream health in the Rouge for the past 7 years. This is in general agreement with land use changes at the landscape level being only incremental during this time period. Localized variation (at the site level) can be observed at some stations but again, these differences are not significant. Sampling conditions (e.g., weather, flow) can influence results at a given sampling event but may not be reflective of changes in ecosystem form or function (either positive or negative).

The mean IBI scores for the Rouge are higher than those found for the TRCA jurisdiction and are similar to those calculated for the Humber River and Duffins' Creek watersheds (**Figure 3-2**). These three watersheds support large tracts of land in a relatively natural state. As the Rouge River watershed moves towards full build out in the Markham, Stouffville and Richmond Hill areas and retrofits to stormwater management in existing urban areas are implemented, longer term trends in IBI scores could show significant improvements to middle and lower reaches should the potential to maintain and restore the stream hydrology be realized.

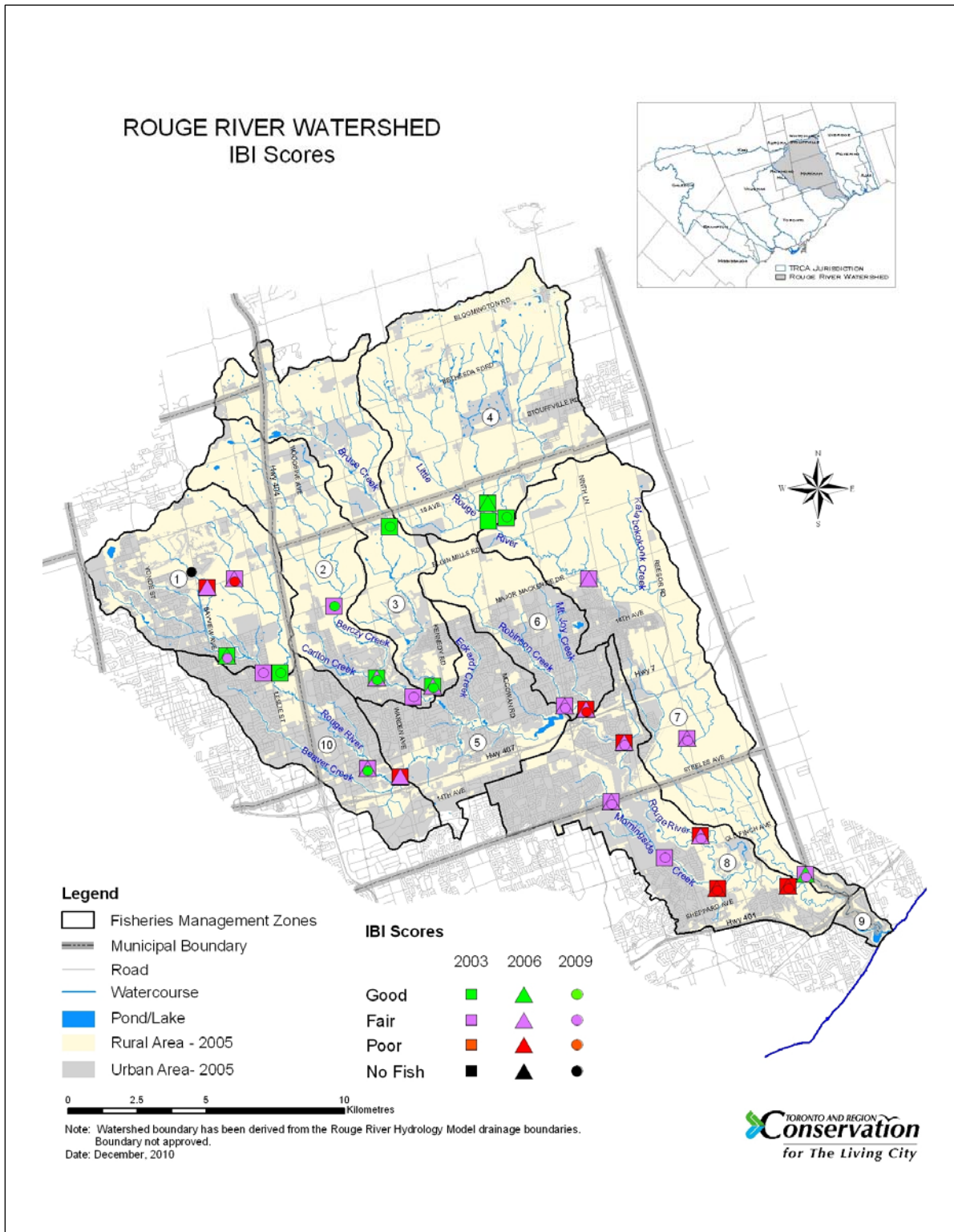


Figure 3-1: Index of Biotic Integrity (IBI) Scores for all RWMP Sites in the Rouge River (2003, 2006, and 2009)

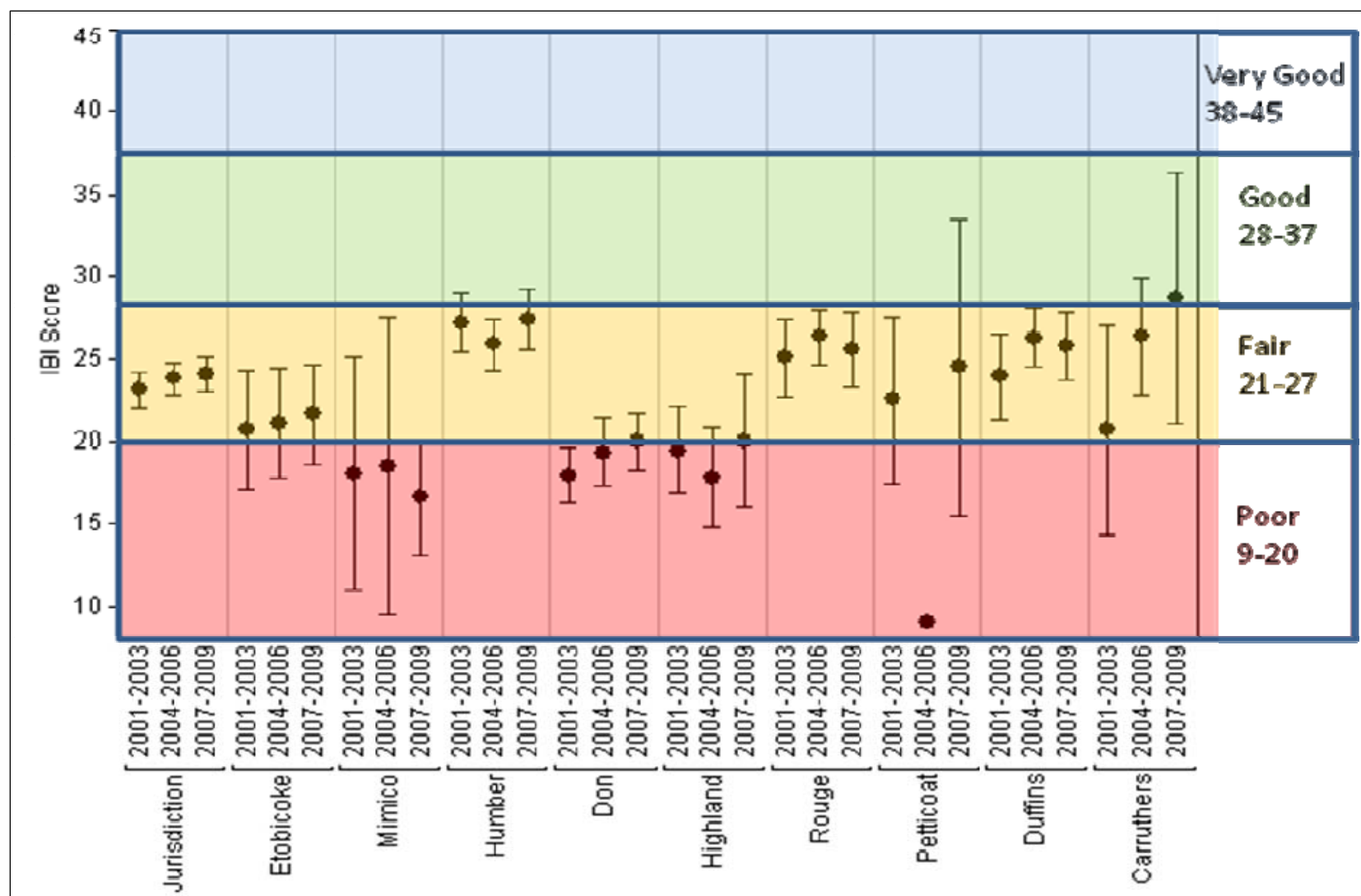


Figure 3-2: Mean Index of Biotic Integrity (IBI) Scores for all Watersheds in TRCA Jurisdiction Across the Ten Year Sampling Period (2000 – 2010)

3.2.3 Fish Canonical Correspondence Analysis (CAA) and Cumulative Impacts

Relationships between the amount of impervious cover (IC) and negative impacts to stream health are widely documented in the literature (Maude and Di Maio 1999; Center for Watershed Protection 2003; EC 2004b). As discussed in Chapter 2, Section 2.4, the development of a Landscape Disturbance Index (LDI), which estimates how much a given type of land cover has disturbed the natural land - stream processes, has gained interest as an alternate metric for predicting shifts in fish communities. This index is quantified by calculating a Fish CCA Score at the subcatchment and the watershed scale (Stanfield and Kilgour 2006; Stanfield and Gibson (2010). Unlike the IBI, which only considers in-stream habitat conditions, Fish CCA scores incorporate the influences of landscape on stream health and predict what fish community based on warm, cool, and cold community character, is likely to be present. These are only modeled results, meant to provide another level of interpretation to metrics like IBI scores and empirical data.

The predicted Fish CCA scores measure the stream condition of the most downstream point of a given catchment; this is effectively a measure of cumulative effects. Attributes used to evaluate the stream condition include: stream slope, surficial, geology, temperature, catchment size, and land use.

CCA Results for the Rouge River

This analysis used 2005 stream temperature data, 2002 land use data, calculated stream slope and catchment area using GIS, and Gelogic Survey of Canada mapping. A more detailed discussion of Fish CCA method, scores, and analysis is provided in the *Rouge River Watershed Scenario Modelling and Analysis Report* (TRCA 2007b).

For the most part, the headwaters of the Rouge have been identified as coldwater habitat. However, still within these upper reaches, the predicted CCA scores indicate the species reflective of the thermal habitat would shift rapidly to cool and/or warmwater despite known presence of groundwater (**Figure 3-3**). This is likely due to the cumulative warming influence of urbanization. Although the CCA does not model for on-line ponds, they are present in many of the upper reaches and would likely exacerbate thermal impacts.

Similar habitat gradients continue down through the watershed, but as the systems move towards warmwater in the lower portions and the cumulative impacts of increased urbanization occur, the range in habitat type is considerably smaller. Below Hwy 407, the predicted habitat is limited to the warmwater range of tolerant fish species.

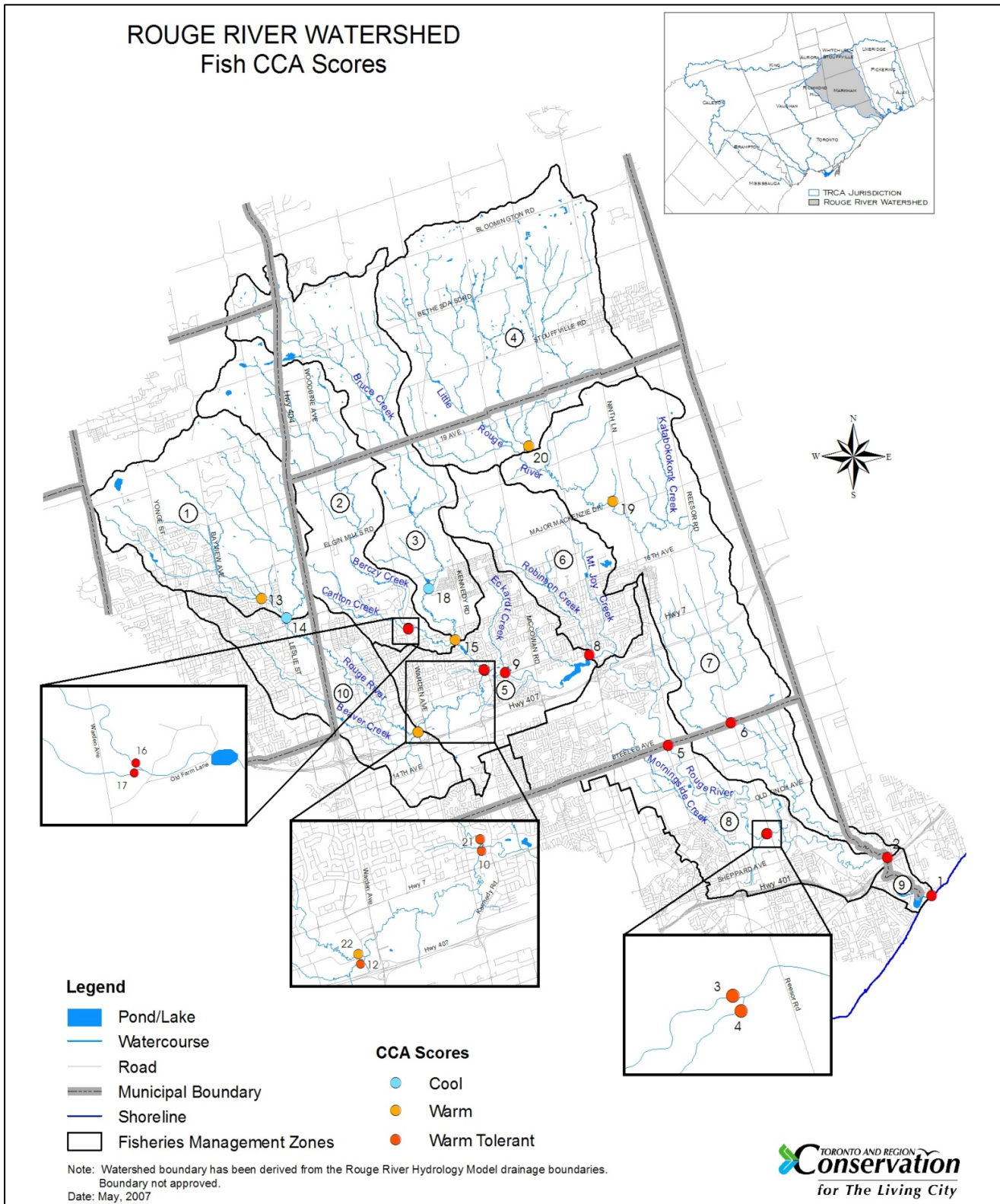


Figure 3-3: Fish Canonical Correspondence Analysis (CCA) Scores Analyzed for 2002 Landcover Types

3.2.4 Redside Dace

The protection and management of Redside Dace and its habitat within the Rouge River Watershed is a priority focus of this FMP. Redside Dace is a small, colourful fish that is endangered. In all of Canada, the species is found only in watersheds draining the western basin of Lake Ontario, with a few additional populations occurring in the Lake Huron and Lake Simcoe watersheds. However, the mid- and upper portions of the Rouge River watershed support the highest concentration of Redside Dace populations in Canada, adding national significance to the watershed. The species is also found in areas of the eastern and mid-western United States where declines have been reported.

Redside Dace characteristically lives in small and medium sized cool water streams. These types of streams have typically suffered significant degradation in urbanizing areas of Ontario as a result of associated changes in water balance, flow regime, channel destabilization, and impairment of water quality. The impacts of urbanization are considered the primary threats to Redside Dace (OMNR, 2010a) and general stream health conditions (TRCA 2010).

Prior to the protection currently afforded Redside Dace under the Endangered Species Act (2007) and up-listing of the species from threatened to endangered, protection requirements were guided principally by the Natural Heritage Sections of the PPS (OMMAH 2005a). It is important to recognize that despite protection efforts employed under the PPS, including over ten years of BMPs focused on stormwater management and channel function, such efforts have generally been ineffective in maintaining stream habitat conditions suitable for Redside Dace (OMNR 2010a) and other sensitive fish species within urbanizing areas (TRCA 2010). More effective assessment and mitigation of the cumulative impacts of urbanization on sub-watershed functions are required to maintain healthy stream conditions.

In recognition of the continuing urbanization pressures within the Rouge River watershed, this FMP endorses the establishment of Redside Dace Conservation Reserves as recommended by the *Recovery Strategy for Redside Dace (Clinostomus elongatus)* (OMNR 2010a). The idea is to identify high quality Redside Dace sub-catchment areas for the acquisition and protection of lands in support of comprehensive stream protection and natural heritage systems.

Redside Dace Protection under the Endangered Species Act (2007) (ESA)

The following section is intended to provide general guidance to agency staff, municipalities, development proponents, consultants, and the general public on how, when, and where the ESA applies to Redside Dace in the Rouge watershed. It is also important to emphasize that in addition to legal protection requirements under the ESA, there are other planning and environmental protection regulations, policies (refer to Chapter One) and management recommendations (refer to Chapters 3 and 4) that are relevant to habitat areas potentially falling under ESA. OMNR and TRCA are working together to ensure that wherever possible, ESA requirements support and complement broader watershed protection and planning objectives.

Under Section 17, the ESA allows for possible issuance of permits to conduct certain activities that would otherwise be prohibited under the Act. This requires that all other options or alternatives have been considered, described, and explained including the option of not proceeding with the proposal. The OMNR Aurora District office will screen and review projects to determine whether the proposal is likely to, or may contribute to the damage and destruction of the species or its habitat, in which case a 17 2(c) permit from OMNR may be required. If OMNR is of the opinion that the proposal is too damaging to the species or its habitat, the Ministry may require that the project not proceed.

In the course of conducting development review under its regulations and policies, the TRCA may discuss development proposals with OMNR and may also advise proponents of their requirement to contact OMNR directly for any works proposed within or potentially impacting upon Redside Dace habitat.

Once the requirement for a 17 2(c) permit has been established, the next part of the permit process requires the proponent to provide more detailed information including design drawings and construction timing. The proponent must also describe how impacts to the habitat will be avoided, reduced, minimized, and mitigated to the greatest extent possible. Once this has been done, the proponent is additionally required to undertake an “overall benefit” contribution to the species being affected by the permitted activity. For Redside Dace, this will typically involve some type of habitat protection, restoration, rehabilitation, water quality improvement or land acquisition. Overall benefit contributions will normally be identified and implemented beyond the area being directly affected by the permitted activity but within the local subcatchment to the extent that enhancement opportunities are present. The overall benefit contribution must clearly demonstrate that the actions taken can be expected to significantly improve habitat conditions and or local population condition above and beyond effective mitigation of the permitted activity. The combined effects of project mitigation and additional habitat enhancements must be sufficient to support the expected result of a positive local population response (e.g. increased reproductive output associated with new access to upstream areas). The scope and scale of overall benefit requirements can reflect the sensitivity of locations and the relative size, impacts, and complexity of development proposals.

Land uses or activities adjacent to Redside Dace habitat that may have indirect impacts that are potentially damaging to the species or its habitat (e.g. storm water outfalls) will also have to be reviewed for possible ESA permit requirements. All projects potentially impacting Redside Dace or its habitat should be submitted for review to the Aurora District Species at Risk Biologist.

The habitat of Redside Dace and that of all other Species at Risk is determined by OMNR. As Redside Dace is a stream dweller and seasonally moves to utilize different components of its habitat (Mark Poos, Fisheries and Oceans Canada, unpublished; OMNR 2011b), the determination of where the species is known to occur is based on a known occupied reach of stream. Stream reaches are identified by OMNR based on criteria used to identify Aquatic Resource Areas (ARAs). These criteria include thermal regime, stream order, channel

morphology, species community composition, and other criteria that help characterize and distinguish one stream reach from another.

As of February 2011, MNR has released a draft *Habitat Regulation for Redside Dace* (OMNR 2011a). The draft regulation identifies the stream corridor habitat of Redside Dace in occupied reaches and recovery areas as the width of meander belt plus an additional 30m, on each side of the stream. Other recommended elements of protected habitat include upstream and headwater drainage features, groundwater discharge areas or wetlands that augment or maintain downstream baseflows and water quality. Once the regulation is enacted, it will describe the habitat and where it occurs. Until that time, the general habitat protection provisions of the Act, pursuant to Section 2, will continue to be applied by OMNR whereby habitat is identified and protection requirements determined based on the best available existing information.

Redside Dace Habitat Screening Zones

For the reasons described above, this FMP provides Redside Dace screening zones that identify only the catchment areas where the species is generally found in the watershed. Not all portions of the catchments will be considered habitat. These screening zones are depicted on **Figure 2.2** and coincide with the construction timing windows for Redside Dace in the Rouge River Watershed. There may also be additional management and habitat protection requirements within these catchments related to Redside Dace, ESA, and natural heritage systems planning. As such, the identification of Redside Dace catchments is intended as a screening tool to show areas where additional regulatory and/or planning requirements may apply.

Construction timing windows are described in detail in Section 2.2. In the case of Redside Dace, there is a specific timing window applied at the subcatchment level where construction activities are limited to the period of July 1st– September 15th. If there is uncertainty about the status or distribution of Redside Dace in a specific zone, the precautionary principle will be applied whereby the more restrictive Redside Dace timing window may be required. Timing windows in areas of known occupied reaches are applied by OMNR. In other areas within Redside Dace catchments, Conservation Authorities apply timing windows on OMNR's behalf.

Redside Dace Long-term Monitoring Program

OMNR, in consultation with the Redside Dace Recovery Team and Conservation Authorities has established a series of long term monitoring stations within several Lake Ontario watersheds currently supporting Redside Dace. This species specific monitoring program is designed to generate the scientific data required to assess long term population trends. Monitoring locations are limited to one station within each currently occupied ARA. Each ARA is a stream reach or series of stream reaches that have similar characteristics such as fish community, thermal regime, channel form, and absence of barriers to fish movement. Some of the monitoring locations are stations previously established by Conservation Authorities as part

of their regional watershed monitoring programs. Through arrangement with OMNR, Conservation Authorities will continue to collect data from these stations in support of both programs. Other stations have been established where data are to be collected by OMNR or other authorized partners.

General Design Considerations for Projects in Redside Dace Habitat

Redside Dace streams are typically low gradient, narrow, slow moving watercourses with either an E or C channel form (Rosgen 1994). These streams are also typified by cool, clean water, often with localized groundwater contributions which support permanent pools used as refuge habitat. The riparian habitat of Redside Dace streams can vary, but open meadow and floodplain communities dominated by grasses and forbs provide optimal channel sinuosity, stable bank undercuts, and insect food production.

Projects intended and designed to support Redside Dace habitat should generally seek to create or enhance these types of conditions. Restoration or rehabilitation works will often be focused on narrowing and sometimes deepening stream channels that have become too wide and shallow as a result of upstream changes in flow regime. Bioengineering techniques have proven to be successful in limiting construction impacts and re-establishing stable, but living, bank conditions.

For the construction of new channels or the restoration of straightened channels, specific considerations of slope, gradient, soils, meander belt, and flow regime are required in order to determine the appropriate C or E channel sinuosity. For such constructed channels, existing groundwater contributions need to be quantified and alternative sources coinciding with the new channel alignment are required.

For riparian plantings, projects should consider the existing riparian conditions within the stream reach beyond the project site. Generally, at the stream reach level, a diversity of vegetated areas is desirable, including forested areas which provide shade and stream temperature moderation, shrub and thicket communities, and meadow and grass communities which support optimal channel conditions and food production for Redside Dace. Most planting projects provide a mix of trees and shrubs, with the trees located further away from the stream, and shrubs planted close to the water.

Is it important to recognize that all efforts directed to improve Redside Dace habitat (e.g., existing channel restoration, new channel creation, and riparian plantings), are only effective if the flow regime of the stream is matched to the enhancements. Unfortunately, there have been many examples in the past where substantial efforts have been undermined because increases in the flashiness of the stream (altered flow regime) have exceeded the capacity of the constructed works and have blown out the newly constructed or restored channel.

The design of all habitat enhancement, rehabilitation or channel realignment projects in Redside Dace areas should be discussed with OMNR prior to submission of any required

permit applications. Additional consultation with TRCA on technical and design considerations relating to channel realignments, specifically hydrological matters, may also be of benefit.

Redside Dace Research Needs

Continued research and follow-up monitoring is required to help determine the effectiveness of actions taken to mitigate impacts on water balance, flow regime, and channel form; and to assess the effectiveness of storm water management designs and planning to address cumulative effects on temperature and water quality parameters. These are the main threats to stream health in the Rouge River watershed, and research and monitoring will be required as part of the effort to reduce these threats.

In addition to these priority actions for the Rouge River, the *Recovery Strategy for Redside Dace* (*Clinostomus elongatus*) (OMNR, 2010a) and the *Redside Dace Ontario Government Response Statement* (OMNR 2010b) list additional research and monitoring considerations with a number of these opportunities applicable to the populations of Redside Dace within the Rouge River watershed. These include: competitive interactions with salmonids, rehabilitation of headwater features and hydrologic functions, invasive species, genetic diversity, physiological and ecological tolerances and changes and planning considerations associated with climate change.

3.2.4.1 Redside Dace Habitat Management Recommendations

The identification of Redside Dace habitat and protection requirements pursuant to the *Endangered Species Act* are provided in the sections above. This section provides recommendations for supporting measures to protect Redside Dace and its habitat.

Recommendation(s):

- (i) That the screening catchment map, provided in this FMP, be used by landowners, consultants, municipalities, agencies, and other stakeholders to help identify general sub-catchment areas where Redside Dace occur, and where additional regulatory and or planning requirements may apply. Development proposals falling within the catchment areas will be screened by the regulatory agencies. The provision of this publicly available map is intended to help all interested parties participating in the planning and development review processes.
- (ii) That best management practices be required on construction sites to meet sediment and erosion control standards. Extensive experience has shown that single constructed sediment fences are prone to failure and often do not work effectively. It is recommended that double sediment fences with hay bales, or equivalent sediment controls, be required for all in-water or near-water works within the Redside Dace screening zone.
- (iii) That soil exposure be minimized within Redside Dace screening zones by reducing the area of top soil stripping and grading prior to the commencement of

construction works, and also limiting the period of time that construction sites are graded prior to commencement of works, in accordance with draft plan approval and consistent with recommendations in the *Erosion and Sediment Control Guidelines for Urban Construction* (GGHAC, 2006), *Rouge River Watershed Plan* (TRCA 2007a), and draft *Guidance for Development Activities in Redside Dace Protected Habitat* (OMNR 2011b) The use of temporary seeding or other stabilizing techniques to minimize the period of soil exposure is recommended.

(iv) That the Berczy Creek (FMZ 2) and Kennedy Road Tributary (FMZ 4) subcatchment areas be considered for inclusion as a Redside Dace Conservation Reserve for the Rouge River watershed based on: existing stream and subwatershed conditions, and associated opportunities to conduct effective natural heritage systems planning.

(v) That the thermal management threshold of 24 ° C be applied to the design of all new stormwater management facilities where outfalls empty into Redside Dace habitat, in either occupied reaches or supporting upstream reaches. Thermal targets should also be applied to the cumulative contributions of multiple stormwater facilities at the subcatchment level.

3.2.5 Brook Trout

Brook Trout is a key target species that occupies relatively confined, coldwater habitat within groundwater fed reaches that occur across the headwaters of the Rouge watershed. This species spawns in the fall over clean gravel and proximal to high groundwater discharge zones. Egg incubation lasts approximately 100 days before fry emergence in the late winter or early spring. Sufficient groundwater contributions through the winter months are critical to providing ice-free conditions with sufficient oxygen for developing trout fry.

3.2.5.1 Brook Trout Habitat Management Recommendations

Providing strong protective management for the habitat of this species will also benefit the larger fish community through due regard for water balance and temperature needs and providing cumulative benefits to all downstream habitat.

Recommendation(s)

- (i) That an in-water or near-water construction timing window from June 15th to September 15th be applied to reaches where Brook Trout are present or immediately downstream.
- (ii) That understanding of water balance needs and the groundwater regime be of high priority and in sufficient detail to guide early land use planning.
- (iii) That dewatering activities be minimal or avoided in all identified Brook Trout habitat, in particular, Brook Trout spawning and egg incubation/hatching habitat (which depends on groundwater upwelling) between October 1st and March 31st.

- (iv) That discharge from any pumping activity meet ambient stream temperatures or be within an acceptable range for key target species as determined by regulatory agencies and not alter the normal flow characteristics of the receiving watercourse, (i.e., discharge flow must not exceed the erosion threshold for the receiving stream channel as determined through appropriate fluvial geomorphic assessment).
- (v) That the highest erosion and sediment control standards be met on construction sites extending as far downstream as the last confluence beyond known Brook Trout habitat required by best management practices and described in *Erosion and Sediment Control Guidelines for Urban Construction* (GGHAC, 2006). These controls should maintain current clarity and low turbidity conditions and water quality parameters, guided by the *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (CCME (Canadian Council of Ministers of the Environment) 1999).
- (vi) That top soil stripping and grading should be minimized prior to the commencement of work, be in accordance with draft plan approval and consistent with recommendations in the *Rouge River Watershed Plan* (TRCA 2007a) and *Erosion and Sediment Control Guidelines for Urban Construction* (GGHAC, 2006).
- (vii) That stormwater management controls be undertaken in a manner that ensures that discharge meets ambient stream temperatures or is within an acceptable range for target species to be determined by the appropriate regulatory agency.

3.2.6 Rainbow Darter

Rainbow Darter is a key target species that is found in highest abundance in the warmer watercourses of the lower Main and Little Rouge Rivers. Sensitive to pollution and siltation they prefer fast-flowing gravel and cobble riffles of clear clean watercourses, but are tolerant of some nutrient enrichment.

3.2.6.1 Rainbow Darter Habitat Management Recommendations

Rainbow darter requires management focus in order to more fully understand the health of the watercourses of the Rouge River. This species has a history of decline and extirpation in highly urbanized watersheds (e.g. Etobicoke, Mimico, Don and Highland Watersheds). Decline in Rainbow Darter abundance or distribution may be an early warning that aquatic system health and integrity are being pushed towards thresholds of wider species loss.

Recommendation(s)

- (i) That an in-water or near-water construction timing window from March 31st - July 1st to be applied in reaches that don't overlap with either Redside Dace or Brook Trout.
- (ii) That meeting water balance conditions and maintaining natural watercourse hydrology in upstream catchments is critical to maintaining spawning habitat for this species in downstream riffle areas.
- (iii) That the highest erosion and sediment control standards be met on construction sites by best management practices and described in *Erosion and Sediment Control*

Guidelines for Urban Construction (GGHAC, 2006). These controls should maintain current clarity and low turbidity conditions and water quality parameters, guided by the *Canadian Water Quality Guidelines for the Protection of Aquatic Life* (CCME 1999).

- (iv) That urban runoff should meet the Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 1999) to generally protect this species.
- (v) That top soil stripping and grading should be minimized prior to the commencement of work, be in accordance with draft plan approval and consistent with recommendations in the *Rouge River Watershed Plan* (TRCA 2007a) and *Erosion and Sediment Control Guidelines for Urban Construction* (GGHAC, 2006).
- (vi) That stormwater management controls be undertaken in a manner that ensures that discharge meets ambient stream temperatures or is within an acceptable range for target species to be determined by the appropriate regulatory agency.
- (vii) That this species should have specific monitoring developed to track its population status and condition within the watershed.

3.2.7 Mussels

Mussels are considered “fish” under the definition provided in the *Fisheries Act*. Freshwater mussels are susceptible to habitat destruction, poor water quality, damming, alterations to shoreline areas and wetlands, and agricultural run-off. The larvae of freshwater mussels depend on host species, usually fish, as they must attach to their fins or gills before they can mature into adults. Therefore, negative impacts on host fish species have direct impact on the freshwater mussels.

3.2.7.1 Mussel Habitat Management Recommendations

There is a lack of recent and comprehensive data for mussel species presence and distribution in the Rouge watershed.

Recommendation(s):

- (i) That construction activity may require a preliminary mussel survey in addition to standard aquatic surveys.
- (ii) That a formal survey for mussel presence and distribution be conducted across the watershed.

3.2.8 Aquatic Invasive Species (AIS)

Aquatic invasive species are introduced species capable of out-competing indigenous species for food or refuge resources and who therefore disrupt the balance of the native ecosystem. The spread of such species is considered to be one of the most serious threats to biodiversity (EC, 2004).

The Rouge River has no barrier at the mouth to prevent potential invasion by AIS from the lake into the watershed. Carp species are established in the Rouge marshes and are collected at various locations across the watershed, often associated with stormwater management ponds. Sea Lamprey (*Petromyzon marinus*) is currently chemically controlled by DFO (see Section 3.2.12 for more details).

Two relatively new AIS are: Rusty Crayfish (*Orconectes rusticus*) and Round Goby (*Neogobius melanostomus*). Rusty crayfish are frequently collected in high abundance in surveys throughout FMZ 7 (Little Rouge). A single Round Goby was first detected at Highway 2 in the Main Rouge by an angler in 2006. A recent survey (2009) conducted by DFO collected a total of 120 Round Goby further upstream at the confluence of the Main Rouge and Little Rouge; the subsequent 2010 survey covered the same area and confirmed the distribution (further upstream areas were not surveyed).

There is a dam on the main branch at Milne Reservoir that can control access to headwaters via a manually operated cage/gate system. The Little Rouge has no such barrier and is quite vulnerable to AIS spreading throughout this system and up into the headwaters.

OMNR is monitoring the relative seasonal position of Round Goby below dams to determine its movement patterns and see if there is a management window during which rivers are less vulnerable to new invasion (e.g., does Round Goby move out into the Lake to overwinter?). The Ontario Federation of Anglers and Hunters (OFAH) also has outreach programs to educate the general public regarding AIS and what they can do to prevent introductions and spread.

3.2.8.1 AIS Management Recommendations

The increased distribution and/or continued presence of AIS in the Rouge River watershed is currently being measured through monitoring activities.

Recommendation(s):

- (i) Priority emphasis should be placed on monitoring and preventing the spread of invasive and exotic fish species and disease.
- (ii) Increase the coordination of existing stewardship and outreach programs to prevent new introductions and any further spread of aquatic invasive species, particularly Round Goby and Sea Lamprey. Priority on AIS prevention should be placed on the Little Rouge as there are no significant in-stream barriers from the Lake to headwaters.
- (iii) Continue to support investigations initiated by DFO Sea Lamprey Control to assess the feasibility of a seasonal barrier at the mouth of the Rouge River as an alternative to chemical control of Sea Lamprey. Upon the completion of this FMP, move forward with inter-agency consultation (DFO, OMNR, TRCA) to determine future Sea Lamprey control strategy.

3.2.9 Stocking

The introduction of Pacific salmon species into Lake Ontario has been occurring at various intensities since the late 1800s with formal stocking of some rivers feeding Lake Ontario beginning in the 1960s by OMNR (Kerr, 2006).

History of Stocking in the Rouge

Commencing in the 1980s, Rainbow Trout were stocked in several of the smaller feeder streams above the Milne Reservoir on the Rouge River Main Branch for the purpose of establishing a Rainbow Trout fishery as part of the Lake Ontario Fisheries Management Program. By the time the 1992 RRFMP had been completed, it was recognized that in order to achieve self-sustaining populations of Rainbow Trout and other species, rehabilitation of watershed conditions was required. This would allow adult fishes returning to the river from the lake to access the headwaters of the Main Rouge and some of the tributaries above the dam. The objective of establishing a naturalized population of Rainbow Trout in the Rouge River was laid out in the 1992 RRFMP. Annual stocking of Rainbows was to continue in support of this objective until such time as natural reproduction was confirmed and a self-sustaining population was established.

The 1992 RRFMP also recognized the importance of protecting resident Brook Trout populations in headwater areas from displacement or foraging competition from Rainbow Trout. This was to be achieved by the strategic maintenance of some of the existing barriers that prevent Rainbow Trout from accessing headwater areas. A provincial Class EA for the development of the Milne Reservoir Fishway further detailed the need to maintain specific barriers on Bruce Creek at Bruce's Mill Conservation Area and the Silver Springs Farms dam in Richmond Hill to prevent Rainbow Trout movement into these headwater systems. The 2010 Rouge River FMP reiterates this emphasis on protecting Brook Trout and additionally identifies a similar need to ensure that Redside Dace are not negatively impacted by Rainbow Trout.

In 1994, the Metro East Anglers (MEA) became an active partner in the fisheries management program for the Rouge River. With funding provided by the OMNR Community Fisheries Improvement Program (CFIP) and other partners, the club constructed an upwelling incubation box for trout on a small groundwater tributary of the Rouge River at the Parkview Golf Course property early in 1995. Egg collections from wild Rainbow Trout were conducted in March of 1995. Due to the difficulty of capturing sufficient numbers of mature adult Rainbows in the Rouge River, the egg collections were carried out in Duffins Creek. From 5800 eggs, which were placed into the incubation boxes, 3500 fry were released into the river in June. In April of 1996, Rainbow Trout egg collections again occurred, and in November, Brown Trout and Atlantic Salmon eggs were also incubated, with these eggs being supplied by the OMNR fish hatcheries. Over the next few years, the club continued hatching these species and the upwelling boxes were phased out as a small hatchery facility was constructed at the tributary site. In the fall of 2006, the MEA operation was transferred to the Ringwood Fish Culture Station, where volunteers continue their work in association with OFAH and OMNR. As of Fall

2010, the future operations of the Ringwood Hatchery are not certain as lease agreements between OFAH and OMNR expire.

Existing Conditions: Stocking in the Rouge River

Fish species identified as targets for a lake-based fishery are Atlantic Salmon, Rainbow Trout, Brown Trout, Chinook Salmon and Coho Salmon. From this list, only Rainbow and Brown Trout are currently stocked annually in the Rouge River for sustained recreational angling opportunities. Chinook are also found within the Rouge River, but they are not stocked in this watershed. Chinook are present in Lake Ontario as a result of stocking practices in neighbouring watersheds and some individuals stray to the Rouge during the spawning migration.

Stocking sites are located across the watershed proximal to known discharge zones in the lower reaches of FMZ 1, FMZ 2, FMZ 3, FMZ 4, FMZ 6 (Robinson Creek) and FMZ 8 (Morningside Creek). Stocking sites were selected based on the direction provided by the 1992 RRFMP which included mapping of high quality habitat for juvenile Rainbow Trout. Some of the sites were located above in-stream barriers which would prevent returning adults from gaining access to the habitat, and some sites were located in streams that contained healthy Brook Trout or Redside Dace populations.

3.2.9.1 Stocking Recommendations

Main Rouge River

Rainbow Trout stocking has occurred in the Rouge River watershed since the early 1980s. As part of the original 1992 RRFMP, the goal of this stocking program was to support the production of Rainbows for watershed and the Lake Ontario fishery. The 1992 RRFMP also established the goal of the eventual naturalization of Rainbow Trout in the Rouge system, which is a self-sustaining population. In 2004, the completion of the Milne Dam Fishway allowed for passage of Rainbow Trout (and native species) above the Milne Dam and reservoir into previously inaccessible upper and middle portions of the Rouge River watershed.

In addition to fishway operations, spawning surveys of adult Rainbow Trout returning from Lake Ontario have documented substantial spawning activity in several tributaries of the Rouge. Young-of-the-year (YOY) Rainbow Trout have been showing up with increasing frequency in fish sampling stations indicating that there may be natural recruitment of Rainbow Trout now occurring in the Rouge River watershed. Additional assessment and monitoring of natural Rainbow Trout production in the Rouge is required to inform management decisions. Confirmation of a self-sustaining population would mark the successful achievement of the 1992 RRFMP objectives. If this objective has in fact been achieved, or is likely to be achieved, the discontinuance of stocking in the Rouge River should be considered.

The *Rouge River Watershed Plan* (TRCA 2007a) has provided a substantial amount of new information on hydrogeology and hydrology within the watershed. This type of information

helps further identify, and possibly predict areas within the specific fisheries management zones that are suitable for the production of Rainbow Trout. These areas include groundwater discharge zones and general coldwater conditions that are favourable for the production of Rainbow Trout. Three areas identified to support Rainbow Trout, without impacting Redside Dace or Brook Trout populations are; the middle reaches of the Main Rouge (FMZ 10); the lower reaches of Robison Creek from the confluence with the Main Rouge upstream to the barrier dam north of Highway 7 (FMZ 6); and the lower reaches of Morningside Creek from the confluence with the Main Rouge upstream to the collapsed concrete channel structure (FMZ 8).

Recommendation(s):

- (i) That assessment of the occurrence and level of natural production of Rainbow Trout in the Rouge be continued.
- (ii) That monitoring activities at the Milne Fishway be continued and expanded partnership opportunities with other interested groups be considered.
- (iii) That spawning surveys and YOY surveys to be continued and expanded.
- (iv) That all fishes stocked in the Rouge should be marked (by fin clipping or other means) to allow for identification of hatchery origin. This will allow for the distinction and identification of naturally produced fish.
- (v) That concerns and evidence relating to the potential adverse effects of stocked Rainbow and Brown Trout on Redside Dace (i.e., predation and/or resource competition) be assessed and documented by MNR prior to any future proposed stocking of Rainbow or Brown Trout in those portions of the Rouge watershed supporting Redside Dace. This recommendation also applies to headwater areas supporting Brook Trout.
- (vi) That the recent decision by OMNR to relocate all Brown Trout stocking to the Lake Ontario shoreline is supported by this FMP.
- (vii) That no other non-native salmonid species be stocked in the Rouge River watershed.

Little Rouge River

In the Little Rouge subwatershed there are no significant barriers to migrating Rainbow Trout between Lake Ontario in Toronto and 19th Avenue in Markham. Although there are a number of stocking sites in this subwatershed, there has been no follow-up assessment of survival and growth of the stocked fish, or spawning surveys to document reaches of stream being utilized by returning adults.

Following from technical studies in the *Rouge River Watershed Plan* (TRCA 2007a) a potential Rainbow Trout production zone in the Little Rouge subwatershed is the main stem of the Little Rouge (FMZ 7) between 16th Avenue and Elgin Mills Road. Rainbow Trout production in this reach should not impact Redside Dace or Brook Trout populations.

Recommendation(s):

- (i) That stocking recommendations (i) and (iii)-(viii) inclusive provided above for the Main Rouge River be similarly applied to the Little Rouge subwatershed.

3.2.10 In-Stream Structures and Barriers

In-stream structures refer to a variety of things, natural and man-made, such as road crossings (e.g., bridges, culverts), dams, low head weirs, channelization, velocity control structures, protective covering for sewers, pipes, cables, log jams and beaver dams. All of these structures, whether fully or partially within the watercourse, have the potential to affect fluvial-geomorphologic processes. Some of these structures may also impede or fully prevent fish movement, either seasonally or year round, and are referred to, in this FMP, as in-stream barriers. Impacts to fishes and fish habitat associated with in-stream barriers include:

- Preventing or impeding the passage of both migratory and resident fish species
- Preventing or impeding access to spawning, nursery or feeding habitats and refugia (e.g., temperature, spills)
- Preventing or impeding the ability to re-colonize new habitats
- Limiting gene flow
- Altering the natural flow regime of a watercourse
- Changes to sediment transport and nutrient cycles
- Increasing stream temperatures when on-line impoundment ponds are created, this in turn alters the metabolic rates of aquatic species

These fundamental alterations to fishes and fish habitat can have significant ecological ramifications at a range of spatial and temporal scales (Poff et al.1997; Poff and Hart 2002; Cumming GS 2004; Wofford et al. 2005). One specific example involves on-line impoundment ponds that cause suspended particles to settle out due to lower water velocities. Over time, the pond fills with sediment, potentially starving downstream reaches of natural bedload. The risk to fishes associated with this accumulation of sediment is if the weir or dam structure fails and there is an uncontrolled release of sediment. This material can damage downstream aquatic habitats by siltation and/or smother eggs impairing successful recruitment. In addition, ponds receive little shade and can warm up considerably during the summer months. The warmer water may reach temperatures above limits tolerated by downstream aquatic communities and gradually change cold or cool downstream habitats to warmwater.

In general, a goal for fisheries management is to reconnect the headwater habitats to the lake, but some barriers can be an effective measure for preventing the spread of invasive fish species or provide strategic partitioning between native resident fishes and migratory native or introduced populations. As such, the removal, mitigation, or maintenance of a barrier needs to consider the suite of ecological and management objectives at play. The traditional approach

of first removing or mitigating the lower-most barrier within a watershed, then working systematically upstream, may still be reasonable after weighing the issues of invasive species, then landownership, financial, and technical constraints. However, some priority should be given to conducting work where there is opportunity to improve the distribution of rare or at-risk species to ensure their continued survival, regardless of location.

Existing Conditions in the Rouge River: In-stream Barriers

A formal survey of in-stream structures and assessment of barriers to fish passage were conducted in the Rouge River Watershed from 2005-2006. A total of 353 km out of 427 km (total watershed stream length) were surveyed. A total of 806 structures were documented of which approximately 253 were determined to be barriers to fish passages, with the majority of barriers being road crossings (e.g., perched culverts), weirs, and dams (**Figure 3-4**). For purposes of this FMP, the top 33 barriers for priority management (e.g., removal, mitigation, or species partition) are identified and are presented as recommendations in the following Section 3.2.10.1.

