DELISTING TARGETS FOR FISH & WILDLIFE HABITAT & POPULATION BENEFICIAL USE IMPAIRMENTS FOR THE ROUGE RIVER AREA OF CONCERN

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GLOSSARY

The following is a glossary of acronyms and abbreviations for this report to assist the reader in understanding this document:

ARC – Alliance of Rouge Communities

AOC – Area of Concern

BMP – Best Management Practice

BUI – Beneficial Use Impairment

CMI – Clean Michigan Initiative

CSO – Combined Sewer Overflow

DO – Dissolved Oxygen

GI – Green Infrastructure

IJC – Internal Join Commission

MDEQ – Michigan Department of Environmental Quality

MDNR – Michigan Department of Natural Resources

NPDES – National Pollutant Discharge Elimination System

PAC – Public Advisory Council

RAP – Remedial Action Plan

RGC – Rouge Green Corridor

RPO – Rouge Program Office

RRAC – Rouge River Advisory Committee

SSO – Sanitary Sewer Overflow

SWAG – Subwatershed Advisory Group

SWMA – Storm Water Management Area

TMDL – Total Maximum Daily Load

TSS – Total Suspended Solids

USACE – United States Army Corp of Engineers

USEPA – United State Environmental Protection Agency

WMP – Watershed Management Plan

WQS – Water Quality Standards

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1.0 Executive Summary

The Rouge River Area of Concern (AOC) delisting targets project was initiated to define "how-clean-is-clean" for the Rouge River watershed and develop endpoints that would allow for the ultimate delisting of the watershed as an AOC under the Great Lakes Water Quality Agreement. This report presents the delisting targets for habitat and population-related Beneficial Use Impairments (BUIs). It also presents a project approach and recommended projects for delisting targets needed to be developed relatively independent of the existing RAP.

Current Michigan Department of Environmental Quality (MDEQ) guidance for developing BUI delisting targets includes the need to develop local restoration plans for Degraded Fish and Wildlife Populations and Loss of Fish and Wildlife Habitat (MDEQ, 2006). The local restoration plans also need to consider the impact associated with degradation of benthos, the third habitat and population related BUI in the Rouge River AOC. The approach reflected in the ultimate delisting target recommendations within this report identify the need to develop the necessary site specific inventory, prioritization, and implementation steps that are part of the local plan to work towards the BUI delisting. These draft plans have been finalized with the assistance of the Technical Committee, the individual subwatershed advisory groups (SWAG), and the Public Advisory Council (PAC). The site-specific demonstration projects included in the delisting targets represent a cross section of the types of implementation projects that will address habitat and population impairments within the AOCs. Implementation of these projects will be a key step to accomplish delisting and a move toward full restoration thus benefiting the watershed residents and users of the Rouge River as well as Lake Erie and the Detroit River connecting channel.

Beneficial Use

Uses that are valued by society, such as water quality that is suitable for drinking, swimming, agricultural, and industrial uses; healthy fish and wildlife populations which support a broad range of subsistence, sport, and commercial uses; and aesthetics.

The draft *Supporting Guidance for Local Restoration Criteria Development: Loss of Fish and Wildlife Habitat and Degradation of Fish and Wildlife Population* published by MDEQ outlines the process of developing delisting targets for habitat and population BUIs within Michigan's AOCs. The guidance outlines six components and steps that are required for developing a local, site-specific restoration plan (MDEQ, 2006). Those six components each have a chapter in the report and are summarized below:

Chapter 3 – Component A: Narrative on the historical habitat and population issues in the AOC

The Rouge River and its tributaries are warm water fisheries, with the exception of Johnson Creek, located in the headwaters of the Middle Branch, which is a designated cold water fishery. Historically, the river was home to more than 60 species of fish, but the river and its tributaries have experienced significant declines as a result of poor water quality, changes in the flow regime, degraded in-stream and riparian habitat and habitat fragmentation by dams and the concrete channel. Chapter 3 describes the historical fish and wildlife habitat and

population issues in the AOC. It further describes the important linkages between water quality and the observed fish and wildlife impairments.

Chapter 4 – Component B: Description of the impairment(s) and location for each site

> ***Area of Concern***
>
> *Specific areas where degraded environmental conditions have created impairments to human or ecological use of the water body.*

While significant strides have been achieved across the AOC, including implementation of both combined and sanitary sewer overflow controls along with substantial efforts directed towards mitigating storm water runoff impacts, challenges remain in further addressing water quality and quantity impacts. Urban development across the AOC has transformed much of the native vegetation into impervious surfaces, such as roads, parking lots, rooftops and turf areas. Significant non-point source storm water runoff contributes to a river flow that is unstable, warm and polluted. The unstable nature of the river and its tributaries is the common characteristic reflective of the population and habitat impairments described at length in Chapter 4.

Chapter 5 – Component C: Locally derived restoration target for each site

A guiding list of delisting targets was developed for use as the basis for future delisting of the two BUIs described in this report. The targets are primarily focused on improving fish populations in the Rouge River, including the Main, Upper, Middle and Lower branches. These delisting targets are summarized below. It's important to recognize that the identified potential monitoring sites were selected based on the existence of historical fish community assessment data. Past assessments were made using both the Index of Biotic Integrity (IBI) (Karr, 1981) and the Michigan Department of Environmental Quality, Surface Water Quality Division, Great Lakes Environmental Assessment Section, Procedure 51 (GLEAS 51) methodologies. The IBI and GLEAS 51 methodologies measure the biotic integrity of a fish population. This is defined as a *"balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitat of the region"* (Karr & Dudley, 1981).

Degradation of Fish and Wildlife Populations

1. Beneficial Use Impairment for Degradation of Benthos is removed.
2. Using the Wiley-Seelbach model (Wiley et.al., 1998) and the Michigan Department of Natural Resources (MDNR) 1995 Fisheries Assessment (Leonardi, 1996) as the baseline, it may be expected that a minimum number of game fish species may be achieved in the following segments of the Rouge River (Figure 5-1 identifies Potential Fish Monitoring Locations):

   - ***Rouge River Main Branch*** from the mouth upstream to Beech Road (US5). Example game species may include northern pike, smallmouth bass, channel catfish and walleye. Potential monitoring locations include the following:

Site ID	Geographic Location
US5	Beech Rd. (USGS, Southfield
MN-10**	Below Ford Dam – Melvindale Boat Launch
MN-4*	Spinoza Rd in Rouge Park, Detroit

*Sites surveyed in 1986 using IBI & 1995 MDNR

** Site surveyed in 1995 MDNR

   - ***Lower Rouge River*** from the confluence with the Main Branch upstream to Sheldon Road (L-1). Example game species may include northern pike, rock bass and smallmouth Bass. Potential monitoring locations include the following:

Site ID	Geographic Location
LO6	Wayne Rd , Wayne
L-4*	Ford Field Park , Dearborn
L-1*	Sheldon Road, Canton

*Sites surveyed in 1986 using IBI & 1995 MDNR

   - ***Middle Rouge River*** from the confluence with the Main Branch upstream to Hines Drive (D06). Example game species may include northern pike, rock bass and smallmouth bass. Potential monitoring locations include the following:

Site ID	Geographic Location
US2 (MD-7*)	Inkster Rd, Dearborn Heights (USGS Station)
DO6	Hines Dr. Near Ford Rd, Dearborn Heights

*Sites surveyed in 1986 using IBI & 1995 MDNR

   - ***Upper Rouge River*** from the confluence with the Main Rouge River upstream to Powers Road (U-1). Example game species may include northern pike, rock bass. Potential fish monitoring locations include the following:

Site ID	Geographic Location
U-3*	5 Mile Rd, Redford Twp
U-1*	Powers St., Farmington

*Sites surveyed in 1986 using IBI & 1995 MDNR

3. Two monitoring events with results meeting the criteria above and which occur within a five-year period, but no sooner than one-year apart, shall demonstrate progress towards delisting.

Figure 1-1: Potential Monitoring Locations

Loss of Fish and Wildlife Habitat

1. Degradation of Fish and Wildlife Populations Beneficial Use Impairment is removed.

Chapter 5 presents a more detailed discussion about these guiding delisting targets.

Chapter 6 – Component D: List of all ongoing related habitat and population planning processes in the AOC.

Ongoing planning and restoration efforts in the Rouge River AOC have been significant and have reflected the complete dedication to this process by numerous stakeholders, including local communities, counties, non-profit entities and hundreds of dedicated individual volunteers. While many of these restoration projects and initiatives were made possible through Rouge River National Wet Weather Demonstration Project funding, the implementation success is also due to immeasurable local match resources, both in time and monetary value. These restoration efforts, both completed and ongoing are summarized in Chapter 6 by storm water management area, providing the basis with which future delisting target projects were identified.

Chapter 7- Component E: Scope of work for each site, including components such as Timetable, Funding, Potential Stakeholders, Indicators & Monitoring and Public Involvement.

The Technical Committee identified a series of projects and initiatives that, once implemented and monitored according to site plans, should result in delisting of the habitat and population BUIs. These projects include a wide variety of topics, including large-scale concrete channel modifications to smaller-scale green infrastructure implementation. All of these projects will include a public involvement component that seeks to continue showing the important connections between people and their environment. These projects are detailed in Chapter 7 and are listed as follows:

1) Fish Passage and Dam Modification – Feasibility Study and Implementation
2) Green Infrastructure (GI) – Assessment and Visioning
3) Green Infrastructure – Implementation
4) Green Infrastructure – Land Cover Monitoring
5) Natural Areas Program Management Feasibility Study
6) Green Corridors
7) Concrete Channel Modifications/Enhancements for Habitat and Fish Populations
8) Michigan Avenue and Evergreen Road Storm Water Treatment and Habitat Restoration
9) Tournament Players Golf Course Storm Water Treatment and Wetland Restoration
10) Oakwood Common Oxbow Restoration
11) Fordson Island Habitat Restoration
12) Lakes and Impoundments – Feasibility Study & Restoration
13) Evans Creek Constructed Wetland
14) Booth Park Streambank Stabilization

Chapter 8 – Component F: Method for project reporting to MDEQ

Chapter 8 describes and outlines a mechanism for reporting on the progress of the implementation process to MDEQ.

Due to the large size of the Rouge River AOC (entire Rouge River Watershed), the EPA and MDEQ agreed that summarization of the habitat and population impairments and selection

of priority projects was appropriate for this effort. Items A through F are addressed in this document.

2.0 Project Introduction and Rationale

2.1 PROJECT RATIONALE

The original listing of AOCs within the Great Lakes was based on the presence of beneficial use impairments (BUIs). These BUIs were defined by the International Joint Commission (IJC) along with generalized criteria for determining when a beneficial use was impaired. The first set of guidance for delisting targets was put forth in 1991 by the IJC. These criteria were fairly general and led to a more specific set of guidance published by the U.S. Environmental Protection Agency (EPA) in 2001 (Policy Committee, 2001).

In 2006, the Michigan Department of Environmental Quality (MDEQ) released the Guidance for Delisting Michigan's Great Lakes Areas of Concern (MDEQ, 2006). The MDEQ guidance is very specific regarding targets for non-habitat related BUIs and in general can be applied throughout Michigan with minimal variation. There are often significant variations within an AOC with respect to the habitat and the ability of the restored habitat to support the same degree of fish and wildlife populations. This observation is magnified if you try to apply a single target throughout all of the Michigan AOCs. Therefore, MDEQ's guidance for fish and wildlife habitat and population-related BUI removal is based on a criteria-setting process and requires the development and implementation of an AOC-specific restoration plan. The MDEQ will review and approve the restoration plan and the final delisting targets determined by the Public Advisory Council (PAC) in each AOC.

Rouge River AOC

Beneficial Use Impairments

- ✓ *Restrictions on fish and wildlife consumption*
- ✓ *Eutrophication or undesirable algae*
- ✓ *Degradation of fish and wildlife populations***
- ✓ *Beach closings*
- ✓ *Fish tumors or other deformities*
- ✓ *Degradation of aesthetics*
- ✓ *Degradation of benthos*
- ✓ *Restriction on dredging activities*
- ✓ *Loss of fish and wildlife habitat***

***Delisting criteria for BUIs in this report.*

The primary goal of developing delisting targets is to create a blueprint for the delisting/restoration of the AOC. The delisting target develops an endpoint for measuring progress in the remediation of the river and recovery of the fish and wildlife BUIs that were considered to be impaired within the AOC and documented in the Rouge River Remedial Action Plan (RAP).