This project was used to gain a more comprehensive understanding of the distribution of in-stream barriers to fish movement, and to assist fisheries managers when making management decisions with regard to:

- Species at risk (e.g., Redside Dace)
- Native fish population
- Invasive species (e.g., Rusty Crayfish, Round Goby)
- Migratory vs. resident fish populations
- Thermal classification
- Freshwater mussel populations

For the purposes of fisheries management, barriers can be broadly classified as either “impacting” or “beneficial” and is the basis for management direction in this FMP. Beneficial barriers perform a function of “desired” species partitioning (e.g., Redside Dace separate from Brown Trout; resident fish communities separate from migratory or invasive species). Generally speaking all other barriers are arguably impacting by way of fragmenting habitat of resident fishes or causing warming of downstream temperatures.

In-stream barriers were assessed under summer low flow conditions to the extent possible (72 hours of no rain prior to survey). These conditions present the most likely scenario that fish movement would be blocked (highest elevation change between downstream surface water level and top of barrier). However, under higher flows (spring, fall) these same structures may become passable, particular for jumping fish species. Thus, the term “seasonal barrier” may apply.

The cost of barrier mitigation work is significant. The work that is undertaken should target those structures that offer the most benefit to the aquatic system. Through the barrier assessment process, key structures have been identified that will offer the aquatic system the greatest immediate benefits. It is recommended that the prioritized list of structures within this Plan form the basis from which discussions are initiated.

It should be noted that a portion of the barrier mitigations undertaken occur through *Fisheries Act* requirements for compensation due to a harmful alteration, disruption, or destruction of fish habitat, which are often tied to the general area of an infraction. Where possible, a systems based view is advocated, and compensation activities should be targeted on work that will offer the greatest benefit to the system. This may involve examining off-site compensation.

The ownership of structures and feasibility of the specific undertakings has not yet been conducted, and shall require additional site-specific investigation. From a feasibility perspective, where on-line ponds are present, taking the pond off-line or entirely removing a barrier are the preferred alternatives to mitigate their impacts. Where infeasible, either providing fish passage or the conversion of the outlet to a bottom draw structure should be considered, however, careful assessment must be undertaken to ensure downstream habitat is improved.

A bottom draw configuration allows cooler water from the pond bottom to be drawn to the outlet. Downstream aquatic communities benefit from the higher oxygen content and lower relative temperature of the cooler water. However, this method still precludes fish passage, requires continued maintenance, and in some cases may not improve downstream oxygen content due to the biological oxygen demand (BOD) in the pond itself.

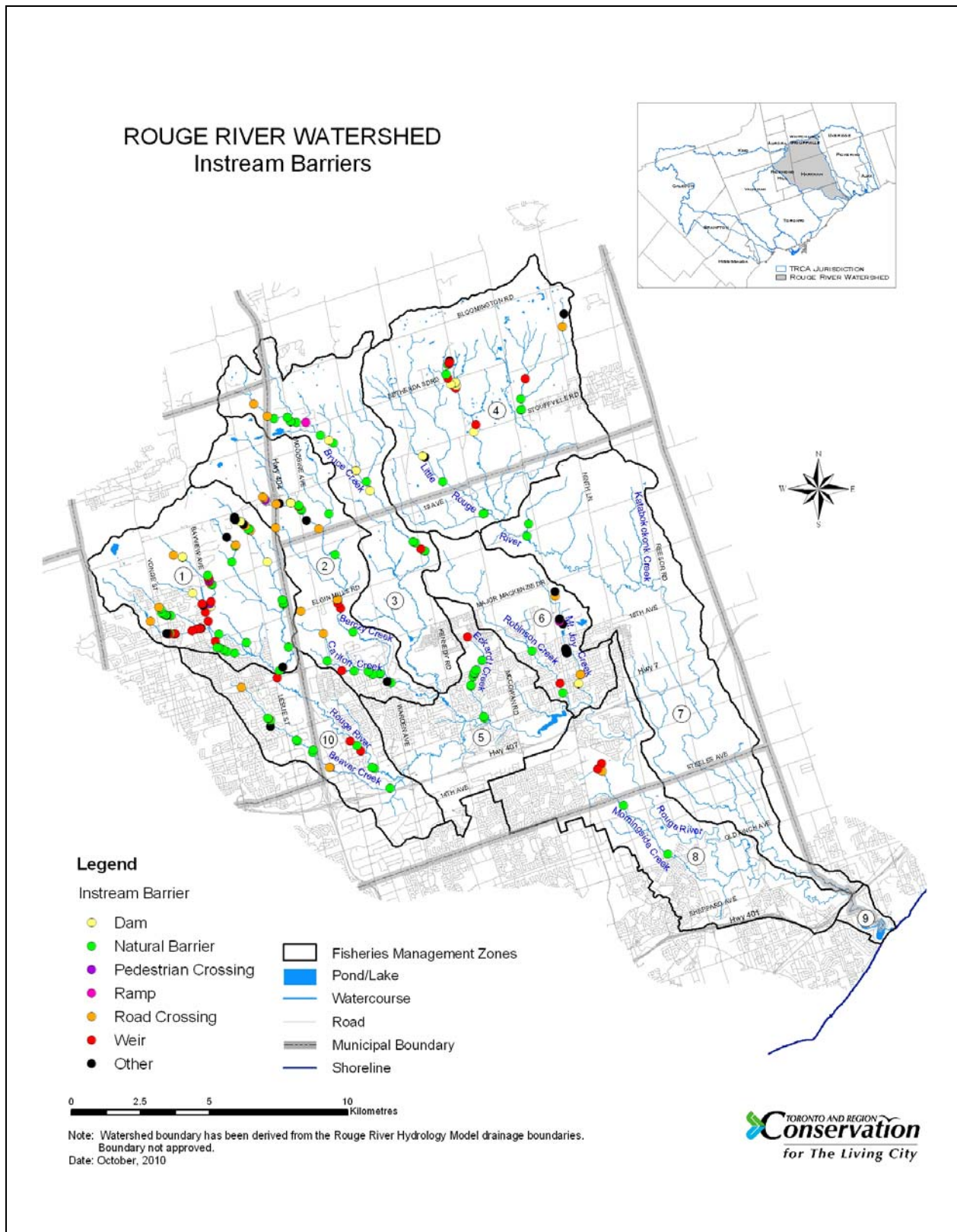


Figure 3-4: All Existing Fish Passage Barriers within the Rouge River Watershed

3.2.10.1 Fish Passage Recommendations

For the purposes of fisheries management, certain critical impacts or functions of barriers can be defined and used as the basis for identifying management priorities. These include:

- barriers which have negative impacts such as fragmenting fish populations or warming stream temperatures especially in coldwater habitat;
- strategically beneficial barriers which either exist or could be constructed to partition resident species from migratory species OR invasive species;
- the presence of good stream habitat condition within an FMZ that is not currently subject to future and/or extensive urban planning.

The entire barrier database was examined in order to identify priority barriers for each of the Fisheries Management Zones. A total of 33 key barriers to fish passage, which meet the criteria for being priority barriers were identified.

Figure 3-5 shows the location of the priority barriers. **Table 3-3** provides information on the priority barriers.

Recommendation(s)

- (i) That the priority barriers identified in this FMP be used to direct strategic management actions subject to ownership, feasibility, and permitting considerations.
- (ii) That there is continued support of investigations initiated by DFO Sea Lamprey Control to assess the feasibility of a seasonal barrier at the mouth of the Rouge River as an alternative to chemical control of Sea Lamprey. Upon the completion of this FMP, move forward with inter-agency consultation (DFO, OMNR, TRCA) to determine future Sea Lamprey control strategy.

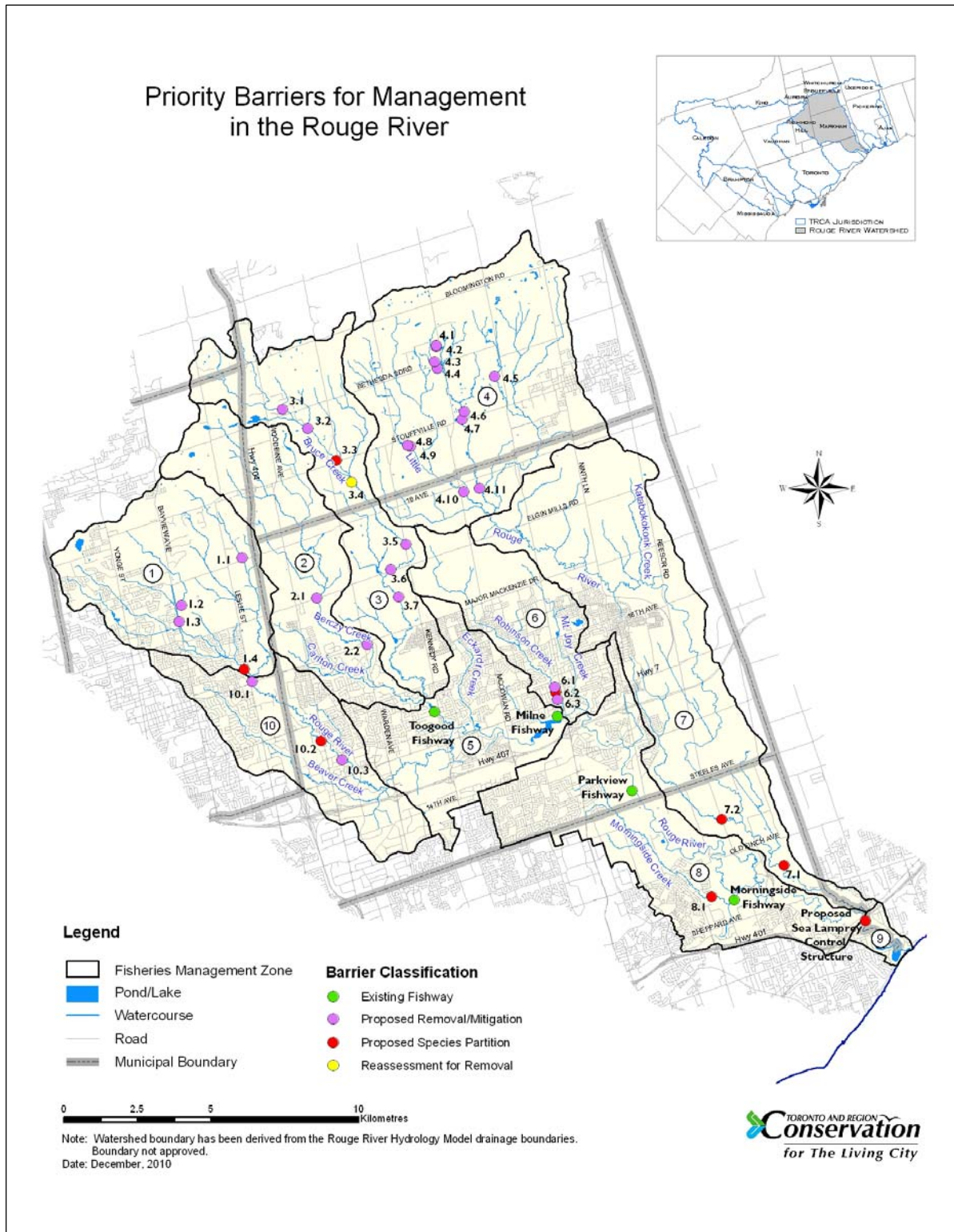


Figure 3-5: Priority Barriers for Management in the Rouge River

Note: Inclusion in this FMP does not preclude any barrier project from requiring approvals and permits under existing legislation. Engineering feasibility, economics and structure ownership/access have **not** been determined

Table 3-3: Prioritized Structures for In-stream Barrier Management

Priority Barrier	FMZ	Reach (if applicable)	Description and Proposed Management Action	Rationale
1.1	1	Leslie Tributary	Concrete dam on private property upstream of 19th Ave should be mitigated or removed.	Barrier to fish movement (potential Redside Dace zone)
1.2	1	West Tributary	Old concrete dam upstream of private driveway, opposite Subrisco Ave. should be mitigated or removed.	- Thermal impacts from top draw dam - Barrier to fish movement (Brook Trout zone).
1.3	1	West Tributary	Weir at nursery on Bayview Ave. upstream of Elgin Mills should be mitigated or removed.	- Thermal impacts from top draw dam - Barrier to fish movement (Brook Trout zone).
1.4	1	West Tributary	"Silver Streams Farm" dam is a decades old structure with stop logs that should remain as a species partition.	Continued protection of Brook Trout habitat from migratory salmonids (Rainbow Trout, Brown Trout and Chinook Salmon)
2.1	2	Berczy Creek	Perched culvert under Elgin Mills should be mitigated (e.g., rocky ramp).	Barrier to fish movement
2.2	2	Berczy Creek	Concrete dam on private property south of Major MacKenzie Dr. and east of Warden Ave. should be mitigated (e.g., bypass channel).	Barrier to fish movement
3.1	3	Bruce Creek	Perched culvert upstream of Bethesda Rd. should be mitigated.	Perched culvert fragments coldwater Brook Trout habitat
3.2	3	Bruce Creek	Large concrete dam on private property between Stouffville Rd. and Bethesda Rd. should be mitigated or removed.	- Thermal impacts from top draw dam - Barrier to fish movement (Brook Trout zone)
3.3	3	Bruce Creek	Large concrete dam upstream of Stouffville Road should be mitigated (e.g. bypass channel) or removed.	- Thermal impacts from top draw dam - Barrier to all fish movement (Brook Trout zone)
3.4	3	Bruce Creek	Remnant infra-structure of Bruce's Mill Dam requires re-assessment for removal versus maintenance as a species partition.	Barrier to all fish movement (potential range expansion of Redside Dace habitat) but protects upstream Brook Trout habitat from migratory salmonids
3.5	3	Bruce Creek	Old concrete dam upstream of Elgin Mills Rd and east of Kennedy Rd should be mitigated or removed .	Barrier to fish movement (Redside Dace zone)
3.6	3	Bruce Creek	Low head weir upstream of Elgin Mills Rd. and west of Kennedy Rd. should be mitigated or removed.	Barrier to non-jumping fish movement (Redside Dace zone)
3.7	3	Bruce Creek	Small old concrete dam on Angus Glen Golf Course is failing and should be removed.	Barrier to non-jumping fish movement

Priority Barrier	FMZ	Reach (if applicable)	Description and Proposed Management Action	Rationale
4.1	4	McCowan Tributary	A small weir South West of McCowan Road that has been made out of concrete cinder blocks should be mitigated or removed.	Barrier to all fish movement (Brook Trout zone)
4.2	4	McCowan Tributary	A small weir south-west of McCowan Rd. made out of wooden stop logs should be mitigated or removed.	Barrier to resident fish movement (Brook Trout zone)
4.3	4	McCowan Tributary	Small weir constructed of steel beams upstream of Bethesda Rd. should be mitigated or removed.	Barrier to resident fish movement (Brook Trout zone)
4.4	4	McCowan Tributary	Small weir constructed of 4 by 4 beams downstream of Bethesda Rd. should be removed.	Barrier to resident fish movement (Brook Trout zone)
4.5	4	Markham Tributary	Large concrete dam (95cm in height) on Spring Lakes Golf Club upstream of Stouffville Rd and west of Hwy 48 should be mitigated or removed.	- Thermal impacts from top draw dam - Barrier to all fish movement (Brook Trout zone)
4.6	4	McCowan Tributary	Small weir on Spring Lakes Golf Club up stream of Stouffville Rd. should be mitigated or removed.	Barrier to non-jumping fish movement
4.7	4	McCowan Tributary	Concrete dam upstream of Stouffville Rd. should be mitigated (e.g., bypass channel) or removed.	Barrier to all fish movement
4.8	4	Kennedy Tributary	Large concrete dam south of Stouffville Rd. should be mitigated or removed.	- Thermal impacts from top draw dam - Barrier to all fish movement (Redside Dace zone)
4.9	4	Kennedy Tributary	A large pile of wood debris (pallets) and other material that limits fish movement and is unlikely to be moved by natural processes.	Barrier to resident fish movement (Redside Dace and Brook Trout)
4.10	4	Kennedy Tributary	Large concrete dam (66 cm in height) south-east of McCowan Rd. and 19th Ave. should be mitigated or removed.	- Thermal impacts from top draw dam - Barrier to all fish movement (Redside Dace zone)
4.11	4	McCowan Tributary	Large concrete dam downstream of 19th Ave should be mitigated or removed.	- Thermal impacts from top draw dam - Barrier to all fish movement (Brook Trout zone)
6.1	6	Robinson Creek	Weir at Robinson St. crossing should be mitigated (e.g., rocky ramp) or removed.	Weir blocks non-jumping fish movement (Redside Dace zone)
6.2	6	Robinson Creek	Small concrete dam 300m north of Hwy 7 may limit Rainbow Trout migration when water levels are low - consider retaining and potentially raising barrier as a species partition.	Fragments Redside Dace habitat but could protect this habitat from migratory Rainbow Trout

Priority Barrier	FMZ	Reach (if applicable)	Description and Proposed Management Action	Rationale
6.3	6	Robinson Creek	Weir immediately upstream of Hwy 7 should be mitigated or removed.	Weir blocks non-jumping fish movement (Redside Dace zone)
7.1	7	Little Rouge River	A small weir made of armour stone that prevents non-jumping fish movement under very low flow conditions - consider retaining and potentially raising as a species partition.	This is the first structure upstream of Lake Ontario within the Little Rouge River. Further expansion of the AIS Round Goby is of high concern.
8.1	8	Morningside Creek	A large, collapsing velocity control weir, made of poured concrete – possible direction to stabilize this structure and retain as a species partition requires further investigation and consultation with Rouge Park and other stakeholders.	Protects upstream Redside Dace habitat from migratory salmonids
9.1	9	Mouth of the Rouge	No existing structure/barrier - consider the installation of a seasonal or removable barrier to prevent migration of sea lamprey.	As an alternative to lampricide, DFO is currently assessing feasibility of seasonal/removable barrier at the mouth of the Rouge for Sea Lamprey control.
10.1	10	Upper Rouge	Culvert under Major MacKenzie Rd. east of Leslie St. has a drop structure associated with it that should be mitigated or removed.	Drop structure blocks non-jumping fish movement
10.2	10	Upper Rouge	Weir at Markham Golf club under a pedestrian walkway - consider maintenance of this structure as a species partition.	With movement of Round Goby into the system, its future distribution is yet to be determined. This structure could act as a control option should this species move up beyond Milne Reservoir.
10.3	10	Upper Rouge	Gabion baskets lining the stream east of Woodbine Ave. and upstream of Hwy 7 should be removed in conjunction with appropriate bank stability measures if required.	Limits movement of non jumping fish and appears to be a small scale project

3.2.11 Riparian Habitat

Within the context of this Plan, the riparian zone is defined as the area within 30m immediately adjacent, on either side, to the stream. The amount and type of vegetation within the Rouge River riparian zone was based on 2002 air photo and used the following habitat categories: forest, meadow, successional, and wetland habitats. Based on this analysis, only 65% of the total potential riparian area in the watershed has natural cover, with a large portion of that occurring within Rouge Park. Of this existing riparian vegetation, forest cover represents 54% (922 ha) then meadow at 35% (603 ha) followed by successional and wetlands at about 5% coverage each. For more detailed discussion on existing riparian condition, see the *Rouge River State of the Watershed Report* (TRCA 2007c).

It is recognized that the above riparian analysis is fairly coarse and thus meant only as preliminary guidance. Information collection at the site level and/or from more recent years may produce a detailed design for riparian planting that does not exactly reflect the FMP mapping. Alternate techniques to delineate drainage patterns (e.g. ArcHydro) may also be used to create more refined and detailed mapping than is presented in this Plan. Such refined drainage mapping may have the benefit of identifying more area for riparian planting opportunities.

Restoration efforts are continually underway across the watershed to increase riparian zone vegetation. Such projects are undertaken by a number of different agencies and groups, including TRCA, Rouge Park, Municipalities, Ontario Streams and Ten Thousand Trees.

3.2.11.1 Riparian Habitat Recommendations

The riparian habitat in the Rouge River watershed was further examined and divided into 3 zones based on vegetation type needed to support the key target fish species (**Figure 3-6**). This direction is meant as a starting point for riparian rehabilitation and restoration plans but in some cases planting opportunities may be extended to the floodplain and/or tableland consistent with the targeted TNHS as outlined in the *Rouge River Watershed Plan* (TRCA 2007a).

Recommendation(s):

- (i) That a closed tree canopy be considered in areas coded dark blue. These are generally coldwater habitats where tree planting will provide shading to mitigate thermal impacts and improve connections to upland forest through maximizing infiltration and restore/maintain hydrological function to the watercourse.
- (ii) That mixed vegetation communities ((e.g., tall grasses, shrubs, herbaceous and emergent plants) be considered in areas coded light blue. These locations currently have minimal direct tree cover but likely to benefit from the suggested riparian cover through bank stabilization, maintenance of stream morphology.
- (iii) That mixed vegetation with a mature tree set back is considered in areas coded orange. These areas are generally located in lower reaches of the watershed and in need of

bank stabilization as flows increase. Treed set backs are recommended to reduce damage to large woody vegetation from flooding and winter ice.

- (iv) That in addition to the Rouge River FMP, the TRCA *Terrestrial Natural Heritage Strategy* (2007d) be consulted for direction on appropriate natural cover targets on table lands and the Provincial *Endangered Species Act* (2007) be consulted for specific regulations on restoration and rehabilitation works within the riparian zone for Redside Dace streams. This zone includes, at a minimum, the width of the stream meander belt plus an additional 30 metres on both sides of the stream.
- (v) That all other landscape level planning initiatives be consistent with the most protective direction for riparian widths applicable for a given area in the watershed, e.g., along the Oak Ridges Moraine there is a minimum vegetation protection zone of 30 m to be determined by a natural heritage evaluation of features and function as described in the *Oak Ridges Moraine Conservation Plan* (OMMAH 2002) and within Rouge Park as defined by the *Rouge Park Management Plan* (Province of Ontario 1994), the *Little Rouge Corridor Management Plan* (RPA 2007), and the *Rouge North Management Plan* (RPA 2001).
- (vi) That alternative methods (to that presented in this Plan) for delineating drainage patterns be supported on a project by project basis such that the maximum amount of riparian habitat may potentially be restored across the Rouge Watershed.

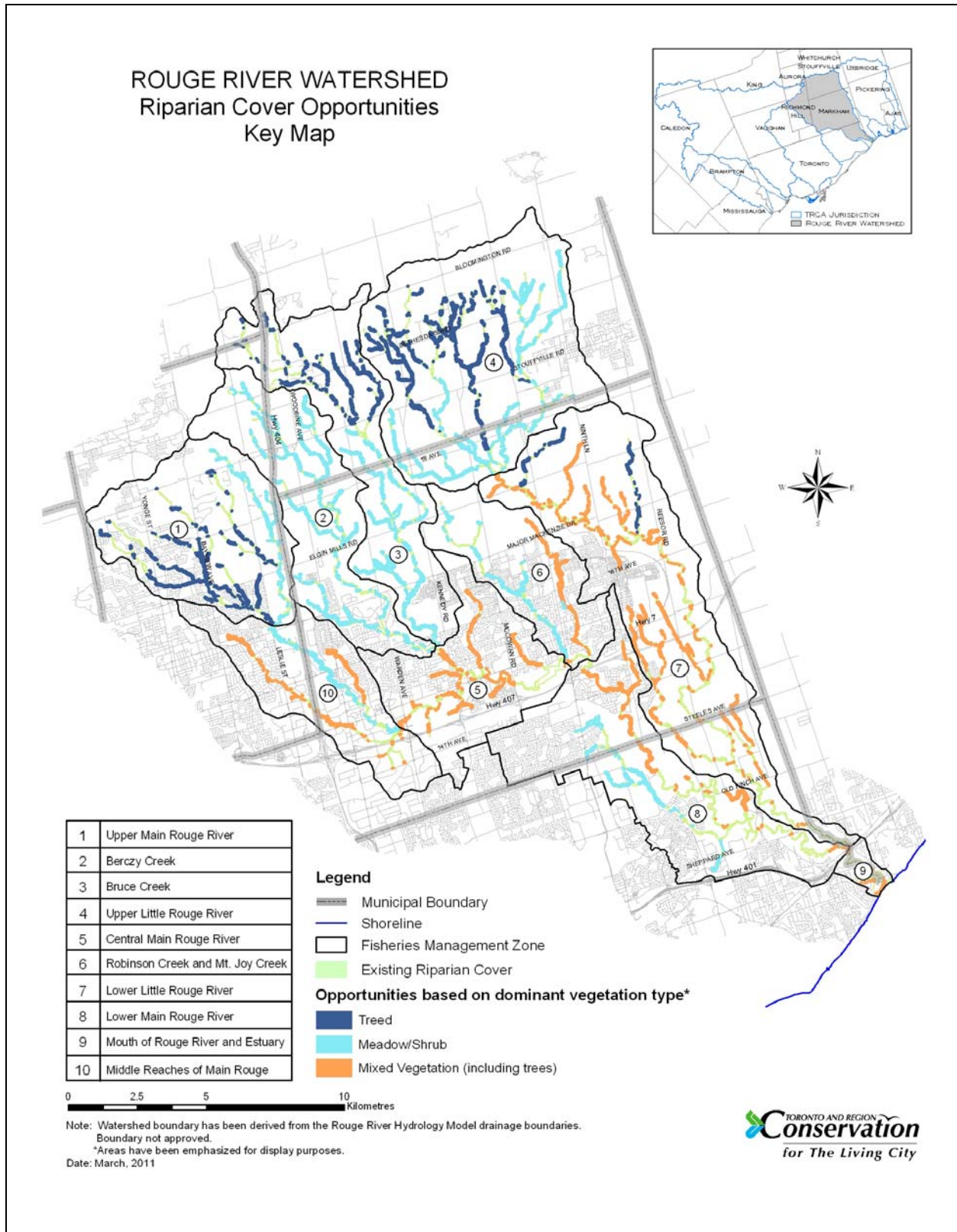


Figure 3-6: Riparian Cover Opportunities in the Rouge River

3.2.12 Fishways and Invasive Species Control

There are four fishways within the Rouge River watershed: Milne Reservoir, Toogood Pond, Parkview and Morningside (see **Figure 3-5**). A control program for Sea Lamprey targets the mouth of the river.

Milne Reservoir Fishway

In 2003, following the direction provided in the 1992 RRFMP and *Clean Water, Clear Choices: Recommendations for Action* (MTRRAP 1994), the Milne Fishway, owned by OMNR, was constructed on the main stem of the Rouge River (located in FMZ 5) in order to provide passage of native and naturalized fishes above the dam. By providing upstream access for Rainbow Trout and several native species, the fishway provides the major function of reconnecting the fragmented aquatic ecosystem. In addition to supporting the self sustainability of fish populations by providing access to spawning and rearing habitat, the fishway also contributes to increased species and genetic diversity, to ecosystem productivity at the watershed level, and to increased productivity of the Lake Ontario fishery.

The fishway also provides the important opportunity to identify and monitor the number of fishes and the number of species migrating above the dam. This is critical to assessing the diversity and health of the aquatic ecosystem. The design of the fishway (denil with a removable sorting cage) also allows biologists and volunteers to monitor the extent of natural recruitment of fishes from upstream areas. The fishway also allows for the monitoring and control of non-native invasive species like Common Carp (*Cyprinus carpio*), Goldfish (*Carassius auratus*) and Sea Lamprey.

For several years, OMNR, MEA and other partners have been monitoring migrating Rainbow Trout passing through the Milne Fishway. Before being passed over the dam, the fishes are caught in a cage, sorted and data are collected on size, weight, sex, and year class of migrating adults returning from Lake Ontario. OMNR has also established a program of pit tagging Rainbow Trout, which allows for positive identification of all individuals and further generation of data on growth, health, age, and spatial and temporal movements within the watershed. See Section 4.1.5.2 for recommendations on enhanced monitoring at the Milne fishway.

Toogood Pond Fishway

This fishway is located upstream of Milne Reservoir also in FMZ 5 and is owned by the Town of Markham. Toogood Pond fishway is a passive design and operation – that is, stop logs are in place at a height that allows jumping species to pass.

Parkview Fishway

This fishway is located downstream of Milne Reservoir on the main branch of the Rouge River in FMZ 8 (approximately 0.5km north of Steeles Avenue). In partnership between OMNR and

Parkview Golf Club, a by-pass channel fishway was built to mitigate a dam. The project was completed in 1997 and designed to pass jumping and non-jumping fish species.

Morningside Fishway

Located on the Morningside Creek, 0.5km from its confluence with the Main Rouge and approximately 1 km north of Sheppard Avenue in FMZ 8, this fishway was constructed in 2003 as a by pass channel around an energy dissipater built in 1974. The fishway design has a series of step pools meant to facilitate upstream passage of resident and migratory fish species such as Redside Dace and Rainbow Trout, respectively. Currently, there is multi-agency interest in reviewing this structure under the context of further improving fish passage.

Sea Lamprey Control

The control of Sea Lamprey is managed and implemented by DFO. The chemical 3-trifluoromethyl-4-nitrophenol (TFM) is the primary method used to control Sea Lamprey in the Rouge River watershed (targets the ammocoete or larval stage). Applications of this lampricide have occurred about every 3-4 years resulting in a high level of Sea Lamprey control. There are few non-target species that are known to be sensitive to TFM; those in the Little Rouge include White Sucker, catfishes, and mudpuppies) (Boogaard et al. 2003; Hewitt et al. 1998; Bills and Johnson 1992). In total, ten lampricide treatments of the Rouge have been conducted since 1971 with pre-treatment larval distribution ranging widely from 10 to 30 km of the watershed.

The target concentration of TFM during treatments is dependent on stream pH and alkalinity, but is normally around 5 mg/l for the Rouge. The current estimated cost of a single treatment is approximately \$50,000. In addition to lampricide, the Milne Dam and fishway serves as a barrier to migrating Sea Lamprey on the Main Rouge. Fewer than 5 adult lamprey per year have been recorded at the fishway.

New control measures are being investigated by DFO, specifically the use of a temporary, seasonal barrier at the mouth of the Rouge River that includes 'fishway structures' which allow for passage of non-jumping species. These structures have significant operational, maintenance, and funding requirements which may be addressed through an inter-agency Memorandum of Understanding. DFO has already initiated a feasibility assessment for a barrier at the Rouge River mouth in consultation with OMNR and TRCA and pursuant to the management directions provided in this FMP.

Other studies are being undertaken to improve targeting on Sea Lamprey and to limit the risk of toxicity associated with TFM and oscillating stream chemistry conditions. Research is being conducted on the use of pheromones and other hormone treatments that are non-toxic and are specific to Sea Lamprey. Other potential options include modelling.

3.2.13 Recreational Angling

The aquatic system is a recreational resource for many anglers. As indicated above, stocking of non-native trout and salmon is largely practised to provide recreational angling opportunities in the Great Lakes ecosystem. In recent years, angling groups have become more active in the direct management of the fisheries resource and their involvement in the Rouge River watershed has been increasing (e.g. MEA undertaking primary activities at Ringwood FishHatchery, under the direction of OMNR).

Several fish management zones have been identified as currently known places for recreational fishing, including the Little Rouge River (FMZ 7), Lower Main Rouge River (FMZ 8), and Rouge River Marsh (FMZ 9). The diversity of angling opportunities and activity in the Rouge watershed reflects the diversity of the fish community. Anglers have access to three different fish communities:

Coldwater Species

Most of the headwater zone of the watershed is privately owned, but there are some areas where public access is available to provide Brook Trout angling. Much of the lower sections of the watershed are in public ownership. Angling for Rainbow and Brown Trout, and Chinook and Coho Salmon tends to be focused on the main stem of the Rouge, south of Highway 2. In the main Rouge, angling occurs below the Milne Reservoir and in various locations downstream to the junction with the Little Rouge. Rouge Park Woodlands Area, south of Steeles Ave on the Little Rouge is a popular area, and other locations downstream to the junction also have public access.

Cool and Warmwater Species

Inland fishing for cool and warmwater species tends to be focused on pond and reservoir habitat, which can be found in the Milne Reservoir and Toogood Pond or within the main channel of the Rouge River below Highway 7. Fish species sought include gamefish such as Largemouth Bass (*Micropterus salmoides*), Smallmouth Bass (*Micropterus dolomieu*), and Northern Pike (*Esox lucius*), and panfish species such as Yellow Perch (*Perca flavescens*), Black Crappie (*Pomoxis nigromaculatus*), Brown Bullhead (*Ameiurus nebulosus*), White Sucker (*Catostomus commersoni*), Common Carp (*Cyprinus carpio*), Rock Bass (*Ambloplites rupestris*), and Pumpkinseed (*Lepomis gibbosus*).

Lake-based Species

Waterfront fishing is found in the Rouge Marshes, probably one of the most popular angling locations within the watershed but it has restricted access points unless fishing from a boat. Game species that can be caught here include Northern Pike, panfish such as Yellow Perch and crappie, Brown Bullhead, White Sucker, Common Carp, bass and sunfish species. Some of the more rare species that can be captured here include *White Bass (Morone chrysops)*,

Gizzard Shad (Dorosoma cepedianum), Alewife (Alosa pseudoharengus), Bowfin (Amia calva), and Mooneye (Hiodon tergisus).

3.2.14 Baitfish Harvest

Baitfish harvesting is a licensed practice managed and enforced by the OMNR according to Baitfish Harvest Area (BHA). There is only one license issued per BHA. Baitfishes typically include suckers, sticklebacks, darters, sculpins, and minnows (e.g., dace, shiners, chub). The captured fishes are sorted by species and any gamefish, such as trout, salmon, pike, and bass, are returned to the stream. The collected species are then graded by size and transported to holding tanks in local retail stores.

A single licence is issued for the Rouge River watershed (BHA U11) with species harvest focused on common species such as Creek Chub and White Sucker. However, in light of protection requirements for Redside Dace, and the potential for incidental or unintended capture, OMNR has recently reviewed its issuance of licences in the Rouge and other watersheds supporting Redside Dace. New restrictions on bait harvest will now apply to areas of known Redside Dace habitat. Please contact the Aurora District office of the OMNR for further information.

4 FISH MANAGEMENT ZONES – SPECIFIC ISSUES, MANAGEMENT RECOMMENDATIONS, AND IMPLEMENTATION PROJECT OPPORTUNITIES

This final chapter contains detailed descriptions of each FMZ with respect to fish community and local habitat health conditions and issues. Following each description are tables of FMZ specific and prioritized recommendations, and examples of implementation project ideas. The lists of recommendations at the FMZ level are long but by focusing multiple efforts within this finer spatial scale we may achieve subwatershed health objectives sooner and reduce cumulative impacts downstream.

Each of the ten fisheries management zone is unique, often having a different fisheries community, spatial distribution, and range of supporting ecological processes. Individual zones also have unique landscape characteristics (e.g., urban vs. rural) that can drive issues as well as opportunities. The characterization in both text and figures of each FMZ uses past fish collection data (1950's to 2005) where it exists, data from the most recent surveys (2006, 2009, 2010) as well as drawing upon the analyses done for the *Rouge River Watershed Plan* which are presented in the *Rouge River Scenario Modelling and Analysis Report* (TRCA 2007b) and *Rouge River State of the Watershed Report* (TRCA 2007c)

Short-term recommendations (0 to 5 years) have been proposed to address priority issues, achieve more immediate gains to benefit the aquatic ecosystem, and/or expand our knowledge of existing conditions. Examples include habitat creation/rehabilitation/restoration, short terms studies or assessments, and stewardship opportunities. Some of these recommendations emphasize the need for testing new and innovative management, restoration, or monitoring techniques in support of the FMP objectives, and promote adaptive management.

Long-term recommendations (5 to 10 years) are ones that also address priority issues but may take longer than five years to achieve a desired outcome, given existing conditions. Some of these recommendations help stabilize the current system from further degradation by encouraging the initiation of large scale projects or practices that have the potential to address multiple and complex issues. These initiatives need to be incorporated into the land use planning and development review process at the earliest possible stage.

The recommendation tables should be read laterally from left to right and are structured as a progression:

Ecological processes → issues affecting the ecology → recommendations that address the issues → Implementation Project Opportunities linked to priority recommendations → target species being supported

A colour coding scheme has been developed to help focus attention on what work should be done sooner based on ecological considerations only (i.e., required approvals and permits, funding, ownership and technical feasibility has not yet been determined). Within the recommendation tables, the following coding applies:

- **green** coloured recommendations are those that should be worked on within the 5 year timeframe of the plan (priority management focus), and
- **purple** coloured recommendations will likely need to occur on a longer timeframe.

This approach of prioritizing issues and recommendations is not meant to minimize or exclude the importance of the other recommendations provided or other project ideas that have been developed or are being developed by other groups. Authors of this FMP strongly encourage independent programs, projects and activities that support the objectives of this Plan.

To follow-through with priority recommendations, a series of **Implementation Project Opportunities (IPOs)** were developed. To facilitate the user's understanding of what an IPO might entail, a series of tables (Project Sheets) have been created that provide the project description, a general list of activities and what resources might be available to assist with getting the project started. A figure is also provided for each FMZ showing the approximate locations of projects.

The IPOs are not fully developed and do not have pre-approved project status. They are presented as potential opportunities to work towards the goals of this FMP with general support by OMNR and TRCA for the concepts outlined.

IPOs are also a means to help measure implementation success of the Plan even though there is no mechanism to ensure that work is initiated and completed. It is up to individuals, agencies and organizations to work with an agency-led Advisory Group to undertake what is both feasible and achievable within fiscal and resource realities. It is hoped that by identifying places to start within the watershed an easier dialogue can begin on how to meet the goal and objectives of this FMP.

4.1.1 Upper Reaches of Main Rouge River (FMZ 1)

Located in the upper-west corner of the watershed, this zone represents the headwaters of the Main Rouge River within the Town of Richmond Hill. The various fish species collected in the past and recent survey years are listed in **Table 4-1** indicating a total of 29 species ever captured in this zone of which only 16 were collected in the most recent sampling (2009). The target species, thermal regime and other existing conditions, monitoring stations, stocking sites and water balance priorities are shown on **Figure 4-1**.

This FMZ is considered cold to coolwater water based on hydrogeology and the past dominance and continued persistence of cold and coolwater fish species through the sampling record. The expected fish community structure would be relatively low in diversity and in-line with the characteristics of colder water regimes. However, the present fish community is

relatively diverse and represents the full thermal habitat spectrum, that is, from coldwater (e.g., Brook Trout, American Brook Lamprey, Mottled Sculpin (*Cottus bairdii*)) through coolwater (e.g., Redside Dace, White Sucker) and expanding into warmwater (e.g., Pumpkinseed (*Lepomis gibbosus*)).

It is possible that chronic thermal warming impacts from on-line ponds and urban runoff have effectively increased the habitat diversity. Acute thermal impacts may also select for fish species with tolerance for both higher temperatures and fluctuations. For example, following an intense rainfall event in 2005, stream temperatures increased more than 5°C in less than 15 minutes in headwater tributaries within the urban part of this zone.

Adding to the diversity in this zone are stocked coldwater species: Rainbow Trout and, up until 2009, Brown Trout. This stocking took place in habitat utilized by native Brook Trout and Redside Dace. There are questions around potential competition for resources amongst these species and whether stocking practices should continue as discussed in Section 3.2.9. Natural reproduction of stocked salmonids may be occurring and previously stocked Brown Trout appear to have become resident, however, specific surveys have not confirmed and/or quantified either status.

Related to this issue is the matter of species partitioning and whether there are existing in-stream barriers that should remain in place. There is currently a weir (stop logs) at the bottom of this FMZ that effectively partitions Brook Trout populations from migrating salmonids but not from fishes stocked inside this reach.

The 1999 collection record of Atlantic Salmon, an extirpated native species, should be explained: this species does not show up in any historic collection record (1950s) and the relatively recent presence is assumed to be a result of “escapees” from local hatcheries rather than the result of natural reproduction in the system.

Strong groundwater discharge zones characterize the reaches that Brook Trout and Redside Dace occupy. The groundwater table in this zone is shallow and particle tracking results suggest reliance on local recharge areas (see TRCA 2007c). Thus, there are concerns that future developments not alter the volume and pattern of groundwater discharge within this area. In addition, a private landowner maintains an active, flowing wellhead that currently sources groundwater to an upper tributary (**Figure 4-1**). If this practice is stopped, the affected stream may experience a significant loss in stream flow.

Field inspections (2005, 2008, and 2009) have confirmed that Brook Trout are present and spawning in the western reaches. It is believed that this existing coldwater habitat is still present and relatively high quality due to (unintentional) augmentation of groundwater contributions along Bayview Avenue. The planned widening of this roadway is expected to result in the loss of the eastern channel but there is a requirement to create a new channel contiguous with the larger system and equal in form, function, and fish productivity.

Surface flow analysis described in the *Rouge River Watershed Plan* (TRCA 2007a) identified issues of erosion through the bottom of the western reaches (see **Figure 4-1**). The deposition of this eroded material largely affects downstream habitat (FMZ 10). The erosion issue is linked to increased surface flows; an outcome of the catchment urbanizing at a time when limited or no stormwater management was in practice.

The eastern half of this FMZ supports an abundant and healthy population of Redside Dace in the downstream reaches. The upstream catchment is now slated for development with the MESP planning stage set to begin sometime in 2010. As urbanization expands across this FMZ, increased impact on the cold and coolwater habitats is possible without sound planning and management to maintain the current hydrologic function.

Research conducted in partnership with the University of Toronto, TRCA, and OMNR around Redside Dace behaviour (e.g., spawning, seasonal movement, and home range), physical habitat requirements, and population estimates have focused on this area. The work began in 2007 and has continued for several years as a means of gathering the baseline condition to help inform future land use planning and regulatory requirements for the protection of this species and its habitat pursuant to the ESA.

Table 4-1: Past and Present Fish Species in FMZ 1

Species Name	Scientific Name	Last Record
American Brook Lamprey	<i>Lethenteron appendix</i>	08/07/2009
Atlantic Salmon	<i>Salmo salar</i>	29/09/1999
Black Crappie	<i>Pomoxis nigromaculatus</i>	11/07/2006
Blacknose Dace	<i>Rhinichthys atratulus</i>	24/09/2009
Bluntnose Minnow	<i>Pimephales notatus</i>	24/09/2009
Brook Stickleback	<i>Culaea inconstans</i>	14/07/2009
Brook Trout	<i>Salvelinus fontinalis</i>	20/05/2009
Brown Bullhead	<i>Ameiurus nebulosus</i>	17/05/2000
Brown Trout	<i>Salmo trutta</i>	24/09/2009
Common Carp	<i>Cyprinus carpio</i>	08/08/2001
Common Shiner	<i>Luxilus cornutus</i>	24/09/2009
Creek Chub	<i>Semotilus atromaculatus</i>	24/09/2009
Emerald Shiner	<i>Notropis atherinoides</i>	08/08/2001
Fathead Minnow	<i>Pimephales promelas</i>	24/09/2009
Goldfish	<i>Carassius auratus</i>	26/08/2002
Johnny Darter	<i>Etheostoma nigrum</i>	24/09/2009
Koi	<i>Coregonus kiyi</i>	08/08/2001
Largemouth Bass	<i>Micropterus salmoides</i>	03/08/2007

Species Name	Scientific Name	Last Record
Longnose Dace	<i>Rhinichthys cataractae</i>	24/09/2009
Mottled Sculpin	<i>Cottus bairdii</i>	08/07/2009
Northern Hog Sucker	<i>Hypentelium nigricans</i>	21/09/1998
Northern Redbelly Dace	<i>Chrosomus eos</i>	13/08/2008
Pumpkinseed	<i>Lepomis gibbosus</i>	24/07/2003
Rainbow Darter	<i>Etheostoma caeruleum</i>	24/09/2009
Rainbow Trout	<i>Oncorhynchus mykiss</i>	24/09/2009
Redside Dace	<i>Clinostomus elongatus</i>	24/09/2009
Rock Bass	<i>Ambloplites rupestris</i>	27/08/2002
Tadpole Madtom	<i>Noturus gyrinus</i>	26/05/1972
White Sucker	<i>Catostomus commersonii</i>	24/09/2009

Note*: Detailed fish collection records and data, in electronic format, are available upon request from TRCA Aquatic Group.

2009/2010 Surveys by Fisheries and Oceans Canada, Sea Lamprey Control
 2009, 2006, 2003, and 2000 surveys by TRCA's Regional Watershed Monitoring Program
 2005 survey by TRCA Aquatic Group
 Pre 2000 data from MNR collection records

2 Aquatic Invasive

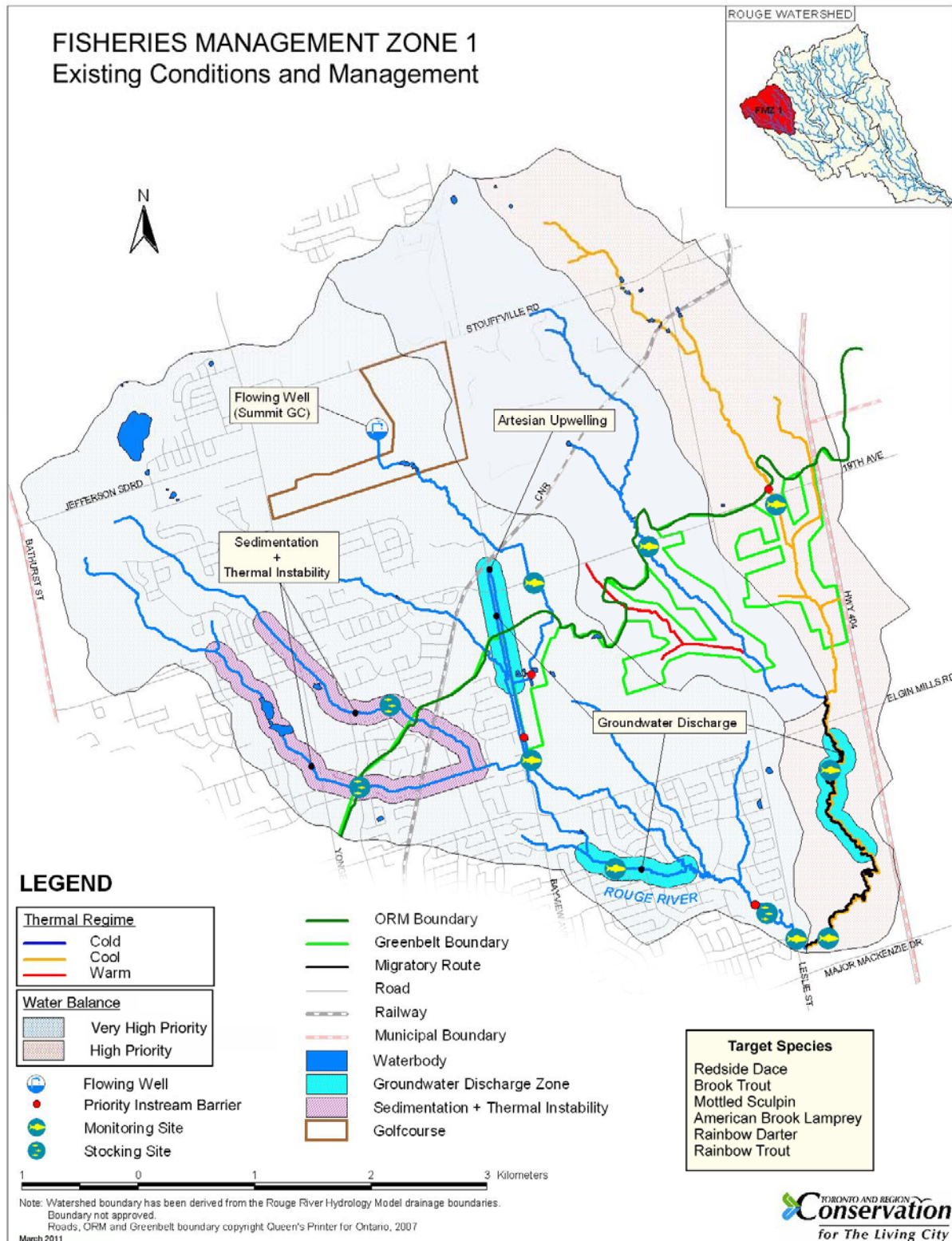


Figure 4-1: FMZ 1 Upper Main Rouge Existing Conditions and Management Map

The thermal regime represents actual stream temperatures which have been interpreted for development and application of construction Timing Windows as provided in the Rouge River FMP (Figure 2.2).

4.1.1.1 Management Recommendations FMZ 1

From a management perspective, this zone is split into two halves with Leslie Street being the dividing line. The eastern portion of the zone is largely non-urban but is in the early stages of land development. The fish community in the eastern portion of the zone is currently healthy and supports Redside Dace. At a minimum, habitat conditions should be maintained, and thus measuring and documenting baseline conditions for Redside Dace as well as studying the landscape response to new habitat protection requirements and planning initiatives is critical for assessing recovery efforts.

The western half of the zone is largely urbanized already and exhibits signs of degrading stream conditions. Management focus in this area includes stormwater management and water balance. Additionally, the new coldwater stream to be created as compensation for the future widening of Bayview Avenue requires careful planning and design considerations to achieve similar Brook Trout productivity in this area. **Table 4-2** provides the full list of recommendations for this zone.

4.1.1.2 Implementation Project Opportunities FMZ 1

There are four IPOs developed for this zone with approximate locations identified on **Figure 4-2** and described in **Table 4-3, Table 4-4, Table 4-5, Table 4-6.**

Table 4-2: FMZ 1 Upper Main Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Surface Water Regime	Urbanization of headwater catchment is planned and has the potential to alter downstream habitats for healthy Redside Dace population and larger fish community.	That all land use planning (i.e., Master Environmental Services Plan (MESP) for North Leslie development) within this FMZ should be informed by appropriate characterization including: pre-development surface water flow regime, groundwater pathway determination, subwatershed water balance, current water taking activity, fluvial-geomorphic dynamics, and assessment of cumulative effects. This characterization should include a minimum 3 years of data to account for different climatic conditions that influence stream hydrology.		all species
	Privately owned well is presently overflowing and augmenting a Redside Dace and Brook Trout stream with coldwater; habitat impacts could be sustained if well is shut off/decommissioned.	Establish a stewardship relationship with the owner(s) of the private well.		all species
		For wells being decommissioned, there should normally be a gradual reduction of flow, over a long enough period of time to allow the watercourse and aquatic species to adjust to the new ecological condition.		all species
	Stormwater flows identified in the <i>Rouge River Watershed Plan</i> (TRCA 2007a) are likely reducing the suitability of stream habitat for target species in the tributaries west of Bayview Avenue.	Retrofit and/or clean out existing priority stormwater management ponds as identified by the Town of Richmond Hill to improve conditions at point of discharge and cumulatively for downstream habitats (e.g., flow regime, temperature, water chemistry, sediment transport). That in future development areas, new and innovative approaches for SWM, geared towards the protection of Redside Dace and associated fish community be supported such that discharge meets ambient stream temperature, water clarity and chemistry or is within acceptable range for target species to be determined by the appropriate regulatory agency.		all species
		Conduct ecological assessments of Brook Trout habitat in the area as well as Rainbow Trout (further downstream).	IPO 1.4 Baseline Flow Regime Characterization	Brook and Rainbow Trout
Groundwater Regime	Shallow groundwater systems that support key target species, including a healthy population of Redside Dace, are vulnerable to potential loss of discharge due to short and long-term dewatering activities associated with construction phase of development.	To identify and avoid groundwater draw down and/or interrupting local discharge pathways to receiving watercourses (note groundwater models have been developed for the Rouge Watershed).		Brook Trout, Redside Dace, American Brook Lamprey, Mottled Sculpin

Table 4-2: FMZ 1 Upper Main Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Groundwater Regime (continued)	Many watercourses and their related aquatic ecosystem functions, have a very high sensitivity to the alteration of the surface and groundwater flow regime as a result of land use change. A lack of required information exists, for these sensitive areas and others, to define a water balance condition that would allow for the maintenance of aquatic ecosystem integrity should urban development proceed within the catchment.	The prioritized need to achieve water balance in this FMZ should reflect the areas identified on Figure 4-1 (1 Very High Priority Zone, 1 High Priority Zone, 1 Medium Priority Zone)		all species
Water Chemistry	Several watercourses directly adjacent to roadways have little to no physical buffer to mitigate road runoff (e.g., salt laden snow melt, accidental chemical spills).	Investigate retrofit alternatives (e.g., oil and grit separators, bioswales) for diverting or collecting run off from roads directly adjacent to watercourses for long-term stream protection or mitigation of pollutants (e.g., salt and accidental chemical spills). Making contact as soon as possible following a spill and supplying photographs can help MOE assess and respond as required to the occurrence. MOE Spills Action Centre phone number is 416-325-3000.		all species
		A report or similar briefing of available results for the salt management study being undertaken by the Town of Richmond Hill should be requested by appropriate agencies as a means of knowledge transfer.		all species
	Land use conversion to commercial/industrial developments are now occurring within portions of the zone which increases the risk of accidental discharge of substances that impact aquatic ecosystems.	All commercial and industrial developments (existing and future) should have an effluent treatment plan and/or an emergency spills capture system that does not connect to a watercourse (e.g., drain protection, oil and grit separator, on-site clean-up equipment, regular maintenance of transport vehicles, sewer shut-off valves); this system should be in place before operations commence.		all species

Table 4-2: FMZ 1 Upper Main Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Temperature	Watercourse temperatures are only moderately stable and experience peaks in summer temperatures that are incompatible with coldwater fisheries within the urbanized western portion of the zone.	Undertake an evaluation of the efficacy of stormwater management techniques to mitigate thermal impacts on 1st - 3rd order streams. Consider the inclusion of the following sites: Riotrin and Urbacon SWM Ponds on Leslie Tributary, Humber Flats SWM system on Upper East Humber, SWM Pond 61 on Black Creek, Cathedral SWM Pond on Rouge River (GEMS technology), and various HWY 407 SWM Ponds.		Brook Trout, Redside Dace, American Brook Lamprey, Mottled Sculpin
		Discharge from SWM ponds during the construction phase of North Leslie lands and the approved built-out condition should meet ambient stream temperatures of receiving watercourses or be within an acceptable range for key target species. There may be specific temperature requirements or thresholds for Redside Dace pursuant to the <i>Endangered Species Act</i> (2007).		all species
		Enhance riparian and/or upland habitat to improve thermal stability through increased shading and infiltration of precipitation.		Brook Trout, Redside Dace, American Brook Lamprey, Mottled Sculpin
Sediment	Areas of sedimentation have been identified in the western tributaries, likely influenced by stormwater drainage.	On site project managers or construction team representatives should be familiar with and able to apply the Great Golden Horseshoe Area Conservation Authorities' <i>Erosion and Sediment Control Guidelines for Urban Construction</i> (GGHACA 2006)		all species
		New and innovative approaches for stormwater management (future and retrofit), geared towards the protection of fish habitat, should be encouraged and supported such that discharge meets design criteria for water clarity and is consistent with acceptable range for target fish species. The clean-out of existing SWM ponds and commitment for future maintenance should also be a high priority action to ensure intended pond performance. The SWM facility improvement projects identified by the Town of Richmond Hill should be used to guide priorities in this FMZ.		all species

Table 4-2: FMZ 1 Upper Main Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Sediment (continued)	Sediment discharge from future construction projects has the potential to impact vulnerable Redside Dace populations and habitat within the Leslie Tributary.	Sediment and erosion controls should be effective at preventing sediment from entering the watercourse. This applies to all scales and types of construction activity.		Redside Dace
	Many of the watercourses through the developed areas (suburban) have fine sediments which are not suitable spawning habitat for Brook Trout or Redside Dace.	Identify sources of fine sediments to watercourses and minimize or eliminate its production. (e.g., velocity reduction technologies, sediment capture (sweeper logs), and run-on management techniques).		all species
Terrestrial Natural Heritage	The quality and quantity of riparian habitat has been significantly reduced along the western tributaries within urban areas.	Identify and undertake riparian planting opportunities to address and improve aquatic habitat quality and quantity. Consistent with recent landscape level planning initiatives (e.g., ORM Act), a 30 m riparian buffer on both sides of the watercourse is recommended for the entire watershed unless there is additional management or regulatory direction in place, then the most protective riparian width should be applied (see section 3.2.11.1 Riparian Habitat Recommendations).		all species
	The specific composition and structure of the riparian habitat required for Redside Dace habitat is not specifically defined.	For all stream reaches determined to be the habitat of Redside Dace, a minimum protected stream corridor consisting of the stream meander belt plus 30m on each side should be applied, as recommended in the <i>Redside Dace Recovery Strategy</i> (OMNR 2010a) and as required by OMNR. This may also be applied to stream reaches identified as recovery habitat for Redside Dace. See Section 3.2.11.1 Riparian Habitat Recommendations for vegetation community type recommendations.	IPO 1.1 Leslie Tributary Stewardship and Riparian Enhancement	Redside Dace
	Available areas for infiltration have been reduced over time and continue to be reduced in urbanizing portions of the FMZ.	Restore natural multi-layer tree canopy cover within the riparian zone to allow for the increased infiltration and retention of water in order to maintain/restore flow balance and groundwater discharge to streams. Focus on public and/or municipally owned lands. (e.g., Phyllis Rawlinson Park).	IPO 1.2 Riparian Community and Upland Habitat Creation Project	all species

Table 4-2: FMZ 1 Upper Main Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Fish Community and Habitat	Loss of productive Brook Trout habitat will occur within the eastern ditches along Bayview Avenue at 19th Avenue once planned road widening is undertaken. The new habitat may need to be created well in advance of the road widening to allow for stream function to become established (e.g., benthic invertebrate food supply) to help ensure the maintenance of a healthy Brook Trout population.	Technical agencies (i.e., TRCA and OMNR) should continue to assist York Region and their consultant with detailed design and implementation of the construction and monitoring of a new channel to support Brook Trout spawning.		Brook Trout
	The most downstream reaches in this FMZ are exhibiting signs of cumulative impacts based on the gradient of benthic invertebrate aggregate scores through the drainage area (i.e., loss of sensitive invertebrate benthic species).	Apply innovative and established best management practices to make substantial gains towards mitigating downstream cumulative impacts and achieving local water balance.		all species
	A healthy Redside Dace population occurs within the eastern portion of this management zone, which may be impacted by future landscape change should alteration to flow regime and habitat result without sufficient mitigation.	OMNR to coordinate continuing habitat and species monitoring of Redside Dace in the Leslie Tributary in cooperation with the Redside Dace Recovery Team, TRCA and other partners.		Redside Dace
		Consider the establishment of a conservation reserve and research area in the eastern tributaries of this FMZ under direction of OMNR in co-operation with DFO, TRCA, Universities and other partners.		Redside Dace
	Competition for resources between native Brook Trout and stocked salmonids within the western tributaries.	Maintain the existing barrier located at Priority Barrier 1.4 (Table 3-3). Relocate stocking sites to the lower portions of this FMZ to avoid potential negative interactions with native fish (see Figure 3-5).		Brook Trout, Rainbow Trout
	Significant in-stream barriers are present that fragment available habitat.	Optimize fish passage of native species through the river system (i.e., removal or mitigation of in-stream barriers that negatively impact native fish communities). However, in making the above consideration, consequences of also passing invasive species OR promoting the interaction with non-compatible species, must be weighed out.	IPO 1.3 Management of Priority Barrier 1.1	all species, including Redside Dace
	The habitat of sensitive species requires consideration for when construction activities can be undertaken.	A construction timing window from June 15th - September 15th is to be applied in all coldwater streams supporting Brook Trout and is not considered occupied or contributing habitat for Redside Dace.		Brook Trout and Redside Dace

Table 4-2: FMZ 1 Upper Main Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Fish Community and Habitat (continued)		A construction timing window from July 1st - September 15th is to be applied in all Redside Dace occupied habitats or in upstream contributing habitats at the discretion of the appropriate agencies.		Redside Dace
	The Main Branch of Rouge River is currently a migratory route for Rainbow Trout which may or may not have a self sustaining population within this Fisheries Management Zone.	Monitoring and assessment of Rainbow Trout adult returns and natural reproduction is required to direct future stocking activity. Until such time, stocking of Rainbow Trout should generally avoid stream reaches determined to be the habitat of Redside Dace.		Rainbow Trout
	Aquatic Invasive Species (AIS) present in stormwater management ponds (e.g., Goldfish) may have easy access to natural watercourses under periods of high flows.	Investigate the development of a systematic program of carp removal in cooperation with Municipalities during the maintenance of stormwater ponds.		all species
		Increase the coordination of existing stewardship and outreach programs to prevent new introductions and any further spread of aquatic invasive species (AIS).		all species
Anthropogenic	Future urbanization and road widenings may interfere with the spawning success in traditional spawning areas where ecological processes are altered through development.	Brook Trout spawning success depends on groundwater upwellings and therefore every precaution should be taken to avoid potential impacts from dewatering or water taking activities between October 1st and March 31st. However, there should be particular attention paid to the reproductive period where eggs lay in the stream bed from the middle of October to early February.		Brook Trout
	Existing or future urbanization and associated activities.	Refer to recommendations above.		all species

Legend**Timeframe for Potential Implementation**

Priority Focus	1 to 5 years
Management Focus	5 to 10 years

Table 4-2: FMZ 1 Upper Main Rouge Management Recommendations

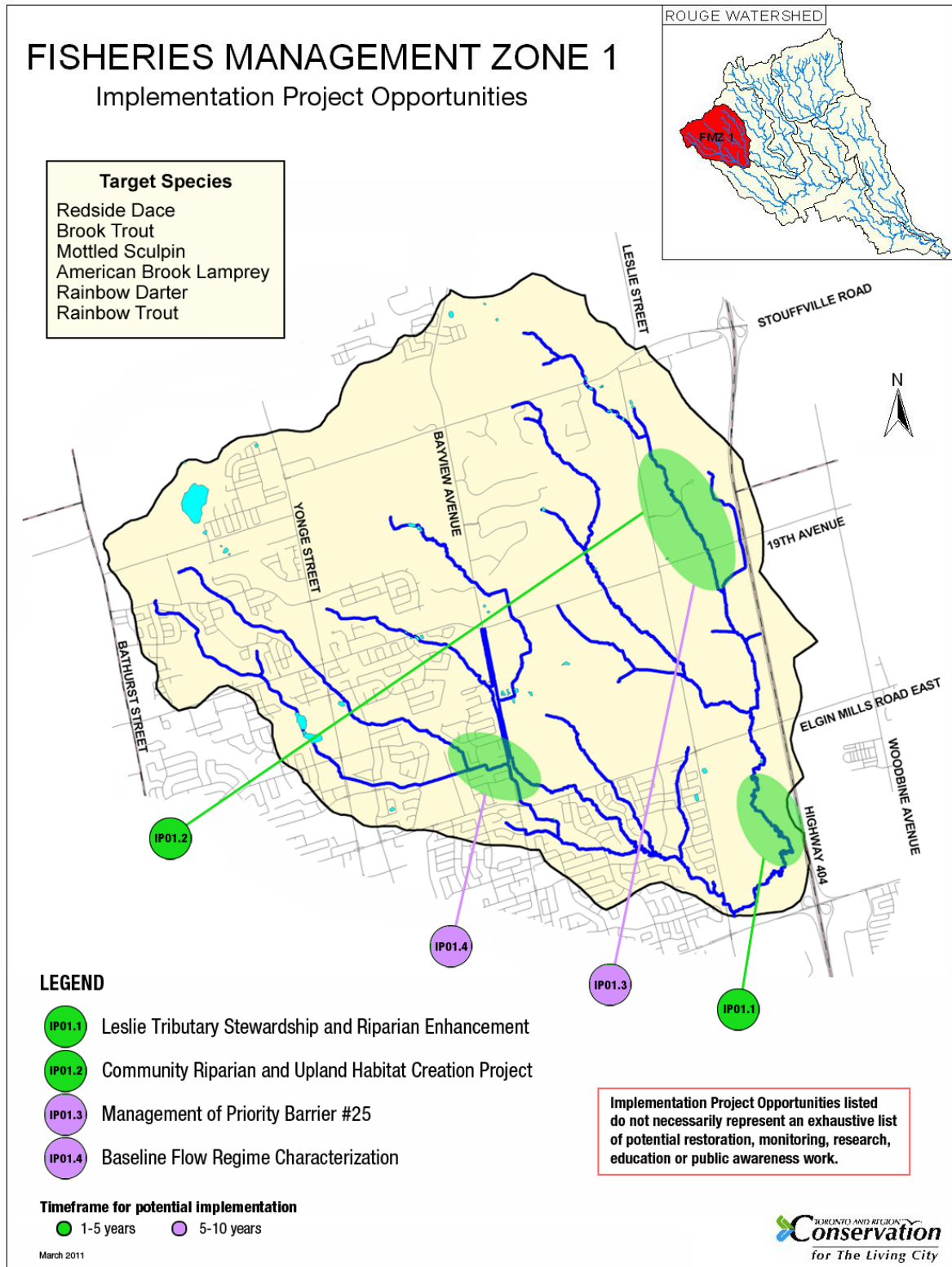


Figure 4-2: FMZ 1 Upper Main Rouge IPO Locations

IPOs are recommended with the expectation that prior or concurrent improvements in stormwater management proceed, and that water balance understanding is obtained for this FMZ in support of a healthy aquatic ecosystem

Table 4-3: IPO 1.1 Leslie Tributary Stewardship and Riparian Enhancement

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 1.1 Leslie Tributary Stewardship and Riparian Enhancement
	Project Description	Focus on riparian area enhancements to improve bank stability, channel form and general aquatic habitat as well as raise awareness and understanding of the local aquatic ecosystem. Critical to the success of this instream and valley corridor work is linked to early land use planning and pre-development investigations associated with the upstream catchment (i.e., North Leslie). Sufficient subwatershed planning as described in this Plan should be applied to the upper catchment such that post-development water balance is achieved; thus making the stewardship and riparian efforts true enhancements to a still-functioning aquatic system.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Fish Community		
Sampling		Educational sampling to illustrate the fish community to area residents or corporate partners.
2. Channel Morphology		
Stream Assessment		- Assess the stream bank stability and channel form to help determine where riparian improvements should be undertaken. - Support volunteer efforts to assist with habitat enhancements.
3. Riparian Area		
Plantings		- Develop riparian plan and associated maintenance program for 2 years post planting - Consult with the Ministry of Natural Resources and/or Toronto Region Conservation Authority to obtain design criteria / direction for enhancements.
4. Community Corporate Outreach		
Community Engagement		- Undertake community plantings and/or riparian restoration work. - Develop educational and presentation material for community and corporate partners. - Build on preliminary TRCA Species at Risk stewardship initiative for protecting Redside Dace habitat.
5. Reporting		
Summary Report		Report on work undertaken through small technical report or presentation materials.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

Table 4-4: IPO 1.2 Riparian Community and Upland Habitat Creation Project

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 1.2 Riparian Community and Upland Habitat Creation Project
	Project Description	Required riparian and upland planting for habitat enhancement along headwater drainage features also referred to as “zero” order streams. These streams may only flow seasonally or during rain events but have an ecological connection to downstream habitat through various contributions, including, terrestrial insects, woody material or other upland vegetation, nutrients, sediment/soil. The long-term goal is for self sustaining riparian habitat and possibly a fully closed canopy.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Habitat Management		
“Zero” Order Stream		- Find a suitable “zero” order stream to restore the connection between upland and riparian corridor. - Combine with a small educational program to illustrate the re-connection of ecological services within the urban landscape.
Planting Implementation Plan		Develop a planting plan that stipulates location, community, species and benefits to the aquatic habitat. Plantings should consider the guidance of existing strategies, for example, TRCA <i>Terrestrial Natural Heritage System Strategy</i> (TRCA 2007d) for the <i>Rouge River Watershed</i> (1994) or <i>Rouge Park North Management</i> (2003) <i>Plans</i>.
Implementation and Monitoring		Undertake habitat plantings as per approved plan. All plantings require follow-up, i.e., watering for 2 years to ensure survival. Provide feedback to agencies on plant survival.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

Table 4-5: IPO 1.3 Management of Priority Barrier 1.1

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 1.3 Management of Priority Barrier 1.1
	Project Description	Barrier Mitigation: Priority barrier 25 is located just upstream of 19th Avenue between Leslie Street and Hwy 404. This dam is causing habitat fragmentation within Brook Trout and Redside Dace habitat, and increasing in downstream temperatures. A number of mitigation options are available for consideration under the approvals process (e.g., removal of the dam, removal of the stop logs slowly over a number of years).
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Barrier Mitigation		
Undertake Approvals Process		Barrier mitigation can be a complex process; agency consultation and approvals are required. Detailing the merits of mitigation will be an important aspect of gaining approval. Land and structure owner permission must also be obtained.
Implementation and Construction		Adherence with agency approvals.
Monitoring		Post construction monitoring should happen as part of assuring merits of project have been achieved.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

Table 4-6: IPO 1.4 Baseline Flow Regime Characterization

Implementation Project Opportunity		
ESA Permit Might Be Required		
	Project Name	IPO 1.4 Baseline Flow Regime Characterization
	Project Description	Assessment of baseflow and surface flow regime in this area as part of subwatershed planning and to inform development planning.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Flow Regime		
Baseflow Measurements		Understanding of baseflow should be obtained to address issues of management of target species in this FMZ (i.e., Brook Trout requirements for significant groundwater discharge).
Flow Regime Assessment		Understanding seasonal flow regime should be obtained to address issues of management for key target species in this FMZ (i.e., Brook Trout).
2. Channel Morphology		
Fluvial Geomorphological Assessment		Understanding of fluvial geomorphology should be obtained to address issues of management for target species in this FMZ (i.e., support for existing or designed pool habitats).
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Implementation Committee, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

4.1.2 Berczy Creek (FMZ 2)

Located directly to the east of FMZ 1, this zone is still largely rural and represents the headwaters of Berczy Creek. The various fish species collected in past and recent surveys are listed in **Table 4-7**, indicating a total of 34 species ever captured in this zone of which only 15 were collected in the most recent sampling (2009). The target species, thermal regime and other existing conditions, monitoring stations, stocking sites and water balance priorities are shown on **Figure 4-3**.

The species that are “missing” from recent surveys are more pond-based habitat users (or large rivers), a type of habitat not generally sampled anymore. There is good continuity between the historic community and existing populations of typical stream-based fishes which suggests that stream conditions have been maintained. The biodiversity is also high, covering cold to warmwater species. It should be noted that native species requiring true coldwater habitat (i.e., Brook Trout, Mottled Sculpin) have never been collected in this zone and the Rainbow and Brown Trout are stocked (though natural recruitment is suspected to an extent).

Stream temperatures indicate cool water conditions that shift to warm. This trend is interrupted mid-way through the zone as groundwater inputs modify the habitat (cool it) and an abundant, healthy Redside Dace population is found. The furthest downstream contributing system is Carlton Creek, which is largely warmwater. This supports the understanding that Berczy is a naturally warmer headwater system as compared to others in the Rouge River (i.e., FMZ1, FMZ 3, and FMZ 4) and thus provides thermal habitat suitable for a wider range of species.

There is an in-stream barrier that splits the available Redside Dace habitat and may only allow downstream movement of Redside Dace as it is unlikely it can re-negotiate the barrier and return to upstream habitat (**Figure 4-3**). Research conducted by the University of Toronto studied the movement of Redside Dace within the reach above the barrier and in the Leslie Tributary (Mark Poos, Fisheries and Oceans Canada, Unpublished). This work demonstrated that the use of some pools was preferred over others and that home range is larger than expected for a small fish species; in the order of 1 – 2 km. Both findings underscore the importance of barrier mitigation.

Both Rainbow Trout and Brown Trout are stocked into this Redside Dace habitat. Sampling records have found adult Rainbow and Brown Trout above the barrier, so it is assumed that these species are able to jump the existing structure.

Upstream land use is largely agricultural with limited forest cover, which may be a factor in warmwater conditions persisting in upstream reaches. Multiple golf courses are also present which can have impacts on water quality/quantity and loss of riparian vegetation. The Carlton Creek catchment has been urbanizing over the past few years with active construction happening today. An assessment of the creek, including a channel realignment using natural channel design principles, is being conducted by TRCA (2010) to document the response of the system to the rapid change in land use.

Table 4-7: Past and Present Fish Species in FMZ 2

Species Name	Scientific Name	Last Record
American Brook Lamprey	<i>Lethenteron appendix</i>	10/08/2007
Banded Killifish	<i>Fundulus diaphanus</i>	04/07/1980
Black Crappie	<i>Pomoxis nigromaculatus</i>	20/09/2005
Blacknose Dace	<i>Rhinichthys atratulus</i>	24/09/2009
Bluegill	<i>Lepomis macrochirus</i>	06/07/2001
Bluntnose Minnow	<i>Pimephales notatus</i>	30/06/2009
Brassy Minnow	<i>Hybognathus hankinsoni</i>	06/07/2001
Brook Stickleback	<i>Culaea inconstans</i>	24/09/2009
Brown Bullhead	<i>Ameiurus nebulosus</i>	01/05/1987
Brown Trout	<i>Salmo trutta</i>	13/07/2009
Central Stoneroller	<i>Campostoma anomalum</i>	28/09/2000
Common Carp	<i>Cyprinus carpio</i>	06/07/2001
Common Shiner	<i>Luxilus cornutus</i>	24/09/2009
Creek Chub	<i>Semotilus atromaculatus</i>	24/09/2009
Emerald Shiner	<i>Notropis atherinoides</i>	12/07/1999
Fathead Minnow	<i>Pimephales promelas</i>	13/07/2009
Finescale Dace	<i>Phoxinus neogaeus</i>	12/07/1999
Goldfish	<i>Carassius auratus</i>	05/08/2003
Hornyhead Chub	<i>Nocomis biguttatus</i>	26/05/1954
Johnny Darter	<i>Etheostoma nigrum</i>	24/09/2009
Largemouth Bass	<i>Micropterus salmoides</i>	20/09/2005
Longnose Dace	<i>Rhinichthys cataractae</i>	30/06/2009
Northern Pike	<i>Esox lucius</i>	01/05/1987
Northern Redbelly Dace	<i>Chrosomus eos</i>	13/07/2009
Pumpkinseed	<i>Lepomis gibbosus</i>	30/06/2009
Rainbow Darter	<i>Etheostoma caeruleum</i>	13/07/2009
Rainbow Trout	<i>Oncorhynchus mykiss</i>	13/07/2009
Redside Dace	<i>Clinostomus elongatus</i>	24/09/2009
Rock Bass	<i>Ambloplites rupestris</i>	10/08/2007
Smallmouth Bass	<i>Micropterus dolomieu</i>	12/06/1999
Stonecat	<i>Noturus flavus</i>	20/07/1982
White Sucker	<i>Catostomus commersonii</i>	24/09/2009
Yellow Bullhead	<i>Ameiurus natalis</i>	06/07/2001
Yellow Perch	<i>Perca flavescens</i>	01/05/1987

Note": Detailed fish collection records and data, in electronic format, are available upon request from TRCA Aquatic Group

2009/2010 Surveys by Fisheries and Oceans Canada, Sea Lamprey Control
 2009, 2006, 2003, and 2000 surveys by TRCA's Regional Watershed Monitoring Program
 2005 survey by TRCA Aquatic Group
 Pre 2000 data from MNR collection records

2 Aquatic Invasive

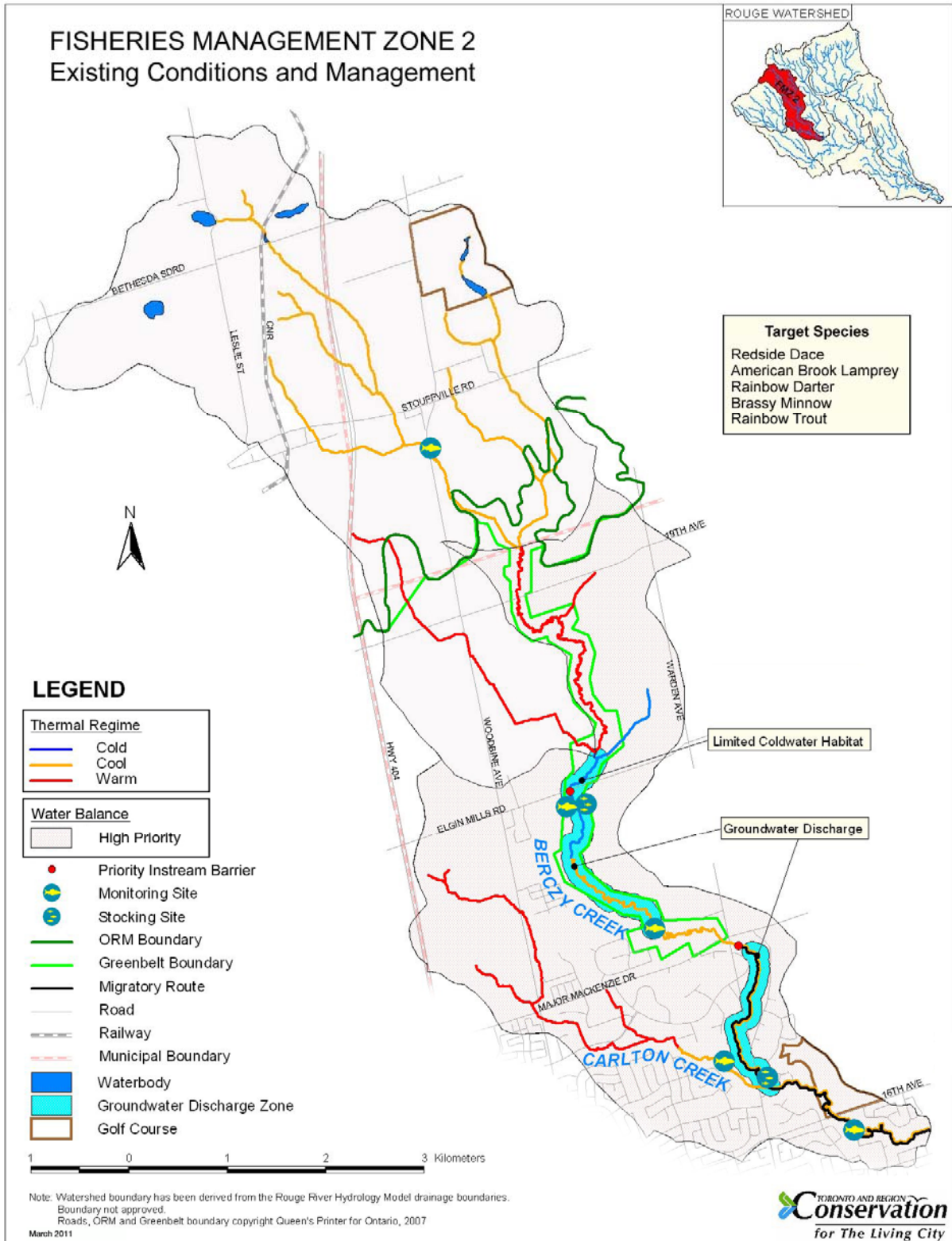


Figure 4-3: FMZ 2 Berczy Creek Existing Conditions and Management Map

The thermal regime represents actual stream temperatures which have been interpreted for development and application of construction Timing Windows as provided in the Rouge River FMP (Figure 2.2).

4.1.2.1 Management Recommendations FMZ 2

From a management perspective, this zone is split into two halves, with the dividing line generally corresponding with Major Mackenzie Rd. The southernmost portion of this zone (including Carleton Creek) has been urbanized for a number of years and there are opportunities to focus on infrastructure retrofits and redesign.

The northern portion of this zone is still largely rural with patches of natural habitats, and supports healthy populations of Redside Dace. This area is anticipated to urbanize over the next 20 years, offering opportunities for new urban forms that support aquatic ecosystem integrity, and for ecosystem enhancements based on ongoing research and monitoring. See **Table 4-8** for full list of management recommendations.

4.1.2.2 Implementation Project Opportunities FMZ 2

There are three IPOs developed for this zone with approximate locations found on **Figure 4-4** and described in **Table 4-9**, **Table 4-10**, **Table 4-11**.

Table 4-8: FMZ 2 Berczy Creek Management Recommendations

Processes And Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Surface Water Regime	Flow regime is not characterized as there is no stream flow gauge within the subwatershed. Development activity is ongoing in the lower portion of the zone with future land use change anticipated for the upper zone within the next 20 years.	That all land use planning (e.g., subwatershed plans, secondary plans, master environmental services plans (MESP)) within this FMZ should be informed by appropriate characterization including: pre-development surface water flow regime, groundwater pathway determination, subwatershed water balance, current water taking activity, fluvial-geomorphic dynamics and assessment of cumulative effects. This characterization should include a minimum 3 years of data to account for different climatic conditions that influence stream hydrology.	<u>IPO 2.1 Baseline Flow Regime Study</u>	all species, including Redside Dace
	Many watercourses and their related aquatic ecosystem functions have a very high sensitivity to the alteration of the surface and groundwater flow regime as a result of land use change. A lack of required information exists, for these sensitive areas and others, to define a water balance condition that would allow for the maintenance of aquatic ecosystem integrity should urban development proceed within the catchment.			all species
	Impacts from cumulative water taking from watercourses is a concern in localized areas which may impact downstream Redside Dace habitat.	To work with MOE and permitted water takers (ground- or surface water) and address concerns relating to impacts to natural heritage features and functions. High priority should be to develop a water use management plan that includes risk assessment, drought management and support the use of self-regulating water withdrawal mechanisms. This planning should be set within the context of understanding the cumulative water taking impacts within this FMZ.		all species
		Encourage stewardship approaches by private landowners towards long-term, ecologically compatible water taking practices.		all species
	Several (4) new stormwater management ponds are being constructed in the Carlton Creek subwatershed.	That in future development areas, new and innovative approaches for SWM, geared towards the protection of Redside Dace and associated fish community be supported such that discharge meets ambient stream temperature, water clarity, and chemistry or is within acceptable range for target species to be determined by the appropriate regulatory agency.		all species

Table 4-8: FMZ 2 Berczy Creek Management Recommendations

December 2010

Processes And Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Groundwater Regime	Shallow groundwater systems that support a very healthy population of Redside Dace are vulnerable to potential loss of discharge due to short and long-term dewatering activities associated with construction phase of development.	To identify and avoid groundwater draw down and/or interruption of local discharge pathways to receiving watercourses associated with construction activity (groundwater models have been developed for the Rouge Watershed).		Redside Dace
	Impacts from cumulative water taking from groundwater resources is a concern in localized areas which may impact downstream Redside Dace habitat.	See above recommendation to address water taking concerns.		Redside Dace and American Brook Lamprey
	Many watercourses and their related aquatic ecosystem functions, have a very high sensitivity to the alteration of the surface and groundwater flow regime as a result of land use change. A lack of required information exists, for these sensitive areas and others, to define a water balance condition that would allow for the maintenance of aquatic ecosystem integrity should urban development proceed within the catchment.	The prioritized need to achieve water balance in this FMZ should reflect the areas identified on Figure 4-3 (1 Very High Priority Zone, 1 High Priority Zone, 1 Medium Priority Zone)		all species
Water Chemistry	Several watercourses directly adjacent to roadways have little to no physical buffer to mitigate road runoff (e.g., salt laden snow melt, accidental chemical spills).	Investigate retrofit alternatives (e.g., oil and grit separators, bioswales) for diverting or collecting run off from roads directly adjacent to watercourses for long-term stream protection or mitigation of pollutants (e.g., salt and accidental chemical spills). Making contact as soon as possible following a spill and supplying photographs can help MOE assess and respond as required to the occurrence. MOE Spills Action Centre phone number is 416-325-3000.		all species
		Support the <i>Rouge River Watershed Plan</i> (TRCA 2007a,) in the recommendation for Municipalities to review/reduce/alter road salting practices.		all species

Table 4-8: FMZ 2 Berczy Creek Management Recommendations
December 2010

Processes And Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Temperature	Thermal conditions in the headwaters are warmer than anticipated for a natural headwater system, and exhibit thermal instability.	Enhance riparian and/or upland habitat to improve thermal stability through increased shading and infiltration of precipitation.	<u>IPO 2.2 Headwater Riparian Zone Tree Planting</u>	Redside Dace
		Discharge from SWM ponds during the construction phase of new development and the approved built-out condition should meet ambient stream temperatures of receiving watercourses or be within an acceptable range for key target species. There may be specific temperature requirements or thresholds for Redside Dace pursuant to the <i>Endangered Species Act</i> (2007).	-	All species
		Determine to what extent existing water taking and online ponds are contributing to stream warming. Ponds should be prioritized for mitigation action.		All species
Sediment	Sediment loadings have been observed from construction projects with this Fisheries Management Zone.	On site project managers or construction team representatives should be familiar with and able to apply the Great Golden Horseshoe Area Conservation Authorities' <i>Erosion and Sediment Control Guidelines for Urban Construction</i> (GGHACA 2006).		all species
		Consistent with draft plan approvals and recommendations in the <i>Rouge River Watershed Plan</i> (TRCA 2007a), minimize the area and duration of soil exposure due to top soil stripping and grading of any new development site. Use temporary seeding or other stabilizing techniques to minimize period of soil exposure.		all species
	Sediment discharge from future construction projects have the potential to impact Redside Dace populations and habitat .	Sediment and erosion controls should be effective at preventing sediment from entering the watercourse. This applies to all scales and types of construction activity.		Redside Dace
Terrestrial Natural Heritage	The loss of tree cover within the riparian zone and table lands overtime reflecting past agricultural practices have likely led to increased water temperatures in the headwater habitats.	Identify and undertake riparian planting opportunities to address and improve aquatic habitat quality and quantity. Consistent with recent landscape level planning initiatives (e.g., ORM Act), a 30 m riparian buffer on both sides of the watercourse is recommended for the entire watershed unless there is additional management or regulatory direction in place, then the most protective riparian width should be applied (see <u>Section 3.2.11.1 Riparian Habitat Recommendations</u>).	<u>IPO 2.2 Headwater Riparian Zone Tree Planting</u>	all species

Table 4-8: FMZ 2 Berczy Creek Management Recommendations
December 2010

Processes And Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Terrestrial Natural Heritage (continued)	Riparian habitat for Redside Dace can be impacted by development activities.	For all stream reaches determined to be the habitat of Redside Dace, a minimum protected stream corridor consisting of the stream meander belt plus 30m on each side should be applied, as recommended in the <i>Redside Dace Recovery Strategy</i> (OMNR 2010a) and as required by OMNR. This may also be applied to stream reaches identified as recovery habitat for Redside Dace. See Section 3.2.11.1 Riparian Habitat Recommendations for vegetation community type recommendations.	IPO 2.3 Meadow Vegetation Riparian Wetland Plantings	Redside Dace and Brassy Minnow
Fish Community and Habitat	An abundant Redside Dace population within the central portion of this management zone, may be impacted by future landscape change should alteration to flow regime and habitat result without sufficient mitigation.	Apply innovative and established best management practices to make substantial gains towards mitigating downstream cumulative impacts and achieving local water balance.	-	all species
		Continue research on population demographics and threats to the species and its habitats.		Redside Dace
		Consider the establishment of a conservation reserve and associated research opportunities in this FMZ in co-operation with OMNR, DFO, TRCA, universities and other partners.		Redside Dace
		Support recovery actions for Redside Dace (e.g., in-stream barrier mitigation).		Redside Dace
	The habitat of Redside Dace can be significantly impacted depending upon when construction activities can be undertaken.	A construction timing window from July 1st - September 15th is to be applied in all Redside Dace occupied habitats or in upstream contributing habitats at the discretion of the appropriate agencies.		all species
	There is one main in-stream barrier within this management zone which limits and confines the aquatic community increasing the vulnerability of the community to stressors (e.g., chemical spills, pathogens, invasive species).	Optimize fish passage of native species throughout the zone (i.e., removal or mitigation of in-stream barriers that negatively impact native fish communities). However, consequences of the potential introduction of invasive species and/or promoting the interaction with non-compatible species must be considered.		all species
	Rainbow Trout stocking locations have historically been within reaches that also support Redside Dace.	Monitoring and assessment of Rainbow Trout adult returns and natural reproduction is required to direct future stocking activity; target monitoring efforts upstream of Toogood Pond. Until such time, stocking of Rainbow Trout should generally avoid stream reaches determined to be the habitat of Redside Dace.		Redside Dace
	The Main Branch of Rouge River is a migratory route for Rainbow Trout which may have a self	Identify production zones for any future stocking of various life stages of Rainbow Trout (fry, fall fingerling and spring yearlings), which should		Rainbow Trout

Table 4-8: FMZ 2 Berczy Creek Management Recommendations

December 2010

Processes And Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Fish Community and Habitat (continued)	sustaining population within this Fisheries Management Zone.	also be monitored for survival and growth over the summer period.		
	Resident Brown Trout fry stocking locations have been within habitat known to support Redside Dace. The present genetic strain of Brown Trout is resident and thus predatory adults are remaining in the system with Redside Dace as a potential food source.	Stocking of Brown Trout in the mid to upper portions of the watershed for purposes of lake fishing opportunities has not been effective and should not be continued in FMZ 2.		Redside Dace and Brassy Minnow
	Aquatic Invasive Species (AIS) present in stormwater management ponds (e.g., Goldfish) may have easy access to natural watercourses under periods of high flows.	Investigate the development of a systematic program of carp removal in cooperation with Municipalities during the maintenance of stormwater ponds.		all species
		Increase the coordination of existing stewardship and outreach programs to prevent new introductions and any further spread of aquatic invasive species (AIS).		all species
Anthropogenic	Existing or future urbanization and associated activities.	Refer to recommendations above.		all species

Legend**Timeframe for Potential Implementation**

Priority Focus	1 to 5 years
Management Focus	5 to 10 years

Table 4-8: FMZ 2 Berczy Creek Management Recommendations
December 2010

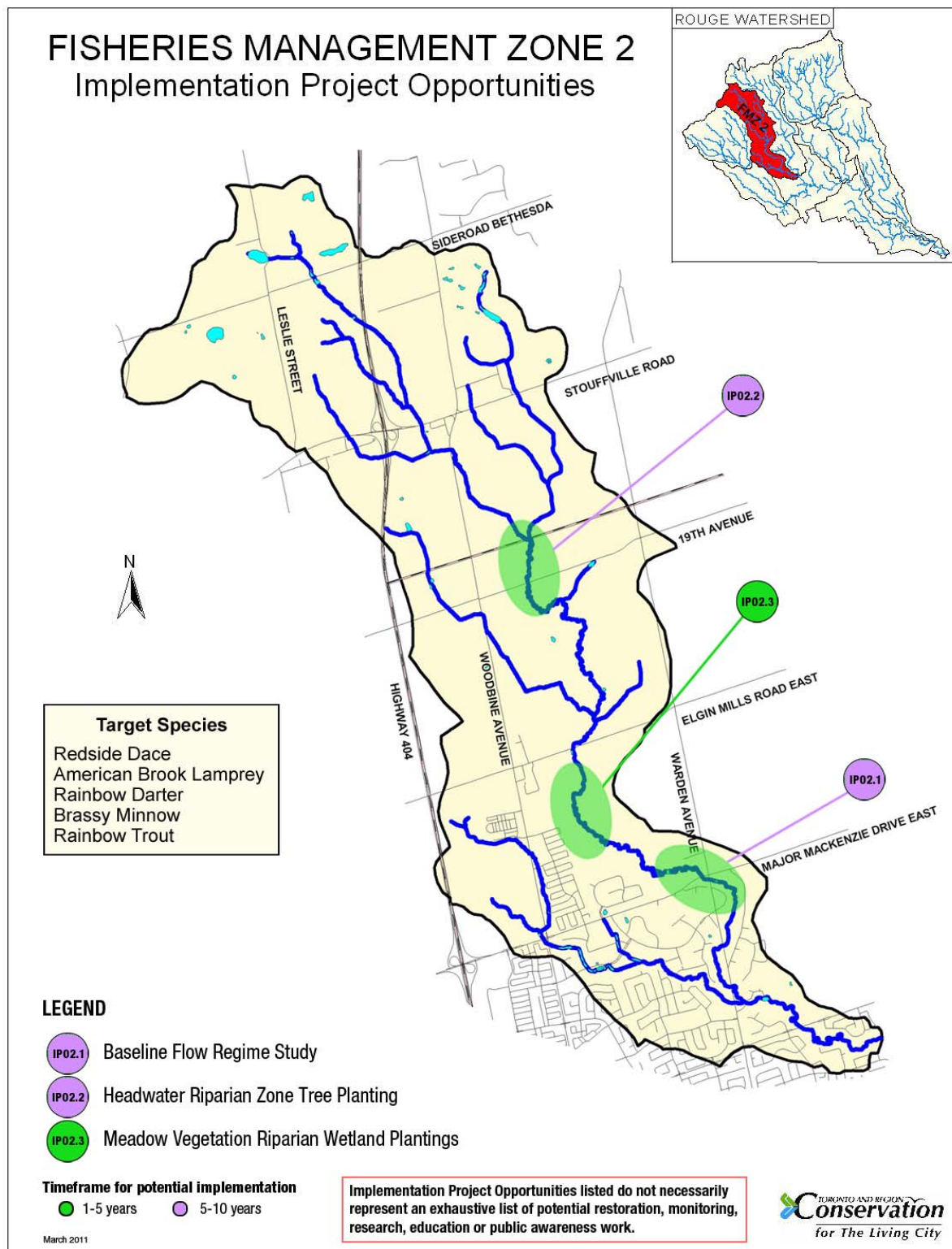


Figure 4-4: FMZ 2 Berczy Creek IPO Locations

IPOs are recommended with the expectation that prior or concurrent improvements in stormwater management proceed, and that water balance understanding is obtained for this FMZ in support of a healthy aquatic ecosystem.