Removing the fish and wildlife habitat and population BUIs is a long-term demonstration of success in the recovery of the Rouge River AOC (Figure 2-1). One benefit of the successful delisting of these BUIs will include the presence of additional recreational opportunities throughout the AOC. These recreational opportunities will be evident not only to the people involved in these restoration efforts, but most notably to the residents of the area. Connecting residents to the river through recreational opportunities provides further incentive for continuing long-term improvement projects. As these fish and wildlife BUIs are removed, there will be numerous ancillary benefits evident across the AOC. These additional benefits may include, but are not limited to the following:

- ✓ Increased public use and enjoyment of the Rouge River associated with increased active recreational uses such as fishing;
- ✓ A potential increase in property values within the AOC following restoration;
- ✓ Increased desirability of the AOC for investment and development following elimination of the AOC designation;
- ✓ Increased public use and enjoyment of the Rouge River associated with increased non-active recreational uses such as wildlife viewing and the general ability to "connect with nature" as aesthetics improve in the AOC; and
- ✓ Providing SWMA specific targets that can be used to evaluate the restoration success outlined in the RAP.

Henry Ford Oxbow Walking Trails

Ecosystem restoration and protection are important to the residents of the Rouge River watershed. The Rouge River Advisory Council (RRAC) restoration vision for the AOC is a *watershed that is aesthetically pleasing, clean and safe, supports a healthy, diverse fish and wildlife community, and provides an enriching variety of recreational experiences* (RRAC, 2004). The development of the fish and wildlife population and habitat-related delisting targets associated with this project will provide the direction necessary to continue implementation actions needed to realize RRAC's vision and restore the environmental integrity of the Rouge River AOC.

Figure 2-1: Rouge River Area of Concern

2.2 FISH & WILDLIFE HABITAT & POPULATION BENEFICIAL USE IMPAIRMENTS

Table 2-1 below outlines the habitat-related beneficial use impairments in the Rouge River AOC (RRAC, 2004). The use impairment, probable and/or known causes of the impairment, extent of the impairment and whether or not the impairment has an impact to the Great Lakes is described in the table.

Table 2-1: Summary of Fish and Wildlife Habitat-Related Beneficial Use Impairments in the Rouge River Watershed.

Use Impairment	Probable and/or Known Causes (RRAC, 2004)	Degree And Geographic Extent	Impact To Great Lakes
Degraded fish and wildlife populations	Streamflow, non-point source pollution, point source storm water discharges, combined/separate sewer overflows, inappropriate management of woody debris and riparian corridors, contaminated sediments, illegal discharges, point source discharges; loss of upland, riparian and aquatic habitat.	Fish Populations: Impaired throughout the watershed; less so in headwaters. Wildlife Populations: Impairment unknown-additional studies necessary	Yes
Loss of fish and wildlife habitat	Physical alteration of habitats (channelization, enclosure or relocation of the streambed, excessive post-storm stream flows) and elimination of stream bank vegetation and woody debris in the stream channel; nonpoint source pollution, point source pollution, and combined/separate sewer overflows; contaminated sediments, stream flow, and illegal discharges; loss of all natural habitats (i.e. forests, wetlands, floodplains) due to development.	Impaired throughout the watershed; less so in the headwaters.	Yes

When addressing habitat, it is important to understand the habitat components that are necessary to actually sustain fish and wildlife populations. These components include food, water, shelter and places to raise young. When any of these components are negatively affected by outside influences, the habitat balance is altered which in turn alters the population balance.

Table 2-1 describes *probable and/or known causes* of the habitat and population impairments. Many of these causes have underlying pollutants and sources associated with them which have impacted habitat components and ultimately populations. The pollutants and their respective sources are further described in this restoration plan with a focus on the impact they have on water quality which further contributes to the fish and wildlife population/habitat use impairments.

The remaining sections of this plan are divided into specific components that outline local criteria for aquatic habitat and population BUI delisting.

Component A (Chapter 3) describes the historical fish and wildlife habitat and population issues in the AOC. This section further describes the important linkages between water quality and these observed fish and wildlife impairments.

Component B (Chapter 4) provides more detailed information regarding the actual fish and wildlife habitat and population impairments across the AOC, including the connections to the original issues identified in the Rouge River Remedial Action Plan.

Component C (Chapter 5) leads into the discussion of the actual delisting targets with supporting background information.

Component D (Chapter 6) provides an outline of ongoing planning processes and implementation projects across the AOC that have demonstrated improvements to these habitat and population impairments.

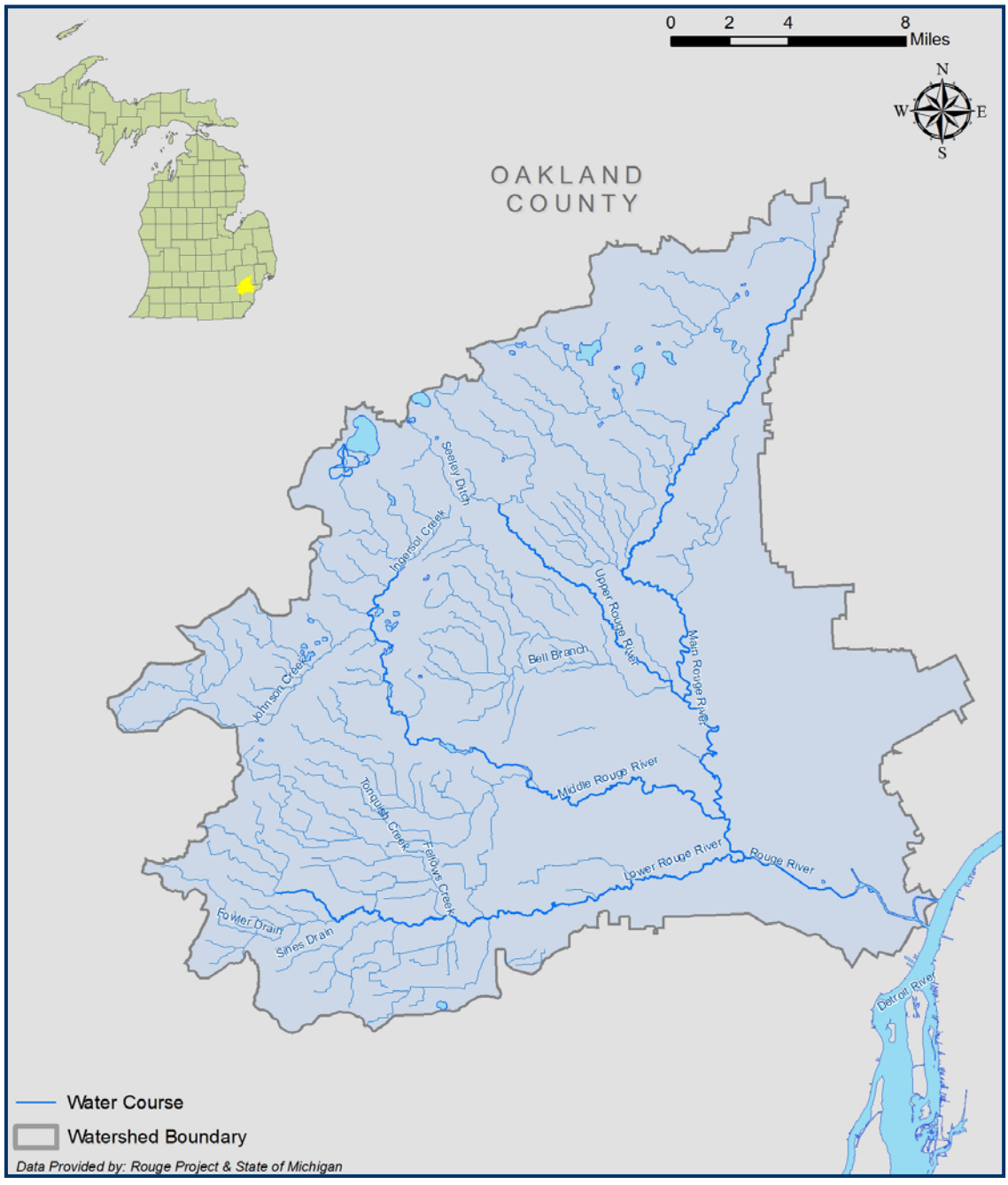
Component E (Chapter 7) provides a list of demonstration projects, each with a defined scope of work, which will result in delisting these two BUIs.

Component F (Chapter 8) outlines a mechanism for reporting to the MDEQ on progress made of the implementation process.

3.0 Component A: Historical Habitat and Population Issues in the AOC

The Rouge River Watershed occupies 466 square miles in southeast Michigan with four main branches totaling approximately 125 miles of waterways. The Rouge River flows through Oakland, Washtenaw, and Wayne counties draining over 400 lakes and 50 miles of riparian parkland. More than one million people live throughout the watershed across 48 local communities and three counties. More than 50 percent of the land use is residential, commercial, and industrial with increased development having occurred in the headwaters over the last 10 years.

Figure 3-1: Rouge River Water Courses



Industrial growth in the lower Rouge River during the first half of the twentieth century, combined with rapid residential and commercial growth during the latter half of the century, has created significant pollution control problems in the Rouge River Watershed. Historic challenges within the watershed have included combined sewer overflows (CSOs), sanitary sewer overflows (SSOs), urban storm water discharges, non-point source pollution, municipal and industrial discharges, and point source pollution (Great Lakes Areas of Concern: Rouge River EPA Website, January 2008). As early as the 1940s, when the Detroit wastewater treatment facility was built, pollution control efforts were implemented in the Rouge River Watershed. Despite these efforts, pollution continued to increase in the river.

More recent urbanization of land surrounding headwater tributaries have increased point and non-point storm water inputs continuing to impair water quality and hydrology. As these changes in land use across the watershed occurred, significant impacts to water quality and the historical flow regime were observed, thus causing detrimental impacts to both the existing habitats and populations. High flows were generated from the increase in impervious surfaces (e.g. buildings, roads, parking lots, compacted turf areas). Increases in impervious cover with corresponding reductions in green infrastructure, including wetlands, woodlands and riparian corridor vegetation, have significantly altered the river's aquatic life. These changes have also had a notable affect on in-stream habitat through an increase in both the quality and quantity of storm water runoff.

Based on the aforementioned conditions, fish and wildlife habitat is considered impaired in all four main branches of the Rouge River and its tributaries. As land areas are altered through development of impervious surfaces, remaining suitable habitat is reduced in area, disconnected from wildlife corridors, and degraded by human pressures. Diverse habitat such as upland forests, wetland areas and stream channel habitats, including plants, woody debris and hard substrates, that was historically present across the watershed supported diverse fish and wildlife populations. As these diverse habitats have been eliminated or impacted by land use changes, water quality impacts and changes in the flow regime, corresponding changes in the food sources for the fish like the benthos population have been evident. As the food source for the fish has been is altered, the quantity and diversity of the fish populations have been altered. These conditions and factors that influence population and wildlife habitat are further described in the following sections.

3.1 FISH AND WILDLIFE HABITAT

Historically, the Rouge River, including the stream and river networks and associated floodplain and upland areas, contained an abundant diversity of fish and wildlife habitat. Various habitat types have included upland forests, emergent, scrub-shrub and forested

wetlands and prairie meadows throughout the watershed. It is estimated that approximately 80 percent of the watershed was forested during pre-European settlement times. The watershed had expansive fields, forests and wetlands capable of absorbing rainfall and snowmelt. Storm water runoff was effectively detained in wetlands and floodplain areas while groundwater provided recharge to the Rouge River and its tributaries. (RRAC, 2004).

Fish and wildlife habitat includes floodplains and uplands, woodlands and wetland areas. It also includes the actual vegetation/habitat conditions along streambanks, including tree canopy and in-stream habitat conditions. Stream corridors are significantly altered by increases in impervious cover. As the vegetation is removed, the quality of any remaining vegetation is often degraded by invasive plants, such as buckthorn, purple loosestrife and garlic mustard.