Table 4-9: IPO 2.1 Baseline Flow Regime Study

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 2.1 Baseline Flow Regime Study
	Project Description	To understand the baseflow and flow regime of this watercourse before any further land use change occurs; with consideration to the protection of Redside Dace habitat.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Flow Regime		
Baseflow Measurements	- Undertake monthly baseflow measurement to establish baseline and develop site specific rating curve to track changes over time. - Consult with Agency baseflow staff to assist with project design, data interpretation and access to existing flow data.	
Flow Regime Assessment	- A comprehensive understanding of the seasonal flow regime should be developed in order to properly understand future channel adjustments in response to flow regime change caused by urban development/landscape alterations. - May require the installation of a flow gauge to determine pre to post urban conditions.	
2. Innovative Stormwater Design / LID		
Implementation	- There are new technologies and design alternatives that have been and are continuously being developed. Where applicable identify where the retrofit of existing structures with new improved designs would provide a significant benefit. - New developments and infrastructure should apply new designs and technologies proactively.	
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

Table 4-10: IPO 2.2 Headwater Riparian Zone Tree Planting

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 2.2 Headwater Riparian Zone Tree Planting
	Project Description	Improve headwater riparian zone habitat to benefit flow regime and cool water temperatures in summer period. The long-term goal is for a fully closed canopy.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Riparian Habitat Management		
Planting Plan		Develop a planting plan that stipulates location, community, species and benefits to the aquatic habitat. Plantings should consider the guidance of existing strategies, for example, TRCA <i>Terrestrial Natural Heritage System Strategy</i> for the Rouge River watershed and <i>Rouge North Management Plan</i>.
Implementation and Monitoring		- Undertake habitat plantings as per approved plan. All plantings require follow-up, that is, watering for 2 years to ensure survival. - Provide feedback to agencies on plant survival.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

Table 4-11: IPO 2.3 Meadow Vegetation Riparian Wetland Plantings

Implementation Project Opportunities		
ESA Permit Might Be Required	Project Name	IPO 2.3 Meadow Vegetation Riparian Wetland Plantings
	Project Description	Improve riparian zone habitat to benefit Redside Dace and potentially Brassy Minnow in suitable habitats.
Proposed Project Components		
1. Riparian Habitat Management		
Planting Plan		- Develop a planting plan that considers a riparian habitat condition suitable for Redside Dace and Brassy Minnow. - Focus on enhancements that include improving food resources for fish species.
Implementation and Monitoring		- All riparian planting should be monitored for survival of plants and to maintain optimal Redside Dace habitat. Although the goal is a healthy riparian habitat, a fully closed canopy may not necessarily be a desired riparian condition. - Provide feedback to agencies on plant survival.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

4.1.3 Bruce Creek (FMZ 3)

Located in the upper-middle of the watershed, this zone contains the headwaters of Bruce Creek. The various fish species collected in past and recent surveys are listed in **Table 4-12**. A total of 37 species have been captured in this zone over time of which 14 species, all native, were collected during the most recent survey (2009). The target species, thermal regime and other existing conditions, monitoring stations, stocking sites and water balance priorities are shown on **Figure 4-5**Error! Reference source not found..

The majority of past cold and coolwater species still persists in the system today, although the distribution of Brook Trout is assumed to have been more extensive through the small headwaters prior to the placement of many in-stream structures. Past collection records show that Bruce Creek also supported warmwater species (e.g., bass, sunfish, carp) that add to the zone's relatively high diversity (typically low in coldwater habitat, as previously noted). The longtime presence of Bruce's Mill at Stouffville Road (constructed in 1829) has likely contributed to a shift in thermal regime and has influenced the fish sampling record which only dates back as far as the 1950s. Temperature data collected in 2003 and 2005 identify the upper east headwater tributaries as warmwater habitat (see Figure 4-10); on-line ponds are the likely cause. The western headwater tributaries are cold but warm up downstream of Bruce's Mill.

A healthy population of Redside Dace occupy the middle reaches below Bruce's Mill dam. Brassy Minnow, also a target species, has not been collected recently but does occur in the historic record. This minnow is a riparian wetland habitat specialist. Its absence from the collection record may be the result of habitat loss associated with landscape change. Another key target species, Rainbow Darter, is still present in the lower to middle reaches of the zone.

Two strong groundwater discharge zones characterize the headwater Brook Trout habitat, maintaining the very cold, high quality conditions but multiple in-stream barriers are limiting current Brook Trout distribution both physically and by thermal impacts. Further down in this catchment another groundwater discharge zone occurs coincident with high Redside Dace abundance. This discharge may be mitigating thermal impacts and water quality associated with ponds and adjacent land use.

Bruce's Mill dam was partially removed in 2006 (stop logs taken out) and the impoundment pond has been allowed to passively drain. There has been no thermal data collected to assess potential changes due to this mitigation. As part of a provincial Class EA, enough of the original structure was left in place as a partition between Brook Trout and Rainbow Trout. Since that time, the reaches downstream of the dam have been identified as occupied Redside Dace habitat. The decision to retain the partial dam structure as a species partition between native and stocked salmonids should now be weighed against the opportunity to expand Redside Dace habitat. There is a large in-stream barrier less than 2km upstream of Bruce's Mill that, if retained, could be an alternate species partition. Stocked Rainbow and Brown Trout currently occupy the reaches coincident with Redside Dace.

This zone is relatively non-urban, with natural forest cover mixed with agriculture (active and fallow) in the upper most reaches, although golf courses become prominent below Bethesda Road and a more urbanized landscape dominates below Major Mackenzie Drive.

Table 4-12: Past and Present Fish Species in FMZ-3

Species Name	Scientific Name	Last Record
American Brook Lamprey	<i>Lethenteron appendix</i>	13/07/2009
Black Crappie	<i>Pomoxis nigromaculatus</i>	19/09/2005
Blacknose Dace	<i>Rhinichthys atratulus</i>	24/09/2009
Bluntnose Minnow	<i>Pimephales notatus</i>	24/09/2009
Brassy Minnow	<i>Hybognathus hankinsoni</i>	12/07/1999
Brook Stickleback	<i>Culaea inconstans</i>	13/07/2009
Brook Trout	<i>Salvelinus fontinalis</i>	29/07/2005
Brown Bullhead	<i>Ameiurus nebulosus</i>	10/08/1994
Brown Trout	<i>Salmo trutta</i>	24/09/2009
Central Stoneroller	<i>Campostoma anomalum</i>	19/09/2005
Common Carp	<i>Cyprinus carpio</i>	19/09/2005
Common Shiner	<i>Luxilus cornutus</i>	13/07/2009
Creek Chub	<i>Semotilus atromaculatus</i>	24/09/2009
Emerald Shiner	<i>Notropis atherinoides</i>	12/07/1999
Fathead Minnow	<i>Pimephales promelas</i>	13/07/2009
Finescale Dace	<i>Phoxinus neogaeus</i>	13/07/1999
Golden Shiner	<i>Notemigonus crysoleucas</i>	20/07/2005
Goldfish	<i>Carassius auratus</i>	19/08/1974
Iowa Darter	<i>Etheostoma exile</i>	28/08/2006
Johnny Darter	<i>Etheostoma nigrum</i>	24/09/2009
Largemouth Bass	<i>Micropterus salmoides</i>	23/08/2007
Longnose Dace	<i>Rhinichthys cataractae</i>	24/09/2009
Mimic Shiner	<i>Notropis volucellus</i>	27/05/1954
Mottled Sculpin	<i>Cottus bairdii</i>	14/08/2003
Northern Pike	<i>Esox lucius</i>	14/08/1968
Northern Redbelly Dace	<i>Chrosomus eos</i>	18/07/1985
Pumpkinseed	<i>Lepomis gibbosus</i>	19/09/2005
Rainbow Darter	<i>Etheostoma caeruleum</i>	24/09/2009
Rainbow Trout	<i>Oncorhynchus mykiss</i>	24/09/2009
Redside Dace	<i>Clinostomus elongatus</i>	13/07/2009
River Chub	<i>Nocomis micropogon</i>	26/08/1999
Rock Bass	<i>Ambloplites rupestris</i>	30/06/2006
Sand Shiner	<i>Notropis stramineus</i>	28/08/2003
Smallmouth Bass	<i>Micropterus dolomieu</i>	28/08/2003
Stonecat	<i>Noturus flavus</i>	25/06/1985
White Sucker	<i>Catostomus commersonii</i>	24/09/2009
Yellow Perch	<i>Perca flavescens</i>	14/08/1968

Note: Detailed fish collection records and data, in electronic format, are available upon request from TRCA Aquatic Group.

2009/2010 Surveys by Fisheries and Oceans Canada, Sea Lamprey Control
 2009, 2006, 2003, and 2000 surveys by TRCA's Regional Watershed Monitoring Program
 2005 survey by TRCA Aquatic Group
 Pre 2000 data from MNR collection records 2 Aquatic Invasive

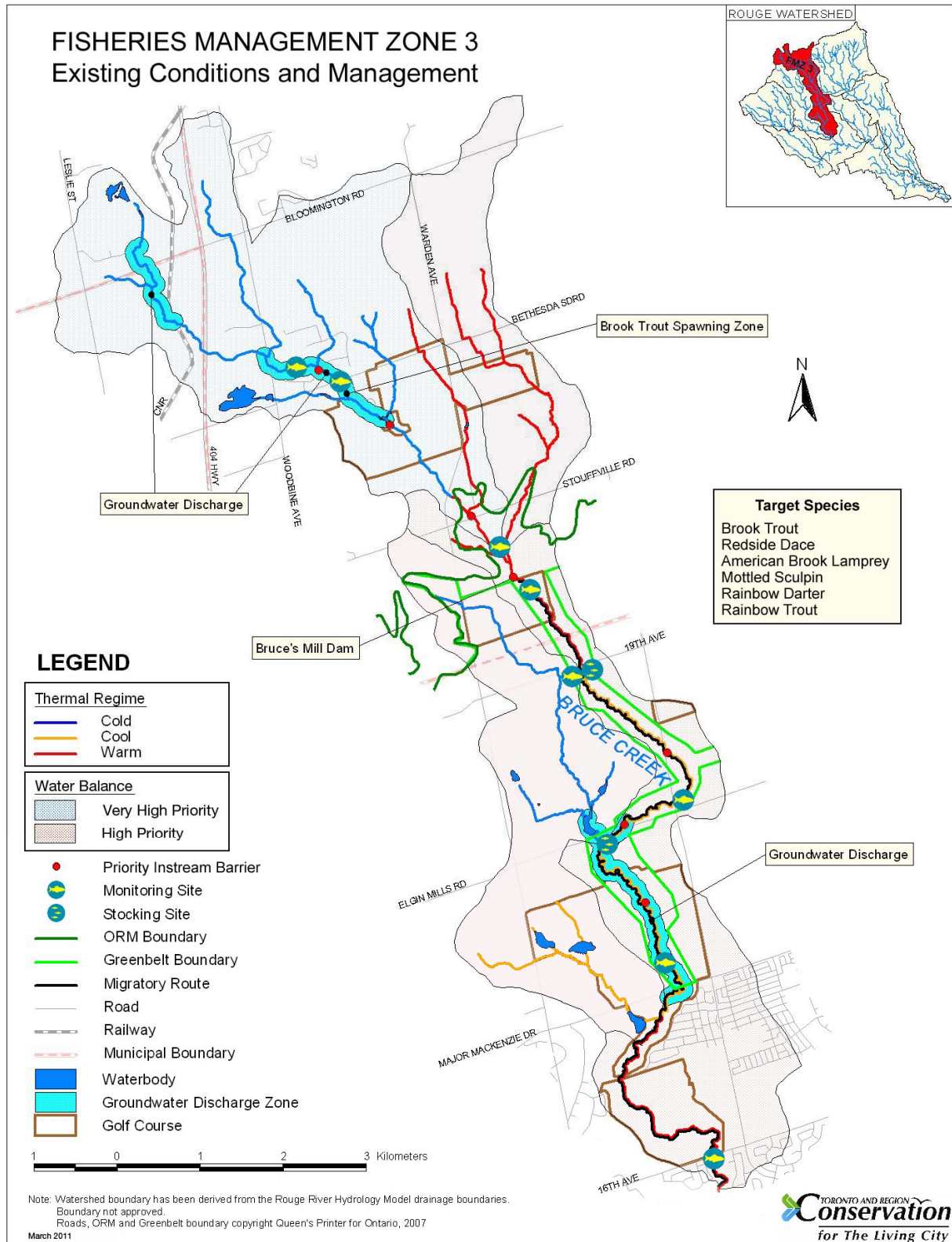


Figure 4-5: FMZ 3 Bruce Creek Existing Conditions and Management Map

The thermal regime represents actual stream temperatures which have been interpreted for development and application of construction Timing Windows as provided in the Rouge River FMP (Figure 2.2).

4.1.3.1 Management Recommendations FMZ 3

From a management perspective, this zone should be split into two halves with the dividing line generally corresponding with Major Mackenzie Rd. The southern portion of this zone has been urbanized for a number of years and there are opportunities to focus on infrastructure retrofits and redesign in support of the key target species Rainbow Darter.

The northern portion of this zone is still largely rural with patches of natural habitats and still supports healthy populations of Redside Dace and Brook Trout. While some development is anticipated over the coming years, the most immediate concern for the aquatic ecosystem are in-stream barriers that fragment habitat and populations. Additionally, this zone has a number of golf courses which offer many opportunities for education and partnerships. See **Table 4-13** for full list of management recommendations.

4.1.3.2 Implementation Project Opportunities FMZ 3

There are 3 IPOs developed for this zone with approximate locations found on

Figure 4-6 and described in **Table 4-14**, **Table 4-15**, and **Table 4-16**.

Table 4-13: FMZ 3 Bruce Creek Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Surface Water Regime	Flow regime is not characterized as there is no stream flow gauge within the subwatershed.	That all land use planning (e.g., subwatershed plans, secondary plans, master environmental services plans (MESP)) within this FMZ should be informed by appropriate characterization including: pre-development surface water flow regime, groundwater pathway determination, subwatershed water balance, current water taking activity, fluvial-geomorphic dynamics and assessment of cumulative effects. This characterization should include a minimum 3 years of data to account for different climatic conditions that influence stream hydrology.		all species
	Many watercourses and their related aquatic ecosystem functions, have a very high sensitivity to the alteration of the surface and groundwater flow regime as a result of land use change. A lack of required information exists, for these sensitive areas and others, to define a water balance condition that would allow for the maintenance of aquatic ecosystem integrity should urban development proceed within the catchment.			
	Impacts from cumulative water taking from watercourses is a concern in localized areas which may impact downstream Redside Dace habitat.	To work with MOE and permitted water takers (ground- or surface water) and address concerns relating to impacts to natural heritage features and functions. High priority should be to develop a water use management plan that includes risk assessment, drought management and support the use of self-regulating water withdrawal mechanisms. This planning should be set within the context of understanding the cumulative water taking impacts within this FMZ.		all species
		Encourage stewardship approaches by private landowners towards long-term, ecologically compatible water taking practices.	<u>IPO 3.3</u> <u>Landowner Stewardship</u>	all species
Groundwater Regime	Impacts from cumulative water taking from groundwater resources is a concern in localized areas which may impact downstream Redside Dace habitat. Water taking from groundwater sources for golf course irrigation is a common practice in this zone.	See Surface water recommendation for water taking concerns.		Redside Dace, American Brook Lamprey

Table 4-13: FMZ 3 Bruce Creek Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Groundwater Regime (continued)	Many watercourses and their related aquatic ecosystem functions, have a very high sensitivity to the alteration of the surface and groundwater flow regime as a result of land use change. A lack of required information exists, for these sensitive areas and others, to define a water balance condition that would allow for the maintenance of aquatic ecosystem integrity should urban development proceed within the catchment.	The prioritized need to achieve water balance in this FMZ should reflect the areas indentified on Figure 4-5(1 High Priority Zone, 1 Medium Priority Zone)		all species
Water Chemistry	Several watercourses directly adjacent to roadways have little to no physical buffer to mitigate road runoff (e.g., salt laden snow melt, accidental chemical spills).	Investigate retrofit alternatives (e.g., oil and grit separators, bioswales) for diverting or collecting run off from roads directly adjacent to watercourses for long-term stream protection or mitigation of pollutants (e.g., salt and accidental chemical spills). Making contact as soon as possible following a spill and supplying photographs can help MOE assess and respond as required to the occurrence. MOE Spills Action Centre phone number is 416-325-3000.		all species
		Support the Rouge River Watershed Plan (TRCA 2007a) in the recommendation for Municipalities to review/reduce/alter road salting practices.		all species
Temperature	In-stream temperatures and thermal stability demonstrate impacts from online impoundment ponds.	Undertake a full inventory of online ponds, measure thermal impacts and prioritize pond mitigation efforts. Interim focus should be on ponds upstream of Bruce's Mill Conservation Area that may be impacting all target species.		Brook Trout, Redside Dace, American Brook Lamprey, Mottled Sculpin
	In-stream temperatures and thermal stability trends also associated with lack of riparian cover.	Enhance riparian and/or upland habitat to improve thermal stability through increased shading and infiltration of precipitation.		Brook Trout, Redside Dace, American Brook Lamprey, Mottled Sculpin

Table 4-13: FMZ 3 Bruce Creek Management Recommendations

December 2010

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Sediment	Alteration in flow regime associated with impoundment ponds have likely caused a shift in natural sediment transport.	New and innovative approaches for future stormwater management, geared towards the protection of fish habitat, should be encouraged and supported such that discharge meets design criteria for water clarity and is consistent with acceptable range for target fish species. A commitment, supported by necessary long-term funding, to cleaning-out future SWM ponds should also be a high priority to ensure intended pond performance. At present, identified sediment impacts from on-line ponds up-stream of Bruce's Mill Conservation Area should be mitigated.		all species
	Sediment loadings have been observed from construction projects with this Fisheries Management Zone.	On site project managers or construction team representatives should be familiar with and able to apply the Great Golden Horseshoe Area Conservation Authorities' <i>Erosion and Sediment Control Guidelines for Urban Construction</i> (GGHACA 2006)		Redside Dace, Rainbow Darter
	Sediment discharge from future construction projects have the potential to impact Redside Dace populations and habitat.	Sediment and erosion controls should be effective at preventing sediment from entering the watercourse. This applies to all scales and types of construction activity.		Redside Dace
Terrestrial Natural Heritage	Ongoing active management of riparian cover by landowners limiting succession and regeneration of natural vegetation along watercourses.	Identify and undertake riparian planting opportunities to address and improve aquatic habitat quality and quantity. Consistent with recent landscape level planning initiatives (e.g., ORM Act), a 30 m riparian buffer on both sides of the watercourse is recommended for the entire watershed unless there is additional management or regulatory direction in place, then the most protective riparian width should be applied (see Section 3.2.11.1 Riparian Habitat Recommendations).		all species
	Riparian habitat for Redside Dace is negatively impacted by development activities.	For all stream reaches determined to be the habitat of Redside Dace, a minimum protected stream corridor consisting of the stream meander belt plus 30m on each side should be applied, as recommended in the <i>Redside Dace Recovery Strategy</i> (OMNR 2010a) and as required by OMNR. This may also be applied to stream reaches identified as recovery habitat for Redside Dace. See Section 3.2.11.1 Riparian Habitat Recommendations for vegetation community type recommendations.		Redside Dace
	One of two areas in the watershed where Iowa Darter has been identified consistently and may persist because of the local vegetation.	A portion of riparian habitat restoration should ensure that cedar trees are included along stream margins with deep pools and organic debris with dense aquatic vegetation and/or exposed fibrous roots to support Iowa Darter habitat. Also see Section 3.2.11.1 Riparian Habitat Recommendations for other vegetation community types.	-	all species

Table 4-13: FMZ 3 Bruce Creek Management Recommendations

December 2010

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Fish Community and Habitat	Habitat fragmentation associated with in-stream barriers.	Optimize fish passage of native species throughout the zone (i.e., removal or mitigation of in-stream barriers that negatively impact native fish communities). However, consequences of the potential introduction of invasive species and/or promoting the interaction with non-compatible species, must be considered.		all species
		Specifically investigate the feasibility of removing Bruce's Mill dam to extend current range of Redside Dace habitat and recreate stream morphology.	<u>IPO 3.2 Re-assessment of Bruce's Mill Dam</u>	Brook Trout, Redside Dace
		Specifically investigate the feasibility of mitigating the on-line pond SW of Stouffville and Warden Ave. to reconnect habitat upstream and downstream to support all life stages for Brook Trout.	<u>IPO 3.1 Management of Priority Barrier</u>	Brook Trout
	The habitat of sensitive species requires consideration for when construction activities can be undertaken.	A construction timing window from June 15th - September 15th is to be applied in all coldwater streams supporting Brook Trout and at the discretion of the appropriate agency.	-	
		A construction timing window from July 1st - September 15th is to be applied in all Redside Dace occupied habitats or in upstream contributing habitats at the discretion of the appropriate agencies.		Brook Trout and Redside Dace
	Migratory Rainbow Trout are passed over Milne Dam and navigate a fishway at Toogood Pond Dam to enter this system, however the potential negative interactions between adult Rainbow Trout and Redside Dace are not fully understood.	Monitoring and assessment of Rainbow Trout adult returns and natural reproduction is required to direct future stocking activity; target monitoring efforts upstream of Toogood Pond. Until such time, stocking of Rainbow Trout should generally avoid stream reaches determined to be the habitat of Redside Dace.		Rainbow Trout, Redside Dace
	Rainbow Trout stocking locations have historically been within reaches that also support Redside Dace.			
	Resident Brown Trout fry stocking locations are within habitat known to support Redside Dace. The present genetic strain of Brown Trout is resident and thus predatory adults are remaining in the system with Redside Dace as a potential food source.	Stocking of Brown Trout in the mid to upper portions of the watershed for purposes of lake fishing has not been effective and should not be continued in FMZ 3.		Redside Dace

Table 4-13: FMZ 3 Bruce Creek Management Recommendations

December 2010

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Anthropogenic	Water taking activity in this zone is common.	See surface water recommendation for water taking concerns.		All species
	Existing or future urbanization and associated activities.	Refer to recommendations above.		all species

Legend	Timeframe for Potential Implementation
Priority Focus	1 to 5 years
Management Focus	5 to 10 years

Table 4-13: FMZ 3 Bruce Creek Management Recommendations
December 2010

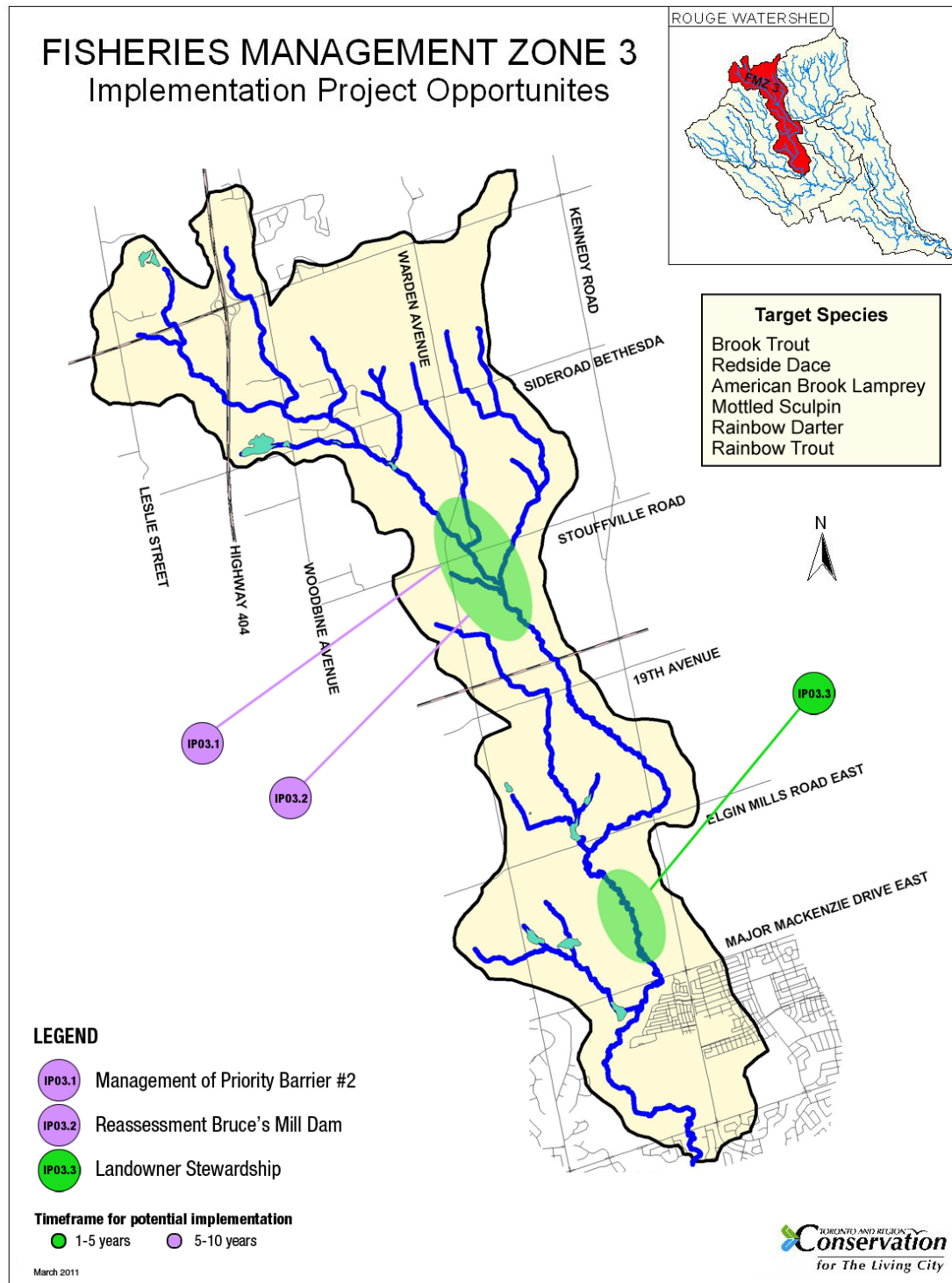


Figure 4-6: FMZ 3 Bruce Creek IPO Locations

IPOs are recommended with the expectation that prior or concurrent improvements in stormwater management proceed, and that water balance understanding is obtained for this FMZ in support of a healthy aquatic ecosystem.

Table 4-14: IPO 3.1 Management of Priority Barrier 3.2

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 3.1 Management of Priority Barrier 3.2
	Project Description	Priority Barrier 3.2 (see Table 3-3 of this FMP), located between Stouffville Road and Bethesda Road, west of Warden Ave, is a barrier to all fish species passage. This large concrete dam is a top draw structure that has measurable thermal impacts on the downstream reach which is classified as coldwater habitat for Brook Trout. This structure is located 700 m upstream of the Bruce's Mill dam which is being considered for removal to allow for passage of Redside Dace and other species. Any decision to mitigate Bruce's Mill dam for passage should take into account the feasibility of mitigating this barrier 3.2, as habitat gains may be minimal in terms of stream length opened up.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Barrier Management		
Undertake Approvals Process		- Barrier mitigation can be a complex process; agency consultation and approvals are required. - Detailing the merits of mitigation will be an important aspect of gaining approval. - Land and structure owner permission must also be obtained.
Implementation and Construction		Adherence with agency approvals.
Monitoring		Post construction and monitoring should happen as part of ensuring merits of project have been achieved.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

Table 4-15: IPO 3.2 Re-assessment of Bruce's Mill Dam

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 3.2 Re-assessment of Bruce's Mill Dam
	Project Description	In light of recovery planning consideration for Redside Dace, the potential for range expansion within this FMZ supports the re-assessment of Barrier 3.2 at Bruce's Mill (between Stouffville Rd and Bethesda Rd). This structure was partially mitigated in 2006 and the head pond allowed to drain to address thermal impacts to downstream habitat. Enough of the structure was left in place to be a species partition between Brook Trout (upstream) and Rainbow Trout (downstream) as per the original Rouge River FMP (1992) and a Class EA. Redside Dace are known to occupy downstream reaches as well.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Barrier Management		
Re-assessment and Potential Mitigation		- Barrier re-assessment would be directed by OMNR - Should removal or mitigation to allow passage be decided, this can be a complex process; agency consultation and approvals are required. - Detailing the merits of mitigation will be an important aspect of gaining approval. Land and structure owner permission must also be obtained.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

Table 4-16: IPO 3.3 Landowner Stewardship

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 3.3 Landowner Stewardship
	Project Description	Large blocks of land are held in private/public ownership and offer opportunity for effective restoration of ecological services focused on aquatic management.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Fish Community		
Sampling		Video recording to show landowners what they have on their property.
2. Thermal Regime		
Detailed Temperature Profiling		- Deployment of temperature loggers within the channel to delineate potential discharge areas and establish thermal regime to gauge improvements over time. - Identify opportunities on the property to stabilize the existing thermal regime.
3. Water Quality and Quantity		
Problem Identification		- Identify opportunities to utilize the landscape to add storage and detainment of water from upstream sources (e.g., peak shaving). - Identify opportunities to improve water quality downstream.
Erosion Potential		Utilize existing channel morphology and flow data to make assessments about the erosion potential of the watercourse in order to be predictive and to help assess the amount of channel adjustment in the future for which management activities may need to be taken.
4. Riparian Habitat		
Riparian and channel enhancements		Select areas to re-establish or enhance the riparian zone and perhaps riparian wetland conditions to improve aquatic habitat conditions.
5. Low Impact Development (LID)		
Site Selection		Focus on areas where design solutions could be implemented on the existing property and perhaps some of the surrounding landscape.
Retrofits		Select areas and design options that will retrofit existing engineered designs in order to enhance water quality and quantity towards a pre-development condition (e.g. reconstruction of SWM outlet structures).
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

4.1.4 Upper Little Rouge River (FMZ 4)

Located in the upper west corner of the watershed, this zone contains the headwaters to the Little Rouge River. The various fish species collected in past and recent surveys are listed in **Table 4-17**. A total of 31 species have been captured in this zone over time of which 12 species, all native, were collected during the most recent survey (2009). The target species, thermal regime and other existing conditions, monitoring stations, stocking sites and water balance priorities are shown on **Figure 4-7**.

The present fish community maintains the full complement of cold – cool water species found in the historic records (1950s -1972), including Brook Trout, Redside Dace, Mottled Sculpin, Rainbow Darter, Brassy Minnow, and Pearl Dace (*Margariscus margarita*) all of which are considered habitat specialists. This is strong evidence that the headwater system has maintained ecological integrity. However, some shift in habitat condition has occurred based on the recent collection of warmwater species not found in earlier records (i.e., Central Stoneroller (*Campostoma anomalum*), Brook Stickleback (*Culaea inconstans*) Brown Bullhead (*Ameiurus nebulosus*), Hornyhead Chub (*Nocomis biguttatus*), Largemouth Bass, Pumpkinseed and Rock Bass (*Ambloplites rupestris*)). These species are adding to the surprisingly high level of diversity for a headwater system and are likely utilizing the on-line pond habitat that has become increasingly prevalent in the landscape. Also contributing to the diversity are the stocked salmonids, Rainbow Trout and Brown Trout.

There are only four known coldwater reaches still supporting Brook Trout (3 in the top headwaters, 1 middle reach). Two of these four reaches are augmented with groundwater from privately owned, flowing wells. A similar situation was discussed in relation to the Upper Main Rouge River (FMZ 1) that identified the vulnerability of the coldwater habitat in the case of the wells being “turned off”. The distribution of Redside Dace is through the cool water, middle reaches. Stocking of both Rainbow Trout and Brown Trout also occur in these middle reaches.

The main branch of the Little Rouge flows through this zone and experienced a major fish kill (including Reside Dace) due to a chemical spill in the spring of 2007 as photo-documented by TRCA and OMOE. Post-monitoring in the fall 2007 indicated some re-establishment of the general community, however biodiversity was relatively low and Redside Dace were not found. TRCA's Regional Watershed Monitoring Program sampled this reach again in 2009 and noted a very high abundance of Central Stoneroller and a few other species but no Redside Dace were captured.

There are several known areas of significant groundwater discharge but habitat fragmentation by in-stream barriers and thermal warming by the associated on-line ponds are significant issues for the upper half of this zone. Conversely, there are no known in-stream barriers from Lake Ontario up through the Little Rouge and into the lower reaches of this zone. The majority of stable, cold water temperatures occur coincident with Brook Trout habitat. A likely cumulative impact from the on-line ponds is the wide fluctuation of stream temperatures

measured in the lower half of the system (based on 2003 and 2005 logger data; see TRCA 2007c).

Potential urban impact issues are largely confined to the eastern tributaries that drain the Stouffville area. The majority of other land cover is a mix of natural (including Oak Ridges Moraine and Greenbelt space) and agriculture with only a few golf courses.

Table 4-17: Past and Present Fish Species in FMZ 4

Species Name	Scientific Name	Last Record
Atlantic Salmon	<i>Salmo salar</i>	01/09/2000
Blacknose Dace	<i>Rhinichthys atratulus</i>	01/10/2009
Bluntnose Minnow	<i>Pimephales notatus</i>	08/08/2006
Brassy Minnow	<i>Hybognathus hankinsoni</i>	12/08/2003
Brook Stickleback	<i>Culaea inconstans</i>	20/08/2005
Brook Trout	<i>Salvelinus fontinalis</i>	11/08/2005
Brown Bullhead	<i>Ameiurus nebulosus</i>	20/08/2005
Brown Trout	<i>Salmo trutta</i>	01/10/2009
Central Stoneroller	<i>Campostoma anomalum</i>	01/10/2009
Coho Salmon	<i>Oncorhynchus kisutch</i>	17/08/1989
Common Shiner	<i>Luxilus cornutus</i>	22/08/2007
Creek Chub	<i>Semotilus atromaculatus</i>	01/10/2009
Fathead Minnow	<i>Pimephales promelas</i>	01/10/2009
Goldfish	<i>Carassius auratus</i>	11/06/2001
Hornyhead Chub	<i>Nocomis biguttatus</i>	08/08/2006
Iowa Darter	<i>Etheostoma exile</i>	12/08/2003
Johnny Darter	<i>Etheostoma nigrum</i>	01/10/2009
Largemouth Bass	<i>Micropterus salmoides</i>	08/08/2006
Longnose Dace	<i>Rhinichthys cataractae</i>	01/10/2009
Mottled Sculpin	<i>Cottus bairdii</i>	01/10/2009
Northern Hog Sucker	<i>Hypentelium nigricans</i>	07/10/1983
Northern Redbelly Dace	<i>Chrosomus eos</i>	17/08/1989
Pearl Dace	<i>Margariscus margarita</i>	20/08/2005
Pumpkinseed	<i>Lepomis gibbosus</i>	26/10/2009
Rainbow Darter	<i>Etheostoma caeruleum</i>	01/10/2009
Rainbow Trout	<i>Oncorhynchus mykiss</i>	01/10/2009
Redside Dace	<i>Clinostomus elongatus</i>	12/09/2005
Rock Bass	<i>Ambloplites rupestris</i>	12/07/2005
Smallmouth Bass	<i>Micropterus dolomieu</i>	07/07/1987
Stonecat	<i>Noturus flavus</i>	31/07/2003
White Sucker	<i>Catostomus commersonii</i>	01/10/2009

Note: Detailed fish collection records and data, in electronic format, are available upon request from TRCA Aquatic Group.

2009/2010 Surveys by Fisheries and Oceans Canada, Sea Lamprey Control
 2009, 2006, 2003, and 2000 surveys by TRCA's Regional Watershed Monitoring Program
 2005 survey by TRCA Aquatic Group
 Pre 2000 data from MNR collection records

1 Aquatic Invasive

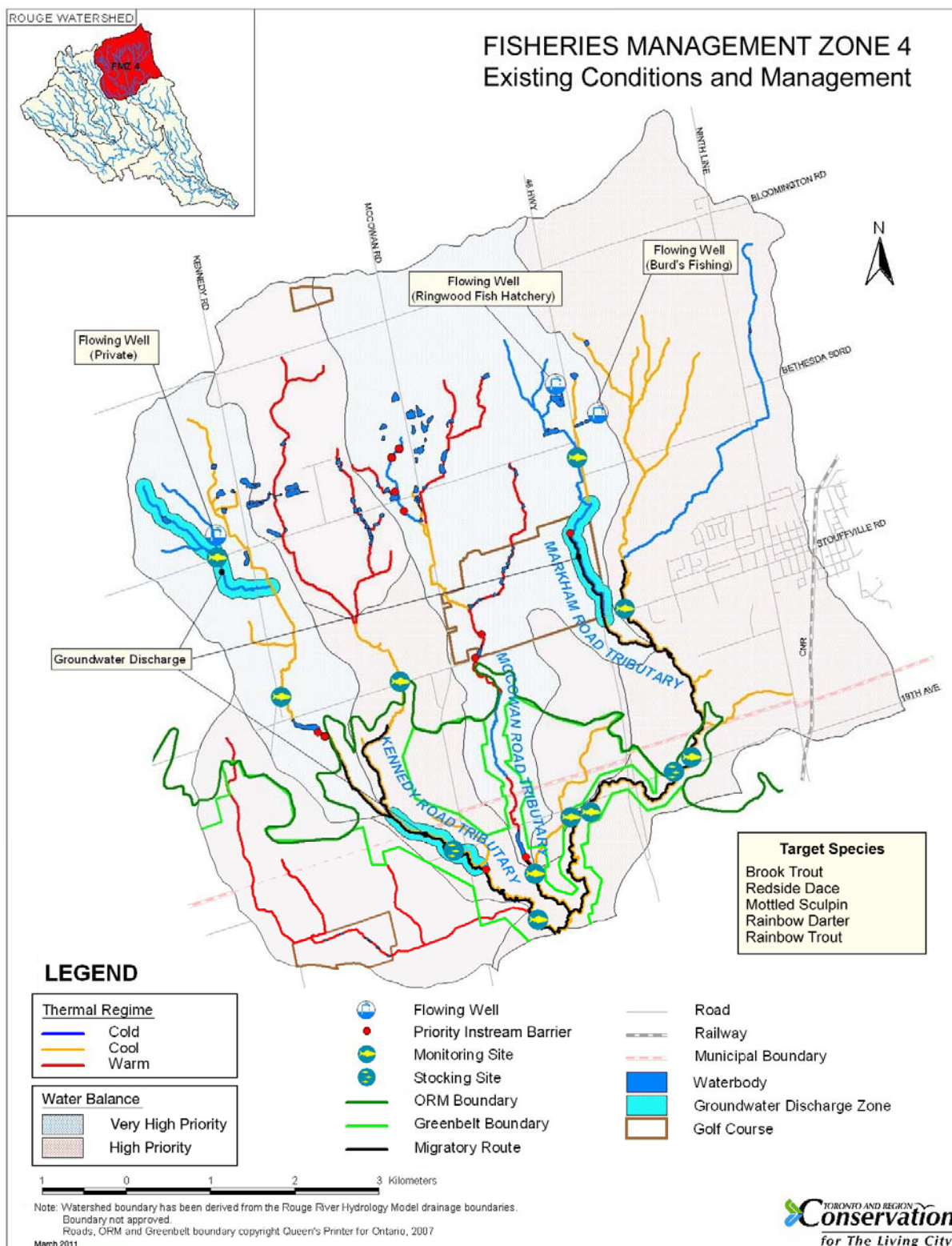


Figure 4-7: FMZ 4 Upper Little Rouge River Existing Conditions and Management Map

The thermal regime represents actual stream temperatures which have been interpreted for development and application of construction Timing Windows as provided in the Rouge River FMP (Figure 2-2).

4.1.4.1 Management Recommendations FMZ 4

This zone should be managed in two halves with the dividing line generally corresponding with Markham Road (HWY 48). The eastern portion has been urbanized for a number of years and is currently expanding (Whitchurch-Stouffville) though development has a defined limit as outlined in the *Oak Ridges Moraine Conservation Plan* (OMMAH 2002). A number of new stormwater ponds have been constructed as part of this build-out.

The western portion of this zone is largely rural and natural with only the northern portion falling on the Oak Ridges Moraine, generally above Stouffville Road. The lower portion of this half is off the Moraine but there is no significant level of development anticipated over the next 5-10 years. See **Table 4-18** for full set of recommendations.

4.1.4.2 Implementation Project Opportunities FMZ 4

There are 4 IPOs developed for this zone with approximate locations found on **Figure 4-8**. They are described in **Table 4-19**, **Table 4-20**, **Table 4-21**, **Table 4-22**.