In-Stream Habitat and Riparian Corridor

Characteristics of quality stream habitat include diversity (pools, riffles, and woody debris), suitable substrate types, available cover, flow stability, depth variability, low sedimentation, stable stream banks and stable water temperatures. A vegetated riparian corridor, or all the land adjacent to the river and creeks, can provide shading and cooling for water; organic debris to feed aquatic organisms; bank stabilization with its root structure; cover, perching and nesting areas for aquatic organisms; and a buffer for pollutants and sediments from surface runoff. In addition to providing habitat for aquatic organisms, the corridor is used by many birds and mammals. In many urbanized areas, riparian corridors have been converted to lawn, but significant strides have occurred to enhance these corridors and educate the public about their important role in the environment.

Wetlands

Since pre-settlement, many acres of wetlands have been lost across the watershed. According to state laws, only wetlands over five acres in size or that are contiguous to or within 500 feet of a waterbody, are protected by the State of Michigan. Smaller wetlands and those further away or not connected to water bodies, are not given state protection. There are a number of types of wetlands including emergent, scrub-shrub and forested. Wetlands provide a number of beneficial functions including floral and wildlife habitat; fish and herptile habitat; flood water storage; non-point source pollution abatement; shoreline and streambank protection; aesthetic and recreational opportunities; and groundwater recharge potential. General wetland protection guidelines include maintaining connection between the waterways, not mowing or disturbing native vegetation around wetlands, removing invasive species and creating buffer zones around wetlands.

Woodlands

Woodlands, forests and heavily treed areas provide many benefits to water quality, water quantity and wildlife habitat. Wooded areas provide nesting, perching, feeding and cover for birds and mammals. Wildlife commonly found in the area include grey fox, deer, song birds, wood ducks, weasels, skunks, flying squirrels, chipmunks, opossum, and others. Wooded areas also provide water quality and quantity benefits by cooling and shading storm water, intercepting storm water as it falls with leaf and trunk surface area and leaf

litter, and increasing infiltration of storm water with root systems and often more permeable soils.

3.2 FISH POPULATIONS

The Rouge River and its tributaries are warm water fisheries, with the exception of Johnson Creek, which is located in the headwaters of the Middle Branch and is a designated cold-water fishery. Game fish, such as the largemouth bass, northern pike, suckers and catfish have been evident in limited numbers, but have experienced significant declines as a result of poor water quality, changes in the flow regime, degraded in-stream and riparian habitats and habitat fragmentation by dams and the concrete channel. Historically, the Rouge River was home to more than 60 species of fish. The more recent fish survey (Leonardi, 1996) found 53 species with game fish primarily located to the Middle Branch impoundments and areas below the Henry Ford Estate dam in the Main Branch. The Henry Ford Estate dam and the channelization of the lower portions of the Main Branch have contributed to blocking fish migrations upstream, including expected game fish such as smallmouth bass, walleye and sturgeon. Johnson Creek, Seeley Creek, and Minnow Pond Drain, all headwater tributaries are home to a Michigan threatened species, the redside dace. Headwaters are also home to other sensitive fish species including northern hog sucker, mottled sculpin, rock bass, and brook lamprey.

As previously mentioned, poor water quality combined with high flow variability have negatively impacted the fish communities in the watershed. This includes low dissolved oxygen concentrations, high nutrient levels, high turbidity or suspended solids in the water column and changes in the flow regime. Water velocities and volumes after rainstorms and excessive sedimentation from streambank and upland soil erosion destroys instream habitat. Habitat fragmentation by the 62 dams across the watershed also limits fish movements and spawning migrations. These structural impacts combined with higher pollutant loadings and lower dissolved oxygen have altered the existence of diverse habitat and aquatic communities.

3.3 FLOW REGIME

The river flow regime is also described by how much and at what rate water travels in the river channels. In a natural river system, storm water is intercepted by vegetation, stored temporarily on the land in wetlands or infiltrates into groundwater, and then is slowly released into the surface water system, with only a small fraction of water entering the river via surface runoff. This hydrologic scenario describes a stable flow regime of which characteristics include riffles and cool water temperatures leading to increased dissolved oxygen concentrations. However, the streams and the river itself are commonly referred to as "flashy" as they experience rapid increases in both the amount and rate of water in the system during both small and large storm events. A flashy river system provides unstable habitat – low base flows and high peak flow rates – for fish and aquatic organisms. The channels become degraded with high sediment loads and scoured streambanks. In the Rouge River Watershed, the natural clay geology and the development of impervious surfaces across the landscape has significantly reduced the groundwater recharge contributions to the streams and river. Thus negative impacts caused by poor storm water management and removal of riparian buffer zones have been magnified.

This results in a myriad of negative impacts on the biota and habitat. High flows carry away small woody and other debris from the stream channel, eliminating flow refugia and hard substrates upon which many macroinvertebrates forage and endemic fish species lay eggs. Excessive sedimentation covers and embeds critical habitat leaving a relatively flat channel configuration. Elimination of terrestrial components necessary for moderating the intensity of storm water inputs has also resulted in a decrease in ground water flow and loss of riparian canopy that may result in increased in-stream temperatures and lower retention of dissolved oxygen.

3.4 DISSOLVED OXYGEN (DO)

A certain concentration of DO is essential for the survival of fish and other aquatic organisms. DO is an important component in the respiration of aerobic plants and animals, photosynthesis, oxidation-reduction processes, solubility of minerals, and decomposition of organic matter. The decomposition of organic matter and plant respiration extract dissolved oxygen from the water causing DO levels to decline. At lower water temperatures, larger amounts of DO are retained in the water. High levels of bacteria from sewage pollution and high levels of organic matter in the water can lead to low DO levels. The amount of oxygen an organism requires varies according to species and stage of life. DO levels below

1 or 2 mg/L (milligrams/liter) will not support fish populations. DO levels below 3 mg/L are stressful to most aquatic organisms. DO levels of 5 to 6 mg/L are usually required for growth and activity. Low DO levels encourage the growth of anaerobic organisms and nuisance algae causing poor odors and low food supply for aquatic organisms. State water quality standards specify that a minimum of 5 mg/L of DO shall be maintained for a warm water fishery which includes the Rouge River and its tributaries with the exception of Johnson Creek. As a designated cold water fishery, Johnson Creek should have DO levels above 7 mg/L.


Johnson Creek

3.5 TEMPERATURE

Water temperature directly affects many physical, biological, and chemical characteristics of a river. It affects the amount of oxygen that can be dissolved in the water, the rate of photosynthesis by algae and larger aquatic plants, the metabolic rates of aquatic organisms and the sensitivity of organisms to toxic wastes, parasites and diseases. Increased water temperature in the streams can be caused by heated discharges from industrial operations, runoff from impervious surfaces and removal of vegetation and tree cover along the riparian corridor. Typically, warm water fish such as bass, crappie, bluegill, carp and catfish live in temperatures above 20°C; aquatic insects and some cold water fish survive in temperatures between 13 - 20°C; and many sensitive species such as mayfly nymphs, caddisfly larvae, water beetles and water striders along with cold water trout live in temperatures below 13°C.

3.6 BACTERIA

High *E. coli* bacteria counts, a part of fecal coliform bacteria, suggest the presence of microorganisms that threaten public health from untreated human and/or animal waste. High bacteria levels lead to low DO concentrations thus directly affecting the presence and types of aquatic life in the river system. Historically, the sources of high bacteria levels were CSOs and SSOs. As the CSOs and SSOs have been corrected, improvements in the presence and types of aquatic life have been observed.

3.7 TOTAL SUSPENDED SOLIDS

Total suspended solids (TSS) are a reflection of the amount of sediment in the water column. Sources of TSS include streets and other paved surfaces, streambank erosion, construction sites and agricultural areas. High TSS in the water column decreases light penetration for aquatic plants, clogs gills of aquatic organisms and fish, reduces growth rates and disease resistance, decreases photosynthesis and reduces DO levels, and prevents egg and larval development. It also destroys habitat of aquatic life by covering and filling in critical habitat areas in the river and stream channels. Settled particles accumulating on the stream bottom can smother fish eggs and aquatic insects, suffocate newly-hatched insect larvae and make river bottom micro-habitats unsuitable for mayfly nymphs, stoneyfly nymphs, caddisfly larvae and other benthic macroinvertebrates.

3.8 NUTRIENTS


Newburgh Lake

Phosphorus is an essential nutrient required for plant growth and occurs in natural waters in the form of phosphates. Nitrogen is an essential nutrient required by all plants and animals for building protein. Algae and larger aquatic vascular plants rapidly utilize specific forms of phosphorus and nitrogen. Excess phosphorus and nitrogen in the water causes accelerated algal growth, which can decrease oxygen levels and limit food sources for aquatic life. Excess phosphorus and nitrogen enter water bodies from human and animal wastes, industrial pollution and fertilizers.

As the remainder of this document focuses on priorities, targets and restoration, the criteria emphasizes working towards delisting the Loss of Fish Populations impairment for two primary reasons. First of all, as the fish populations are restored, the macroinvertebrate population and the habitat must exist to support the fish communities. Furthermore, fish populations, not wildlife populations, were directly cited as the original reason behind the Degradation of Fish and Wildlife Populations use impairment. Because the 1989 RAP did not specifically address the degradation of wildlife populations, this restoration plan will not focus on achieving specific wildlife targets.

4.0 Component B: Habitat & Population Impairments & Notable Areas

4.1 WATERSHED-WIDE

Much of the land area within the Rouge River AOC has been transformed into impervious surface resulting in a loss of native, deep-rooted vegetation resulting in significant non-point source storm water runoff challenges (RRAC, 2004). This additional storm water runoff is responsible for a river flow that is unstable, warm, and polluted. The Rouge River also experiences a flashy flow regime, with annual flow peaks 20 to 90 times the base flows (Szlaga & Ridgway, 2008). Summer base flow averages 10 cubic feet per second (cfs) with fluctuations of over 500 cfs after rain events. This flashiness destabilizes banks, creates large moving sediment bedloads, dislodges and destroys riparian habitat, strands and kills organisms, and interferes with recreational uses of the river (RRAC, 2004). As a result habitat, fish, animal, and insect diversity and abundance have experienced significant declines. Furthermore, the lack of floodwater storage results in increased erosion and sediment loading causing an increase in flow volume and velocity, turbidity, and decreased DO levels, which further degrade in-stream habitat.

Quality stream habitat is an important contributing factor to a fish community. Characteristics of a quality stream habitat include: diversity (pools, riffles, and woody debris), available substrate, adequate cover, flow stability, depth variability, low sedimentation, and stable stream banks. An evaluation of stream habitats was undertaken as part of the MDNR's fish assessment (Leonardi, 1996) and again during the MDEQ's biological assessments in 2000 and 2005 (Catalfio et.al, 2006). Figure 4-1 shows the stream habitat scores associated with these surveys (Catalfio et.al, 2006).

Much of the river's flow is composed of warmer, less reliable storm water runoff. Stream flow is extremely important as frequent and higher flood flows undercut banks and flush potential organic and inorganic fish cover downstream or onto floodplains. At some sites organic debris can be observed 10-feet above normal water levels making it unavailable as cover or food to invertebrates and fish during normal flow. Stream cross-sections are frequently bowl shaped and devoid of cover (Leonardi, 1996). As a result, the number of species and the biomass of macroinvertebrates are reduced due to the lack of large solid substrate and low water velocities associated with low flows. It has been well documented that many fish species, including smallmouth bass, have a strong affinity for in-stream cover that provides a resting place out of the current, cover from predators and light, and a good source for the macroinvertebrates that colonize these structures (Leonardi, 1996). Figure 4-2 presents results of the fish community assessments while Figure 4-3 shows macroinvertebrate survey results across the watershed (Catalfio et.al, 2006).

Figure 4-1: Stream Habitat Quality Ranking

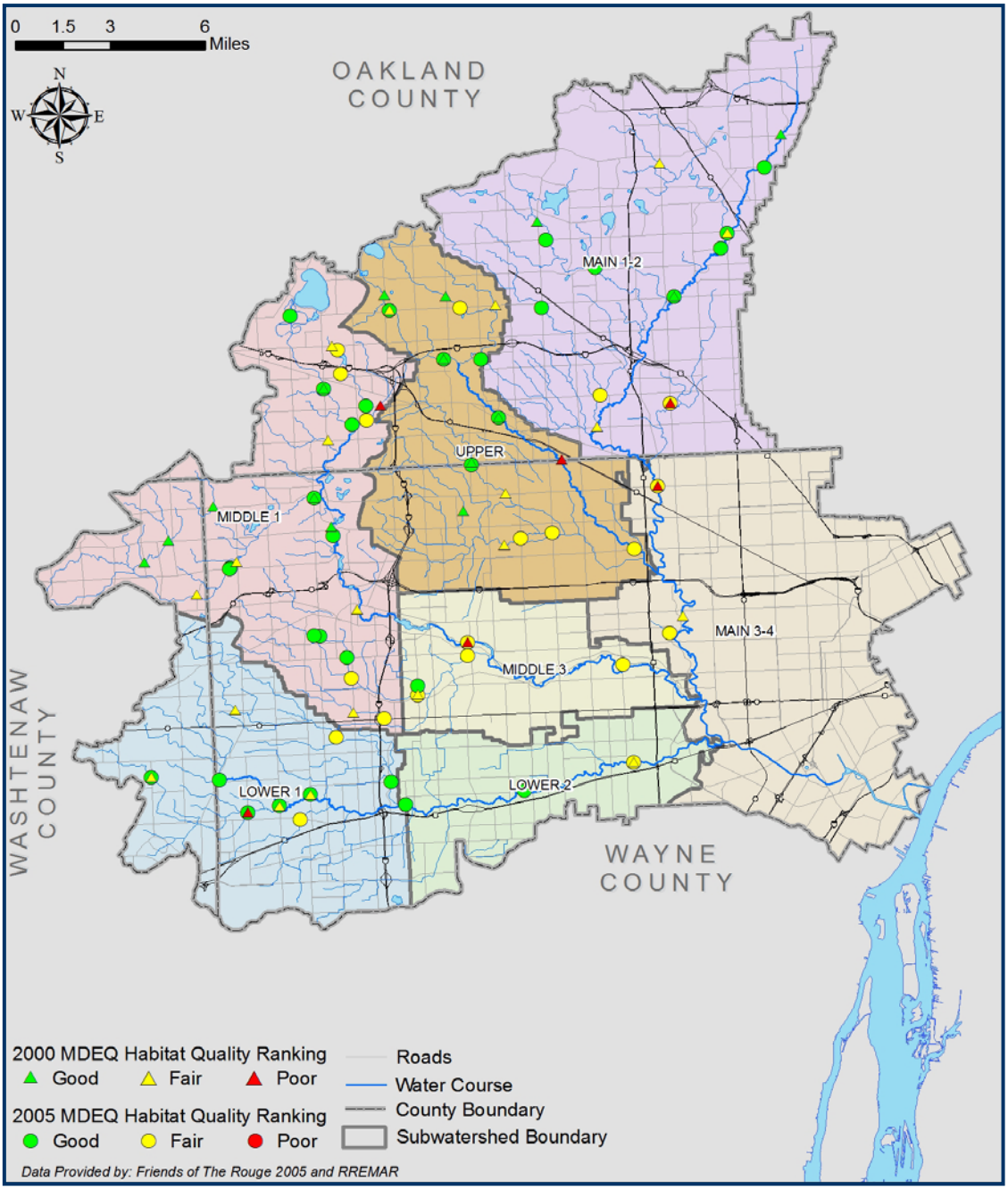


Figure 4-2: Fish Quality Ranking

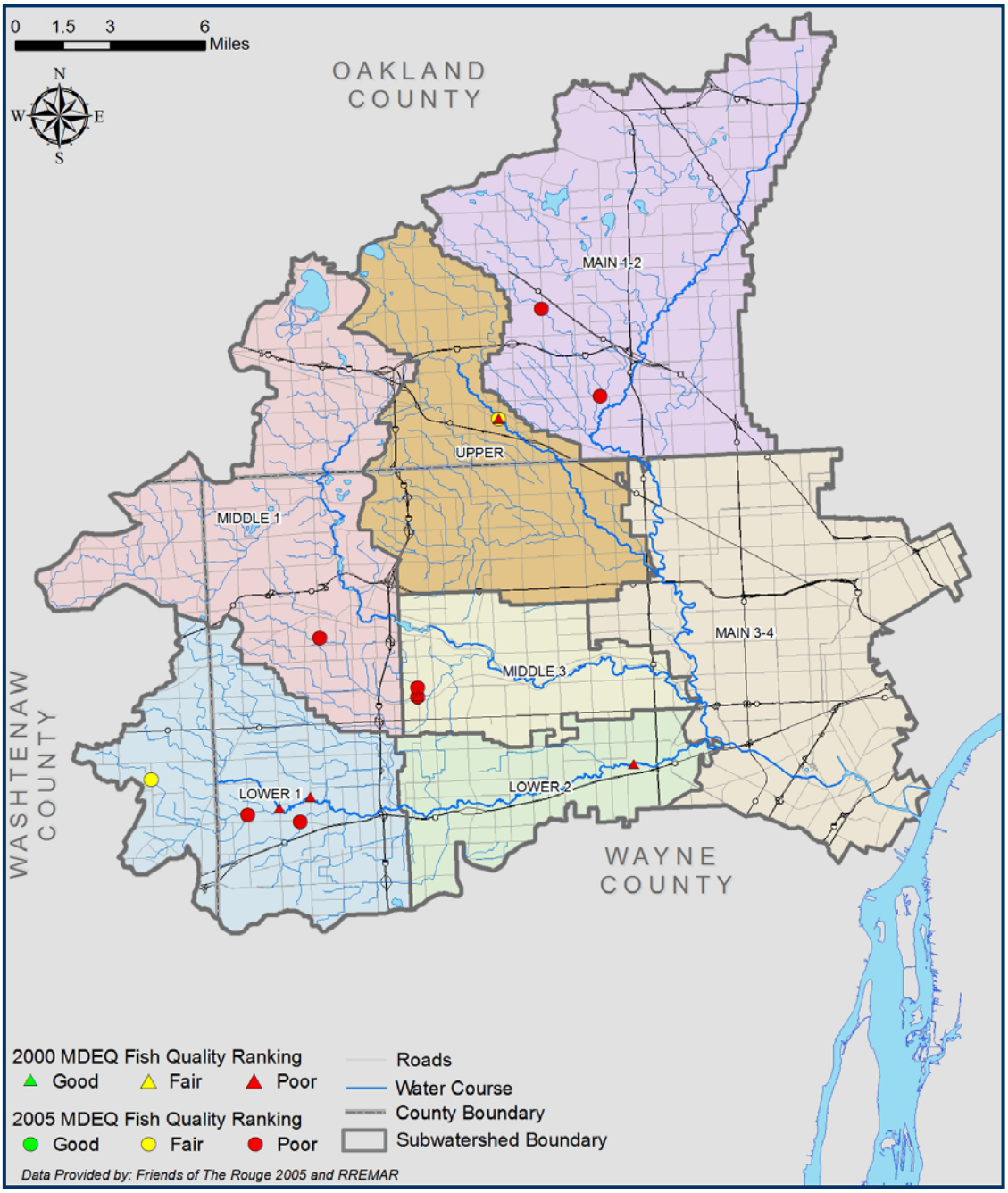
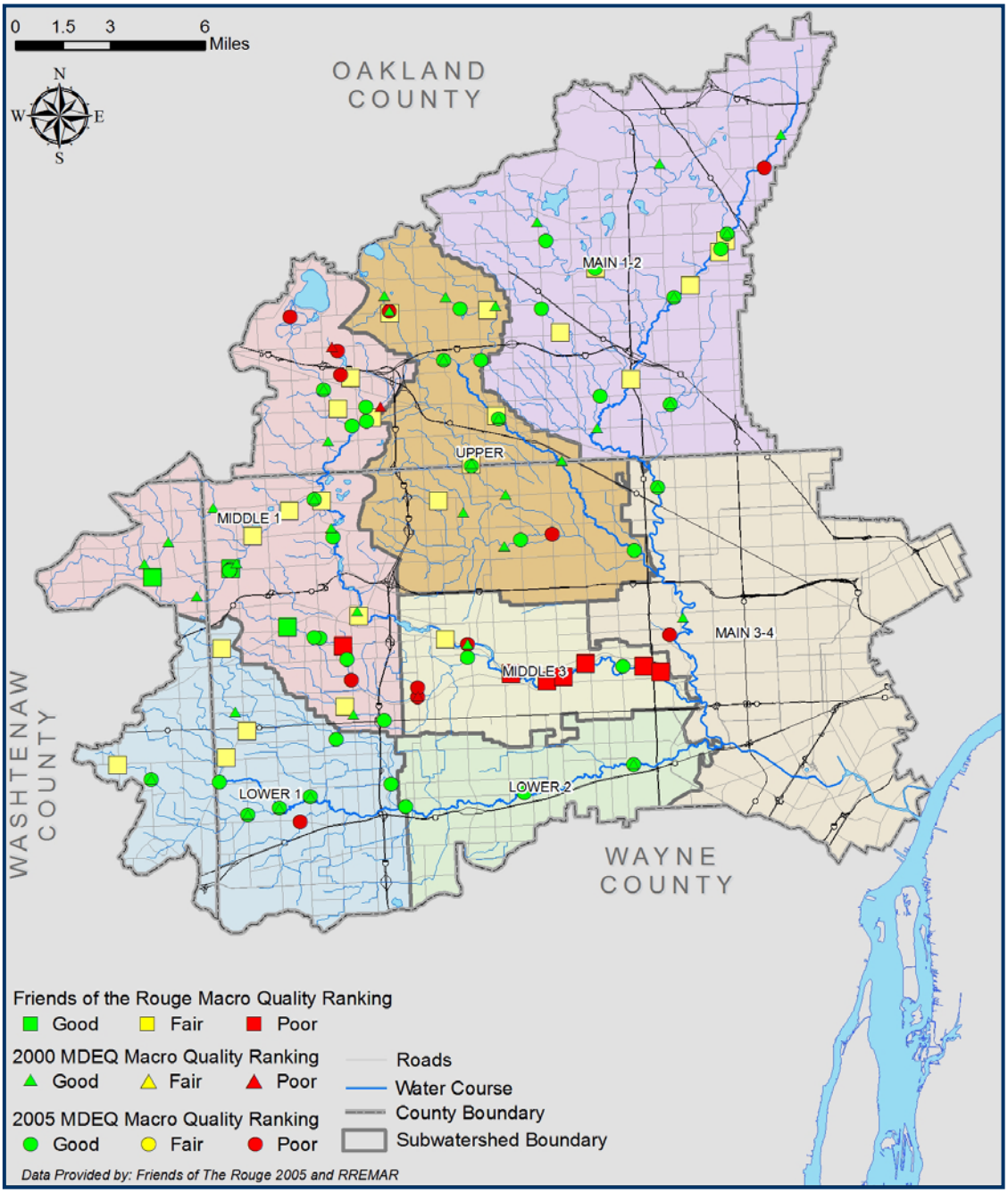
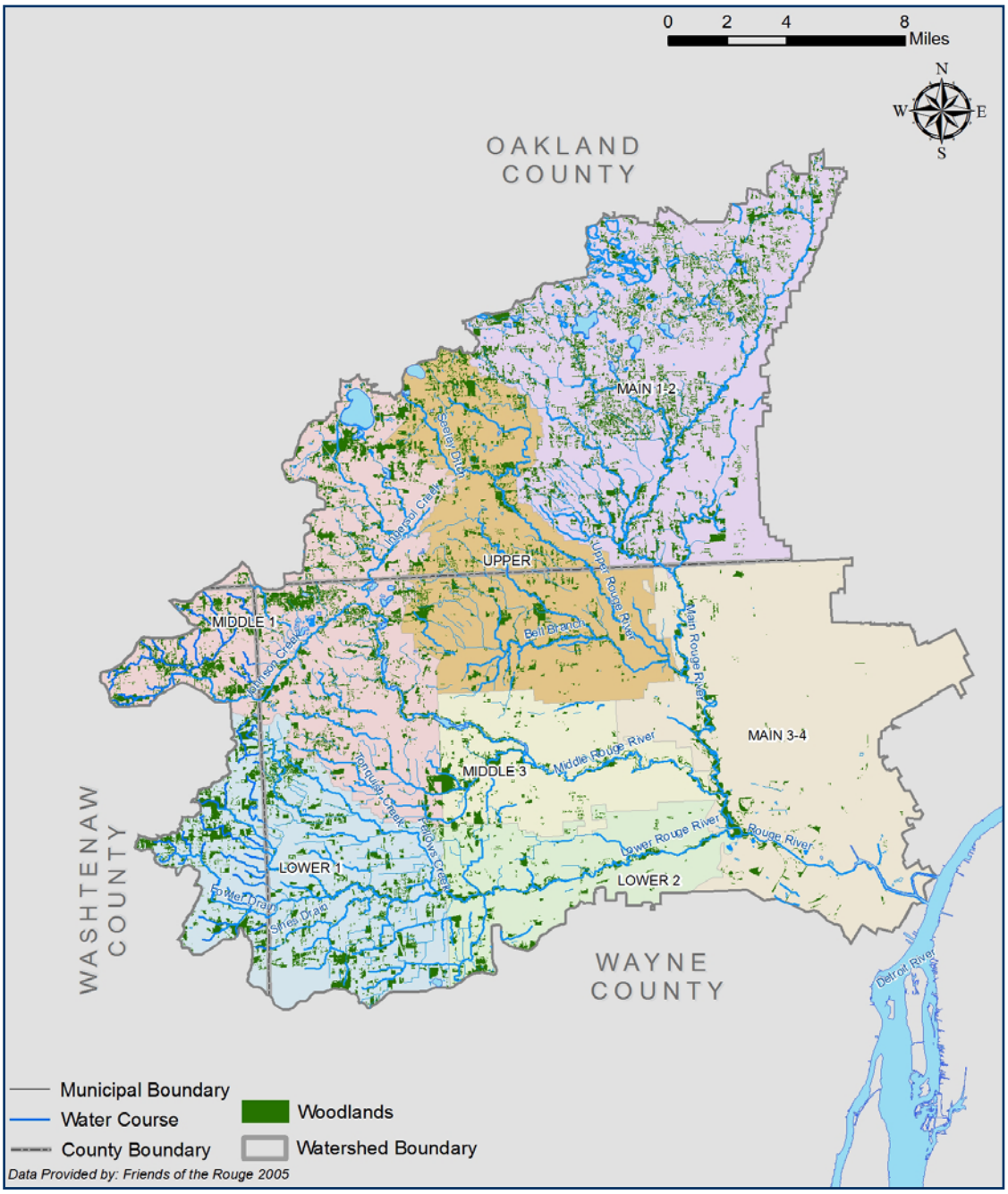