Table 4-18: FMZ 4 Upper Little Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Surface Water Regime	Privately owned well is presently overflowing and augmenting a Redside Dace, Brook Trout stream with coldwater; habitat impacts could be sustained if well is shut off/decommissioned.	Establish a stewardship relationship with the owner(s) of the private wells.	IPO 4.3 Aquatic Habitat Stewardship for Owners of Flowing Wells	all species
	The Eastern portion of this zone is undergoing significant levels of development and there are likely to be significant shifts in flow regime observed.	That in future development areas, new and innovative approaches for SWM, geared towards the protection of Redside Dace and associated fish community be supported such that discharge meets ambient stream temperature, water clarity and chemistry or is within acceptable range for target species to be determined by the appropriate regulatory agency.		all species
	Large online privately owned impoundments within the Kennedy and McCowan tributaries likely altering flow characteristics of downstream watercourses.	The maintenance and, where possible, the re-establishment of a natural flow regime should be a primary goal of mitigation efforts.		all species
	Impacts from cumulative water taking from watercourses is a concern in localized areas which may impact downstream Redside Dace habitat.	- Encourage stewardship approaches by private landowners towards long-term, ecologically compatible water taking practices. - To work with MOE and permitted water takers (ground- or surface water) and address concerns relating to impacts to natural heritage features and functions. High priority should be to develop a water use management plan that includes risk assessment, drought management and supports the use of self-regulating water withdrawal mechanisms. This planning should be set within the context of understanding the cumulative water taking impacts within this FMZ.		all species
	Many watercourses and their related aquatic ecosystem functions have a very high sensitivity to the alteration of the surface and groundwater flow regime as a result of land use change. A lack of required information exists, for these sensitive areas and others, to define a water balance condition that would allow for the maintenance of aquatic ecosystem integrity should urban development proceed within the catchment.	That all land use planning (e.g., subwatershed plans, secondary plans, master environmental services plans (MESP)) within this FMZ should be informed by appropriate characterization including: pre-development surface water flow regime, groundwater pathway determination, subwatershed water balance, current water taking activity, fluvial-geomorphic dynamics and assessment of cumulative effects. This characterization should include a minimum 3 years of data to account for different climatic conditions that influence stream hydrology.		all species

Table 4-18: FMZ 4 Upper Little Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Groundwater Regime	Pathways of shallow groundwater flow are being intercepted and diverted during active construction and post development.	To identify and avoid groundwater draw down and/or interruption of local discharge pathways to receiving watercourses associated with construction activity (groundwater models have been developed for the Rouge Watershed).		all species
	Impacts from cumulative water taking from groundwater sources is a concern in localized areas which may impact Brook Trout habitat and/or downstream Redside Dace habitat.	See recommendation for surface water taking concerns.		Brook Trout, Redside Dace, American Brook Lamprey
	Many watercourses and their related aquatic ecosystem functions, have a very high sensitivity to the alteration of the surface and groundwater flow regime as a result of land use change. A lack of required information exists, for these sensitive areas and others, to define a water balance condition that would allow for the maintenance of aquatic ecosystem integrity should urban development proceed within the catchment.	The prioritized need to achieve water balance in this FMZ should reflect the areas identified on Figure 4-7 (3 High Priority Zones, 2 Medium Priority Zones).		all species
Water Chemistry		Support the <i>Rouge River Watershed Plan</i> (TRCA 2007a,) in the recommendation for Municipalities to review/reduce/alter road salting practices.		Redside Dace, American Brook Lamprey
	Several watercourses directly adjacent to roadways have little to no physical buffer to mitigate road runoff (e.g., salt laden snow melt, accidental chemical spills).	Investigate retrofit alternatives (e.g., oil and grit separators, bioswales) for diverting or collecting run off from roads directly adjacent to watercourses for long-term stream protection or mitigation of pollutants (e.g., salt and accidental chemical spills). Making contact as soon as possible following a spill and supplying photographs can help MOE assess and respond as required to the occurrence. MOE Spills Action Centre phone number is 416-325-3000.		n/a
	A large chemical spill impacted the aquatic community in the Markham Tributary in 2007 killing thousands of fishes, including Redside Dace. Redside Dace have not been collected in this reach since the spill.	Continue with post-spill monitoring efforts to document the recovery of the aquatic community within this system.	Table 4-20: IPO 4.2 Markham Tributary Recovery Assessment	all species

Table 4-18: FMZ 4 Upper Little Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Water Chemistry (continued)	Fish hatchery operations can cause water quality impairment if effluent release is not treated.	Confirm the effluent treatment and discharge practices at Ringwood Hatchery are not having a negative effect on the receiving watercourse.		all species
Temperature	Areas under development in Stouffville will generate stormwater that may have warming impacts to stream where sensitive target species are present, particularly Redside Dace.	Undertake an evaluation of the efficacy of stormwater management techniques to mitigate thermal impacts on 1st - 3rd order streams. Consider the inclusion of the following sites: Riotrin and Urbacon SWM Ponds on Leslie Tributary, Humber Flats SWM system on Upper East Humber, SWM Pond 61 on Black Creek, Cathedral SWM Pond on Rouge River (GEMS technology), various HWY 407 SWM Ponds.		Redside Dace, American Brook Lamprey, Mottled Sculpin
		Discharge from SWM ponds during the construction phase of new development and the approved built-out condition should meet ambient stream temperatures of receiving watercourses or be within an acceptable range for key target species. There may be specific temperature requirements or thresholds for Redside Dace pursuant to the <i>Endangered Species Act</i> (2007).		Redside Dace, American Brook Lamprey, Mottled Sculpin
	Warm surface discharge in the summer months from online ponds appears to be causing thermal impacts to receiving watercourses.	Determine to what extent existing water taking and online ponds are contributing to stream warming. Ponds should be prioritized for mitigation action.		Brook Trout, Redside Dace, American Brook Lamprey, Mottled Sculpin
		Enhance riparian and/or upland habitat to improve thermal stability through increased shading and infiltration of precipitation.		Brook Trout, Redside Dace, American Brook Lamprey, Mottled Sculpin

Table 4-18: FMZ 4 Upper Little Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Sediment	Areas under development in Stouffville have the potential to cause the discharge of sediment with a related increase in turbidity downstream where sensitive target species are present, particularly Redside Dace.	Sediment and erosion controls should be effective at preventing sediment from entering the watercourse. This applies to all scales and types of construction activity.		Redside Dace, Rainbow Darter
		On site project managers or construction team representatives should be familiar with and able to apply the Great Golden Horseshoe Area Conservation Authorities' <i>Erosion and Sediment Control Guidelines for Urban Construction</i> (GGHACA 2006).		Redside Dace, Rainbow Darter
		Consistent with draft plan approvals and recommendations in the <i>Rouge River Watershed Plan</i> (TRCA 2007a), minimize the area and duration of soil exposure due to top soil stripping and grading of any new development site. Use temporary seeding or other stabilizing techniques to minimize period of soil exposure.		Redside Dace, Rainbow Darter
	Alteration in flow regime associated with impoundment ponds has caused a shift in natural sediment transport.	All existing ponds in this FMZ should be assessed to determine the magnitude and scope of impacts to the streams, including sediment issues; priority ponds for mitigation should then be identified.		Redside Dace
Terrestrial Natural Heritage	The easternmost tributaries along Markham Road have riparian zone habitats that may be significantly degraded, reduced or lost in urbanizing areas.	For all stream reaches determined to be the habitat of Redside Dace, a minimum protected stream corridor consisting of the stream meander belt plus 30m on each side should be applied, as recommended in the <i>Redside Dace Recovery Strategy</i> (OMNR 2010a) and as required by OMNR. This may also be applied to stream reaches identified as recovery habitat for Redside Dace. See Section 3.2.11.1 Riparian Habitat Recommendations for vegetation community type recommendations.		all species
	The loss of tree cover within the riparian zone and table lands overtime, reflecting agricultural practices.	Identify and undertake riparian planting opportunities to address and improve aquatic habitat quality and quantity. Consistent with recent landscape level planning initiatives (e.g., ORM Act), a 30 m riparian buffer on both sides of the watercourse is recommended for the entire watershed unless there is additional management or regulatory direction in place, then the most protective riparian width should be applied (see Section 3.2.11.1 Riparian Habitat Recommendations)	-	Redside Dace
	One of two areas in the watershed where Iowa Darter has been identified consistently and may persist because of the local vegetation.	A portion of riparian habitat restoration should ensure that cedar trees are included along stream margins with deep pools and organic debris with dense aquatic vegetation and/or exposed fibrous roots to support Iowa Darter habitat. Also see Section 3.2.11.1 Riparian Habitat Recommendations for other vegetation community types.		all species

Table 4-18: FMZ 4 Upper Little Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Fish Community and Habitat	Multiple barriers and ponds fragment aquatic habitat and are barriers to many fish species, specifically Brook Trout.	Optimize fish passage of native species throughout the zone (i.e., removal or mitigation of in-stream barriers that negatively impact native fish communities). However, consequences of the potential introduction of invasive species and/or promoting the interaction with non-compatible species, must be considered.	Table 4-19: IPO 4.1 Management of Priority Barrier	all species
		Identify suitable recovery habitat for Brook Trout expansion as required through the use of in-stream temperature data, groundwater investigations as well as field reconnaissance.	-	Brook Trout
	Some portions of habitat appear to have low population abundance of Redside Dace and as such might be at higher risk from stochastic events (e.g., 2007 liquid fertilizer spill).	- Support recovery actions for Redside Dace (e.g., in-stream barrier mitigation). - Consider the establishment of a conservation reserve and associated research opportunities in this FMZ (i.e., Kennedy Tributary) in co-operation with OMR, DFO, TRCA, universities and other partners.	-	Redside Dace
	The potential "perching" of culverts associated with the removal of the impoundments due to their proximity to upstream road crossings is a concern.	The watercourse and crossings immediately upstream of dams would require specific studies such as a geomorphological assessment before the option of complete removal could be considered for mitigation.		all species
	The habitat of sensitive species requires consideration for when construction activities can be undertaken.	A construction timing window from July 1st - September 15th is to be applied in all Redside Dace occupied habitats or in upstream contributing habitats at the discretion of the appropriate agencies.		Rainbow Trout, Redside Dace
	This FMZ is accessible and at risk of aquatic invasive species moving up from Lake Ontario and the lower reaches of the Little Rouge River.	Increase the coordination of existing stewardship and outreach programs to prevent new introductions and spread of aquatic invasive species (AIS) above the Milne Dam, particularly Round Goby.	IPO 7.4 Barrier Re-assessment for Preventing Further Round Goby Invasion into the Little Rouge River	Rainbow Trout

Table 4-18: FMZ 4 Upper Little Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Anthropogenic	The Main Branch of the Little Rouge River (FMZ 7) is currently a migratory route for Rainbow Trout as well as other migratory fish species which can access this FMZ's habitat, and for which there are minimal angling opportunities (locations) and where species partitioning is may be needed.	Stocking of Brown Trout in the mid to upper portions of the watershed for purposes of lake fishing has not been effective and should not be continued in FMZ 4.		Redside Dace
	Livestock are known to have direct access to the watercourse in some areas of this FMZ.	Engage landowners and encourage the practice of stewardship activities to protect stream health (e.g., fencing cattle out of the watercourse).	<u>IPO 4.4 Prevention of Livestock Access to Streams</u>	Rainbow Trout, Redside Dace

Legend	Timeframe for Potential Implementation
Priority Focus	1 to 5 years
Management Focus	5 to 10 years

Table 4-18: FMZ 4 Upper Little Rouge Management Recommendations

December 2010

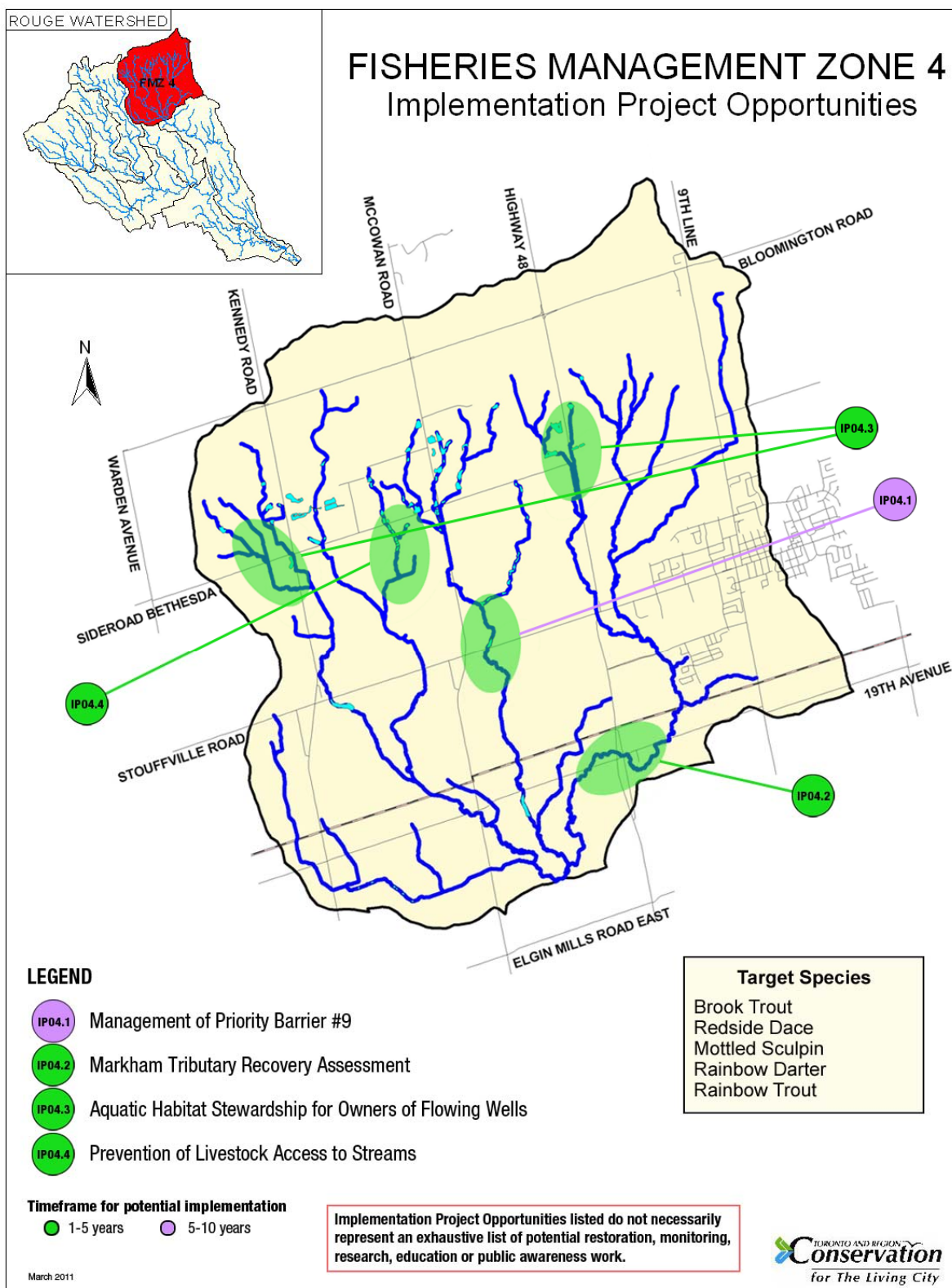


Figure 4-8: FMZ 4 Upper Little Rouge River IPO Locations

IPOs are recommended with the expectation that prior or concurrent improvements in stormwater management proceed, and that water balance understanding is obtained for this FMZ in support of a healthy aquatic ecosystem

Table 4-19: IPO 4.1 Management of Priority Barrier 4.7

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 4.1 Management of Priority Barrier 4.7
	Project Description	Priority Barrier 4.7 (see Table 3-3 of this FMP) is located on the north side of Stouffville Road, east of McCowan Road and prevents passage of all species. This large concrete dam has a significant impoundment above it, and is a top draw structure with measurable thermal impacts to downstream habitat which is classified as coldwater.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Barrier Mitigation		
Undertake Approvals Process	- Land and structure owner permission must be obtained. - Agency consultation and approvals are required. - Detailing the merits of mitigation will be an important aspect of gaining approval.	
Implementation and Construction	Adherence with agency approvals.	
Monitoring	Post construction and monitoring should happen as part of ensuring merits of project have been achieved.	
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

Table 4-20: IPO 4.2 Markham Tributary Recovery Assessment

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 4.2 Markham Tributary Recovery Assessment
	Project Description	To continue to document and track the recovery of the fish community in this tributary after a chemical spill on May 7th, 2007.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Fish Community		
Sampling		- Agencies/NGO/Researchers to monitor at established previous sampling locations to track fish population changes over time. This should include size and age class of the individuals within the population. - Monitoring and analysis from this work may provide future directions and restoration options that may need to be investigated or undertaken. - Baseline fish community information is available.
2. Benthic Invertebrate Community		
Sampling		- Determining benthic invertebrate community structure as another indicator of system recovery and/or characterization of a new biotic condition. - Collect benthic invertebrate information and look for specific absences (likely species) from previous sampling data. - Monitoring and analysis from this work may provide future directions and restoration options that may need to be investigated or undertaken.
3. Reporting		
Summary Reporting		A brief summary report should be completed each year to summarize activities, results and where to find the related information.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

Table 4-21: IPO 4.3 Aquatic Habitat Stewardship for Owners of Flowing Wells

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 4.3 Aquatic Habitat Stewardship for Owners of Flowing Wells
	Project Description	Strengthen education and stewardship relationship with owners/managers of properties with flowing wells providing baseflow to sustain coldwater fish habitat in the headwater zone of the upper Little Rouge River.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Education and Stewardship		
Workshop		- A special presentation/talk could be organized for property owners/managers to provide information on the sensitive aquatic habitat in the upper Little Rouge which flows through their properties. The critical importance of groundwater discharge in providing a stable base flow to the stream could be highlighted. Strategies to protect baseflow and water quality by improving the riparian buffer zone could be discussed. Planting prescriptions tailored to headwater groundwater discharge zones could be developed. - Agency or NGO staff could assist with developing and implementing workshop.
Site Visits to Flowing Well Properties		- Stewardship staff could organize site visits with interested property owners/managers to inspect the flowing wells and tour the stream corridor through the property. Problem areas could be identified and possible solutions acceptable to the owners/managers could be discussed. Specific riparian zone planting plans could be designed, and possible implementation mechanisms discussed. - Possible connection to Source Water Protection work. Try to find a linkage.
Monitoring		- After riparian zone project has been designed, approved and implemented, post planting monitoring must be undertaken to document whether the defined goals of the work are being achieved (e.g., survivorship of plantings). - An electrofishing survey could be conducted to introduce residents to local fish community and illustrate landscape connections. - Once it has been identified that the project has achieved its goals for protecting the flow regime and coldwater habitat, a plan is required to monitor the flowing well and stream corridor periodically in a formalized manner to ensure fish community is healthy.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

Table 4-22: IPO 4.4 Prevention of Livestock Access to Streams

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 4.4 Prevention of Livestock Access to Streams
	Project Description	Strengthen education and stewardship relationship with owners/managers of agricultural properties with livestock accessing stream for watering in the Little Rouge River.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Education and Stewardship		
Workshops/Presentation	- A special workshop/presentation could be organized for property owners/managers to provide information on the sensitive aquatic habitat in the Little Rouge which flows through their properties. - Strategies to protect water quality by restricting livestock access to the stream could be discussed. - Agency stewardship staff could assist with developing and implementing workshop. May need to occur at an already established event with the target audience present (e.g., Markham Fair, Royal Winter Fair).	
Site Visits to Properties with livestock	- Stewardship staff could organize site visits with interested property owners/managers to inspect the livestock access points and tour the stream corridor through the property. Problem areas could be identified and possible solutions acceptable to the owners/managers could be developed. - Numerous options exist for providing watering stations away from the stream. Fencing above the top of bank should also be installed to protect the riparian zone from trampling. If fencing is installed, planting should occur in the riparian zone.	
Monitoring	- After livestock access to stream has been restricted and riparian zone project has been designed, approved and implemented, post planting monitoring must be undertaken to document whether the defined goals of the work are being achieved. - A water quality survey should be conducted before project implementation to document existing conditions. Periodic surveys should be conducted post-planting to document improvements to water quality. - Once it has been identified that the project has achieved its goals for protecting the stream water quality and fish habitat, a plan should be undertaken to monitor the and stream corridor and water quality periodically in a formalized manner to ensure fish community is healthy.	
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

4.1.5 Central Main Rouge River – Toogood Pond and Milne Reservoir (FMZ 5)

This urban area, in the middle of the watershed, captures drainage flowing down from both Berczy and Bruce Creeks with combined flows moving through Toogood Pond and then Milne Reservoir. The various fish species collected in past and recent surveys are listed in **Table 4-23**. A total of 32 species have been captured in this zone (within the main branch) over time of which 13 species, one invasive (Common Carp), were collected during the most recent survey (2008). The target species, thermal regime and other existing conditions, monitoring stations, stocking sites and water balance priorities are shown on **Figure 4-9**. Target species selected to reflect the recreational angling potential of the ponds are Yellow Perch and Largemouth Bass.

The present fish community is largely warmwater and comprised of many generalist species (e.g., Blacknose Dace, Brook Stickleback, Bluntnose Minnow (*Pimephales notatus*), Common Carp, Creek Chub, Fathead Minnow (*Pimephales promelas*)). The data in **Table 4-23** suggests that Brassy Minnow, Redside Dace, Iowa Darter (*Etheostoma exile*), Sand Shiner (*Notropis stramineus*), and Emerald Shiner (*Notropis atherinoides*) are no longer found in this reach. These species require a range of habitat types characteristic of mid-watershed reaches, including riparian wetland, deep pools, slow moving water, clean sand-gravel substrates. The backwater effects of the reservoir, that is, increased sedimentation to the channel may be a cause for local losses of fish species.

Of particular note is the presence of the key target species Rainbow Darter. The LSAT model predicts Rainbow Darter is at the threshold of decline in the lower half of the watershed (TRCA, 2007c). The extirpation of this species has been observed in neighbouring, more heavily urbanized watersheds. A decline in this species' population may provide an early warning of serious impairment to the biotic system.

The stream reach between Toogood Pond and Milne Reservoir is thermally stable (see TRCA 2007c), warm water and managed as a migratory corridor for lake run species like Rainbow Trout and White Sucker. Chinook Salmon are also known to move up through this zone. These species and resident native communities rely on the managed fishways at Milne Reservoir and Toogood Pond to access higher quality upstream habitat in Bruce and Berczy Creeks.

Table 4-23: Past and Present Fish Species in FMZ 5

Species Name	Scientific Name	Last Record
Black Crappie	<i>Pomoxis nigromaculatus</i>	08/04/2001
Blacknose Dace	<i>Rhinichthys atratulus</i>	02/09/2008
Bluntnose Minnow	<i>Pimephales notatus</i>	02/09/2008
Brassy Minnow	<i>Hybognathus hankinsoni</i>	15/08/1984
Brook Stickleback	<i>Culaea inconstans</i>	02/09/2008
Brown Bullhead	<i>Ameiurus nebulosus</i>	05/04/2000
Brown Trout	<i>Salmo trutta</i>	04/08/2000
Central Stoneroller	<i>Campostoma anomalum</i>	04/04/2001
Common Carp	<i>Cyprinus carpio</i>	04/04/2001
Common Shiner	<i>Luxilus cornutus</i>	02/09/2008
Creek Chub	<i>Semotilus atromaculatus</i>	02/09/2008
Emerald Shiner	<i>Notropis atherinoides</i>	15/04/1997
Fathead Minnow	<i>Pimephales promelas</i>	02/09/2008
Golden Shiner	<i>Notemigonus crysoleucas</i>	02/05/2000
Goldfish	<i>Carassius auratus</i>	02/09/2008
Iowa Darter	<i>Etheostoma exile</i>	04/06/1991
Johnny Darter	<i>Etheostoma nigrum</i>	02/09/2008
Largemouth Bass	<i>Micropterus salmoides</i>	02/05/2000
Longnose Dace	<i>Rhinichthys cataractae</i>	02/09/2008
Mimic Shiner	<i>Notropis volucellus</i>	26/05/1954
Northern Pike	<i>Esox lucius</i>	10/04/2001
Northern Redbelly Dace	<i>Chrosomus eos</i>	13/09/2005
Pumpkinseed	<i>Lepomis gibbosus</i>	02/09/2008
Rainbow Darter	<i>Etheostoma caeruleum</i>	02/09/2008
Rainbow Trout	<i>Oncorhynchus mykiss</i>	02/09/2008
Redside Dace	<i>Clinostomus elongatus</i>	26/05/1954
Rock Bass	<i>Ambloplites rupestris</i>	17/08/2006
Sand Shiner	<i>Notropis stramineus</i>	15/08/1984
Smallmouth Bass	<i>Micropterus dolomieu</i>	13/09/2005
Stonecat	<i>Noturus flavus</i>	17/08/2000
White Sucker	<i>Catostomus commersonii</i>	02/09/2008
Yellow Perch	<i>Perca flavescens</i>	08/04/2001

Note: Detailed fish collection records and data, in electronic format, are available upon request from TRCA Aquatic Group

2009/2010 Surveys by Fisheries and Oceans Canada, Sea Lamprey Control
 2009, 2006, 2003, and 2000 surveys by TRCA's Regional Watershed Monitoring Program
 2005 survey by TRCA Aquatic Group
 Pre 2000 data from MNR collection records

2 Aquatic Invasive

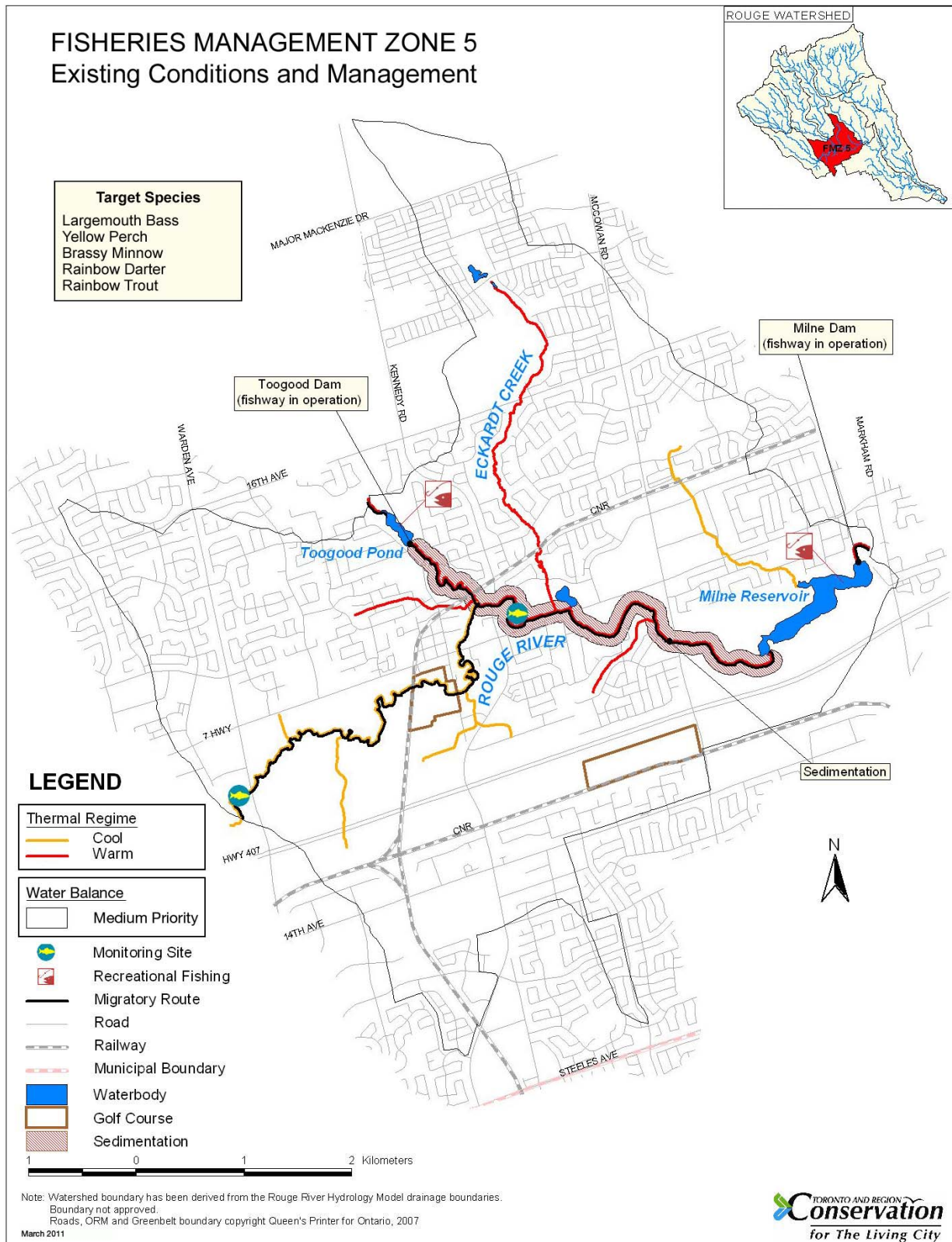


Figure 4-9: FMZ 5 Central Main Rouge River Existing Conditions and Management Map

The thermal regime represents actual stream temperatures which have been interpreted for development and application of construction Timing Windows as provided in the Rouge River FMP (Figure 2-2).

4.1.5.1 Management Recommendations FMZ 5

This zone should be managed as a single unit with stewardship as the focus as it is largely urbanized with a strong and engaged local community around Toogood Pond and the Milne Reservoir. **Table 4-24** provides the full list of recommendations.

4.1.5.2 Implementation Project Opportunities FMZ 5

There are three IPOs developed for this zone with approximate locations found on **Figure 4-10**. Two are described in **Table 4-25** and **Table 4-26**. For a description of IPO 5.3, please refer to the related IPO 7.7 (**Table 4-39**).

Table 4-24: FMZ 5 Central Main Rouge River (Toogood Pond and Milne Reservoir) Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Surface Water Regime	Flow gauging records illustrate an upward trend in flow quantity and increased peakiness through the period of record (TRCA 2007). It is likely that high storm flow volumes and changes in seasonal distribution of flows are contributing to physical changes observed in stream conditions.	Retrofit and/or clean out existing stormwater management ponds to improve conditions at point of discharge and cumulatively for downstream habitats (e.g., flow regime, temperature, water chemistry, sediment transport).		all species
Groundwater Regime	Many watercourses and their related aquatic ecosystem functions, have a very high sensitivity to the alteration of the surface and groundwater flow regime as a result of land use change. A lack of required information exists for urbanized areas to define a water balance condition that could return altered flows to a more natural regime.	The prioritized need to achieve water balance in this FMZ should reflect the areas indentified on Figure 4-9 (retrofit opportunities only).		all species
Water Chemistry	Chlorides associated with road salting and other contaminants from urban run-off are likely accumulating in Milne Reservoir and Toogood Pond. The presence of these contaminants may limit productivity of the aquatic ecosystem within these impoundments and in-stream habitats downstream.	- Support the <i>Rouge River Watershed Plan</i> (TRCA 2007a,) in the recommendation for Municipalities to review/reduce/alter road salting practices. - Analysis of sediment within Milne Reservoir and Toogood Pond should be conducted to better understand the habitat suitability and sustainability of a recreational Largemouth Bass fishery. This information should be available when consulting the local community and general public on the desire for enhanced fishing opportunities in these waterbodies.	see related I.P.O. 5.1 below	all species
	Multiple industrial/commercial operations in FMZ 10 are potential sources of contaminants to downstream reaches within this FMZ 5.	See water chemistry recommendations listed for FMZ 10 on Table 4-49 to address these cumulative impacts.		all species
Temperature	Downstream thermal impacts from the online impoundment ponds are being measured in the Main Rouge River.	Investigate feasibility of bottom draw retrofit at Toogood Dam and use of existing bottom draw outlet at Milne Dam.		all species

Table 4-24: FMZ 5 Central Main Rouge River Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Sediment	Ongoing deposition of significant amounts of sediment in Toogood Pond, Milne Reservoir and to a lesser degree throughout riverine habitats within FMZ 5.	Confirm there is a long term maintenance plan for Milne Reservoir and Toogood Pond that includes a schedule for the removal of sediment.		all species
		Examine potential for improvements through enhanced farming practices upstream in FMZ 2 and FMZ 3 (e.g., riparian zone plantings, cattle fencing).		all species
		See sediment recommendations for FMZ 2 and FMZ 3 to address the issue of excessive sediment transport and accumulation in these downstream water bodies.		all species
Terrestrial Natural Heritage	Amount of riparian habitat has been significantly reduced throughout FMZ 5.	Restore natural multi-layer tree canopy cover within the riparian zone and uplands where available to allow for the increased infiltration and retention of water in order to maintain/restore flow balance and groundwater discharge to streams. See Section 3.2.11.1 Riparian Habitat Recommendations for vegetation community type recommendations.		all species
Fish Community and Habitat	There has been a reduction in the number of habitat specialists occupying these warmwater middle reaches due to both upstream influences (i.e., urbanization impacts) and the effects of the Milne Reservoir and Toogood Pond. The result is a less diverse native fish community consisting primarily of tolerant species.	Apply innovative and established best management practices in upstream catchments to make substantial gains towards mitigating downstream cumulative impacts.		all species
	Ensuring passage of migratory fish species at the Milne Dam fishway.	Maintain passage along Main Rouge River for migratory salmonids through the long-term management and maintenance of Milne Dam fishway in cooperation with government agencies (MNR, TRCA) and local angling groups (e.g., Metro East Anglers).		Rainbow Trout
	The natural recruitment of Rainbow Trout within the Rouge River is not well understood.	Expand the monitoring of migratory fish species at Milne Dam Fishway and explore opportunities for further partnership (agencies, interest groups, and academia).	IPO 5.2 Data Collection at Milne Fishway	Rainbow Trout
		See additional recommendations in 3.2.9.1 Stocking Recommendations		Rainbow Trout

Table 4-24: FMZ 5 Central Main Rouge River Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Fish Community and Habitat (continued)	Pond environments adjacent to highly urbanized catchments may be at higher risk of introductions of aquatic invasive species. Further, with the Milne fishway currently open for most of the year, all species can potentially pass into the upper watersheds; of particular concern is Round Goby.	Increase the coordination of existing stewardship and outreach programs to prevent new introductions and spread of aquatic invasive species above the Milne Dam, particularly Round Goby.	IPO. 5.3—see related IPO 7.7 Invasive Species Detection Program for Volunteers	all species
Anthropogenic	OMNR publications identify recreational fishing opportunities in Milne Reservoir and Toogood Pond.	Assess the use of and viability of the warmwater recreational fishery in Milne Reservoir and Toogood Pond through creel surveys, fish sampling and water quality analysis.	IPO 5.1 Milne Reservoir and Main Branch Recreational Fishery	Largemouth Bass, Yellow Perch
	Existing or future urbanization and associated activities.	Refer to recommendations above.		all species

Legend	Timeframe for Potential Implementation
Priority Focus	1 to 5 years
Management Focus	5 to 10 years

Table 4-24: FMZ 5 Central Main Rouge River Management Recommendations

December 2010

4-66

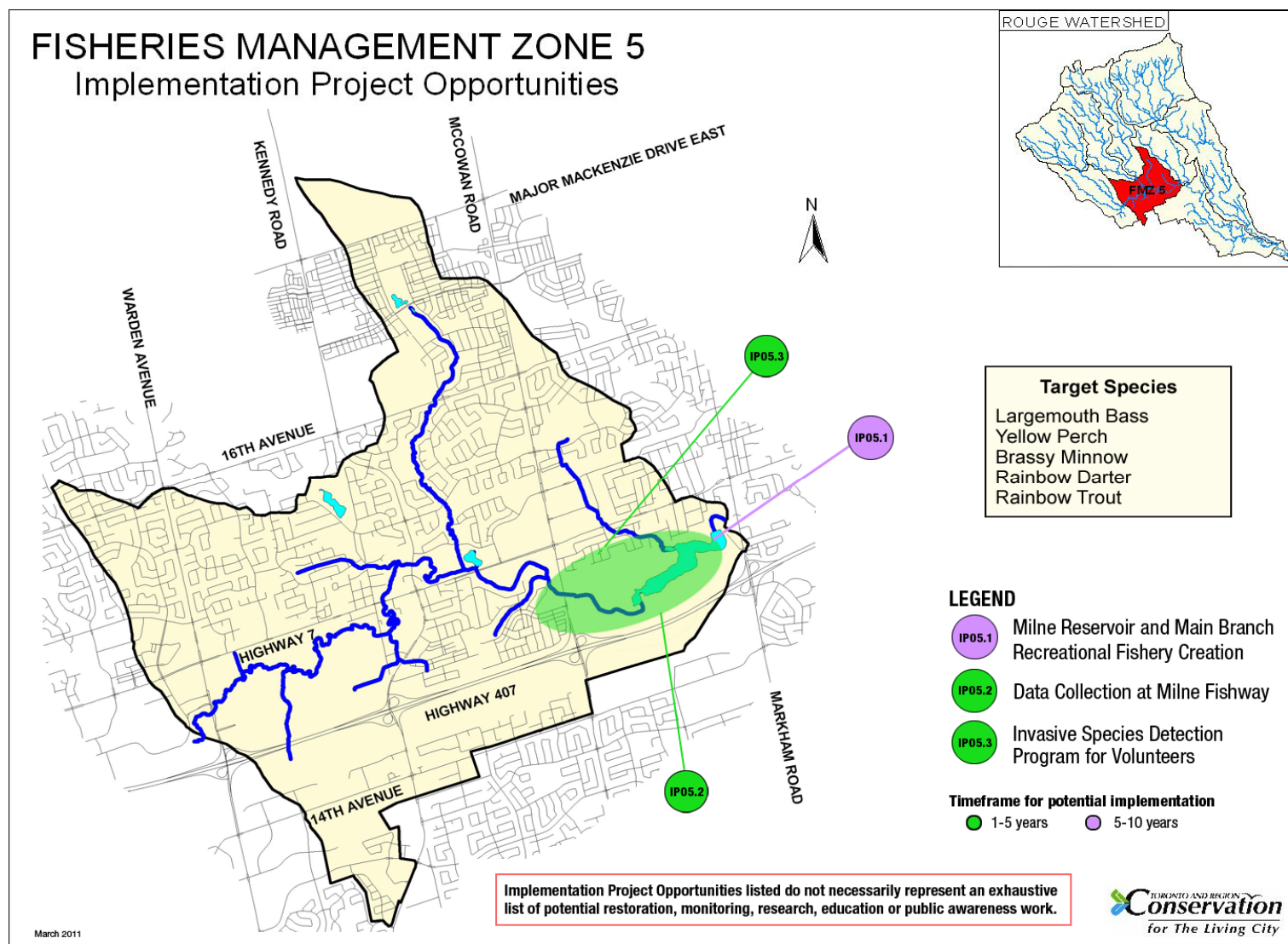


Figure 4-10: FMZ 5 Central Main Rouge River IPO Locations

IPOs are recommended with the expectation that prior or concurrent improvements in stormwater management proceed, and that water balance understanding is obtained for this FMZ in support of a healthy aquatic ecosystem.

Table 4-25: IPO 5.1 Milne Reservoir and Main Branch Recreational Fishery

Implementation Project Opportunity	
Project Name	IPO 5.1 Milne Reservoir and Main Branch Recreational Fishery
Project Description	To determine the social and ecological feasibility of creating a self-sustaining warmwater recreational fishery in Milne Reservoir (e.g., Largemouth Bass, sunfish).
Proposed Project Components	Proposed Project Planning and Design Considerations
1. Fish Community	
Fishery Survey	Determine current fish community within Milne Reservoir (e.g., creel survey and direct sampling) in order to provide direction for the warmwater community.
Habitat Assessment	Through water quality, thermal, and flow condition investigations within the pond, make an assessment if there is suitable habitat present to support a Largemouth Bass or sunfish fishery with minimal stocking efforts, with the goal of establishing a self-sustaining population.
2. Thermal Regime	
Deployment of Temperature Loggers	Deployment of multiple temperature loggers within the reservoir at different locations to develop a continuous thermal profile, and to better understand nearshore habitat conditions.
3. Public Meetings	
Establish if there is a desire to create a warmwater recreational fishery	Consultation with local residents, angling organizations, Municipal representatives and other stakeholders, including Milne Park Conservation Association.
4. Creel Survey	
Localized survey in Markham	A creel survey of anglers who actively fish in the Rouge but do not belong to clubs/organizations.
5. Initial Stocking	
Investigate Source Populations	Determine suitable source populations for transfer exist, and/or organize fishing derbies to capture fishes for transfer to Milne reservoir and Toogood Pond. Alternatively, capture adults through netting project.
Investigate hatchery operations and capacity	Investigate whether there are pike and bass in the rearing system that could be used to stock Milne.
Identify anglers or groups willing to stock	Investigate whether there are groups that would stock and potentially raise fishes for Milne initially, and if there are available resources (e.g., Glen Haffy, Ringwood, Old MEA tanks, Secord Property).
Identify brood stock	Identify where brood stock would come from and whether there are issues surrounding VHS and fish transfers.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).	

Table 4-26: IPO 5.2 Data Collection at Milne Fishway

Implementation Project Opportunity	
Project Name	IPO 5.2 Data Collection at Milne Fishery
Project Description	The monitoring of Rainbow Trout at Milne fishway is being conducted by OMNR to assess stocking efforts and inform long term management direction as discussed in Section 3.2.9.1 of this FMP. The fishway and fish monitoring program additionally provide opportunity for public education and outreach.
Proposed Project Components	Proposed Project Planning and Design Considerations
1. Fish Community	
Data Collection	Scheduled events in the spring coinciding with the annual run of Rainbow Trout could allow for stakeholders and the general public to get a first hand look at fishway operations, data collection procedures and annual egg collections. Contact OMNR Aurora District office for more information.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).	

4.1.6 Robinson Creek and Mt. Joy Creek – formerly Exhibition Creek (FMZ 6)

This zone is centrally located within the watershed and contains two first order tributaries that drain into the main Rouge River: Robinson Creek and Mt. Joy Creek (formerly Exhibition Creek). The various fish species collected in past and recent surveys are listed in **Table 4-27**. A total of 27 species have been captured in this zone over time of which 11 species, including one invasive (Common Carp), were collected in the most recent survey (2009). Reside Dace have only been collected in Robinson Creek and are known to still be present based on a 2010 survey conducted by OMNR. The target species, thermal regime and other existing conditions, monitoring stations, stocking sites and water balance priorities are shown on **Figure 4-11**.

All species in the recent survey were present in Robinson Creek but historic diversity was higher for this stream supporting a range of cool, sensitive, habitat specialists to warm and tolerant pond species. The fish species more typical of pond or large riverine habitat (i.e., Smallmouth Bass, Largemouth Bass, Emerald Shiner, Stonecat (*Noturus flavus*), Rock Bass and Goldfish were caught largely prior to 2000 when sampling methods favoured the capture of these species (i.e., seine nets). The absence of Northern Redbelly Dace (*Chrosomus eos*) since 1954, a definitive riverine species, is more indicative of “species loss” rather than a switch in sampling method. Related, and of particular note, is the continued presence of Pearl Dace (2005), as these two minnow species utilize similar habitat (cool, clear, vegetated pools) and are often found together (Scott and Crossman 1973), although Northern Redbelly Dace have stronger preference for aquatic vegetation than Pearl Dace.

The current community in Robinson Creek reflects the historic coolwater species but also shows a shift to coldwater habitat with the presence of migratory Rainbow Trout. Rainbow Trout are stocked in the lowest reach of Robinson Creek and known to return to this location (2001-2005) but in more recent years, returning adults have been observed higher up in the middle reaches coinciding with increased flow due to temporary additions of groundwater. Stream temperatures taken in 2003 and 2005 (see TRCA 2007c) were in the range of coldwater habitat. There is no historic flow or temperature data for Robinson Creek but anecdotal discussions have suggested that flow conditions between the wetland and the very upper and middle reaches were intermittent in the past. The flow augmentation has now ceased (2008) but continuous summer flow conditions were confirmed in 2009 and Rainbow Trout were still observed in the middle reaches in 2010 coincident with Redside Dace occupied habitat. It is not clear whether the coldwater or flow conditions will continue.

A cool-coldwater regime characterizes Mt. Joy Creek but only 5 of the recently collected 11 species were found in this watercourse (Blacknose Dace, Creek Chub, Fathead Minnow, Longnose Dace and Bluntnose Minnow). These species are tolerant of cool-warm water temperatures and impacts attributed to urbanization. Mt. Joy has been significantly altered, including a reduction to its riparian habitat, significant straightening, channelization and an on-line storm pond. Seasonally dry conditions are experienced in the reach above 16th Avenue. The only natural habitat conditions in Mt. Joy are found through the downstream half of the

watercourse. In addition to poor structural habitat, water quality may be a major limiting factor for the fish community; during the 2003 fish survey, TRCA staff noted a persistent organic odour suggestive of sewage.

Table 4-27: Past and Present Fish Species in FMZ 6

Species Name	Scientific Name	Last Record
Black Crappie	<i>Pomoxis nigromaculatus</i>	29/08/2001
Blacknose Dace	<i>Rhinichthys atratulus</i>	25/06/2009
Bluntnose Minnow	<i>Pimephales notatus</i>	11/09/2007
Brook Stickleback	<i>Culaea inconstans</i>	15/08/2005
Brown Bullhead	<i>Ameiurus nebulosus</i>	29/08/2001
Brown Trout	<i>Salmo trutta</i>	25/06/2003
Central Stoneroller	<i>Campostoma anomalum</i>	25/06/2009
Common Carp	<i>Cyprinus carpio</i>	16/07/2009
Common Shiner	<i>Luxilus cornutus</i>	16/07/2009
Creek Chub	<i>Semotilus atromaculatus</i>	16/07/2009
Emerald Shiner	<i>Notropis atherinoides</i>	10/08/1994
Fathead Minnow	<i>Pimephales promelas</i>	16/07/2009
Goldfish	<i>Carassius auratus</i>	22/04/1998
Johnny Darter	<i>Etheostoma nigrum</i>	16/07/2009
largemouth bas	<i>Coregonus clupeaformis</i>	22/08/1996
Longnose Dace	<i>Rhinichthys cataractae</i>	16/07/2009
Northern Redbelly Dace	<i>Chrosomus eos</i>	04/06/1954
Pearl Dace	<i>Margariscus margarita</i>	02/11/2006
Pumpkinseed	<i>Lepomis gibbosus</i>	12/10/2002
Rainbow Darter	<i>Etheostoma caeruleum</i>	16/07/2009
Rainbow Trout	<i>Oncorhynchus mykiss</i>	16/07/2009
Redside Dace	<i>Clinostomus elongatus</i>	15/08/2005
Rock Bass	<i>Ambloplites rupestris</i>	10/08/1994
Smallmouth Bass	<i>Micropterus dolomieu</i>	11/09/2007
Spottail Shiner	<i>Notropis hudsonius</i>	10/08/1994
Stonecat	<i>Noturus flavus</i>	03/06/1985
White Sucker	<i>Catostomus commersonii</i>	16/07/2009

Note: Detailed fish collection records and data, in electronic format, are available upon request from TRCA Aquatic Group.