Figure 4-3: Macroinvertebrate Quality Ranking



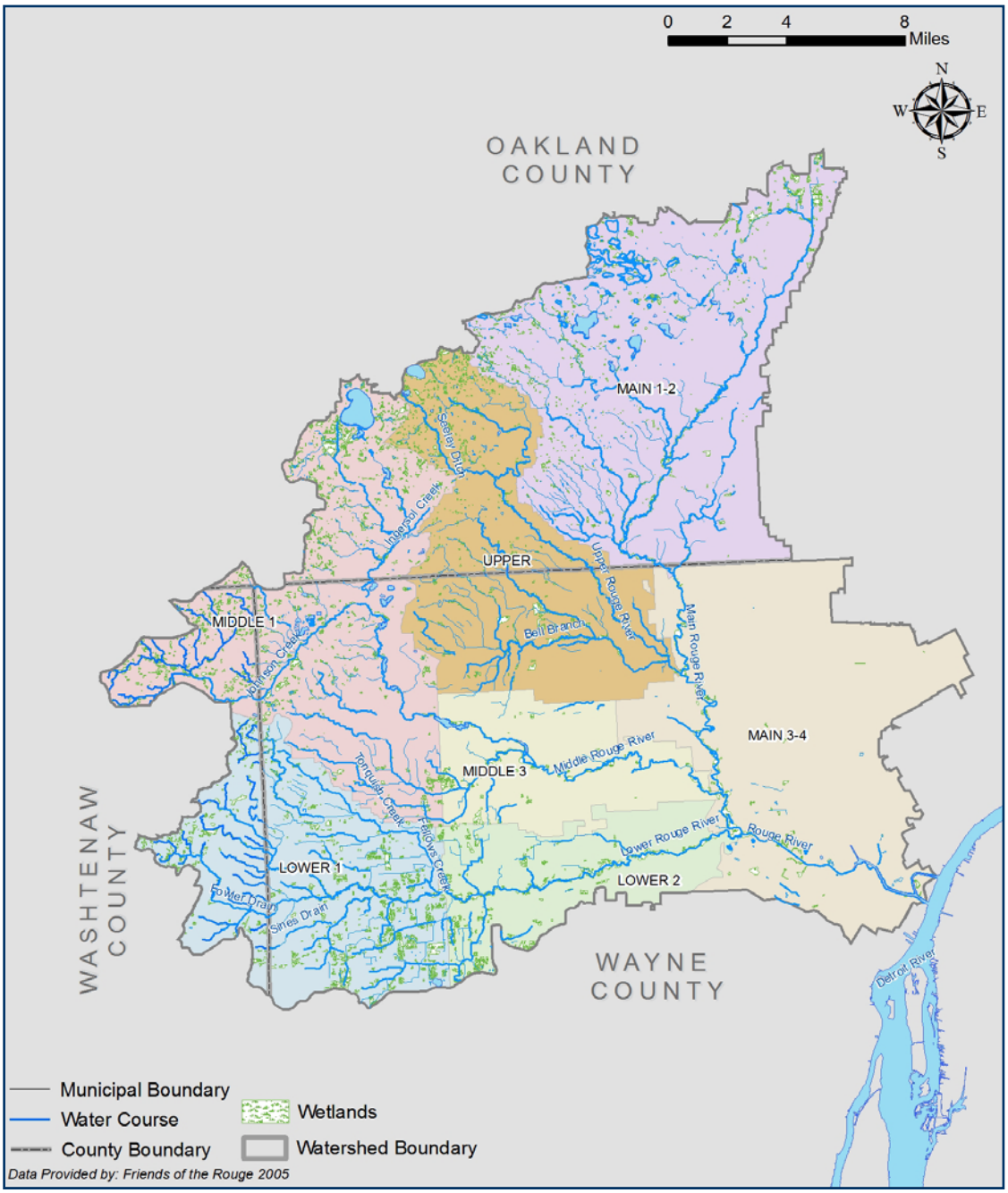
Other critical habitat components include both wetlands and woodlands, the percentage of which has been significantly altered and decreased due to changes in impervious cover across the AOC. Both wetlands and woodlands provide a variety of critical habitat functions that are directly connected to the aquatic life populations evident in the river and its tributaries. Figures 4-4 and 4-5 show the presence of existing woodlands and wetlands, respectively, across the AOC.

Figure 4-4: Existing Woodlands



Many tracts of woodland areas have been removed as development has progressed across the landscape. As is evident in Figure 4-4, there are large tracts of woodland areas still remaining in headwater areas and along segments of the river corridor.

Figure 4-5: Existing Wetlands



Similar to the woodland areas in the AOC, the wetland areas across the AOC have also experienced a significant decline, both in quantity and quality. In many areas where wetland areas are mitigated for development impacts, previous functions and values are not completely restored.

The watershed has been divided into seven storm water management areas (SWMA), based on the four main branches of the river, so that the Rouge River communities could collectively, and effectively, comply with requirements under the National Pollutant Discharge Elimination System (NPDES) Permit. Watershed management plans have been

developed for each SWMA. Each SWMA management plan identifies actions needed to address remaining problems associated with water quality related impaired uses, including fish and wildlife designated uses. Where applicable, activities identified in each SWMA, that are either ongoing or planned to specifically address fish and wildlife habitat, are described in the Recent and Ongoing Planning Efforts section below. For more information on other subwatershed management and water quality monitoring activities, go to: www.allianceofrougecommunities.com.

The following SWMA summaries describe the most significant habitat impairment factors that have been identified to date, including their location within the SWMA, where the impairment is occurring. These main habitat impairments are having a direct impact on the fish community, which is the focus of this restoration plan.

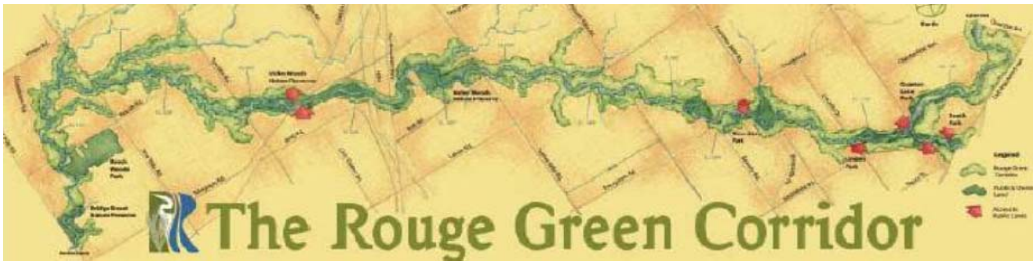
4.2 MAIN 1-2 ROUGE STORM WATER MANAGEMENT AREA

Impairments

The main factors negatively impacting fish community and habitat integrity in the Main 1-2 SWMA are excessive flow variability with low base flow and the lack of appropriate spawning habitat. Removal of riparian vegetation is increasing the rate at which poor quality storm water reaches streams while also exacerbating bank erosion and temperature increases in the water. Excessive sedimentation within impoundments is the result of poor soil erosion management on lands adjacent to the river. Although the impoundments create opportunities for development of recreational fish communities they are also a source of habitat fragmentation preventing upstream and downstream movements of fish species.

Notable Areas

In general, habitat quality was slightly better along the Main 1-2 reach of the Rouge River than in its tributaries. In 1995, the highest quality fish communities were found in Franklin Branch, Cranbrook Creek, and on the main stem at Beech Road in Troy (Leonardi, 1996). Franklin Branch may be capable of supporting brown trout, if extreme flow variations are controlled. Other sensitive fish populations that have been observed along this corridor include the rock bass, Johnny darter and stonecat. It is also home to the largest and most diverse population of freshwater mussels within the entire Rouge River watershed. Several of the species found include the fluted shell, white heelsplitter, and squawfoot-mussel (OCPDES, 2006).




Franklin Branch, Farmington Hills, MI

In 2005, good quality aquatic habitat was found in the Franklin Branch, Pebble Creek and the Main Branch of the Rouge. A considerable amount of the streams within the Main 1-2 SWMA are flanked by intact riparian buffer zones that protect the aquatic habitat. These "green corridors" are found along the Quarton Branch, Franklin Branch, Main Branch and a portion of the Ravines Branch in Farmington and the City of Southfield adjacent to Carpenter Lake. Expanding and protecting these green corridors will be necessary to further enhance habitat quality and improve fish populations in the Main 1-2 SWMA.

4.3 MAIN 3-4 ROUGE STORM WATER MANAGEMENT AREA

Impairments


Main Branch – Concrete Channel

The Main 3-4 SWMA should support a fairly diverse aquatic community; however, the habitat in this reach suffers from excessive flow variation, which is manifested in unstable banks and the lack of streamside cover, riffles and pools. In addition, the conditions in the area of the Main Branch, between its confluence with the Upper and its confluence with the Middle branches have changed very little during dry weather events because much of the Main 3-4 is still influenced by uncontrolled CSOs (Catalfio et.al, 2006). Presence of sewage (i.e. bacteria) in the river negatively affects levels of DO and nutrients in the river system which, in turn, has an impact on fish, benthic and wildlife populations in the AOC.

Separation of river segments, or habitat fragmentation, has been affected by the Henry Ford Estate dam in Dearborn along with the concrete channel in the lowest reaches of the river. The four mile concrete channel from Michigan Avenue to the Turning Basin acts as a barrier to the movement of fish and other aquatic life to the upstream reaches of the river. In addition, the Henry Ford Estate dam prevents fish passage migrating from Lake Erie and

the Detroit River upstream to other river branches. The impoundment at the Henry Ford Estate combined with the poor physical and water quality condition in the lower river district's channel, are serious impediments to the normal functioning of the Rouge River system (Wiley, et.al., 1998).

The upper reaches of this stream run through urban and suburban areas that have contributed greatly to the alteration of the natural flow regime. Increases in flashiness from increased impervious surfaces have contributed to stream bank erosion and sedimentation, which has resulted in significant impacts on the aquatic communities.

Notable Areas


Steelhead in the Rouge River!

The Main 3-4 SWMA is heavily developed, however it still retains a moderately intact riparian corridor in the northern reaches due, in part, to the connection of the floodplain riparian corridor with the river. This floodplain function also provides opportunities for future habitat enhancements on adjacent parklands and given its accessibility to the Detroit River and ultimately Lake Erie, its potential to sustain a thriving community of game fish is a high priority. At present, there are fish species, such as the steelhead and Chinook salmon, found in this SWMA, specifically at Henry Ford at Greenfield Roads that are found nowhere else in the watershed (Wiley, et.al., 1998).

4.4 Upper Rouge Storm Water Management Area

Impairments

Low DO levels, siltation in the spawning and feeding areas of the stream channels and degradation of physical habitat from bank erosion and streambed scouring linked to the high flow variability in the streams are the most significant factors limiting the abundance of fish species in the Upper Rouge SWMA. Biotic integrity quickly diminishes from the headwaters to the main branch of the Upper Rouge River. Tarabusi Creek (at Orchard Lake Road) and the Bell Branch (between Beech-Daly and Telegraph roads) exhibit unstable, eroded stream banks due to extreme flow patterns. Physical impacts to these tributaries and the river, including removal of riparian vegetation, channelization, relocation and enclosure have resulted in negative cumulative impacts on fish communities as well. The downstream portions of the SWMA have historically experienced significantly degraded water quality due to CSOs. Water quality and thus the diversity of habitat and aquatic communities will continue to improve as the effectiveness of the CSO controls is demonstrated.


Redside Dace

Notable Areas

One of the more notable characteristics of the Upper Rouge SWMA is its river gradient, or the change in elevation of the River from the upstream headwater areas to its

confluence with the Main Rouge River. The average river gradient in the Rouge River Watershed is approximately five feet per mile while the gradient in the Upper Rouge River SWMA averages 21 feet per mile, the highest of the four main river branches. The Bell Branch, within this SWMA, is known for its high gradient characteristic, which could potentially support a wide range of fish and aquatic organism communities due to the regular riffle-pool sequences; however, it also experiences significant flow variability that inhibits establishment of a diverse aquatic community (Catalfio et.al, 2006).

The Upper Rouge River at both Powers and Drake Roads, along with the Seeley Drain and Minnow Pond Drain, were rated "Good" in both the 1995, 2000 and 2005 assessments using GLEAS 51 protocols (Catalfio et.al, 2006). The Minnow Pond and Seeley Drains contain aquatic habitat that supports both sensitive fish and aquatic macroinvertebrate species. Of the four locations sampled, Minnow Pond Drain (near Farmington Road) and Seeley Drain (at Halsted Road) contained sensitive fish species (e.g., redside dace and mottled sculpin) and the most diverse aquatic habitat. Adult rainbow trout have been stocked near Powers Road to support short-term fishing derbies; however, there is no evidence of the establishment of a permanent population. Protection efforts, such as maintaining/ restoring riparian vegetation, minimizing flow variability, and maintaining good water quality, have been completed to ensure that this reach of the Rouge River continues to support sensitive species is essential.

4.5 MIDDLE 1 ROUGE STORM WATER MANAGEMENT AREA

Impairments

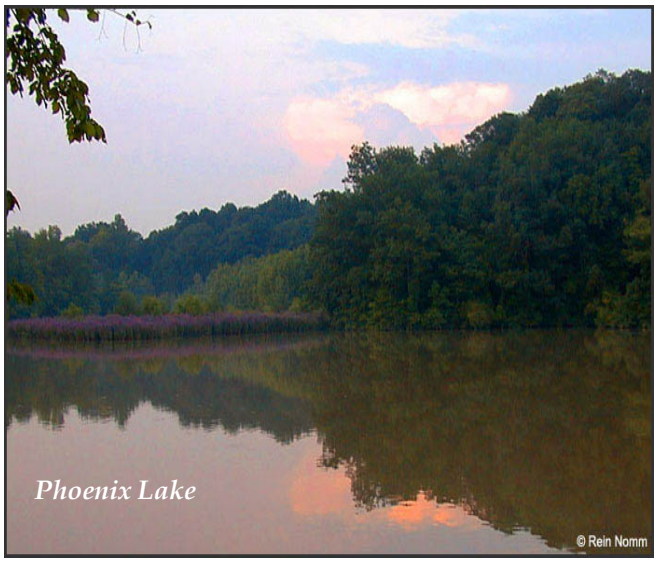
The Middle 1 SWMA has experienced fish and wildlife habitat and population impairments similar to other SWMAs. It exhibits a diverse underlying geology, including sand and sandy loam soils that should support a viable population of aquatic habitat suitable for cool and coldwater aquatic organisms. However, both point and non-point storm water inputs continue to impair water quality and the natural flow regime. Researchers have noted both physical and chemical impairments to aquatic habitat such as sedimentation, erosion, lack of cover, *E.coli*, DO, etc. (Leonardi, 1996). Hydrologic irregularity caused by channelization, agricultural, and urban land use impacts continue to impair spawning and refuge habitats. These habitat impairments are mostly due to conversion of forest and open space to agricultural and urban land uses. Higher than average peak flows and lower than desirable summer flows are also thought to be the major cause of the lack of diversity (Wiley, et.al., 1998).

Due to frequent violations of the 7mg/L Michigan Water Quality Standard (WQS), Johnson Creek was placed on the 2006 303(d) impaired water body list, which is included in the Clean Water Act Water Quality and Pollution Control in Michigan: Section 303(d) and 305(b) Integrated Report, submitted by the MDEQ to U.S. EPA every two years. The Total Maximum Daily Load (TMDL) developed by the MDEQ for the impaired portion of the water body prescribes loads to meet the DO standard in a two mile long reach that extends

from the confluence with the Walled Lake Branch of the Rouge River upstream to Six Mile Road. Factors which have been identified as contributors to the depleted oxygen in Johnson Creek include carbonaceous biochemical oxygen demand, nitrogenous oxygen demand, sediment oxygen demand, and plant respiration (MDEQ, 2007).

Notable Areas

Johnson Creek is a headwater stream that supports a high quality fish and biotic community. The stream reaches between Six Mile Road and Beck Road with a section 1,000 feet upstream of Pickford Avenue to Edenberry Road exhibit high quality aquatic habitat and flow characteristics worthy of preservation (Crawford & Denison, 1997). Johnson Creek is a designated cold water stream that supports a viable population of cold and cool water species including brown trout, dace, darters and mottled sculpin.



Phoenix Lake

Bishop Creek was found to have "marginal" habitat per GLEAS 51 ratings in 2005 (Catalfio et.al, 2006). The watershed of Bishop Creek has experienced rapid development, and the intensity of storm water runoff can overcome rehabilitative efforts and further degrade this stream. Walled Lake is the largest waterbody in the watershed and contains a healthy population of warm water fish species. In addition, there are numerous impoundments within the Middle 1 SWMA but public access is limited or restricted. Phoenix Lake and Wilcox Lake provide the best opportunities for recreational fishing for warm water fish species and other recreational opportunities associated with the river. Providing additional public access along the Rouge River and surrounding inland lakes within the watershed will help to ensure that everyone can enjoy natural resources the watershed provides.

The intact riparian corridors within the Middle 1 SWMA provide habitat opportunities and stabilized streambanks, and wetlands in this SWMA are also critical to maintaining high quality habitat diversity and aquatic communities.

4.6 MIDDLE 3 ROUGE STORM WATER MANAGEMENT AREA

Impairments


Tonquish Creek Streambank

The Middle 3 SWMA of the Rouge River should support a fairly diverse aquatic community. The primary cause of degraded stream habitat in the Middle 3 is the excessive flow instability and accompanying erosion and sedimentation and a lack of habitat complexity. Specifically, excessive and variable stream flows, lack of appropriate spawning habitat, lack of streamside vegetation and cover and few pools and riffles are negatively impacting fish community integrity in the Middle 3 (Leonardi, 1996). The size and diversity of the fish community in this SWMA is also constrained by the dams at Newburgh Lake, Nankin Lake and the Henry Ford Estate, which prevent fish passage to upstream areas. Additional impairments include sedimentation, erosion, excessive total suspended solids, E.*coli*, low dissolved oxygen (Leonardi, 1996), and algal blooms in the impoundments. These habitat limitations arise from point and nonpoint sources.

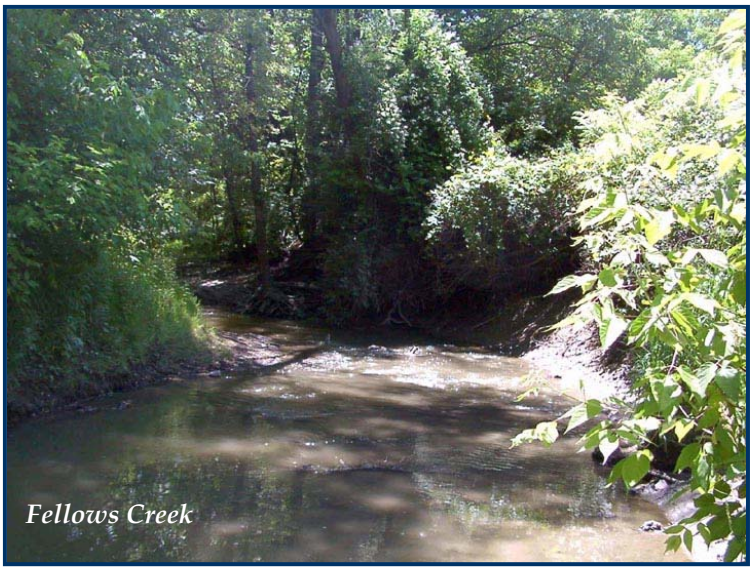
Severe streambank erosion exists along Tonquish Creek, an upstream tributary of the Middle Rouge River. The erosion areas are due to the increase in impervious surfaces combined with little storm water management; thus, flow variability is a significant issue. As a result, the habitat and aquatic communities have been degraded.

Notable Areas

The restoration of Newburgh Lake has produced an active recreational area for use by the public for fishing, boating and passive recreation. In addition, the grow zones and rain gardens that have been constructed along the Middle Rouge River have further enhanced habitat diversity and created opportunities for enhancing aquatic communities. Continuing to protect and enhance the riparian corridors along with further reducing the rate and volume of storm water runoff will improve both habitat and aquatic community populations.

4.7 LOWER 1 ROUGE STORM WATER MANAGEMENT AREA

Impairments


Fellows Creek

The Lower 1 SWMA of the Rouge River exhibits an underlying geology that predisposes the streams to extremes in both flow and temperature, and prohibits high rates of groundwater contribution to streams. Point and non-point storm water inputs continue to impair water quality and hydrology. Elimination of terrestrial components necessary for moderating the intensity of storm water inputs has also resulted in a decrease in groundwater flow and loss of riparian vegetation, which results in increased in-stream temperatures and lower retention of DO. Negative impacts caused by poor storm water management and removal of riparian vegetation also magnify habitat and population impacts.

The excessive flow variation and lack of appropriate spawning habitat have been the main factors negatively impacting the Lower 1 fish community. In addition, increases in impervious surfaces have impacted the tributaries to the Lower Rouge River along with the headwaters of the Lower Rouge upstream of Beck Road. Fellows Creek also has severe streambank erosion in areas downstream of Canton Center Road.