2009/2010 Surveys by Fisheries and Oceans Canada, Sea Lamprey Control
 2009, 2006, 2003, and 2000 surveys by TRCA's Regional Watershed Monitoring Program
 2005 survey by TRCA Aquatic Group
 Pre 2000 data from MNR collection records

1 Aquatic Invasive

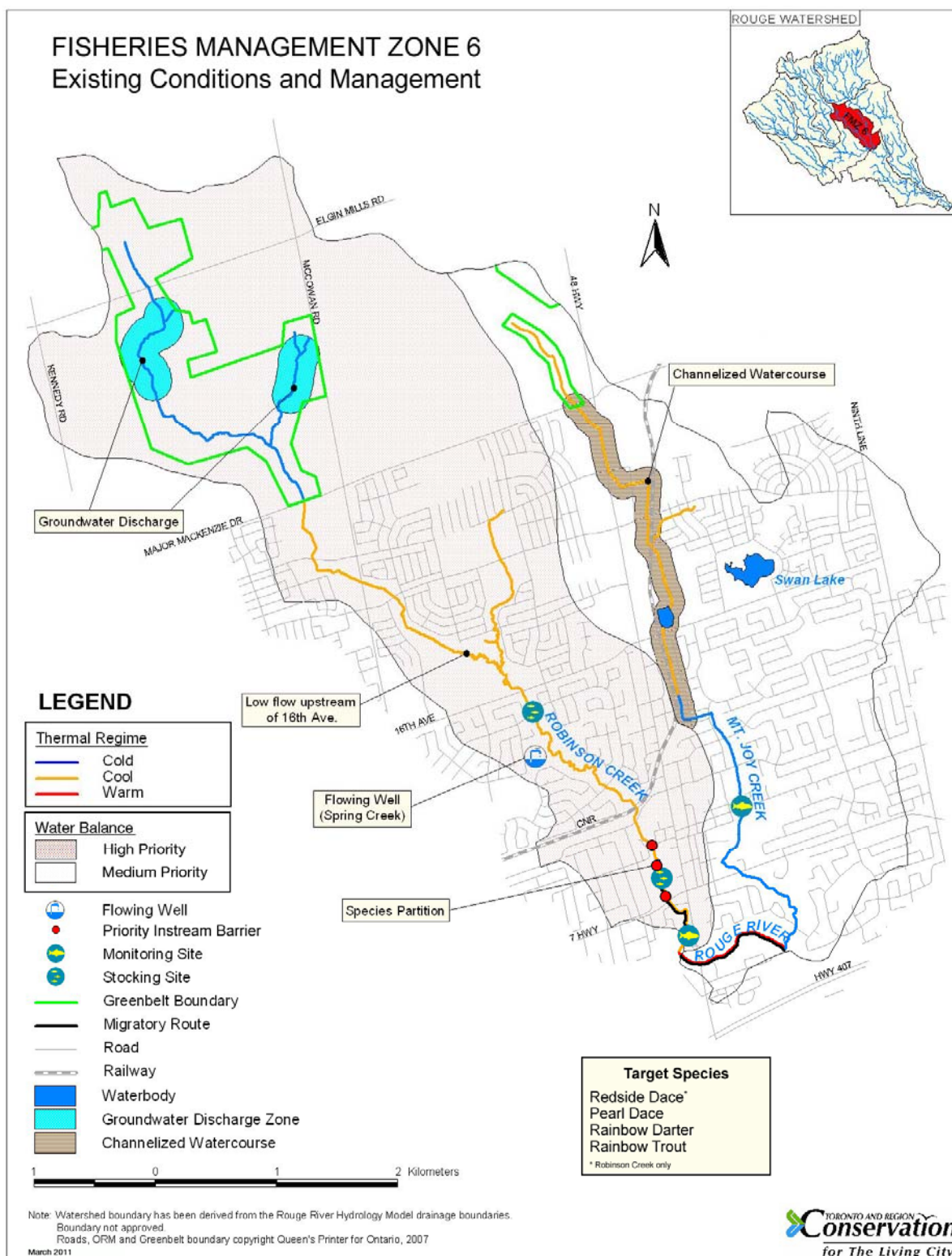


Figure 4-11: FMZ 6 Robinson Creek and Mt. Joy Creek Existing Conditions and Management Map

The thermal regime represents actual stream temperatures which have been interpreted for development and application of construction Timing Windows as provided in the Rouge River FMP (Figure 2-2).

4.1.6.1 Management Recommendations FMZ 6

This zone is a combination of two separate, small streams that have very different fish communities. Management direction for Robinson Creek needs to be consistent with the ESA for Redside Dace. There are water balance management opportunities relevant to new development in the upper portion and retrofits in the lower more urban areas.

Management direction for Mt. Joy follows retrofit opportunities for improvement drainage, in-stream channel restoration but with a more immediate focus on identifying and addressing potential water quality issues that may be limiting the aquatic community. See **Table 4-28** for a full set of recommendations.

4.1.6.2 Implementation Project Opportunities FMZ 6

There are 2 IPOs developed for this zone with approximate locations found on **Figure 4-12** and described in **Table 4-29** and **Table 4-30**.

Table 4-28: FMZ 6 Robinson Creek and Mt. Joy Creek Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Surface Water Regime	Many watercourses and their related aquatic ecosystem functions, have a very high sensitivity to the alteration of the surface and groundwater flow regime as a result of land use change. The catchment that affects the wetland and very upper reaches of Robinson Creek is planned for urban development. There is Redside Dace habitat further downstream.	That all future land use planning that will affect drainage into Robinson Creek should be informed by appropriate characterization including: pre-development surface water flow regime, groundwater pathway determination, subwatershed water balance, current water taking activity, fluvial-geomorphic dynamics and assessment of cumulative effects. This characterization should include a minimum 3 years of data to account for different climatic conditions that influence stream hydrology.		all species
		In future development areas, new and innovative approaches for SWM, geared towards the protection of Redside Dace and associated fish community be supported such that discharge meets ambient stream temperature, water clarity and chemistry or is within acceptable range for target species to be determined by the appropriate regulatory agency.		Redside Dace
	Mt. Joy is a highly altered, urbanized stream with long reaches of channelization to convey high storm flows which are likely limiting the habitat potential of more natural downstream reaches.	Retrofit and/or clean out existing stormwater management ponds to improve conditions in Mt. Joy Creek at point of discharge and cumulatively for downstream habitats (e.g., flow regime, temperature, water chemistry, sediment transport); That in future development areas, new and innovative approaches for SWM, geared towards the protection of Redside Dace and associated fish community be supported such that discharge meets ambient stream temperature, water clarity and chemistry or is within acceptable range for target species to be determined by the appropriate regulatory agency.		all species
	Flow regime in Robinson Creek was temporarily altered; current flows may still be responding as the system is allowed to re-naturalize.	Develop and undertake an enhanced monitoring program to characterize the existing flow regime in Robinson Creek to provide current direction for Redside Dace management and/or Rainbow Trout. Incorporate existing monitoring data as appropriate.		all species
Groundwater Regime	Local recharge areas have been identified as the pathway supporting the groundwater discharge in Robinson Creek and are spatially concurrent with future development areas.	To identify and avoid groundwater draw down and/or interruption of local discharge pathways to receiving watercourses associated with construction activity.		Redside Dace, Pearl Dace and Rainbow Trout
	Many watercourses and their related aquatic ecosystem functions, have a very high sensitivity to the alteration of the surface and groundwater flow regime as a result of land use change. A lack of required information exists for urbanized areas to define a water balance condition that could return altered flows to a more natural regime.	The prioritized need to achieve water balance in this FMZ should reflect the areas identified in the upper catchment on Figure 4-11 (1 High Priority Zone) and in future retrofit areas.		all species

Table 4-28: FMZ 5 Robinson Creek and Mt. Joy Creek Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Water Chemistry	Field activities in the lower portion of Mt. Joy Creek have indentified an organic odour together with low fish abundance records which suggests a potential water quality problem.	Collect water quality samples to determine if there is sewage discharge to the downstream reaches of Mt. Joy Creek that may be impairing or limiting the fish biodiversity.	<u>IPO 6.2 Investigate and Mitigate a Potential Source of Water Quality</u>	all species
		Investigate retrofit alternatives (e.g., oil and grit separators, bioswales) for diverting or collecting run off from roads directly adjacent to watercourses for long-term stream protection or mitigation of pollutants (e.g., salt and accidental chemical spills). Making contact as soon as possible following a spill and supplying photographs can help MOE assess and respond as required to the occurrence. MOE Spills Action Centre phone number is 416-325-3000.		all species
	Chlorides from road salting practices are affecting watercourses in this FMZ.	Support the <i>Rouge River Watershed Plan</i> (TRCA 2007a) in the recommendation for Municipalities to review/reduce/alter road salting practices.		all species
Temperature	It is currently unknown if temperature conditions within Robinson Creek will remain suitable for Rainbow Trout and possibly for Redside Dace now that groundwater augmentation has ceased.	Continue stream temperature monitoring in Robinson Creek as a means to direct fisheries management for Redside Dace in the upper reaches and Rainbow Trout in the very lowest reach.		Redside Dace, Pearl Dace and Rainbow Trout
	Existing stormwater inputs may cause thermal impacts to Robinson Creek now that groundwater augmentation has ceased. Additional stormwater inputs are anticipated as upstream catchment urbanizes.	Undertake an evaluation of the efficacy of stormwater management techniques to mitigate thermal impacts on 1st - 3rd order streams. Consider the inclusion of the following sites: Riotrin and Urbacon SWM Ponds on Leslie Tributary, Humber Flats SWM system on Upper East Humber, SWM Pond 61 on Black Creek, Cathedral SWM Pond on Rouge River (GEMS technology), various HWY 407 SWM Ponds.		all species
		Discharge from SWM ponds during the construction phase of new development and the approved built-out condition should meet ambient stream temperatures of receiving watercourses or within an acceptable range for key target species. There may be specific temperature requirements or thresholds for Redside Dace pursuant to the <i>Endangered Species Act</i> (2007).		Redside Dace, Pearl Dace and Rainbow Trout
Sediment	The low flow conditions present in the upper reaches of Robinson Creek have little capacity to buffer potential increases in sediment loading associated with future planned construction activities.	On site project managers or construction team representatives should be familiar with and able to apply the Great Golden Horseshoe Area Conservation Authorities' <i>Erosion and Sediment Control Guidelines for Urban Construction</i> (GGHACA 2006)		all species
Sediment (continued)		Consistent with recommendations in the <i>Rouge River Watershed Plan</i> (TRCA 2007a), minimize the area and duration of soil exposure due to top soil stripping and grading as lands the Robinson Creek catchment are developed. Use temporary seeding or other		all species

Table 4-28: FMZ 5 Robinson Creek and Mt. Joy Creek Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
		stabilizing techniques to minimize period of soil exposure.		
	Sediment discharge from future construction projects have the potential to impact vulnerable Redside Dace populations and habitat within Robinson Creek.	Sediment and erosion controls should be effective at preventing sediment from entering the watercourse. This applies to all scales and types of construction activity.		all species
Terrestrial Natural Heritage	Riparian habitat along Mt. Joy Creek is consistently poor or not present.	Identify and undertake riparian planting opportunities to address and improve aquatic habitat quality and quantity (See Section 3.2.11.1 Riparian Habitat Recommendations).	-	all species
	The Provincially Significant Wetland that occurs at the headwaters of Robinson Creek will be adjacent to planned development.	Protect and enhance the wetland habitat to allow for the increased infiltration and retention of water in order to maintain/restore flow balance and groundwater discharge to streams.	-	redside and Pearl Dace
	The specific composition and structure of the riparian habitat required for Redside Dace habitat within Robinson Creek has not been currently defined.	For all stream reaches determined to be the habitat of Redside Dace, a minimum protected stream corridor consisting of the stream meander belt plus 30m on each side should be applied, as recommended in the <i>Redside Dace Recovery Strategy</i> (OMNR 2010a) and as required by OMNR. This may also be applied to stream reaches identified as recovery habitat for Redside Dace. See Section 3.2.11.1 Riparian Habitat Recommendations for vegetation community type recommendations.		Redside Dace
Fish Community and Habitat	Resident Redside Dace population has shown declines in recent years as reported in fish collection records.	Support recovery actions for Redside Dace.	IPO 6.1 Water Quality/Quantity and Riparian Improvements	Redside Dace
		A construction timing window from July 1st - September 15th is to be applied in all Redside Dace occupied habitats or in upstream contributing habitats at the discretion of the appropriate agencies.		all species
	Visual observations confirmed (2010) that adult Rainbow Trout under high flow conditions have been able to move up Robinson Creek into reaches occupied by Redside Dace.	Consider identifying a suitable location in the vicinity of Highway 7 for a species partition between Redside Dace upstream and Rainbow Trout downstream.		Redside Dace
	Past Rainbow and Brown Trout stocking have occurred spatially concurrent with occupied Redside Dace habitat.	Monitoring and assessment of Rainbow Trout adult returns and natural reproduction is required to direct future stocking activity. Until such time, stocking of Rainbow Trout should generally avoid stream reaches determined to be the habitat of Redside Dace.		Redside Dace
Fish Community and Habitat	Mt. Joy Creek is a highly altered system with long reaches of channelization to convey high stormwater flows.	Should any habitat improvements be identified and implemented in Mt. Joy Creek, follow-up monitoring to assess increased fish community diversity and abundance is recommended.		all species

Table 4-28: FMZ 5 Robinson Creek and Mt. Joy Creek Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
(continued)				
Anthropogenic	See issues relating to changes in Robinson Creek flow regime and degradation in Mt. Joy Creek.	See corresponding recommendations.		all species
	Existing or future urbanization and associated activities.	Refer to recommendations above.		all species

Legend	Timeframe for Potential Implementation
Priority Focus	1 to 5 years
Management Focus	5 to 10 years

Table 4-28: FMZ 5 Robinson Creek and Mt. Joy Creek Management Recommendations

December 2010

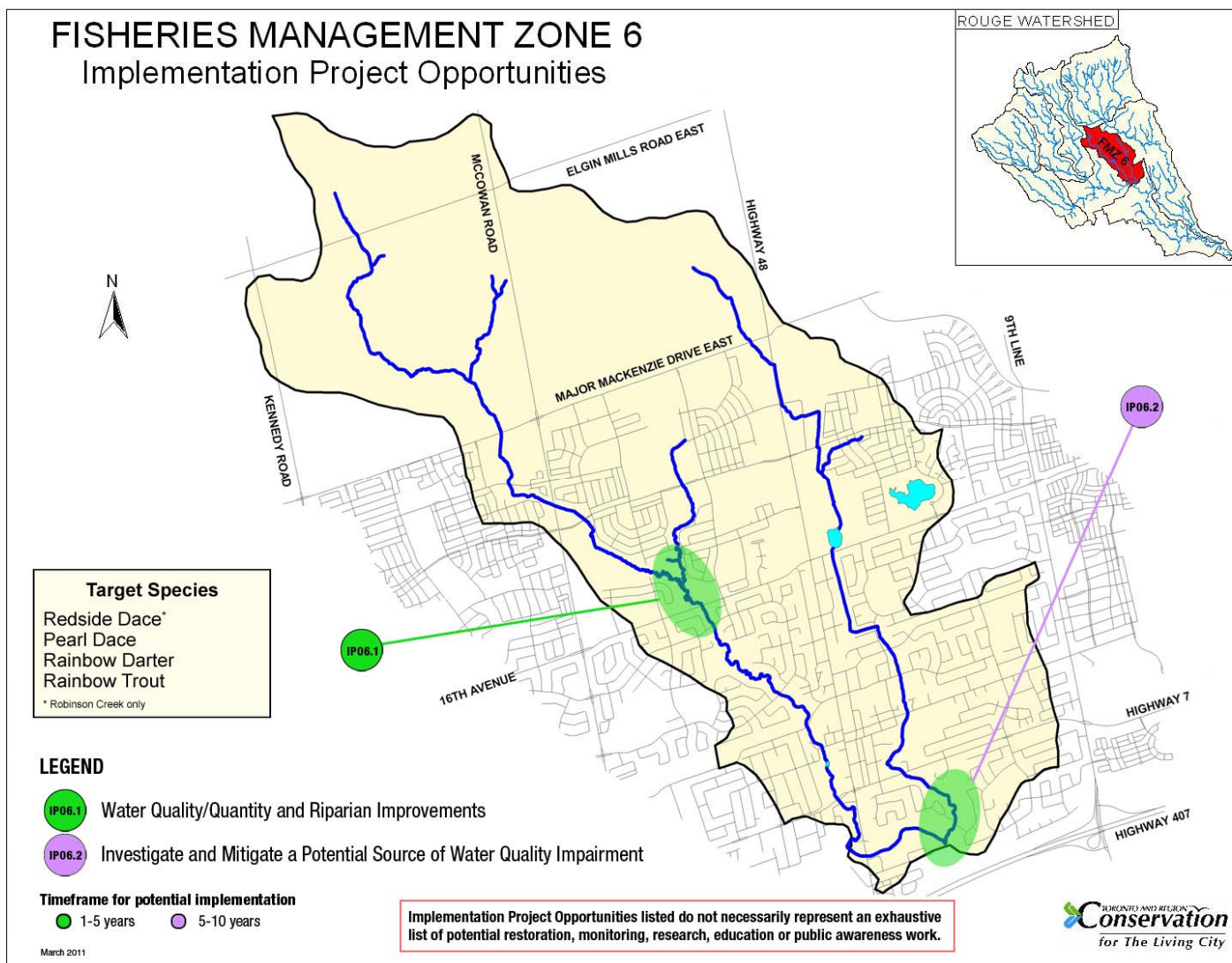


Figure 4-12: FMZ 6 Robinson Creek and Mt. Joy Creek IPO Locations

IPOs are recommended with the expectation that prior or concurrent improvements in stormwater management proceed, and that water balance understanding is obtained for this FMZ in support of a healthy aquatic ecosystem

Table 4-29: IPO 6.1 Water Quality/Quantity and Riparian Improvements

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 6.1 Water Quantity/Quality and Riparian Improvements
	Project Description	There have been a series of ecological changes to upper Robinson Creek that may be addressed by channel restoration or mitigation undertaken through a variety of both engineered and biological solutions.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Fish Community		
Sampling	Although existing fish data is available, additional sampling might be required in order to evaluate the benefit of restorative actions. This should include pre- and post- project monitoring.	
2. Thermal Regime		
Deployment of Temperature Loggers	- Deployment of multiple temperature loggers within the channel to delineate potential discharge areas and establish thermal regime to measure improvements over time. - Logger deployment should in the same location over the length of the project.	
3. Flow Regime		
Document the changes in flow regime and baseflow.	- Utilize the existing flow information to help determine the changes that have occurred. - Baseflow measurements should be conducted several times a season to understand the changes in volume.	
Erosion Potential	Utilize existing channel morphology and flow data to make assessments about the erosion potential of the watercourse to help guide stream restoration or SWM retrofits.	
4. Riparian Habitat		
Site Selection	Focus on riparian enhancements north of 16th Avenue.	
6. Low Impact Development (LID)		
Retrofits	Select areas and design options that will retrofit existing engineered designs to improve water quality and quantity controls (e.g., reconstruction of SWM outlet structures).	
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

Table 4-30: IPO 6.2 Investigate and Mitigate a Potential Source of Water Quality Impairment

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 6.2 Investigate and Mitigate a Potential Source of Water Quality Impairment
	Project Description	Although there is good riparian habitat along Mt. Joy Creek, there is a surprising lack of fish diversity and abundance, including very pollution tolerant species. Water quality investigations are required to determine if there is a fundamental problem which may be impacting the fish community in the Mt Joy Creek tributary.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Investigation and Mitigation		
Water quality sampling program		Preliminary <i>E. coli</i>, nutrient and trace metal sampling is recommended. If present and water quality problems are determined to be a result of broader scale issues (e.g., sewer cross connections), a more comprehensive water quality sampling program should be developed in coordination with MOE and municipality.
Addressing Water Quality Impairment		Should sampling identify specific sources of impairment, a retrofit clean-up program should be designed, approved and implemented. Post clean-up monitoring, including fish community, could be undertaken to document whether the defined goals of the work are being achieved.
2. Fish Community Restoration		
Sampling		- Conduct detailed sampling of the present fish community in Mt Joy Creek. Identify appropriate pool habitats to conduct monitoring. Monitor to track population changes over time in response to any required clean-up action. - Sampling requires a fish collection permit from OMNR.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

4.1.7 Lower Little Rouge River (FMZ 7)

Receiving flows from FMZ 4, this zone contains much of Rouge Park and is found along the east side of the watershed representing the lower half of Little Rouge River. The various fish species collected in past and recent surveys are listed in **Table 4-31**. A total of 48 species have been captured in this zone over time, of which 22 species (including 2 invasive species) were collected in the most recent surveys (2009 and 2010). The target species, temperature regime, other existing conditions, monitoring stations, stocking sites and water balance priorities are shown on **Figure 4-13**.

Overall, the fish community reflects a diversity that is no longer common in most urban watersheds and is characterized by a predominantly warm water community. The presence of Rouge Park is recognized as a significant buffer against stressors of adjacent urbanization. Species absent for more than 20 years from the collection record are cold-cool water habitat specialists (i.e., American Brook Lamprey, Redside Dace, Brassy Minnow, and Central Mudminnow (*Umbra limi*)). The transition from a cold-coolwater system found upstream in FMZ 4 to the warmwater habitat in this zone is considered natural, however fluvial-geomorphic conditions may have changed with upstream development such that habitat specialist species are less supported downstream (e.g., higher, flashier flows, habitat more homogeneous or less in-stream structure).

Within the transition zone between cool and warm habitat (coincident with the boundary between FMZ 4 and FMZ 7), there is a first order tributary that runs cold (un-named) and another one that is cool when it flows (Katabokokonk) (**Figure 4-13**). They both appear to be sourced by local groundwater contributions; however alternating dry and flowing summer conditions have been anecdotally observed in Katabokokonk Creek over the past several years.

Mussels are also present in the Little Rouge. These are benthic invertebrates that can be impacted by many of the same stresses that affect the broader fish community. While there has not been a formal mussel survey done in the Rouge, there has been sampling by a local NGO (Citizen Scientist) to identify species presence and abundance. From this work, only the middle portion of the Little Rouge has been identified as supporting a small population of freshwater mussels that included the following species: Cylindrical Floater (*Anodontoidea ferussacianus*), Creek Heelsplitter (*Lasmigona compressa*), Common Floater (*Pyganodon grandis*) and Creeper (*Strophitus undulatus*). The habitat in this area is low-slope, dominated by soft sediments and turbid water conditions. The turbidity is poor habitat for freshwater mussel species, but it does offer the opportunity for improving conditions to support the existing population and potential expansion in distribution, abundance and diversity.

Three main issues within this zone, south of Steeles Avenue, are flow, temperature and AIS. First, although summer stream flow (baseflow) is very low in the tributaries and main channel, there is visual evidence of significant erosion year round to the point where trails in Rouge Park need to be closed or moved (e.g., failing banks and many fallen, mature trees jamming the

river). This dynamic situation reflects stream response to flashy storm flows experienced in more urban settings and may be a sign that land use change in the upstream catchment (FMZ 4) is causing impacts downstream.

The second issue is temperature. The maximum summer stream temperatures in these lower reaches were above 32°C on several occasions in 2005 and 2006 (no data available for more recent years). This is beyond the tolerance of most fish species if exposure is prolonged. The stream bed in this area is exposed bedrock and not amenable to further downcutting. Consequently, the channel is widening and water depth is becoming shallower and more readily warmed by large in-stream boulders that transfer solar heat. Direct stream exposure to the sun is also high due to the lack of tree canopy. It unknown to what extent the temperature and channel widening are within the system's natural variation.

The third issue is the vulnerability of the Little Rouge River to AIS moving up from Lake Ontario, (Round Goby and the Sea Lamprey). There is currently no barrier at the mouth of the river. While this facilitates access to the upper reaches for migratory fish, it also allows AIS to enter and potentially reach the headwaters. The control of Sea Lamprey is under the mandate of DFO as described in Chapter 3, Section 3.2.12 of this FMP. Rusty Crayfish has already entered much of the Little Rouge and appears to be well established in the main channel and many of the tributaries based on sampling conducted by the Citizen Scientist group.

Table 4-31: Past and Present Fish Species in FMZ 7

Species Name	Scientific Name	Last Record
American Brook Lamprey	<i>Lampetra appendix</i>	12/06/1972
Black Crappie	<i>Pomoxis nigromaculatus</i>	09/09/2005
Blacknose Dace	<i>Rhinichthys atratulus</i>	11/05/2010
Bluntnose Minnow	<i>Pimephales notatus</i>	02/08/2006
Brassy Minnow	<i>Hybognathus hankinsoni</i>	14/06/1972
Brook Stickleback	<i>Culaea inconstans</i>	16/05/2010
Brown Bullhead	<i>Ameiurus nebulosus</i>	09/09/2005
Brown Trout	<i>Salmo trutta</i>	06/11/2000
Central Mudminnow	<i>Umbra limi</i>	03/07/1984
Central Stoneroller	<i>Campostoma anomalum</i>	16/05/2010
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	11/05/2010
Common Carp	<i>Cyprinus carpio</i>	21/08/2000
Common Shiner	<i>Luxilus cornutus</i>	16/05/2010
Creek Chub	<i>Semotilus atromaculatus</i>	16/05/2010
Emerald Shiner	<i>Notropis atherinoides</i>	09/06/1972
Fathead Minnow	<i>Pimephales promelas</i>	16/05/2010
Gizzard Shad	<i>Dorosoma cepedianum</i>	08/08/2005
Golden Shiner	<i>Notemigonus crysoleucas</i>	09/06/1972
Hornyhead Chub	<i>Nocomis biguttatus</i>	11/05/2010
Iowa Darter	<i>Etheostoma exile</i>	16/05/2010
Johnny Darter	<i>Etheostoma nigrum</i>	16/05/2010
Lake Chub	<i>Couesius plumbeus</i>	11/05/2010
Largemouth Bass	<i>Micropterus salmoides</i>	09/07/1998

Species Name	Scientific Name	Last Record
Logperch	<i>Percina caprodes</i>	17/07/2009
Longnose Dace	<i>Rhinichthys cataractae</i>	16/05/2010
Mimic Shiner	<i>Notropis volucellus</i>	02/06/1954
Mottled Sculpin	<i>Cottus bairdii</i>	26/08/1992
Northern Hog Sucker	<i>Hypentelium nigricans</i>	19/10/1983
Northern Redbelly Dace	<i>Chrosomus eos</i>	13/05/2010
Pearl Dace	<i>Margariscus margarita</i>	23/09/1996
Pumpkinseed	<i>Lepomis gibbosus</i>	16/05/2010
Rainbow Darter	<i>Etheostoma caeruleum</i>	16/05/2010
Rainbow Trout	<i>Oncorhynchus mykiss</i>	16/05/2010
Redside Dace	<i>Clinostomus elongatus</i>	15/06/1972
River Chub	<i>Nocomis micropogon</i>	22/08/2005
Rock Bass	<i>Ambloplites rupestris</i>	02/08/2006
Rosyface Shiner	<i>Notropis rubellus</i>	08/08/2005
Round Goby	<i>Neogobius melanostomus</i>	16/05/2010
Sand Shiner	<i>Notropis stramineus</i>	02/08/2006
Sea Lamprey	<i>Petromyzon marinus*</i>	13/09/2009
Smallmouth Bass	<i>Micropterus dolomieu</i>	16/05/2010
Spotfin Shiner	<i>Cyprinella spiloptera</i>	08/08/2005
Spottail Shiner	<i>Notropis hudsonius</i>	09/09/2005
Stonecat	<i>Noturus flavus</i>	17/07/2009
Trout-perch	<i>Percopsis omiscomaycus</i>	03/06/1953
White Bass	<i>Morone chrysops</i>	03/07/1984
White Sucker	<i>Catostomus commersonii</i>	16/05/2010
Yellow Perch	<i>Perca flavescens</i>	05/07/2006

Note: Detailed fish collection records and data, in electronic format, are available upon request from TRCA Aquatic Group

2009/2010 Surveys by Fisheries and Oceans Canada, Sea Lamprey Control
 2009, 2006, 2003, and 2000 surveys by TRCA's Regional Watershed Monitoring Program
 2005 survey by TRCA Aquatic Group
 Pre 2000 data from MNR collection records

2 Aquatic Invasive

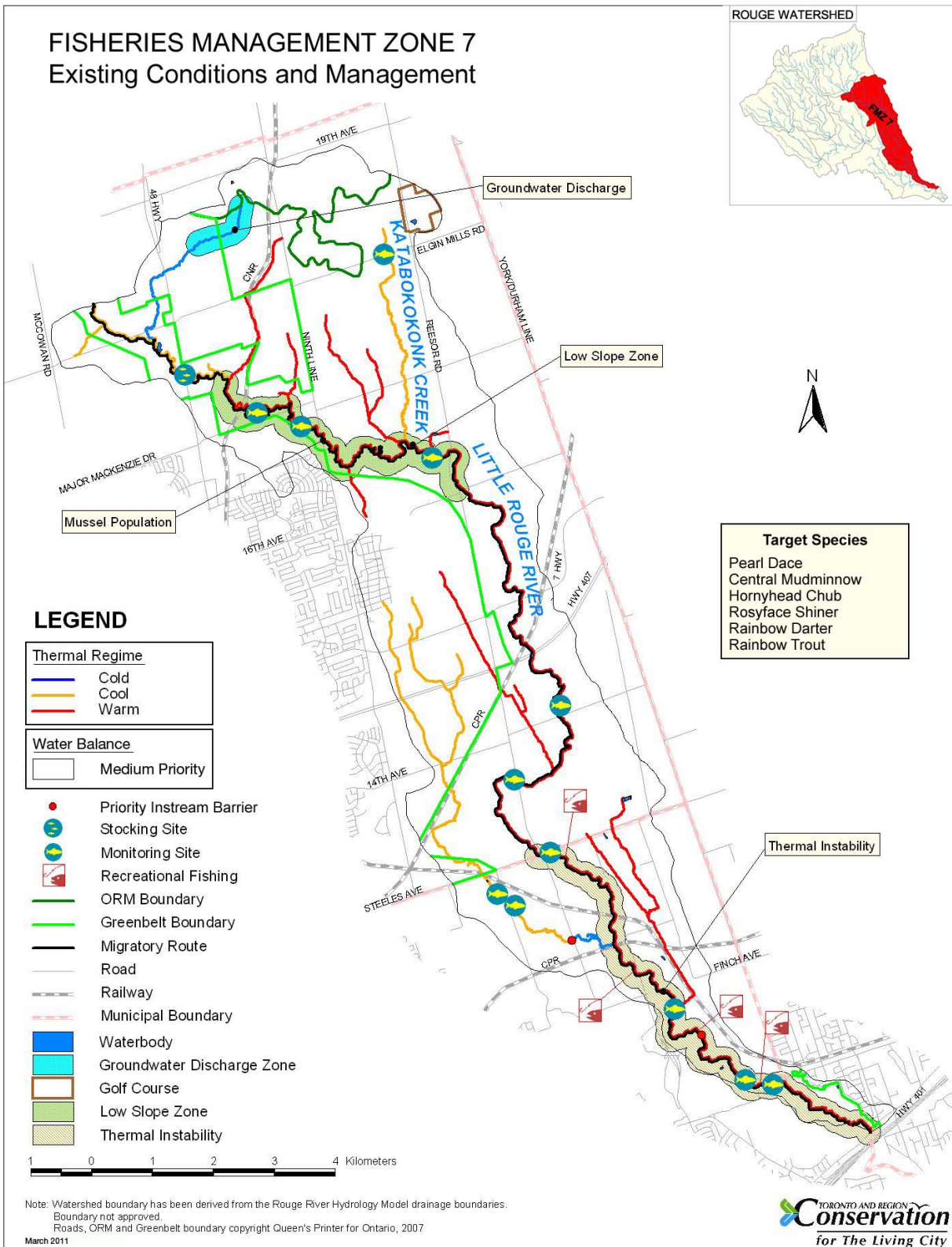


Figure 4-13: FMZ 7 Lower Little Rouge River Existing Conditions and Management Map

The thermal regime represents actual stream temperatures which have been interpreted for development and application of construction Timing Windows as provided in the Rouge River FMP (Figure 2-2).

4.1.7.1 Management Recommendations FMZ 7

This FMZ is made up of two zones, northern and southern halves, with the dividing line fall along Steeles Avenue. Much of this zone falls within the boundaries of Rouge Park which provides relatively undeveloped, high quality tableland and riparian habitat through most of the Lower Little Rouge.

The northern portion is largely rural with natural habitat corridors and limited urban development. There are a number of specialist fish species that may benefit from wetland habitat creation along the side tributaries which are characterized as low slope channels with relatively slow moving water.

The southern portion of the zone has sustained impacts not observed in the northern half. The three main issues are very high summer maximum stream temperatures (e.g., 32°C), low baseflow and the expanding presence of aquatic invasive fish species. See **Table 4-32** for a full set of recommendations.

4.1.7.2 Implementation Project Opportunities FMZ 7

There are 7 IPOs developed for this zone with approximate locations found on **Figure 4-14** . They are described in **Table 4-33**, **Table 4-34**, **Table 4-35**, **Table 4-36**, **Table 4-37**, **Table 4-38**, and **Table 4-39**.

Table 4-32: FMZ 7 Lower Little Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Surface Water Regime	Lowest reaches of the river continually experiencing changes in morphology such as widening of stream channel and decreased water column depth; It is likely that high stormwater flow volumes coming from upstream urban areas are contributing to these physical changes.	That future growth planning for Town of Markham (upper section of this FMZ) should be informed by appropriate characterization including: pre-development surface water flow regime, groundwater pathway determination, subwatershed water balance, current water taking activity, fluvial-geomorphic dynamics and assessment of cumulative effects. This characterization should include a minimum of 3 years of data to account for different climatic conditions that influence stream hydrology;		Hornyhead Chub, Rosyface Shiner, Rainbow Darter
	Lower Little Rouge (downstream of Steeles Ave.) is experiencing low summer baseflow which has reduced available aquatic habitat and its suitability for some species.	Assessment of past and present fluvial-geomorphologic conditions needs to be conducted to determine if current stream widening is a natural process or a response to land use changes higher in the watershed; potential restoration needs should be identified if appropriate.		all species
Groundwater Regime	Limited information on current habitat characteristics of Katabokokonk Creek and adjacent watercourses (appear to be coldwater).	Field assessment of Katabokokonk Creek to provide detailed characterization of existing stream form and function.	IPO 7.6 Water Balance Study for Headwaters of Katabokokonk Creek and Adjacent Watercourses	all species
		That future growth planning for Town of Markham that may affect baseflow in the coldwater tributary Katabokokonk Creek should be informed by appropriate characterization including: baseflow regime, groundwater pathway determination, subwatershed water balance, current water taking activity, fluvial-geomorphic dynamics and cumulative effects inventory. This characterization should encompass multiple years of data to account for different climatic conditions that influence stream hydrology;		all species
		The prioritized need to achieve water balance in this FMZ should reflect the areas identified on Figure 4-13 (Medium Priority as natural condition should be largely maintained); continue to support the <i>Rouge North Management Plan</i> reforestation initiative as one means to meeting water balance with particular attention paid to the few coldwater streams.		all species

Table 4-32: FMZ 7 Lower Little Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Water Chemistry	Turbidity of water from SWM pond outlets discharging into the Little Rouge River in the vicinity of Major Mackenzie Dr./16th Ave/Markham By-Pass has been observed above ambient stream conditions.	Retrofit and/or clean out existing stormwater management ponds to improve conditions at point of discharge and cumulatively for downstream habitats (e.g., turbidity, flow regime, temperature).	-	all species
	Recent fish kill (2007) occurred due to road-side chemical spill within the Little Rouge.	Investigate retrofit alternatives (e.g., oil and grit separators, bioswales) for diverting or collecting run off from roads directly adjacent to watercourses for long-term stream protection or mitigation of pollutants (e.g., salt and accidental chemical spills). Making contact as soon as possible following a spill and supplying photographs can help MOE assess and respond as required to the occurrence. MOE Spills Action Centre phone number is 416-325-3000.		all species
		Continue with post-spill monitoring efforts to document the recovery of the aquatic community within this system.	<u>IPO 4.2 Markham Tributary Recovery Assessment</u>	all species
Temperature	Stream temperatures through main the lower main branch are both unstable and reach daily maximums that cause stress for all fish species for portions of the summer period.	Determine if the current range in stream temperatures (including >32 °C summer spikes) is a natural condition or a response to land use changes higher in the watershed. One component of the investigation should include an account of historic Brook Trout distribution in this catchment.	<u>IPO 7.3 Pilot Demonstration of Thermal Refuge Habitat Creation</u>	Hornyhead Chub, Rosyface Shiner, Rainbow Darter
	Anecdotal evidence of historic (1960s) coldwater habitat supporting Brook Trout where no current viable habitat exists today.			all species
Sediment	Presence of fine organic material during spring and fall likely associated with agricultural land use on adjacent table lands throughout FMZ 7.	Examine potential to limit soil erosion from agricultural lands in this FMZ through Best Management Practices (e.g., riparian zone plantings, cattle fencing, tile drain disconnection).		Rainbow Darter

Table 4-32: FMZ 7 Lower Little Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Terrestrial Natural Heritage		Support the objectives of the <i>Rouge North Management Plan</i> (RPNMP) to restore natural/forest cover along the Little Rouge Corridor with top priority on planting first order streams or areas identified as high habitat enhancement/restoration opportunities within the RPNMP.		all species
	Fragmentation of natural cover within riparian zone in FMZ 7.	For streams identified within the <i>Rouge North Management Plan</i>, including some Redside Dace streams, additional stream corridor protection beyond the meander belt plus 30 m has been recommended and should be applied. Consistent with recent landscape level planning initiatives (e.g., ORM Act), a 30 m riparian buffer on either side of the watercourse is recommended for the remaining streams in this FMZ. See Section 3.2.11.1 Riparian Habitat Recommendations for vegetation community type recommendations.		all species
	Riparian wetland habitat for existing warmwater specialists species (e.g., Brassy Minnow) has been in decline.	Identify restoration and/or enhancement opportunities for increasing riparian wetland habitat.	IPO 7.1 Wetland Species and Rearing Habitat Enhancements	all species
Fish Community and Habitat	Redside Dace currently inhabits tributaries just upstream of this FMZ with no known barriers to prevent movement should downstream habitat become appropriate for these species.	Investigate suitable recovery habitat for potential Redside Dace expansion as required for recovery planning.	-	future species
	No specific management for Walcott Tributary that currently supports a healthy and unique fish community. Tributary is considered isolated from the main Little Rouge due to steep gradient at confluence but is proximal to existing urbanization.	Optimize opportunities within Rouge Park to mitigate potential impacts from adjacent urbanization and protect/enhance aquatic habitat within this watercourse.	IPO 7.2 Consideration for Species Partition	all species
	A seasonal in-stream barrier to fish passage is present at the culvert under Beare Rd.	Verify the ease of barrier mitigation and facilitate the undertaking with appropriate partners.	IPO 7.4 Barrier Re-assessment for Preventing Further Round Goby Invasion into the Little Rouge River	all species

Table 4-32: FMZ 7 Lower Little Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Fish Community and Habitat (continued)	Known mussel habitat is impacted by sedimentation.	Improve riparian habitat adjacent to farmland, investigate alternative management practices that would reduce sediment discharge to streams.	-	all species
		Construction activities in the vicinity of or within habitat supporting freshwater mussel populations should require a mussel survey in addition to standard aquatic surveys to establish species presence and density.		all species
	The main branch of the Little Rouge River is currently a migratory route for Rainbow Trout as well as other migratory fish species but natural recruitment is not well understood in this FMZ.	Monitoring and assessment of Rainbow Trout adult returns and natural reproduction is required to direct future stocking activity. Until such time, stocking of Rainbow Trout should generally avoid stream reaches determined to be the habitat of Redside Dace.		Rainbow Trout
	Little Rouge River is vulnerable to Aquatic Invasive Species moving up from Lake Ontario (e.g., Sea Lamprey, Round Goby, carp, Rusty Crayfish).	Continue to support investigations initiated by DFO Sea Lamprey Control to assess the feasibility of a seasonal barrier at the mouth of the Rouge River as an alternative to chemical control of Sea Lamprey. Upon the completion of this FMP, move forward with inter-agency consultation (DFO, OMNR, TRCA) to determine future Sea Lamprey control strategy.		all species
		Increase the coordination of existing stewardship and outreach programs to prevent new introductions and any further spread of aquatic invasive species (AIS), particularly Round Goby and Sea Lamprey. Priority on AIS prevention should be placed on the Little Rouge as there are no significant in-stream barriers from the Lake to headwaters.	IPO 7.7 Invasive Species Detection Program for Volunteers	all species

Table 4-32: FMZ 7 Lower Little Rouge Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Anthropogenic	Cattle are accessing and crossing the stream along the main branch north-west of the intersection of Reesor Rd. and Steeles Ave.	Cattle access to streams should be prevented through both physical restriction (i.e., fencing) and outreach with farmers and/or private land owners.	IPO 7.5 <u>Prevention of Livestock Access to Stream</u>	all species
	Existing or future urbanization and associated activities.	Refer to recommendations above.		all species

Legend	Timeframe for Potential Implementation
Priority Focus	1 to 5 years
Management Focus	5 to 10 years

Table 4-32: FMZ 7 Lower Little Rouge Management Recommendations

December 2010

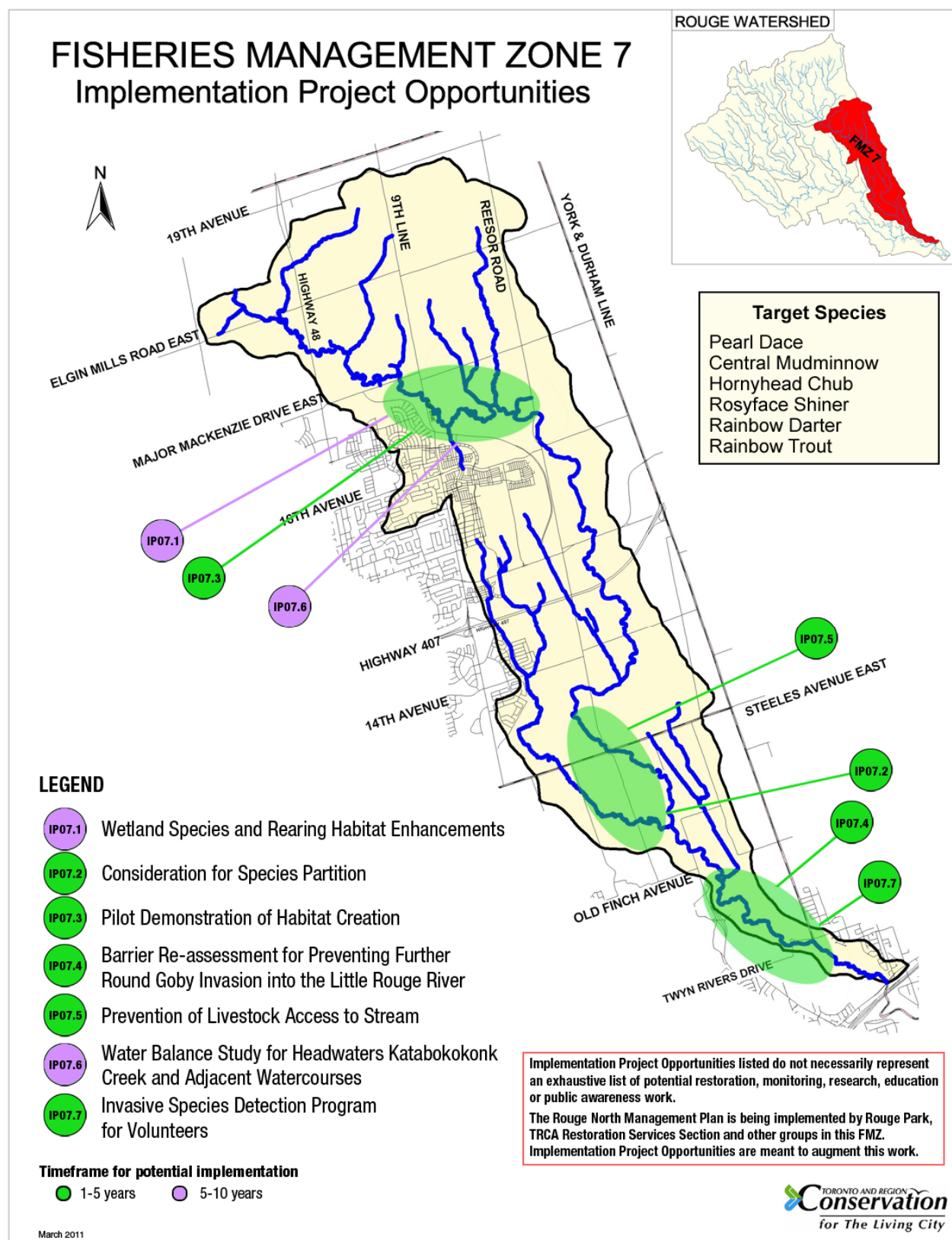


Figure 4-14: FMZ 7 Lower Little Rouge River IPO Locations

IPOs are recommended with the expectation that prior or concurrent improvements in stormwater management proceed, and that water balance understanding is obtained for this FMZ in support of a healthy aquatic ecosystem.