Notable Areas


YCUA Outfall at Beck Road

The Lower Rouge River between Beck Road and Sheldon Road, and Fowler Creek at Harris Road exhibit high quality aquatic habitat (Catalfio et.al, 2006). In addition, the increased base flow at Beck Road from the Ypsilanti Community Utility Authority (YCUA) outfall has transformed the Lower Rouge from being a very low base flow system to a midsized river with moderate base flow yields (Wiley, et.al., 1998). The YCUA discharge also has had a marked improvement in DO levels. Within the past couple of years, local representatives have also sighted trout in this section of the river. Thus, continued attention to rehabilitation of this branch will

continue to produce significant improvements to both habitat and aquatic community diversity.

The Lower Rouge River through Canton has an extensive forested floodplain that should be preserved. However, many invasive shrub species have become established, reducing native ground flora in these forested areas. The tributaries upstream of Beck Road, including both Fowler Creek and Sines Drain also exhibit some impacts due to recent development, but opportunities exist to enhance these corridors since streambank erosion is not a significant issue.

Fellows Creek upstream of Canton Center Road exhibits opportunities to enhance the riparian corridors for habitat and aquatic community diversity; however, it also exhibits severe streambank erosion downstream of Canton Center Road. The Flodin Park's Fellows Creek wetland was constructed to reestablish a natural stream system. The wetland area effectively manages flow variability and has significantly increased both habitat and aquatic community diversity.

Flodin Park Regional Wetland

4.8 LOWER 2 ROUGE STORM WATER MANAGEMENT AREA

Impairments

The Lower 2 SWMA of the Rouge River should support a fairly diverse aquatic community. The habitat in the Lower 2 branch, like much of the Rouge River, suffers from excessive flow variation, which is manifested in unstable banks, lack of streamside cover, riffles and pools. The natural geology of the Lower 2 SWMA restricts high rates of groundwater contribution to streams; therefore negative effects from a lack of storm water management and removal of riparian vegetation are magnified. The dam at Wayne Road in the City of Wayne fragments aquatic habitats and renders this reach of river unavailable for some fish species.

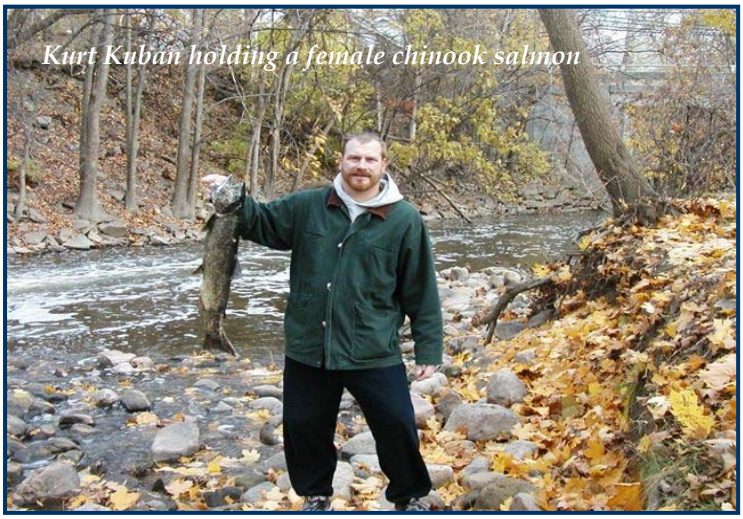
Historically, excessive flow variation and lack of appropriate spawning habitat have been the main factors negatively impacting the Lower 2 fish community. Like the Lower 1 SWMA, base flow enhancement has dramatically increased the fishery potential of the Lower 2 SWMA. Continued attention to rehabilitation of this branch will continue to enhance both habitat and aquatic community diversity. The increase in impervious surfaces upstream has also caused an increase in the frequency with which the extreme flashiness occurs in the river. The remaining uncontrolled CSOs must be separated and controlled as they result in considerable deterioration of water quality.

Notable Areas

The Lower 2 SWMA is heavily developed; however, it still retains a moderately intact riparian corridor in the communities of Wayne, Inkster and Dearborn. This riparian

corridor is seasonally flooded providing important connections with the river. This dynamic is readily observed in the vicinity of the Inkster Valley Constructed Wetlands Project. This area is also important as it demonstrates the use of natural and created wetlands to treat non-point source pollution from storm water runoff.

Similar to the Lower 1 SWMA, the addition of increased base flow from the YCUA outfall has transformed the Lower Rouge within the Lower 2 SWMA. With the YCUA flow enhancements, the Lower Rouge has changed from being a very low base flow system to a midsized river with moderate base flow yields (Wiley, et.al. 1998). Given this enhanced base flow combined with other restoration projects, opportunities could exist for fishing.



Kurt Kuban holding a female chinook salmon

Recently, a local watershed resident found a female Chinook salmon near downtown Wayne. This is evidence that water quality is improving and that habitat improvements, including dam modification, will continue to work towards delisting the Rouge AOC.

5.0 Component C: Delisting Criteria for Habitat and Populations

Goals in the Rouge River Remedial Action Plan (RAP) include a focus of developing and expanding recreational opportunities (RRAC, 2004). Although significant progress has been made towards increasing these opportunities, fishing is the recreational focus for the public's connection to the river. Setting targets for removal of the impairments to habitat and population will work specifically toward these goals outlined in the RAP.

Oftentimes, fish are considered to be the best indicator of overall water quality as their sustained presence indicates a complex habitat system with acceptable flow, temperature, water quality, and channel habitat. More than 60 fish species are historically native to the Rouge River AOC. Today, at least 53 of these species are found in the Rouge River (Leonardi, 1996). Though many native species are still present, some species' numbers have severely declined. For example, the redside dace (a state threatened species) was once found in Johnson Creek and now is rarely found. Fish species identified in the Rouge River are typical of those species found in aquatic systems under stress. The four miles of concrete channel in Main Branch has posed a significant barrier to available fish habitat in the lower portion of the river. Fish passage around the Henry Ford Estate dam and other key dams throughout the Rouge River would connect and make available miles of the river to source populations of many game fish species that are otherwise isolated within the watershed. Although dams work to fragment the system, their impoundments also contain the most concentrated game fish populations in the watershed. Newburgh Lake in particular, provides recreational opportunities including access to a thriving largemouth bass, northern pike, bluegill, pumpkinseed, and black crappie fishery (Leonardi, 1996).

The MDNR's Fisheries Division Institute for Fisheries Research and the University of Michigan's School of Natural Resource developed a correlation, known as the Wiley-Seelbach model (Wiley et. al, 1998). This model predicts what fish communities, or target communities, could exist in segments of the Rouge River, based on the stream size, position in the watershed and seasonal variation in water flows and temperature. The report analysis was based on measurements and modeling of the structure of the fish communities in ecologically similar rivers throughout southern Michigan. The report emphasizes hydrologic regime (e.g. base flow and peak flow) and temperature regime (e.g. summer minimum, maximum and median temperature) as the factors controlling fish community composition, and assumes that factors like in-stream habitat quality, and prey availability are already suitable for the identified fish species (Wiley et.al., 1998). In addition, the fish populations in the lower portions of the Rouge River are also affected by water quality. The goal of the Wiley-Seelbach model was to aid in the development of management criteria based on an accurate assessment of what potential fish population assemblages are expected to occur in a specific reach of the Rouge River. The 1995 MDNR fish assessment data set was used to compare potential fish species to what was actually found during the survey (Leonardi, 1996).

The river segments within the entire Rouge River Watershed were defined into segments consistent with the Wiley-Seelbach model: Small-Sized Streams with Very Low Baseflow, Small Streams with Low Baseflow, Small Streams with Moderate Baseflow, Mid-Sized Streams with Low Baseflow, and Mid-Sized River with Moderate Baseflow. These segment

groups do not always correspond to the storm water management area designations, but reflect river characteristics that will support fish communities. Based on these segment groups, recommendations for target fish associations, including game or angling fish, are provided based on model predictions (Wiley et.al, 1998).

5.1 SMALL-SIZED STREAMS WITH VERY LOW BASEFLOWS

The Lower Rouge River segment upstream of Palmer Road in Canton was originally categorized as a small-size stream with very low base flow. Two to five fish species are expected in this type of river segment, including the central mudminnow and brook stickleback. Game species are not typical for these types of streams. However, YCUA enhancements have modified the baseflow downstream of Beck Road and steelhead have been observed in this area.

5.2 SMALL STREAMS WITH LOW BASEFLOW

This segment category includes the Main Branch and Evans Ditch located in the Main 1-2 SWMA, the Upper Rouge and Bell Branch located in the Upper SWMA, and portions of the Middle Branch in both the Middle 1 and Middle 3 SWMAs. Target communities include a range of 18 – 32 species with up to four game species. Indicator species included the creek chub, northern pike and green sunfish while potential angling opportunities include bullheads, sunfish and northern pike. The MDNR fish assessment observed 15 species with one game fish, slightly below expectations (Leonardi, 1996).

5.3 SMALL STREAMS WITH MODERATE BASEFLOWS

This category includes the headwaters of the Main and Upper Branches along with Johnson Creek, located in the Middle 1 SWMA. Expected fish communities ranges from 5-17 species, including the mottled sculpin and creek chub, but with very limited game fish opportunities. Areas assessed by the MDNR found nine species with one angling opportunity (Leonardi, 1996).

5.4 MID-SIZED STREAMS WITH LOW BASEFLOWS

This type of segment is characteristic of the Middle Rouge at Hines/Merriman downstream to the confluence with the Main Branch in the Main 3-4 SWMA, the Main Branch at Bonnie Brook in Southfield downstream and the Main Branch itself in the Main 3-4 SWMA. The target fish communities include a range of 29-46 species including rock bass, northern pike, golden redhorse and channel catfish. Up to 10 species are expected to provide significant angling opportunities including bullheads, sunfishes, suckers, rock bass, northern pike, smallmouth bass, walleye, carp and channel catfish. The MDNR fish assessment found only seven of these species, including carp (Leonardi, 1996).

5.5 MID-SIZED RIVER WITH MODERATE BASEFLOW

This segment type applies to the Lower Branch, with the YCUA flow enhancement, upstream of its confluence with the Main Branch. There is a potential for up to 29 species, 7

of which provide angling opportunities including smallmouth bass, walleye, and northern pike. The MDNR assessment found a range of 3 – 12 fish species (Leonardi, 1996).

When viewing the Rouge River Watershed from a fish community perspective, the most common species groups include creek chub, common shiner, green sunfish, and white sucker. These are representative of small warm water streams with moderate to low base flow. A low base flow is of particular interest as it is on the low end of the spectrum of what is needed by the majority of game fish species that occur in the Rouge River. With the exception of a few areas in the headwaters, the fish communities generally lack population integrity (Leonardi, 1996). Sites in question were dominated by low-flow tolerant species such as creek chub and green sunfish, while sites in the headwaters with higher quality stream integrity tended to support low-flow intolerant species such as mottled sculpin and brown trout. Furthermore, no new species were identified in 1995 beyond those found in 1986. Two species typical of good base flow and water quality that were found in 1986 were absent in the 1995 survey (Leonardi, 1996).