Table 4-33: IPO 7.1 Wetland Species and Rearing Habitat Enhancements

Implementation Project Opportunity	
Project Name	IPO 7.1 Wetland Species and Rearing Habitat Enhancements
Project Description	This section of the Little Rouge River channel is presently not providing an optimal level of fish habitat. As a result of changes in a upstream flow regime and historic clearing of riparian areas, the channel has widened, water depths and pool/riffle sequences have declined, in-stream structural habitat has been lost, and temperatures have increased. There are a number of opportunities for in-stream works to narrow the channel, re-establish pool/riffle sequences, contribute to adjacent wetland enhancements, and improve the riparian habitat condition. Projects designs should be discussed with TRCA and OMNR. The Rouge North Management Plan should also be reviewed for direction regarding Town of Markham becoming the future owner of lands adjacent to select tributaries.
Proposed Project Components	Proposed Project Planning and Design Considerations
1.Fish Community	
Sampling	- Once enhancement sites have been selected, conduct surveys to gauge species composition and abundance occurring within the reach/site before and after habitat enhancement. - Utilize existing fisheries data to target areas for wetland habitat creation, may require some additional sampling to confirm their presence (e.g., Sand Shiner).
2.Physical Habitat	
Habitat Surveys	- Focus on low slope sections of the mid to upper portions of the FMZ which are conducive to the development and formation of wetland habitats. - Should utilize groundwater model to help define areas of higher groundwater discharge, also use Digital Elevation Model (DEM) to define where there is a broad floodplain. - Ultimately a restored wetland must be capable of the temporal sequences of vegetation change (succession) characteristic of its type.
3.Flow Regime	
Establishing Appropriate Hydrology	- Water depths, flow rates, water level fluctuations, ensure that flow magnitudes are incorporated into the design. - Use downstream gauge data and existing baseflow data. May need to augment with new baseflow measurements to better define extreme low flow conditions in the design. - Identify and maintain existing disturbance regimes such as fluctuating water levels that occur at small magnitudes and allow wetlands to regenerate.
4.Bathymetry	
Develop Appropriate Contours	Survey the selected site to develop contours that compliment hydrology.
5.Wetland Habitat Management	
Design	- Restored wetlands that will persist are likely to resemble natural wetlands in the region. Examine small scale riparian wetlands upstream and downstream and incorporate their structures and functions into the wetland design. - Ensure vegetation communities are designed to take advantage of seasonal hydrology. It is also important to consider ice flows and winter scour. - Habitat should be designed to support target species and other wetland habitat specialists that may be in decline locally. - Wetland(s) design should focus on feeding, shelter, spawning and nursery habitat and the dispersal of young.
Implementation and Monitoring	- Undertake project, as per approved plan, and with a contractor having previous experience with wetland creation. - All planting should be monitored for survival of plants and fish community use of the new habitat(s). - Provide feedback to agencies on plant survival and fish community usage.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).	

Table 4-34: IPO 7.2 Consideration for Species Partition

Implementation Project Opportunity	
Project Name	IPO 7.2 Consideration for Species Partition
Project Description	There is an in-stream barrier identified at Ressor Rd. which, if maintained, would protect this relatively high quality tributary from aquatic invasive species. Such partitioning would ensure continued biodiversity while maintaining the native fish community and protecting high quality habitat.
Proposed Project Components	Proposed Project Planning and Design Considerations
1. Fish Community	
Sampling	- Although enough fisheries data for the watercourse exist to suggest high biodiversity, updated surveys may be required to determine species presence, community structure, distribution and relative abundance. - A fish collection permit is required from OMNR.
2. Channel Morphology	
Detailed Cross-Sections Measurements	- Without a flow gauge on the watercourse there needs to be some pre-monitoring to determine how stable the watercourse is currently, in order to ensure the maintenance of biodiversity in the watercourse over time. - The number of cross-sections will be determined based on site selection and recommendations from the site selection process.
Pebble Counts	- Ensure that there is sufficient spawning habitat available for the long term maintenance of the species present. - Detailed pebble counts should be conducted at each detailed cross-section to monitor changes over time.
3. Flow Regime	
Baseflow Measurements	- Develop monthly baseflow conditions to build a better understanding of changes in flow conditions over time. - Should be sampled until upstream development has been completed and stabilized.
4. Temperature Regime	
Deployment of Temperature Loggers	- Deployment of multiple temperature loggers within the channel to narrow down potential discharge areas and to better establish thermal regime. - Logger deployment should be in the same location over multiple years to assess and track changes in the thermal regime that can be used to inform restoration if required.
Spot Measurements	Spot measurements could be taken at various times of the year to relate back to temperature logger information, and to more specifically find or identify localized thermal habitat conditions or impacts.
5. Public Education	
Site Tours	Although a formal trail system is not currently in place, a limited and restricted access trail could be developed in order to lead aquatic ecosystem educational programming for local schools and community groups.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).	

Table 4-35: IPO 7.3 Pilot Demonstration of Thermal Refuge Habitat Creation

Implementation Project Opportunity	
Project Name	IPO 7.3 Pilot Demonstration of Thermal Refuge Habitat Creation
Project Description	Summer stream temperatures have been measured above 32°C for extended periods of time in the main branch of the Little Rouge River. There may be opportunity to enhance and/or direct the baseflow, on a site scale, within the Little Rouge River into areas that may support riparian wetland pockets of relatively cooler temperatures to increase the available rearing and feeding habitat for native species during summer months. An approximate and potential location for this work is downstream of Major Mackenzie Drive, shown on Figure 4-14. Other appropriate locations may exist in this FMZ. The Rouge North Management Plan should be reviewed for direction regarding Town of Markham becoming the future owner of lands adjacent to select tributaries.
Proposed Project Components	Proposed Project Planning and Design Considerations
1. Fish Community	
Sampling	- Once pilot enhancement site has been selected, conduct specific survey to quantify the species abundance occurring within the reach/site before habitat enhancement. Fish collection permit required through OMNR. - Utilize existing fisheries data to target specific area for riparian wetland habitat creation; may require some additional sampling to confirm presence of target species (e.g., Pearl Dace, Rosyface Shiner).
2. Physical Habitat	
Habitat Surveys	- Focus on low slope sections of the mid to upper portions of the FMZ which are conducive to the maintenance of riparian wetland habitats. - Can use Digital Elevation Model (DEM) to help define where there is a broad floodplain. Contact TRCA for assistance.
3. Flow Regime	
Identifying Appropriate Hydrology	Identify existing areas of groundwater discharge and disturbance regimes such as fluctuating water levels that occur at small magnitudes to allow wetlands to regenerate. This information will inform habitat design.
4. Bathymetry	
Develop Appropriate Contours	Survey the selected site to develop habitat design contours that compliment existing hydrology.
5. Wetland Habitat Management	
Design	- Created wetlands should resemble natural wetlands in the region. Examine small scale riparian wetlands upstream and downstream and incorporate their structures and functions into the created wetland design. - Ensure vegetation communities are selected to take advantage of seasonal hydrology. Also consider effects of ice flows and winter scour. - Habitat should be designed to support target species and other wetland habitat specialists that may be in decline locally. - Wetland design should focus on providing cooler thermal regime, feeding, spawning and nursery habitat.
Implementation and Monitoring	- Undertake pilot project as per approved plan and with a contractor having previous experience with wetland creation. All planting should be monitored for survival of plants and fish community use of the new habitat(s). - Provide feedback to agencies on plant survival and fish community usage.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).	

Table 4-36: IPO 7.4 Barrier Re-assessment for Preventing Further Round Goby Invasion into the Little Rouge River

Implementation Project Opportunity	
Project Name	IPO 7.4 Barrier Re-assessment for Preventing Further Round Goby Invasion into the Little Rouge River
Project Description	This existing partial barrier to fish passage has been identified by OMNR and TRCA as a potential strategic barrier to prevent the upstream expansion of Round Goby and other invasive species into the Little Rouge subwatershed. This FMP is recommending that the barrier be maintained and enhanced for this reason. Following the agency review and approvals process, there may be future opportunities to contribute towards the maintenance or enhancement of this barrier.
Proposed Project Components	Proposed Project Planning and Design Considerations
1. Barrier Management	
Re-assessment	The re-assessment of this structure to remain as a species partition should be directed by OMNR.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).	

Table 4-37: IPO 7.5 Prevention of Livestock Access to Stream

Implementation Project Opportunity	
Project Name	IPO 7.5 Prevention of Livestock Access to Stream
Project Description	Strengthen education and stewardship relationship with owners/managers of agricultural properties with livestock accessing stream for watering in the Little Rouge River.
Proposed Project Components	Proposed Project Planning and Design Considerations
1. Education and Stewardship	
Workshops/Presentation	- A special workshop could be organized for property owners/managers to provide information on the sensitive aquatic habitat in the Little Rouge which flows through their properties. - Strategies to protect water quality by restricting livestock access to the stream could be discussed, as well as the importance of doing so. - Stewardship staff could assist with developing and implementing workshop/presentation. The work will likely need to be tied into another event (e.g., Markham Fair or Royal Winter Fair).
Site Visits to Properties with livestock	- TRCA Stewardship staff could organize site visits with interested property owners/managers to inspect the livestock access points and tour the stream corridor through the property. Problem areas could be identified and possible solutions acceptable to the owners/managers could be developed. - Numerous options exist for providing watering stations away from the stream. Fencing above the top of bank should also be installed to protect the riparian zone from trampling. If fencing is installed, planting should occur in the riparian zone.
Monitoring	- After livestock access to the stream has been restricted and the riparian zone project has been designed, approved, and implemented, post-planting monitoring must be undertaken to document whether the defined goals of the work are being achieved. - A water quality survey should be conducted before project implementation to document existing conditions. - Periodic surveys should be conducted post-planting to document improvements to water quality. - Once it has been identified that the project has achieved its goals for protecting the stream water quality and fish habitat, a plan is required to monitor the and stream corridor and water quality periodically in a formalized manner to ensure fish community is healthy (e.g., utilize existing programs).
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).	

Table 4-38: IPO 7.6 Water Balance Study for Headwaters of Katabokokonk Creek and Adjacent Watercourses

Implementation Project Opportunity	
Project Name	IPO 7.6 Water Balance Study for Headwaters of Katabokokonk Creek and Adjacent Watercourses
Project Description	Investigate potential impacts of pumping for golf course irrigation on aquifer levels and baseflow in headwater zone of Katabokokonk Creek area. Strengthen education and stewardship relationship with golf course owners/managers and area residents to sustain coldwater fish habitat in this headwater zone. The Rouge North Management Plan should also be reviewed for direction regarding Town of Markham becoming the future owner of lands adjacent to select tributaries.
Proposed Project Components	Proposed Project Planning and Design Considerations
1. Education and Stewardship	
Workshops/Presentation	- A special workshop/presentation could be organized for property owners/managers to provide information on the sensitive aquatic habitat in the upper Little Rouge which flows through their properties. Demonstrate the critical importance of groundwater discharge in providing a starting point for the aquatic ecosystem. - Agency and NGO staff could assist with developing and implementing workshop/presentation materials. Perhaps hold a presentation/seminar at the Markham Fair where the target audience is already present. Also consider activities that may result from Source Water Protection legislation.
Site visits to properties with headwater streams or watercourses that have dried up recently.	- Stewardship groups (e.g. at OMNR or TRCA) could organize site visits with interested property owners/managers to inspect the property and look for opportunities (e.g., zero order stream enhancements). Problem areas could be identified and possible solutions acceptable to the owners/managers could be presented. - Convey the importance of cumulative effects to both groundwater and surface flow system.
Monitoring	- Identify properties with wells that can serve as monitoring locations for the groundwater table. - Investigate options for monitoring flow over the course of a couple of years to better understand potential ecological impacts. - It is important to involve relevant hydrogeological staff so that informed interpretation is possible and corrective options can be developed and proposed.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).	

Table 4-39: IPO 7.7 Invasive Species Detection Program for Volunteers

Implementation Project Opportunity	
Project Name	IPO 7.7 Invasive Species Detection Program for Volunteers
Project Description	Facilitate the opportunity for volunteer involvement in the detection and reporting of aquatic invasive species.
Proposed Project Components	Proposed Project Planning and Design Considerations
1. Education and Stewardship	
Workshop/Presentation	- A special workshop could be organized for property owners/managers to provide information on the sensitive aquatic habitat in the Little Rouge which flows through their properties (e.g., utilize existing programs OFAH/OMNR). - Strategies to protect aquatic ecosystem from aquatic invasive species should be conveyed, and illustrate why it is important in this FMZ in particular.
Co-ordination	Improved and elevated co-ordination of existing efforts to monitor, report, and document AIS in the vulnerable areas of the Rouge River (e.g., joint OFAH and OMNR programs).
Monitoring	If monitoring is going to be undertaken there should also be a response strategy in place. This response could involve the volunteers that have participated in the project.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).	

4.1.8 Lower Main Rouge River and Morningside Creek (FMZ 8)

This zone represents the lower reaches of the Main Rouge River that flow through the southern end of the Town of Markham (below Highway 407) and through the City of Toronto to Highway 401. Rouge Park borders the east side of the zone but drainage is received from the urban and rural catchments above (FMZ 1, 2, 3, 5, 6, and 10). Morningside Creek, which flows through a highly urban catchment within the City of Toronto, is also part of this zone. The various fish species collected in the past and recent surveys are listed in **Table 4-40**. A total of 48 species have been captured in this zone over time, of which 29 species (including 4 invasive) were collected in the most recent surveys (2009 and 2010). The target species, temperature regime and other existing conditions, monitoring stations, stocking sites and water balance priorities are shown on **Figure 4-15**. Redside Dace are target species for Morningside Creek only.

The existing fish community in the main channel is made up of largely cool-warm water species expected for this portion of a large river system. The biodiversity is high, capturing a range of species that are habitat specialists and/or considered sensitive (i.e., Brassy Minnow, Blackchin Shiner, Iowa Darter, and Rainbow Darter) to the very common and tolerant generalists (i.e., White Sucker, Creek Chub, Blacknose Dace, Fathead Minnow, Brook Stickleback, Longnose Dace, and Johnny Darter etc). Diversity is also enhanced through the lake-river connection and likely influences the presence of sunfish, catfish, carp and migratory species. As recreational angling is a common activity in this zone, there has been regular stocking of both Rainbow and Brown Trout.

Species that appear to have been lost or in decline from this zone are Mottled Sculpin (cold water) and small-bodied minnows that would be expected to move between the lakefront and the river mouth habitats (i.e., Emerald Shiner, Sand Shiner, Rosyface Shiner, and Spottail Shiner (*Notropis hudsonius*)). The latter group are known to be intolerant to turbidity and siltation; both conditions appear to impact the lowest reaches of the Rouge River as a result of cumulative watershed effects.

Although maximum summer temperatures in the main Rouge River are not as extreme as in the Little Rouge River, data collected in 2003 and 2005 indicate an abrupt shift from coolwater habitat in the upper zones (FMZ 5 and FMZ 6) to warmwater in the main branch. This is likely a combined influence of natural shifts in stream temperatures as the channel widens and cumulative impacts of upstream drainage (e.g., stormwater and heated water from Toogood Pond and Milne Reservoir). Chloride levels are also generally increasing in the main channel. Groundwater seepage along the banks of the main branch, combined with significant track of natural cover (i.e., Rouge Park), are assumed to provide a level of mitigation to the lower reaches.

The main branch of the Rouge River is a migratory route for lake-run fish and with the operation of Milne and Toogood Pond fishways, most fish can make it up to the headwaters in FMZ 1, FMZ 2 and FMZ 3. This also means that invasive species have access to the same upper reaches (unless the fishways are closed). The first collection of Round Goby in this zone was

in 2006 by an angler that found one specimen at Highway 2. In 2009, DFO surveys collected 120 Round Goby further up the Main Rouge at the confluence with the Little Rouge. The most recent sampling by DFO (2010) increased the area of sampling and found Round Goby even further upstream in both the main Rouge and Little Rouge River. Sea Lamprey were also found in all of these surveys. Current Sea Lamprey control has been described in Section 3.2.12.

Morningside Creek warrants a separate discussion as this watercourse supports a small population of Redside Dace. The Redside Dace population is confined to the upper reaches of the watercourse where suitable habitat and groundwater inputs are still found but recent surveys (2007, 2008, and 2009) indicate a decline in abundance. The challenges for this species are multiple and include: flashy stormwater flows, frequent turbidity, major channel erosion, warming stream temperatures (from cold to warm), in-stream barriers and possible competition/predation pressure from stocked salmonids.

The stream warming and an altered flow regime are considered impacts of past urbanization and the associated type of stormwater management (i.e., ponds located in the headwater area of Morningside Creek). Localized groundwater discharge is significant despite the overall warming trend and thus this creek is attractive spawning habitat for Rainbow and Brown Trout. A fishway (i.e., by-pass channel) was constructed by OMNR several years ago to improve passage conditions in the lower reaches of this watercourse. The development of more detailed recommendations than presented in this FMP will require further consultation with groups that have expressed interest in the restoration of Morningside Creek, including Rouge Park and the City of Toronto.

Table 4-40: Past and Present Fish Species in FMZ 8

Species Name	Scientific Name	Last Record
Alewife	<i>Alosa pseudoharengus</i>	09/06/1972
Blackchin Shiner	<i>Notropis heterodon</i>	12/05/2010
Black Crappie	<i>Pomoxis nigromaculatus</i>	07/08/2009
Blacknose Dace	<i>Rhinichthys atratulus</i>	12/05/2010
Bluegill	<i>Lepomis macrochirus</i>	12/05/2010
Bluntnose Minnow	<i>Pimephales notatus</i>	12/05/2010
Brassy Minnow	<i>Hybognathus hankinsoni</i>	13/05/2010
Brook Stickleback	<i>Culaea inconstans</i>	16/05/2010
Brown Bullhead	<i>Ameiurus nebulosus</i>	16/05/2010
Brown Trout	<i>Salmo trutta</i>	15/08/2005
Central Mudminnow	<i>Umbra limi</i>	09/06/1972
Central Stoneroller	<i>Campostoma anomalum</i>	16/05/2010
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	13/05/2010
Coho Salmon	<i>Oncorhynchus kisutch</i>	18/10/1984
Common Carp	<i>Cyprinus carpio</i>	14/07/2005
Common Shiner	<i>Luxilus cornutus</i>	16/05/2010
Creek Chub	<i>Semotilus atromaculatus</i>	16/05/2010
Emerald Shiner	<i>Notropis atherinoides</i>	09/06/1972

Species Name	Scientific Name	Last Record
Fathead Minnow	<i>Pimephales promelas</i>	16/05/2010
Gizzard Shad	<i>Dorosoma cepedianum</i>	23/08/1994
Golden Shiner	<i>Notemigonus crysoleucas</i>	15/07/1998
Goldfish	<i>Carassius auratus</i>	07/08/2009
Hornyhead Chub	<i>Nocomis biguttatus</i>	16/05/2010
Iowa Darter	<i>Etheostoma exile</i>	16/05/2010
Johnny Darter	<i>Etheostoma nigrum</i>	16/05/2010
Lake Chub	<i>Couesius plumbeus</i>	01/08/1985
Largemouth Bass	<i>Micropterus salmoides</i>	15/08/2000
Logperch	<i>Percina caprodes</i>	26/06/2003
Longnose Dace	<i>Rhinichthys cataractae</i>	16/05/2010
Mimic Shiner	<i>Notropis volucellus</i>	05/09/1995
Mottled Sculpin	<i>Cottus bairdii</i>	02/11/1984
Northern Redbelly Dace	<i>Chrosomus eos</i>	12/05/2010
Pumpkinseed	<i>Lepomis gibbosus</i>	15/05/2010
Rainbow Darter	<i>Etheostoma caeruleum</i>	16/05/2010
Rainbow Trout	<i>Oncorhynchus mykiss</i>	17/07/2009
Redside Dace	<i>Clinostomus elongatus</i>	08/07/2009
River Chub	<i>Nocomis micropogon</i>	05/09/1995
Rock Bass	<i>Ambloplites rupestris</i>	16/05/2010
Rosyface Shiner	<i>Notropis rubellus</i>	15/10/1984
Round Goby	<i>Neogobius melanostomus*</i>	16/05/2010
Sand Shiner	<i>Notropis stramineus</i>	01/08/1985
Sea Lamprey	<i>Petromyzon marinus</i>	16/05/2010
Smallmouth Bass	<i>Micropterus dolomieu</i>	16/05/2010
Spotfin Shiner	<i>Cyprinella spiloptera</i>	05/09/1995
Spottail Shiner	<i>Notropis hudsonius</i>	01/01/1998
Stonecat	<i>Noturus flavus</i>	15/05/2010
White Sucker	<i>Catostomus commersonii</i>	16/05/2010
Yellow Perch	<i>Perca flavescens</i>	05/08/2005

Note: Detailed fish collection records and data, in electronic format, are available upon request from TRCA Aquatic Group

*Redside Dace only found in Morningside Tributary

2009/2010 Surveys by Fisheries and Oceans Canada, Sea Lamprey Control
 2009, 2006, 2003, and 2000 surveys by TRCA's Regional Watershed Monitoring Program
 2005 survey by TRCA Aquatic Group
 Pre 2000 data from MNR collection records

4 Aquatic Invasive

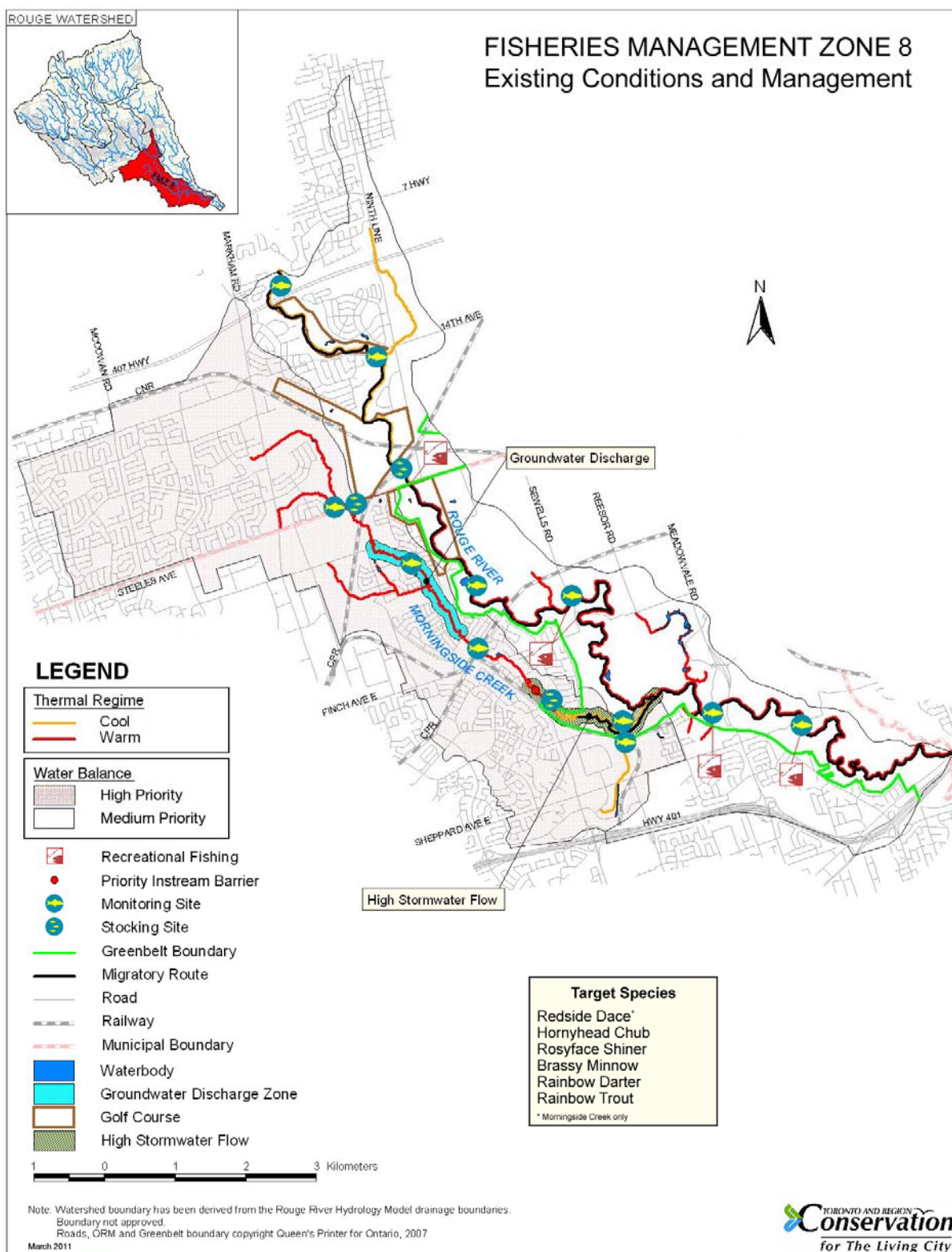


Figure 4-15: FMZ 8 Lower Main Rouge River and Morningside Creek Existing Conditions and Management Map

The thermal regime represents actual stream temperatures which have been interpreted for development and application of construction Timing Windows as provided in the Rouge River FMP (Figure 2-2).

4.1.8.1 Management Recommendations FMZ 8

This FMZ contains the lower main Rouge River and Morningside Creek. The lower main Rouge is largely open to the Lake Ontario ecosystem and supports a variety of both riverine and lake-based fishes (native and invasive). There are 4 in-stream structures towards the upper end of this zone that may be seasonal barriers to non-jumping fish species (not considered priorities for mitigation). This lower reach of the main Rouge flows through Rouge Park and affords it similar benefits as discussed in FMZ 7. The major issues are turbidity associated with storm events and siltation assumed to be a result of cumulative impacts through the upper watershed.

Morningside Creek flows through a heavily urbanized subcatchment and has sustained impacts due to poorly controlled stormwater. A small population of Redside Dace occupies the upper reaches but habitat degradation is likely contributing to species decline. The creek is also fragmented by at least 2 in-stream structures that do not allow for fish passage. See **Table 4-41** for a full set of recommendations.

4.1.8.2 Implementation Project Opportunities FMZ 8

There are 4 IPOs developed for this zone with approximate locations found on **Figure 4-16**. Three are described in **Table 4-42** and **Table 4-43**. For a description of IPO 8.4, please refer to the related IPO 7.7 (**Table 4-39**).

Table 4-41: FMZ 8 Lower Main Rouge and Morningside Creek Management Recommendations

Processes And Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Surface Water Regime	High flow volumes during storm events that discharge directly into Morningside Creek have caused a significant shift in channel morphology (e.g., August 19th, 2005) throughout the lower portion of this watercourse.	Investigate opportunities to increase infiltration through lot-level retrofits of existing urban community in north-east Scarborough.		all species
	Stormwater management ponds within the headwaters of Morningside Creek do not appear to be mitigating downstream erosion and water quality changes.	Retrofit and/or clean out existing stormwater management ponds to improve conditions at point of discharge and cumulatively for downstream habitats (e.g., flow regime, temperature, water chemistry, sediment transport).		all species
	Cumulative impacts to flow regime and general habitat in the Main River are known but not well quantified.	Support all recommendations that advocate mitigation of cumulative impacts on watershed hydrology, sedimentation processes and water quality, especially the use of innovative techniques.		all species
Groundwater Regime	Many watercourses and their related aquatic ecosystem functions, have a very high sensitivity to the alteration of the surface and groundwater flow regime as a result of land use change. A lack of required information exists for urbanized areas to define a water balance condition that could return altered flows to a more natural regime.	The prioritized need to achieve water balance in this FMZ should reflect the areas identified on Figure 4-15 (1 High Priority Zone in Morningside Creek and retrofit opportunities in community located in north-east Scarborough).		all species
Water Chemistry	Chlorides from road salting practices are affecting watercourses in this FMZ.	Support the <i>Rouge River Watershed Plan</i> (TRCA 2007a) in the recommendation for Municipalities to review/reduce/alter road salting practices.		all species
		Investigate retrofit alternatives (e.g., oil and grit separators, bioswales) for diverting or collecting run off from roads directly adjacent to watercourses for long-term stream protection or mitigation of pollutants (e.g., salt and accidental chemical spills). Making contact as soon as possible following a spill and supplying photographs can help MOE assess and respond as required to the occurrence. MOE Spills Action Centre phone number is 416-325-3000.		all species

Table 4-41: FMZ 8 Lower Main Rouge and Morningside Creek Management Recommendations

Processes And Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Temperature	The thermal regime of Morningside Creek has changed from coldwater to more warmwater over the years of monitoring (decade), likely resulting from a loss of riparian cover, discharge from stormwater management ponds, reduced groundwater contributions or a combination thereof.	Undertake an evaluation of the efficacy of stormwater management techniques to mitigate thermal impacts on 1st - 3rd order streams. Consider the inclusion of the following sites: Riotrin and Urbacon SWM Ponds on Leslie Tributary, Humber Flats SWM system on Upper East Humber, SWM Pond 61 on Black Creek, Cathedral SWM Pond on Rouge River (GEMS technology), and various HWY 407 SWM Ponds.		Redside Dace
Sediment	Natural sediment transport and deposition throughout the main channel of the Rouge River has likely been altered by the presence of Milne Dam and/or upstream urbanization.	Characterize the current sediment transport regime and deposition in this in FMZ; identify options for restoration of natural sedimentation processes if necessary.		all species
	High flow volumes during storm events in the lower portion of Morningside Creek have significantly reduced the quantity of small substrate required to support a healthy aquatic community.	See recommendation in Surface Water Regime as it relates to sediment transport.		all species
Terrestrial Natural Heritage	Fragmentation of natural cover within riparian zone in FMZ 8 (Morningside Creek).	For all stream reaches determined to be the habitat of Redside Dace, a minimum protected stream corridor consisting of the stream meander belt plus 30m on each side should be applied, as recommended in the <i>Redside Dace Recovery Strategy</i> (OMNR 2010a) and as required by OMNR. This may also be applied to stream reaches identified as recovery habitat for Redside Dace. See Section 3.2.11.1 Riparian Habitat Recommendations for vegetation community type recommendations.	IPO 8.2 Riparian Habitat Enhancement	Redside Dace
		Restore natural multi-layer tree canopy cover within the riparian zone and uplands where available to allow for the increased infiltration and retention of water in order to maintain/restore flow balance and groundwater discharge to streams. See Section 3.2.11.1 Riparian Habitat Recommendations for vegetation community type recommendations.		all species

Table 4-41: FMZ 8 Lower Main Rouge and Morningside Creek Management Recommendations

Processes And Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Fish Community and Habitat	Recent surveys (2007, 2008, and 2009) indicate a decline in the Redside Dace population in the upper reaches of Morningside Creek. This population is considered to be at considerable risk of extirpation from this watercourse but opportunities for habitat protection, enhancement and rehabilitation remain.	Support recovery actions for Redside Dace .	IPO 8.1 Morningside Creek Restoration	Redside Dace
		A construction timing window from July 1st - September 15th is to be applied in all Redside Dace occupied habitats or in upstream contributing habitats at the discretion of the appropriate agencies		Redside Dace
	Stocking of salmonids spatially concurrent with resident Redside Dace populations in Morningside Creek.	Monitoring and assessment of Rainbow Trout adult returns and natural reproduction is required to direct future stocking activity. Until such time, stocking of Rainbow Trout or Brown Trout should generally avoid stream reaches determined to be the habitat of Redside Dace.	-	Rainbow Trout
	Remnants of historic dams and a Water Survey Canada weir prevent the passage of some fish species during low flow periods through the main Rouge River. Two in-stream barriers are also present in Morningside Creek.	Optimize fish passage of native species throughout the zone (i.e., removal or mitigation of in-stream barriers that negatively impact native fish communities). However, consequences of the potential introduction of invasive species and/or promoting the interaction with non-compatible species must be considered.		Hornyhead Chub, Rosyface Shiner, Brassy Minnow, Rainbow Darter, Rainbow Trout
	The Main Rouge River is vulnerable to Aquatic Invasive Species moving up from Lake Ontario (e.g., Round Goby, carp, Rusty Crayfish and Sea Lamprey).	Increase the coordination of existing stewardship and outreach programs to prevent new introductions and any further spread of aquatic invasive species (AIS), particularly Round Goby and Sea Lamprey.	IPO 8.3 Invasive Species Detection Program for Volunteers- see related IPO 7.7 Invasive Species Detection Program for Volunteers	all species
		Continue to support investigations initiated by DFO Sea Lamprey Control to assess the feasibility of a seasonal barrier at the mouth of the Rouge River as an alternative to chemical control of Sea Lamprey. Upon the completion of this FMP, move forward with inter-agency consultation (DFO, OMNR, TRCA) to determine future Sea Lamprey control strategy.		all species

Table 4-41: FMZ 8 Lower Main Rouge and Morningside Creek Management Recommendations

Processes And Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Anthropogenic	Fishing pressure from recreational angling in the river and adjacent Rouge Park lands are not quantified but may be incompatible with aquatic management objectives.	Continue to engage local angling associations for direction, feedback and involvement with promoting ecologically compatible angling opportunities through Rouge Park south of Steeles Avenue.		all species
	Existing or future urbanization and associated activities/impacts.	Refer to appropriate recommendations above.		all species

Legend	Timeframe for Potential Implementation
Priority Focus	1 to 5 years
Management Focus	5 to 10 years

Table 4-41: FMZ 8 Lower Main Rouge and Morningside Creek Management Recommendations

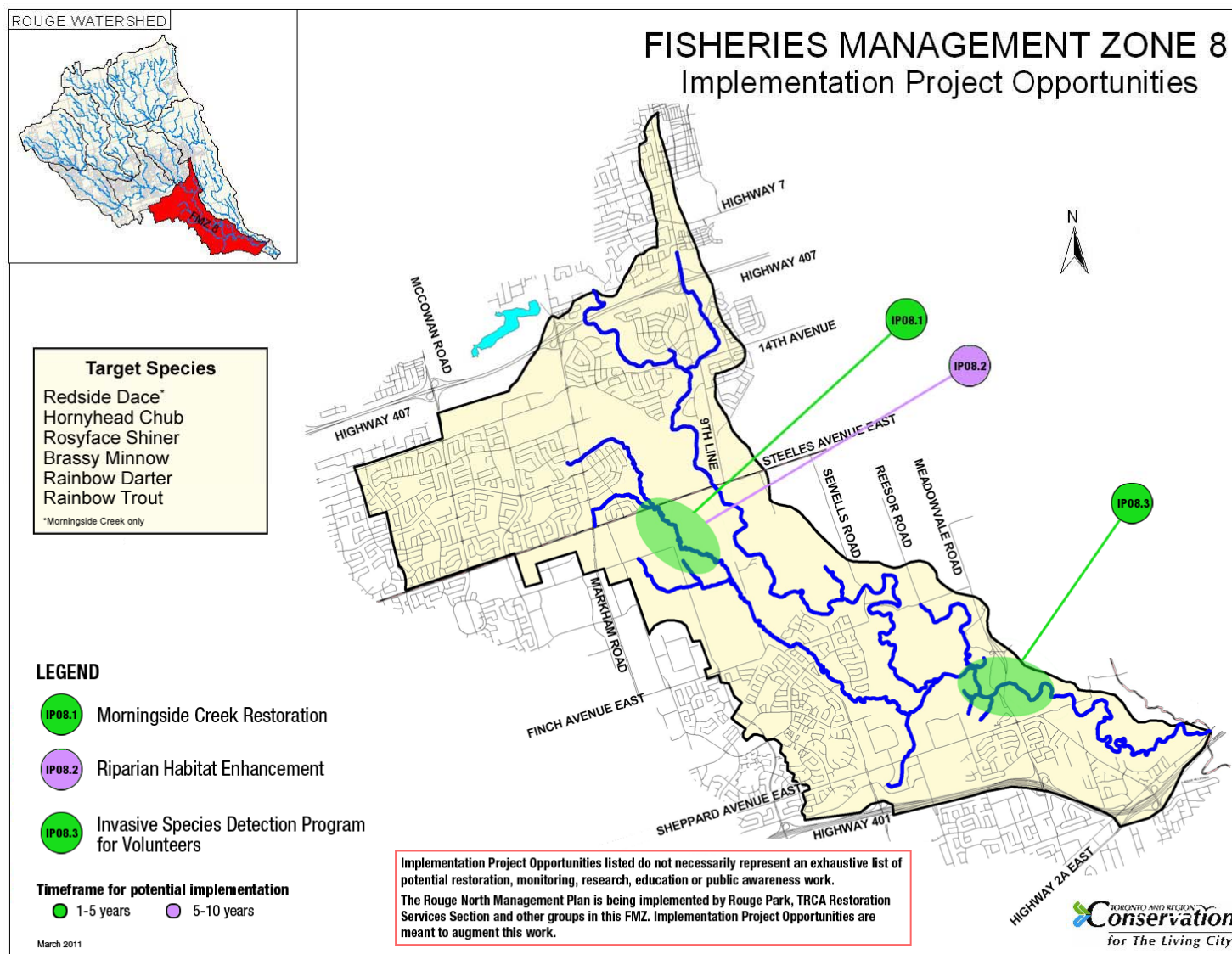


Figure 4-16: FMZ 8 Lower Main Rouge River and Morningside Creek IPO Locations

IPOs are recommended with the expectation that prior or concurrent improvements in stormwater management proceed, and that water balance understanding is obtained for this FMZ in support of a healthy aquatic ecosystem

Table 4-42: IPO 8.1 Morningside Creek Restoration

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 8.1 Morningside Creek Restoration
	Project Description	Morningside Creek has experienced a variety of changes in hydrology and stream temperature over time that has degraded and changed the aquatic habitat of the watercourse. This project seeks to improve portions of the creek's ecological condition starting towards its headwater habitats.
Proposed Project Components	Proposed Project Planning and Design Considerations	
1. Fish Community		
Sampling	Much restoration work has already been undertaken in Morningside Creek to help restore channel function. An assessment of fish community response is recommended within these areas.	
2. Thermal Regime		
Detailed Water Temperature Survey	- A detailed temperature survey should be conducted in order to identify any significant remaining groundwater discharge areas that could be augmented through riparian restoration or engineered infiltration to the watercourse. - The thermal regime of the watercourse in response to stormwater events needs to be developed in order to develop an understanding that can then be used for retrofit options.	
3. Flow Regime		
Document the current flow regime.	As there is no flow gauge on the watercourse which can be used as a basis to undertake natural channel design, utilize engineering models to identify how much flow regime has been altered from pre- to post- urban conditions. Baseflow measurements should be conducted several times a season to understand the changes in volume and to help calibrate model output. This is required in order to redesign or re-engineer the channel to create an improved ecological condition for aquatic species.	
Erosion Potential	- Utilize existing channel morphology and flow data to make assessments about the erosion potential of the watercourse currently, and to help assess the amount of channel adjustment in the future. - The City of Toronto and TRCA may have relevant channel morphology information to further enhance decisions about the future condition of the channel if it was to be redesigned.	
4. Riparian Habitat		
Restoration	Portions of the riparian area have been degraded and may require restoration or enhancement efforts, which might include the need for new topsoil and/or significant site preparation. Consult with the Ministry of Natural Resources to define restoration areas within regulated Redside Dace habitat.	
5. Natural Channel Assessment		
Evaluation of Previous Work	The work areas restored previously should be re-evaluated to determine if they succeeded in their desired goal(s) or specific outcome(s). If not, an understanding should be developed of what the design flaws were in advance of any new undertakings or new in-stream channel or riparian designs.	
6. Analysis and Reporting		
Summary Report of Activities	Develop a final report on findings and outcomes that can provide a basis for learning.	
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

Table 4-43: IPO 8.2 Riparian Habitat Enhancement

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 8.2. Riparian Habitat Enhancement
	Project Description	To enhance the physical riparian habitat in support of Redside Dace.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Riparian Habitat Management		
Planting Plan	- Develop a planting plan which considers a riparian habitat condition suitable for Redside Dace. - Focus on enhancements that are targeted at improving channel form and grass/meadow conditions that may support increased food resources (i.e., insect production) for Redside Dace.	
Implementation and Monitoring	- All riparian planting should be monitored for survival of plants. Although the goal is a healthy riparian habitat, a fully closed canopy may not be a desired riparian condition. - Provide feedback to agencies on plant survival.	
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

4.1.9 Mouth of Rouge River and Marsh (FMZ 9)

This zone is located at the very bottom of the watershed; it includes the mouth of the river and the provincially significant coastal wetland under Rouge Park management. This wetland feature is unique to the watershed and provides shoreline protection, critical habitat to local wildlife and refuge and spawning sites for many aquatic species. It is also the site for human recreational activities, including angling. The various fish species collected in the past and recent surveys are listed in **Table 4-44**. A total of 57 species have been captured in this zone over time, of which 29 species (including 2 invasive) were collected in the most recent surveys (2009 and 2010). The target species, thermal regime and other existing conditions, monitoring stations, stocking sites and water balance priorities are shown **Figure 4-17**.

The diversity at the mouth and coastal wetland has shifted relatively little from past records with a wide range of species found over the past 5 years of sampling, including: Emerald Shiner, Spottail Shiner, Common Shiner (*Luxilus cornutus*), Bluntnose Minnow, Brassy Minnow, White Sucker, Pumpkinseed, Northern Pike (*Esox lucius*), Lake Chub (*Couesius plumbeus*), Bowfin (*Amia calva*), Walleye (*Sander vitreus*) and Goldfish. Recent 2009 surveys conducted by DFO collected a single American Eel (*Anguilla rostrata*) for the first time at the mouth of the Rouge River. This species is provincially endangered under the *Endangered Species Act* (2007).

Species that have not been present in the very recent records, such as Coho Salmon and Brown Trout and Common Carp are known to be in the Lake Ontario system and likely utilizing this zone at various time of the year. Carp have been observed in the marsh itself (antedoctal reports from various agency staff and anglers) but not specifically collected during the surveys.

Aquatic invasive species are present and established in this zone. It is unknown to what extent the marsh habitat has been impacted by the high abundance of carp species and growing presence of Round Goby, although marsh restoration efforts have been underway for several years by the group Ontario Streams. More the issue is the open access of lake-based invasive species to the watershed.

This zone receives drainage from the entire watershed and is influenced by both the cumulative effects from upstream and by the conditions of Lake Ontario. The main impacts from upstream drainage are likely stormwater and the deposition of sediment into the marsh. In terms of lake influences, invasive fish species like Common Carp are abundant and can cause physical disruption to shoreline macrophytes through their benthic feeding and spawning behaviour. This exacerbates turbidity and could potentially cause the release of contaminants or excess nutrients from the sediment. Additionally, there is some concern that human recreational use may not be ecologically compatible with protecting wetland vegetation, nesting shore birds and other wildlife (e.g., fishing pressure, trampling of plants).

Table 4-44: Past and Present Fish Species in FMZ 9

Species Name	Scientific Name	Last Record
Alewife	<i>Alosa pseudoharengus</i>	01/06/2002
American Eel	<i>Anguilla rostrata</i> *	14/05/2010
Blackchin Shiner	<i>Notropis heterodon</i>	15/05/2010
Black Crappie	<i>Pomoxis nigromaculatus</i>	01/06/2002
Blacknose Dace	<i>Rhinichthys atratulus</i>	15/05/2010
Bluntnose Minnow	<i>Pimephales notatus</i>	15/05/2010
Bowfin	<i>Amia calva</i>	07/08/2006
Brassy Minnow	<i>Hybognathus hankinsoni</i>	14/05/2010
Brook Stickleback	<i>Culaea inconstans</i>	15/05/2010
Brown Bullhead	<i>Ameiurus nebulosus</i>	22/09/2008
Brown Trout	<i>Salmo trutta</i>	30/10/1984
Central Mudminnow	<i>Umbra limi</i>	14/09/2009
Central Stoneroller	<i>Campostoma anomalum</i>	15/05/2010
Chinook Salmon	<i>Oncorhynchus tshawytscha</i>	01/12/2003
Coho Salmon	<i>Oncorhynchus kisutch</i>	30/10/1984
Common Carp	<i>Cyprinus carpio</i>	20/05/2004
Common Shiner	<i>Luxilus cornutus</i>	15/05/2010
Creek Chub	<i>Semotilus atromaculatus</i>	15/05/2010
Emerald Shiner	<i>Notropis atherinoides</i>	15/05/2010
Fantail Darter	<i>Etheostoma flabellare</i>	04/06/2002
Fathead Minnow	<i>Pimephales promelas</i>	15/05/2010
Freshwater Drum	<i>Aplodinotus grunniens</i>	20/05/2004
Gizzard Shad	<i>Dorosoma cepedianum</i>	22/09/2008
Golden Shiner	<i>Notemigonus crysoleucas</i>	22/09/2008
Goldfish	<i>Carassius auratus</i>	07/08/2006
Hornyhead Chub	<i>Nocomis biguttatus</i>	15/05/2010
Iowa Darter	<i>Etheostoma exile</i>	15/05/2010
Johnny Darter	<i>Etheostoma nigrum</i>	15/05/2010
Lake Chub	<i>Couesius plumbeus</i>	15/05/2010
Largemouth Bass	<i>Micropterus salmoides</i>	17/08/2001
Logperch	<i>Percina caprodes</i>	15/05/2010
Longnose Dace	<i>Rhinichthys cataractae</i>	15/05/2010
Mimic Shiner	<i>Notropis volucellus</i>	04/04/2000
Mooneye	<i>Hiodon tergisus</i>	02/06/2000
Mottled Sculpin	<i>Cottus bairdii</i>	04/06/1954
Northern Pike	<i>Esox lucius</i>	07/08/2006
Northern Redbelly Dace	<i>Chrosomus eos</i>	16/08/1994
Pumpkinseed	<i>Lepomis gibbosus</i>	15/05/2010
Rainbow Darter	<i>Etheostoma caeruleum</i>	15/05/2010
Rainbow Trout	<i>Oncorhynchus mykiss</i>	15/05/2010
Redside Dace	<i>Clinostomus elongatus</i>	16/08/1994
Rock Bass	<i>Ambloplites rupestris</i>	15/05/2010
Rosyface Shiner	<i>Notropis rubellus</i>	15/05/2010
Round Goby	<i>Neogobius melanostomus</i> *	15/05/2010

Species Name	Scientific Name	Last Record
Sand Shiner	<i>Notropis stramineus</i>	15/05/2010
Sea Lamprey	<i>Petromyzon marinus*</i>	15/05/2010
Smallmouth Bass	<i>Micropterus dolomieu</i>	15/05/2010
Spotfin Shiner	<i>Cyprinella spiloptera</i>	20/05/2004
Spottail Shiner	<i>Notropis hudsonius</i>	07/08/2006
Threespine Stickleback	<i>Gasterosteus aculeatus</i>	04/06/2002
Trout-perch	<i>Percopsis omiscomaycus</i>	17/10/1989
Walleye	<i>Sander vitreus</i>	20/05/2004
White Crappie	<i>Pomoxis annularis</i>	08/08/2002
White Perch	<i>Morone americana</i>	14/07/1983
White Sucker	<i>Catostomus commersonii</i>	15/05/2010
Yellow Bullhead	<i>Ameiurus natalis</i>	07/05/1999
Yellow Perch	<i>Perca flavescens</i>	14/05/2010

Note: Detailed fish collection records and data, in electronic format, are available upon request from TRCA Aquatic Group

2009/2010 Surveys by Fisheries and Oceans Canada, Sea Lamprey Control

2009, 2006, 2003, and 2000 surveys by TRCA's Regional Watershed Monitoring Program

2005 survey by TRCA Aquatic Group

Pre 2000 data from MNR collection records

4 Aquatic Invasive

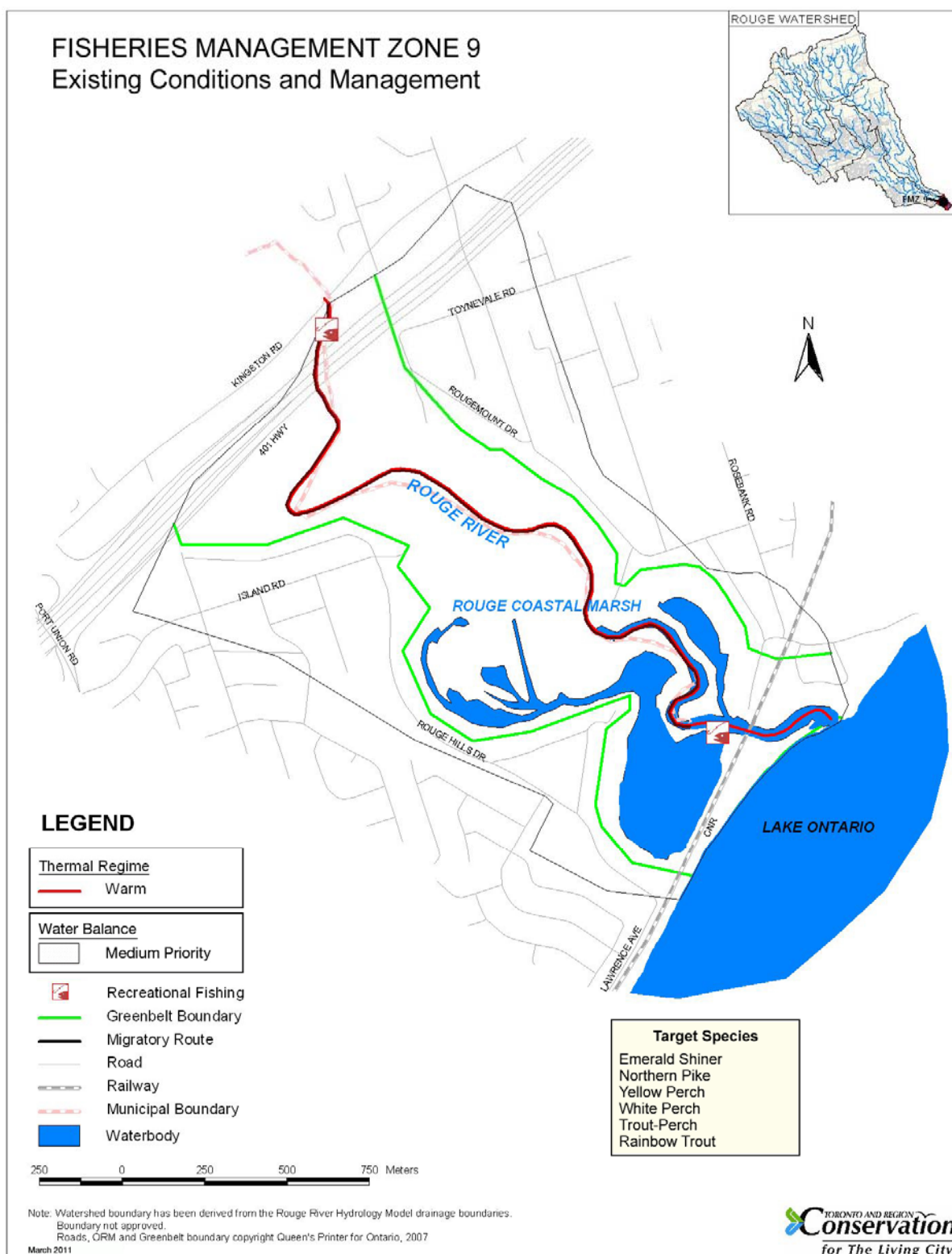


Figure 4-17: FMZ 9 Mouth of Rouge River and Estuary Existing Conditions and Management Map

The thermal regime represents actual stream temperatures which have been interpreted for development and application of construction Timing Windows as provided in the Rouge River FMP (Figure 2-2).

4.1.9.1 Management Recommendations FMZ 9

This FMZ is a singular zone that includes the combined flows of the Main Rouge and Little Rouge below Highway 2 (also known as Kingston Road), the mouth of the watershed and the costal marsh. Although upstream cumulative impacts and Lake Ontario influences likely drive the overall habitat conditions in this zone, local focus is on invasive species management and stewardship opportunities.

Access to the waterfront and beach is highly constrained by the residential area that surrounds them. Opportunities for continued marsh restoration, ecosystem monitoring, educational and interpretative tours, signage and recreational fishing are largely confined to the west side of the marsh in a small area to the north of the railway line. See **Table 4-45** for full set of recommendations.

4.1.9.2 Implementation Project Opportunities FMZ 9

There are 3 IPOs developed for this zone with approximate locations found on **Figure 4-18**. Two are described in **Table 4-46** and **Table 4-47**. For a description of IPO 9.3, please refer to the related IPO 7.7 (**Table 4-39**).

Table 4-45: FMZ 9 Mouth of Rouge River and Estuary Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Surface Water Regime	The mouth of the river and Rouge Marsh is impacted by cumulative effects from the entire watershed, particularly, stormwater and deposition of sediment into the marsh.	Support all recommendations that advocate mitigation of cumulative impacts on watershed hydrology, stream temperature, sedimentation processes and water quality, especially the use of innovative techniques.		all species
Groundwater Regime	The mouth of the river and Rouge Marsh is impacted by cumulative effects from the entire watershed, particularly, stormwater and deposition of sediment into the marsh.	Support all recommendations that advocate mitigation of cumulative impacts on watershed hydrology, stream temperature, sedimentation processes and water quality, especially the use of innovative techniques.		all species
Water Chemistry	Cumulative impacts of road salt and other contaminants conveyed through the watershed have high potential to accumulate in the marsh.	Support the Rouge River Watershed Plan (TRCA 2007a) in the recommendation for Municipalities to review/reduce/alter road salting practices.		all species
		Support all recommendations that advocate mitigation of cumulative impacts on watershed hydrology, stream temperature, sedimentation processes and water quality, especially the use of innovative techniques.		all species
Temperature	No known issue at the present time.			n/a
Sediment	Cumulative impacts of erosion or sediment discharge during construction activity in the watershed have a high potential for increased sediment loading in the marsh that can potentially affect fish and wildlife ecology, seed banks, and prevent plant germination.	Sediment and erosion controls employed during upstream construction projects should be effective at preventing sediment from entering the watercourse. This applies to all scales and types of construction activity.		all species
		Characterize the current sediment transport regime and deposition into the marsh; identify or confirm the most appropriate vegetation communities for any future restoration initiatives.		all species
Terrestrial Natural Heritage	There are presently concerns around the amount, type and intensity of use around the marsh ecosystem that may increase the risk of invasives plants being introduced, reducing plant and animal diversity and generally degrading the marsh habitat.	Promote shoreline and wetland restoration initiatives as well as maintenance projects and incorporate educational signage into trails/boardwalks that exist or may need to be developed to access the edge of the general marsh area. There has been some marsh restoration work already done by Ontario Streams; seek consultation before additional work is undertaken.		all species

Table 4-45: FMZ 9 Mouth of Rouge River and Estuary Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Fish Community and Habitat	At the moment there is a knowledge gap regarding the populations of specific fish species utilizing the marsh ecosystem and other portions of FMZ 9 during the course of the year (e.g., biomass of invasive species (carp) may be increasing, Bowfin reproductive usage).	Consult with Toronto Waterfront Aquatic Habitat Restoration Strategy and/or Durham Region Coastal Wetland Monitoring Project around current programs that may better define the status of fish populations and their seasonal usage of FMZ 9 to inform habitat enhancement work.	IPO 9.2 Marsh Restoration Project	all species
		Identify and explore opportunities to share data with other agencies currently conducting research and/or monitoring activity within or proximal to the marsh (e.g., Canadian Wildlife Service and DFO researchers).		all species
	A knowledge gap exists regarding the presence of native freshwater mussel species found in the marsh ecosystem.	Conduct preliminary mussel surveys to establish the range of species found in the marsh in addition to standard aquatic surveys.		n/a
	The coastal marsh has a large carp population that causes physical damage to marsh plant species and exacerbates water quality issues such as turbidity. Round Goby population estimates are not known for the marsh and neither is the level of threat this species may pose to marsh integrity from a biodiversity perspective.	Increase the coordination of existing stewardship and outreach programs to prevent new introductions and any further spread of aquatic invasive species (AIS), particularly Round Goby and carp.	IPO 9.3 Invasive Species Detection Program for Volunteers – see related IPO 7.7 Invasive Species Detection Program for Volunteers	all species
		Continue to support investigations initiated by DFO Sea Lamprey Control to assess the feasibility of a seasonal barrier at the mouth of the Rouge River as an alternative to chemical control of Sea Lamprey. Upon the completion of this FMP, move forward with inter-agency consultation (DFO, OMNR, TRCA) to determine future Sea Lamprey control strategy.		all species
Anthropogenic	A lack of knowledge regarding the recreational angling pressures affecting the marsh ecosystem that may be incompatible with aquatic management direction and Rouge Park objectives.	Continue to engage local angling associations for direction, feedback and involvement with promoting ecologically compatible angling opportunities within the marsh.		Rainbow Trout, Northern Pike, Yellow and White Perch
		Identify appropriate access points and the need for additional fishing nodes proximal and upstream from the marsh, complete with stewardship signage promoting proper and ethical angling practices. Conduct an initial creel survey to improve the understanding of the fishery and its use within FMZ 9.		all species
	Limited opportunity for public access to the watercourses of FMZ 9.	Ensure that appropriate linkages are made with the Port Union project and investigate a potential access point along Pine Ridge Road.		n/a

Table 4-45: FMZ 9 Mouth of Rouge River and Estuary Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Anthropogenic	A lack of public understanding about the river ecosystem and the linkages between the watershed and the lake.	Develop educational and interpretive signage and displays that can be incorporated into trails and access points within FMZ 9 and extend physical connections to the Port Union project.		all species
		Develop a formal and coordinated educational and monitoring program to track changes and raise awareness about all of the aquatic species utilizing the marsh ecosystem.	<u>IPO 9.1 Marsh Monitoring Program</u>	all species
	Existing or future urbanization and associated activities.	Refer to recommendations above.		all species

Legend	Timeframe for Potential Implementation
Priority Focus	1 to 5 years
Management Focus	5 to 10 years

Table 4-45: FMZ 9 Mouth of Rouge River and Estuary Management Recommendations

December 2010

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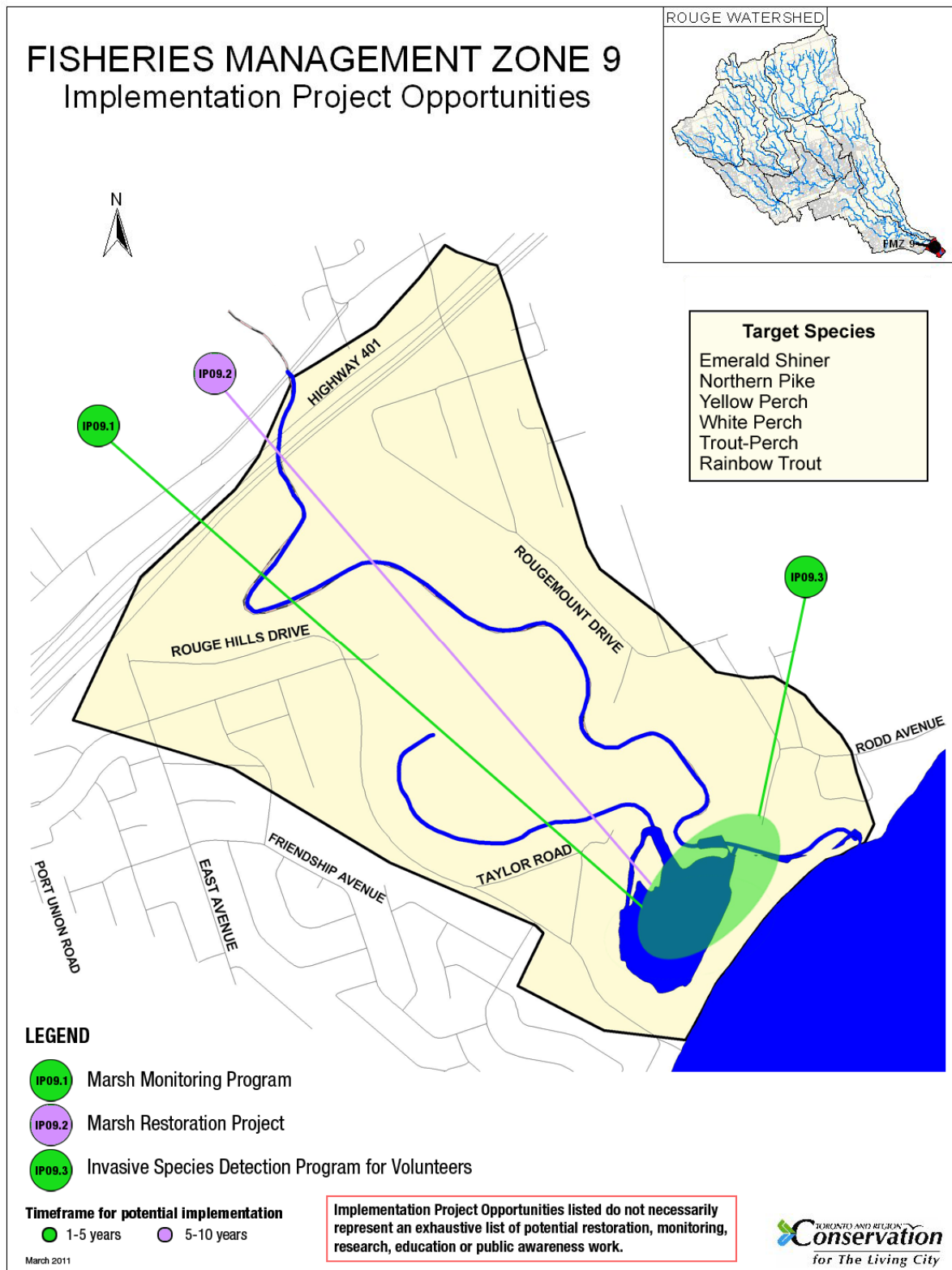


Figure 4-18: FMZ 9 Mouth of Rouge River and Estuary IPO Locations

IPOs are recommended with the expectation that prior or concurrent improvements in stormwater management proceed, and that water balance understanding is obtained for this FMZ in support of a healthy aquatic ecosystem

Table 4-46: IPO 9.1 Marsh Monitoring Program

Implementation Project Opportunity	
Project Name	IPO 9.1 Marsh Monitoring Program
Project Description	To understand the current condition and use of the aquatic resource in the Marsh through the engagement of anglers and volunteers.
Proposed Project Components	Proposed Project Planning and Design Considerations
1. Fish Community	
Invasive Species	Identify the presence of new invasive species. Coordinate with Durham Coastal Wetland Monitoring Project (DCWMP) and TRCA Restoration and Environmental Monitoring Projects Group.
Freshwater Mussels	Identify the presence and species of freshwater mussels within the marsh habitat. Coordinate with Durham Coastal Wetland Monitoring Project (DCWMP) and TRCA Restoration and Environmental Monitoring Projects Group.
Inventory fish species inhabiting Marsh	Coordinate with Durham Coastal Wetland Monitoring Project (DCWMP) and TRCA Restoration and Environmental Monitoring Projects Group. Focus on early spring and late fall surveys which are not currently undertaken.
2. Angling	
Identifying angling pressure and resource use	A formal creel survey at the Marsh to identify angling pressure, fish species sought, and catch information should be undertaken.
Coordination and Communication	There will need to be coordination and organization of volunteers to collect and report the required information. This will likely require the assistance of paid staff.
3. Volunteer Surveys	
A variety of formalized volunteer based marsh monitoring surveys	This can employ existing methodologies, and should where available, tie into existing programs and opportunities and ongoing survey work (e.g., Adopt a Pond, Toronto Zoo). However, the goal is to focus on the creation of additional surveys (e.g., spawning runs, invasive species, freshwater mussels) that will support fisheries management in the watershed.
4. Communications and Reporting	
Summary Results	Yearly monitoring or creel results should be summarized into a very streamlined report.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).	

Table 4-47: IPO 9.2 Marsh Restoration Project

Implementation Project Opportunity	
Project Name	IPO 9.2 Marsh Restoration Project
Project Description	To help direct additional rehabilitation activities by building on past rehabilitation works and incorporating information obtained from Marsh Monitoring Program (IPO 9.1) on the current condition of the aquatic resources in the marsh.
Proposed Project Components	Proposed Project Planning and Design Considerations
1. Aquatic Habitat Mapping	
Obtain existing mapping info and update if required	Communicate with Rouge Park, Canadian Wildlife Service (CWS), Ontario Streams, OMNR and partners involved in Durham Coastal Wetland Monitoring Project to determine level of detail in Marsh monitoring and inventory work previously conducted.
Identify aquatic habitat zones in Marsh	- Utilize data from inventory work to identify spawning and nursery areas. - Consider other aspects of marsh ecology (black terns, dragonflies, turtles).
Prepare aquatic habitat rehabilitation plans	Communicate and coordinate with partners involved in Rouge River Marshes Rehabilitation Project, including Rouge Park, TRCA, Ontario Streams and OMNR.
2. Rehabilitation Activities	
Implement rehabilitation projects	Work with partners already involved in marsh rehabilitation projects to determine which projects should be implemented by each partner. Focus on the detailed implementation of the <i>Toronto Waterfront Aquatic Habitat Restoration Strategy</i> (TRCA 2003) for the Rouge Marsh.
3. Educational Signage	
Ecology	Signage about the importance of the lake/river interface and the productivity and role of the marsh ecosystem. Additional information about the species present and their importance as environmental indicators.
Angling	Information about relevant regulations, consumption advisories and invasive species should all be incorporated into educational signs.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).	

4.1.10 Middle Reaches of Main Rouge River (FMZ 10)

This zone contains the middle reaches of the Main Rouge River that receive drainage from FMZ 1 and flow through the Town of Markham along the western edge of the the watershed. Beaver Creek flows through the Town of Richmond Hill and contributes to the Main Rouge near the southern end of the zone above Hwy 407. The various fish species collected in the past and recent surveys are listed in **Table 4-48**. A total of 26 species have been captured in this zone over time, of which 9 species, all native, were collected in the most recent survey (2009). The target species, thermal regime and other existing conditions, monitoring stations, stocking sites and water balance priorities are shown on **Figure 4-19**

The majority of this zone has been urban and/or received urban drainage with limited or no stormwater management for decades. The surprisingly low biodiversity for middle reaches, even in the past, reflects this older urban context. Almost all of the species collected in 2009 and 2006 are the tolerant cool-warm water minnows, darters and sucker species. Past collections of Redside Dace and American Brook Lamprey (sensitive, cool-coldwater) were confined to the very upper reach of this zone where habitat appears to transition from the relatively natural habitat areas in FMZ 1 to a setting of industrial and commercial land use. The current abundance and distribution of Redside Dace and other target species in this zone are not well understood.

There is an area of high erosion potential at the downstream end of FMZ 1 (TRCA, 2007a); this upstream erosion may have influences on the sedimentation processes and substrates available to biota through the main channel of the Rouge River in this zone. Groundwater discharge has been observed in the upper reaches of this zone but past (2003) and more recent (2006) temperature data indicate a thermal gradient of only cool to warm water habitat. Migratory salmonids have unlimited access through this zone and there may be nursery habitat or potentially spawning habitat if existing groundwater influences and substrates are still appropriate.

Excessive sedimentation has been identified all through Beaver Creek with one result being a fairly homogeneous in-stream environment inconsistent with supporting a diverse fish community. It is most likely that this sedimentation is related to stormwater impacts. There are no significant groundwater contributions to Beaver Creek and temperature data (2005) indicate a stable cool water thermal regime above 2 on-line ponds. Below the ponds, the stream temperature shifts to warm water. This watercourse does not currently support any target species, only tolerant minnows and White Sucker. There are multiple in-stream barriers to the passage of these resident, non-jumping fish species.

Table 4-48: Past and Present Fish Species in FMZ 10 (Main and Beaver Creek)

Species Name	Scientific Name	Last Record
American Brook Lamprey	<i>Lethenteron appendix</i>	14/11/2000
Blacknose Dace	<i>Rhinichthys atratulus</i>	09/07/2009
Bluntnose Minnow	<i>Pimephales notatus</i>	30/06/2006
Brook Stickleback	<i>Culaea inconstans</i>	09/07/2009
Brown Trout	<i>Salmo trutta</i>	14/11/2000
Central Stoneroller	<i>Campostoma anomalum</i>	21/08/2000
Common Carp	<i>Cyprinus carpio</i>	21/07/2003
Common Shiner	<i>Luxilus cornutus</i>	09/07/2009
Creek Chub	<i>Semotilus atromaculatus</i>	09/07/2009
Fathead Minnow	<i>Pimephales promelas</i>	09/07/2009
Finescale Dace	<i>Phoxinus neogaeus</i>	12/07/1999
Golden Shiner	<i>Notemigonus crysoleucas</i>	26/05/1954
Goldfish	<i>Carassius auratus</i>	02/09/2003
Johnny Darter	<i>Etheostoma nigrum</i>	09/07/2009
Largemouth Bass	<i>Micropterus salmoides</i>	21/08/2000
Longnose Dace	<i>Rhinichthys cataractae</i>	09/07/2009
Northern Redbelly Dace	<i>Chrosomus eos</i>	08/08/2003
Pumpkinseed	<i>Lepomis gibbosus</i>	30/06/2006
Rainbow Darter	<i>Etheostoma caeruleum</i>	09/07/2009
Rainbow Trout	<i>Oncorhynchus mykiss</i>	29/07/2003
Redside Dace	<i>Clinostomus elongatus</i>	21/08/2000
Rock Bass	<i>Ambloplites rupestris</i>	16/06/1992
Spottail Shiner	<i>Notropis hudsonius</i>	12/07/1995
Stonecat	<i>Noturus flavus</i>	29/07/2003
Tadpole Madtom	<i>Noturus gyrinus</i>	16/06/1992
White Sucker	<i>Catostomus commersoni</i>	09/07/2009

Note*: Detailed fish collection records and data, in electronic format, are available upon request from TRCA Aquatic Group

2009/2010 Surveys by Fisheries and Oceans Canada, Sea Lamprey Control
 2009, 2006, 2003, and 2000 surveys by TRCA's Regional Watershed Monitoring Program
 2005 survey by TRCA Aquatic Group
 Pre 2000 data from MNR collection records

2 Aquatic Invasive

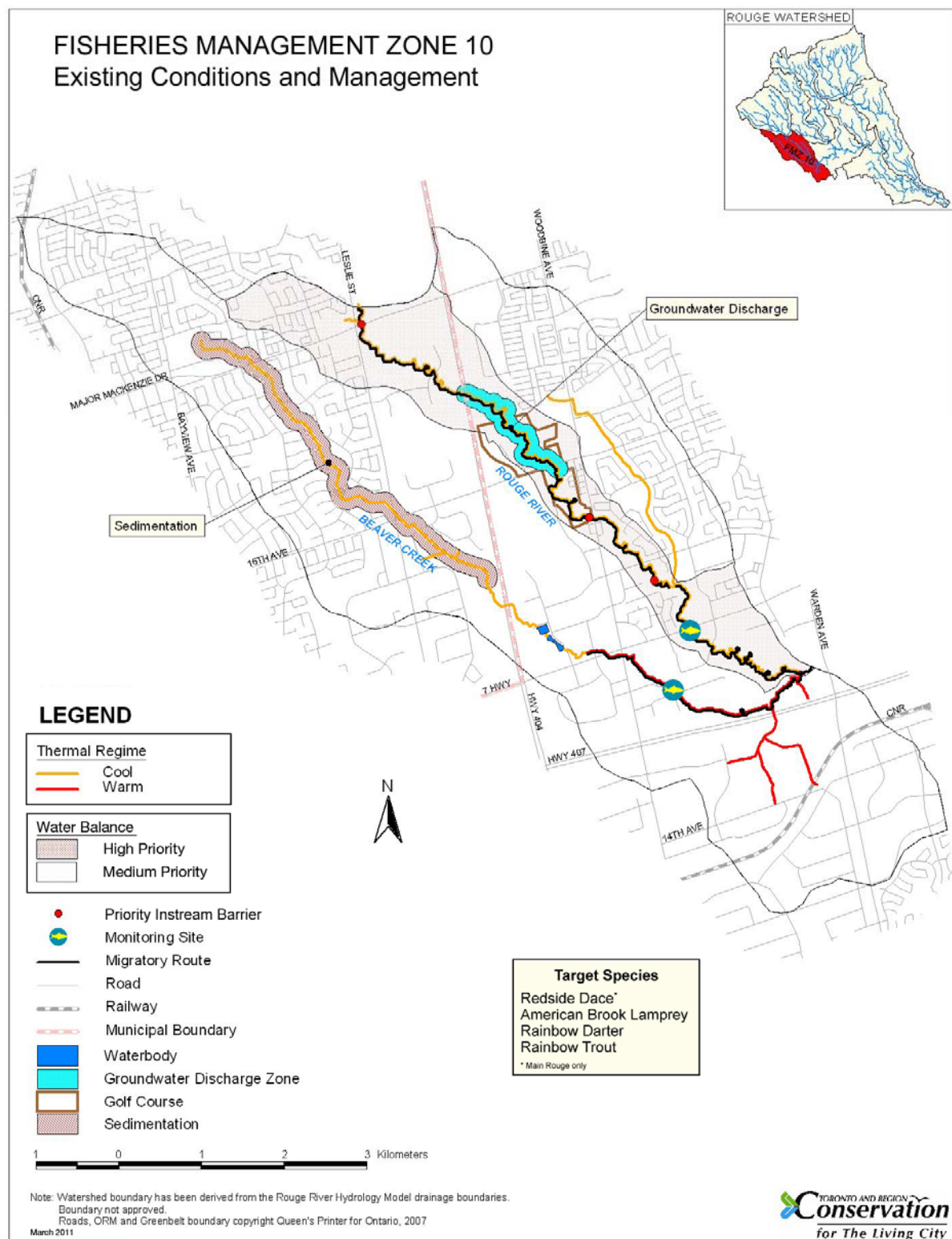


Figure 4-19: FMZ 10 Middle Reaches of Main Rouge Existing Conditions and Management Map

The thermal regime represents actual stream temperatures which have been interpreted for development and application of construction Timing Windows as provided in the Rouge River FMP (Figure 2-2).

4.1.10.1 Management Recommendations FMZ 10

Management for this zone is separated into Beaver Creek and the Main Rouge River.

The Main Rouge River is largely influenced by urban drainage from the Upper Rouge River (FMZ 1). Siltation and relatively uncontrolled stormwater are the main issues. Management options for these issues within the Town of Richmond Hill have been identified via the Town's list of SWM facility retrofit projects. A similar set of priority projects should be generated for the remaining areas in this FMZ.

Beaver Creek has been highly altered over time and is situated in a highly urbanized portion of the watershed with both residential and commercial/industrial land use along its length. Fish communities and the channel itself show signs of degradation, there is minimal stormwater management, multiple in-stream barriers including two large online ponds that are fragmenting and warming the aquatic habitat. See **Table 4-49** for a full set of recommendations

4.1.10.2 Implementation Project Opportunities FMZ 10

There are 3 IPOs developed for this zone with approximate locations found on **Figure 4-20** and described in **Table 4-50**, and **Table 4-51**.

Table 4-49: FMZ 10 Middle Reaches of Main Rouge River Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Surface Water Regime	High stormwater flows from upstream urban areas are likely reducing habitat potential for target species and Rainbow Trout nursery and rearing habitat in the Main Rouge.	New and innovative approaches to stormwater management (future and retrofit), geared towards the protection of fish habitat, should be encouraged and supported to improve conditions at point of discharge and cumulatively for downstream habitats (e.g., flow regime, temperature, water chemistry, sediment transport).		all species
		That in any future development areas within Markham, new and innovative approaches for SWM, geared towards the protection of Redside Dace and associated fish community should be supported such that discharge meets ambient stream temperature, water clarity and chemistry or is within acceptable range for target species to be determined by the appropriate regulatory agency.		Redside Dace
		The clean-out of existing SWM ponds and commitment for future maintenance should also be a high priority action to ensure intended pond performance. The SWM facility improvement projects identified by the Town of Richmond Hill should be used to guide priorities in this FMZ within this municipal boundary.	<u>IPO 10.2 Stormwater Pond Improvement Project(s)</u>	all species
	A lack of adequate stormwater management in Beaver Creek is likely contributing to the flow, water quality and temperature concerns observed further downstream.	Work with the Town of Richmond Hill to facilitate and assist with stormwater pond clean outs and enhance SWM where feasible. Focus on the minimization of nutrient impacts (e.g., geese control).		all species
	Water taking within the zone is a potential concern during certain portions of the year during low flow.	To work with MOE and permitted water takers (ground- or surface water) and address concerns relating to impacts to natural heritage features and functions. High priority should be to develop a water use management plan that includes risk assessment, drought management and support use of self-regulation water withdrawal mechanisms. This planning should be set within the context of understanding the cumulative water taking impacts within this FMZ.		all species
Groundwater Regime	Shallow groundwater systems are present in a portion of the zone which supports Redside Dace habitat. These areas are vulnerable to potential loss of discharge due to dewatering activities during the construction phase of development and the subsequent anthropogenic depression of groundwater levels.	To identify and avoid groundwater draw down and/or interruption of local discharge pathways to receiving watercourses associated with construction activity (groundwater models have been developed for the Rouge Watershed).		all species

Table 4-49: FMZ 10 Middle Reaches of Main Rouge River Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
	Several watercourses and their related aquatic ecosystem functions, have a very high sensitivity to the alteration of the surface and groundwater flow regime as a result of land use change. A lack of required information exists, for these sensitive areas and others, to define a water balance condition that would allow for the maintenance of aquatic ecosystem integrity should urban development/intensification proceed within the catchment.	The prioritized need to achieve water balance in this FMZ should reflect the areas identified on Figure 4-19 (1 High Priority Zone and Medium Priority Zone in 2 retrofit areas).		all species
Water Chemistry	Chlorides from road salting practices are affecting watercourses in this FMZ.	Support the <i>Rouge River Watershed Plan</i> (TRCA 2007a) in the recommendation for Municipalities to review/reduce/alter road salting practices.		all species
		Town of Richmond Hill currently undertaking a process of salt-removal from snow melt. A report of the efficacy of this technology should be formally requested by TRCA and appropriate wider implementation considered.		all species
	Land use conversion to commercial/industrial developments are now occurring within portions of the zone and large portions of the zone are already occupied by this land use type.	All commercial and industrial developments (existing and future) should have an effluent treatment plan and/or an emergency spills capture system that does not connect to a watercourse (e.g., drain protection, oil and grit separator, on-site clean-up equipment, regular maintenance of transport vehicles, sewer shut-off valves); this system should be in place before operations commence.		all species
Water Chemistry (continued)	Buttonville Airport is a potential source of concern until management and containment of chemicals and fuels on-site is understood. (e.g., the application and containment/treatment of glycol runoff).	Contact and arrange a meeting with a representative from Toronto Airways Ltd through the Airport Community Committee. Establish an understanding of company's current environmental operations and work towards building a relationship that fosters stewardship practices.		all species
	Online ponds within Beaver Creek may be influencing downstream water chemistry.	See above recommendation in surface flow regime for stormwater pond retrofits.		all species

Table 4-49: FMZ 10 Middle Reaches of Main Rouge River Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Temperature	A large portion of the zone has been defined as cool water habitat with portions of the zone experiencing higher water temperatures more reflective of warmwater habitat.	Determine to what extent existing online ponds are contributing to stream warming (e.g., ponds at Allstate Parkway). Ponds should be prioritized for mitigation action.		Redside Dace, American Brook Lamprey
		Undertake an evaluation of the efficacy of stormwater management techniques to mitigate thermal impacts on 1st - 3rd order streams. Consider the inclusion of the following sites: Riotrin and Urbacon SWM Ponds on Leslie Tributary, Humber Flats SWM system on Upper East Humber, SWM Pond 61 on Black Creek, Cathedral SWM Pond on Rouge River (GEMS technology), and various HWY 407 SWM Ponds.		Redside Dace, American Brook Lamprey
Sediment	Upstream erosion is likely a source of increased deposition in the downstream reaches of this FMZ.	On site project managers or construction team representatives should be familiar with and able to apply the Great Golden Horseshoe Area Conservation Authorities' <i>Erosion and Sediment Control Guidelines for Urban Construction</i> (GGHACA 2006).		all species
		See above recommendation in surface flow regime for stormwater pond retrofits.		all species
		Sediment and erosion controls should be effective at preventing sediment from entering the watercourse. This applies to all scales and types of construction activity.		all species
Terrestrial Natural Heritage	There is limited opportunity to expand the amount of natural cover within this FMZ to either assist in flow attenuation or increase the infiltration of water.	Restore natural multi-layer tree canopy cover within the riparian zone and uplands where available to allow for the increased infiltration and retention of water in order to maintain/restore flow balance and groundwater discharge to streams. See Section 3.2.11.1 Riparian Habitat Recommendations for vegetation community type recommendations.	IPO 10.1 Corporate Stewardship and Educational Initiative	all species
Terrestrial Natural Heritage (continued)	A need for stream corridor protection.	For all stream reaches determined to be the habitat of Redside Dace, a minimum protected stream corridor consisting of the stream meander belt plus 30m on each side should be applied, as recommended in the <i>Redside Dace Recovery Strategy</i> (OMNR 2010a) and as required by OMNR. This may also be applied to stream reaches identified as recovery habitat for Redside Dace. See Section 3.2.11.1 Riparian Habitat Recommendations for vegetation community type recommendations.		Redside Dace

Table 4-49: FMZ 10 Middle Reaches of Main Rouge River Management Recommendations

Processes and Components	Issue	Recommendations	Proposed Implementation Project Opportunity (IPO)	Directed Target Species Management
Fish Community and Habitat	The current population of Redside Dace in this FMZ appears to be confined and potentially in decline based on available sampling records.	Support recovery actions for Redside Dace (e.g., in-stream barrier mitigation, stormwater outfall retrofits, riparian restoration).		Redside Dace
		A construction timing window from July 1st - September 15th is to be applied in all Redside Dace occupied habitats or in upstream contributing habitats at the discretion of the appropriate agencies		Redside Dace
	Numerous barriers exist through Beaver Creek.	Optimize fish passage of native species through the river system (i.e., removal or mitigation of in-stream barriers that negatively impact native fish communities). However, in making the above consideration, consequences of also passing invasive species.		all species
	One of the only known occurrences of Tadpole Madtom in the watershed.	Conduct small scale habitat assessments and night time sampling/ minnow trapping to determine the likelihood that the species persists in this zone.		n/a
	The Main Branch of Rouge River is a migratory route for Rainbow Trout. The extent of natural reproduction is not known.	Monitoring and assessment of Rainbow Trout adult returns and natural reproduction is required to direct future stocking activity. Until such time, stocking of Rainbow Trout should generally avoid stream reaches determined to be the habitat of Redside Dace.		Rainbow Trout
	Aquatic Invasive Species (AIS) present in stormwater management ponds (e.g., Goldfish) may have easy access to natural watercourses under periods of high flows.	Increase the coordination of existing stewardship and outreach programs to prevent new introductions and any further spread of aquatic invasive species (AIS).		all species
Anthropogenic	Existing or future urbanization and associated activities.	Refer to recommendations above.		all species

Legend	Timeframe for Potential Implementation
Priority Focus	1 to 5 years
Management Focus	5 to 10 years

Table 4-49: FMZ 10 Middle Reaches of Main Rouge River Management Recommendations

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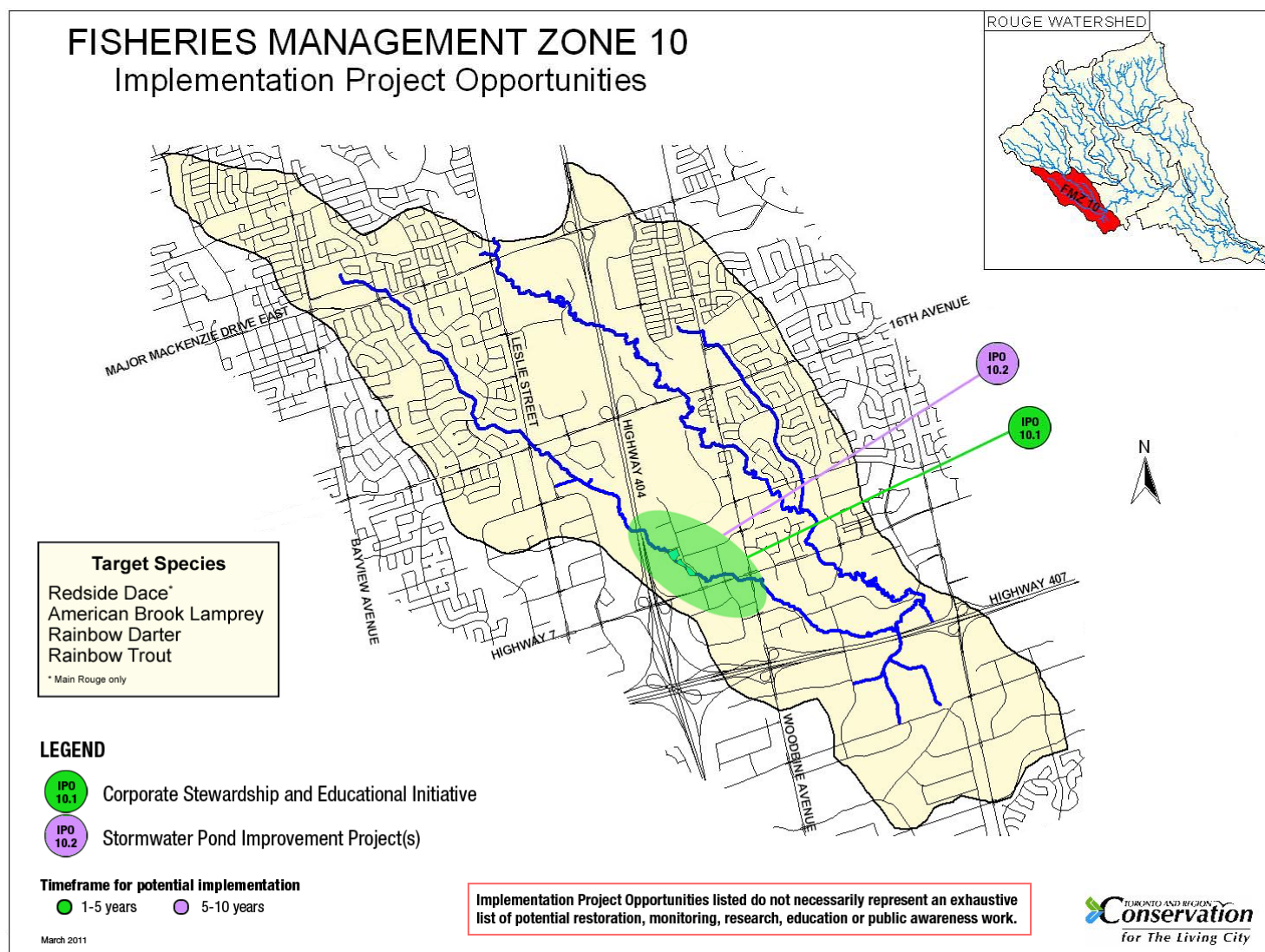


Figure 4-20: FMZ 10 Middle Reaches of Main Rouge IPO Locations

IPOs are recommended with the expectation that prior or concurrent improvements in stormwater management proceed, and that water balance understanding is obtained for this FMZ in support of a healthy aquatic ecosystem.

Table 4-50: IPO 10.1 Corporate Stewardship and Educational Initiative

Implementation Project Opportunity		
ESA Permit Might Be Required	Project Name	IPO 10.1 Corporate Stewardship and Educational Initiative
	Project Description	To provide the opportunity for employees of local businesses to learn about aquatic ecosystems, undertake some minor enhancement work in the field or relatively major work to improve hydrology (infiltration) at an office site.
Proposed Project Components		Proposed Project Planning and Design Considerations
1. Education and Outreach		
Short Hike/Walk		A one hour pre-design walk/hike along the watercourse with an interpretative leader.
Fisheries Demonstration		Expose people to a diversity of species of aquatic organisms (fish, freshwater mussels, benthic invertebrates).
Fisheries Presentation/Educational Materials		Raising awareness about aquatic resources. Develop a standardized presentation that can be used for World Fish Day, Earth Week or World Wetland Day.
2. Restoration		
Tree, Shrub or Wetland Planting		Conduct plantings within the zone that are meaningful and demonstrate ecological processes that are being repaired or enhanced to support target species. Tie back to educational materials or walks, etc.
Bioengineering		Look for areas where old engineered erosion structures are failing and replace with a bioengineered solution.
Nutrient Management		Limit nutrients from external sources in headwater streams, attempt to return watercourses to a more "natural" nutrient regime where productivity is generated from external sources (e.g., leaf litter).
Sustainable Technologies		Installation of porous pavement, green roof, third pipe solutions. Utilize materials and resources available through the TRCA STEP program.
3. Educational Materials		
Ecological Processes		Target materials to a corporate audience (e.g., return of a more natural hydrologic regime).
4. Stewardship		
Coordination and Communication		There will need to be the coordination and organization of volunteers to collect and report the information that is desired.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).		

Table 4-51: IPO 10.2 Stormwater Pond Improvement Project(s)

Implementation Project Opportunity	
Project Name	IPO 10.2 Stormwater Pond Improvement Project(s)
Project Description	Outside the Town of Richmond Hill, identify the stormwater ponds that are having the most negative influence on downstream aquatic resources, define what the problems are and work towards timely solutions with appropriate municipalities and agencies.
Proposed Project Components	Proposed Project Planning and Design Considerations
1. Fish Community	
Defining the Fish Community	Define the fisheries community below the structure and investigate influences on the downstream channel and aquatic community
2. Barrier Management	
Barrier Management Process	Known barriers identified in the FMP have been preliminarily assessed, but further details around structural integrity and stability as well as ownership need to be made before any potential alterations can be made. See Figure 3-5 and Table 3-3 for barriers that pertain to this FMZ.
3. Channel Morphology	
Detailed Cross-Sections Measurements	Some site specific measurements may be required to illustrate the potential level of impairment to the existing aquatic community that can be compared site to site in order for priorities to be established.
4. Flow Regime	
Baseflow Measurements	Measurements should be taken over the course of a year in a wet and a dry season to establish a seasonal response of the watercourse to different climate conditions.
Total Flow Calculations	The total flow volumes of the pond should be known from the initial designs. Current flow measurements should be obtained to estimate current level of pond function.
5. Temperature Regime	
Deployment of Temperature Loggers	Although there might be pre-existing thermal information for the area available, there could be an additional level of detail required to help prioritize where work should occur based on quantified thermal impacts.
6. Stormwater Improvement Projects	
Coordination with Municipality	Develop appropriate mechanism to engage municipalities in the development and implementation of effective SWM retrofit opportunities.
* IPO inclusion in this FMP does not preclude the implementation of other projects or activities that may help achieve FMP objectives in the Rouge Watershed. Also, IPOs identified in this FMP still require approvals and/or permits from appropriate agencies. Further planning and design for each project component are required, including funding, land structure/owner authorization, cost estimates and technical feasibility. Projects should be discussed well in advance of implementation with the Rouge FMP Advisory Group, appropriate agency staff and/or qualified environmental consultant (if necessary) to ensure that technical requirements and permits are identified/established, that proposals are consistent with relevant standards and FMP objectives, and that potential assistance for each project has been explored (partnerships/funding).	

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