5.6 DELISTING TARGETS

The targets are primarily focused on improving fish populations in the Rouge River, including the Main, Upper, Middle and Lower branches due to the fact that the impairment was originally identified as fish, not wildlife populations. As previously mentioned, the fish populations are dependent on both the food source and appropriate habitat. As fish populations are monitored into the future and as the identified delisting targets are reached, it is understood that the habitat must be adequate to support the fish respective communities. It's important to recognize that the identified potential monitoring sites were selected based on the existence of historical fish community assessment data. Past assessments were made using both the Index of Biotic Integrity (IBI) (Karr, 1981) and the Michigan Department of Environmental Quality, Surface Water Quality Division, Great Lakes Environmental Assessment Section, Procedure 51 (GLEAS 51) methodologies. The IBI and GLEAS 51 methodologies measure the biotic integrity of a fish population. This is defined as a "*balanced, integrated, adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of natural habitat of the region*" (Karr & Dudley, 1981). The following delisting targets have been identified for the respective BUIs:

Degradation of Fish and Wildlife Populations

1. Beneficial Use Impairment for Degradation of Benthos is removed.

2. Using the Wiley-Seelbach model and the MDNR 1995 Fisheries Assessment as the baseline (Wiley et. al, 1998), it may be expected that a minimum number of game fish species may be achieved, to include the minimum game fish, in the following segments of the Rouge River (Figure 5-1 identifies Potential Fish Monitoring Locations):

    - Rouge River Main Branch from the mouth upstream to Beech Road (US5). Example game species may include northern pike, smallmouth bass, channel catfish and walleye. Potential monitoring locations include the following:

Site ID	Geographic Location
US5	Beech Rd. (USGS) in Southfield
MN-10**	Below Ford Dam – Launch at Melvindale
MN-4*	Spinoza Rd at Rouge Park in Detroit

*Sites surveyed in 1986 using IBI & 1995 MDNR
** Site surveyed in 1995 MDNR

- Lower Rouge River from the confluence with the Main Branch upstream to Sheldon Road (L-1). Example game species may include northern pike, rock bass and smallmouth bass. Potential monitoring locations include the following:

Site ID	Geographic Location
LO6	Wayne Rd in Wayne
L-4*	Ford Field Park in Dearborn
L-1*	Sheldon Road in Canton

*Sites surveyed in 1986 using IBI & 1995 MDNR

- Middle Rouge River from the confluence with the Main Branch upstream to Hines Drive (D06). Example game species may include northern pike, rock bass and smallmouth Bass. Potential monitoring locations include the following:

Site ID	Geographic Location
US2 (MD-7*)	Inkster Rd in Dearborn Heights (USGS Station)
DO6	Hines Dr. Near Ford Rd. in Dearborn Heights

*Sites surveyed in 1986 using IBI & 1995 MDNR

- Upper Rouge River from the confluence with the Main Rouge River upstream to Powers Road (U-1). Example game species may include northern pike, rock bass. Potential fish monitoring locations include the following:

Site ID	Geographic Location
U-3*	5 Mile Rd in Redford Twp
U-1*	Powers St in Farmington

*Sites surveyed in 1986 using IBI & 1995 MDNR

3. Two monitoring events with results meeting the criteria above and which occur within a five-year period, but no sooner than one-year apart, shall demonstrate progress for delisting.

Loss of Fish and Wildlife Habitat

1. Degradation of Fish and Wildlife Populations Beneficial Use Impairment is removed.

Figure 5-1 highlights potential fish monitoring locations for delisting the Loss of Fish and Wildlife Populations BUIs. These locations were selected due to the fact that they each have historical population data associated them.

Figure 5-1: Potential Fish Monitoring Locations

6.0 Component D: Recent and Ongoing Planning and Restoration Efforts

As stated in the Rouge River Remedial Action Plan Update (RRAC, 2004):

> "Caring for nature means, first, protecting the natural landforms such as streams, valleys, moraines, ravines and plains that are the basis of living communities. Second, it means protecting healthy, diverse habitats, the plants and animals that live there and the network of corridors that link habitats. Third, caring for nature means re-establishing, regenerating, and sometimes creating lost or degraded landforms, habitats and linkages."

In the last 20 years, significant restoration progress has been realized as a result of over one billion dollars of investment by the federal, state and county governments, Rouge River Watershed communities, and area residents (www.allianceofrougecommunities.com). Below is a description of recent and ongoing projects and activities in the Rouge River Watershed. These efforts have been arranged by SWMA and in chronological order, where possible, with the most recent project listed first.

6.1 Main 1-2 Storm Water Management Area

The several impoundments of the Main 1-2 SWMA have their fishery restored. In 2007, the City of Southfield, in partnership with the MDNR, recently released more than 14,000 native game fish species into Carpenter Lake, an impoundment of the Ravines Branch. The fish planting was one component of the lake restoration project that began in 2004. The goal of the project was to restore the lake to a sustainable fish and wildlife habitat, with improved water quality and storm water management. The fish released included largemouth bass, channel catfish, bluegill, sunfish and minnows. Nuisance and exotic fish species were removed because of their tendency to overpopulate and negatively impact game fish populations. A fish stocking plan was developed to limit the re-establishment of nuisance and exotic fish and to continue to provide a unique recreational fishery in an urban setting. ADA access and fishing piers were installed to provide additional public recreation opportunities.

Carpenter Lake – Southfield, MI

Quarton Lake is an impoundment on the Quarton tributary of the Rouge River in the City of Birmingham. The lake was dredged, fish habitat, including woody structure and spawning habitat, were installed, and nuisance and exotic fish species were removed.

Kingswood Lake located at the Cranbrook Educational Community in Bloomfield Hills underwent significant habitat restoration through dredging of excess sediment and restoration of riparian buffers and adjacent wetlands. Increased high quality habitat opportunities have had a demonstrated improvement on fish and wildlife populations.

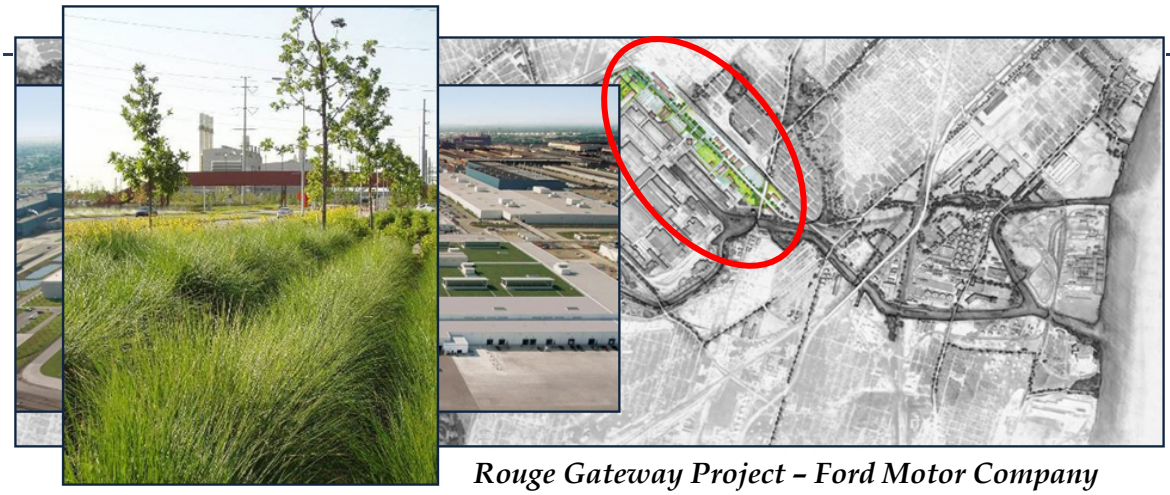
The cities of Troy, Farmington Hills, Southfield and Birmingham have implemented storm water best management practices (BMPs) at parks, golf courses and other publicly-owned lands within the SWMA. These BMPs were designed to reduce the flow variability observed in the river while also enhancing the riparian corridor. Streambank stabilization projects have also been completed in strategic areas across the SWMA to reduce the impacts of erosion on river habitats.

The cities of Beverly Hills, Birmingham and Southfield, Oakland County Planning and Economic Development, Oakland Land Conservancy, now the Six Rivers Regional Land Conservancy, Friends of the Rouge, the Oakland County Drain Commissioner, and Southeast Oakland County Water Authority and the Oakland County Audubon Societies have worked together to highlight the Rouge Green Corridor. This corridor has over nine public parks and preserves, extensive woodlands and prairie meadows for over 100 species of birds, 19 species of butterflies, eight species of frogs and at least 17 species of mammals. Citizen involvement through planting buffers and removing invasive species has provided significant habitat enhancement value. The City of Southfield also purchased substantial property along the Rouge Green Corridor which will ultimately provide enhanced habitat and population diversity across this area (OCPEDS, 2008).

6.2 MAIN 3-4 STORM WATER MANAGEMENT AREA

In 1999, the City of Detroit installed two native plantings along the Rouge River. Two acres of native plants were planted at Eliza Howell Park near the confluence of the Upper and Main branches, and 15 acres of prairie and native plants were planted at Rouge Park, the city's largest park.

In 2002, Ford Motor Company conducted "green" activities at the Ford Motor Rouge Plant including, installing a green roof on the manufacturing plant, using porous pavement at new car storage areas and creating mass plantings of native plants. Ford also partnered with Wayne County Roads to reconstruct Miller Road to include storm water detention.



Rouge Gateway Project – Ford Motor Company

The City of Dearborn has installed rain gardens and a wetland detention area adjacent to the concrete channel to effectively manage storm water runoff from its Department of Public Works Yard. As this provides a storm water benefit, the rain gardens and the wetland area along the river channel will provide numerous habitat enhancements.

In 2001, the western-most oxbow in the Rouge River was restored at the Henry Ford Estate. The restoration provides habitat for fish and wildlife, while providing educational opportunities for hundreds of thousands of people who visit The Henry Ford each year. Funding for the oxbow restoration was provided by Clean Michigan Initiative (CMI) and the Rouge Program Office (RPO). The City of Melvindale created a no-mow zone behind its ice arena along the channelized portion of the Rouge River.

6.3 Upper Storm Water Management Area

Of the four locations sampled, Minnow Pond Drain, near Farmington Road, and Seeley Drain, at Halsted Road, contained sensitive fish species such as redside dace and mottled sculpin, and the most diverse aquatic habitat. Adult rainbow trout have been stocked near Powers Road to support short-term fishing derbies. The City of Livonia constructed an off-line regional storm water management facility at Idyl Wyld Golf Course to manage excess storm water runoff from a 2,700-acre area. The facility significantly reduces the flow variability in the river thus providing a long-term enhancement in habitat and fish/benthic populations.

6.4 Middle 1 Storm Water Management Area

The Johnson Creek Protection Group in partnership with the local communities has continued to encourage volunteer opportunities to enhance areas along this stream while also minimizing pollution impacts. Some of these activities have included enhancement of riparian corridors and removal of invasive species.

The City of Novi has installed flow, water quality and habitat enhancements for at least three regional basins all on tributaries to the Middle Rouge River. Northville Township, the City of Northville and Wayne County implemented both streambank and pond enhancements at Fish Hatchery Park to both improve water quality and provide habitat value. The Johnson Creek Protection Group has worked to maintain the high quality of Johnson Creek through numerous small riparian projects and educational opportunities.

6.5 MIDDLE 3 STORM WATER MANAGEMENT AREA

Since the early 1900s, Newburgh Lake has served as a recreational resource for the surrounding area. Over the years excessive nutrients and various pollutants had entered the lake degrading its recreational use. Nutrients had contributed to excessive aquatic plant growth while other pollutants, some toxic, had accumulated in the sediment. From the sediment, toxic pollutants such as PCBs entered into the food chain making most fish unfit for human consumption. In 1993 the RPO began planning a Newburgh Lake Restoration Project with the goals of eliminating the PCB fish advisory, improving the lakes water quality and enhancing the recreational use of the lake. Construction began in 1997 and by 1998 nearly 560,000 tons of sediment, much of it contaminated with PCBs, had been removed from the lake along with the eradication and removal of over 28,000 pounds of PCB-contaminated fish. Shoal areas were created and planted with beneficial aquatic vegetation, the lake was deepened and over seven acres of fish spawning beds and habitat structures were constructed. The lake was then restocked with over 30,000 fish of various species including bluegills, largemouth bass, catfish and walleyes. In the summer of 2003, the State of Michigan lifted consumption bans for the general population (men and boys over the age of 15 and women who are beyond child bearing years) for carp, channel catfish, largemouth bass and northern pike caught in Newburgh Lake. Newburgh Lake now provides a thriving recreational fishery, however, fish consumption advisories, although no longer as strict, remain as a source of impairment.

Newburgh Lake Restoration

In addition, Wayne County has instituted a successful Grow Zone Strategy within Hines Park along the Middle Rouge River to increase storm water infiltration and reduce flooding impacts while also enhancing habitat opportunities. These grow zones combined with numerous completed streambank stabilization and woody debris management practices have provided a benefit to the river from both a habitat and population standpoint.

6.6 LOWER 1 STORM WATER MANAGEMENT AREA

The YCUA flow enhancements in the Lower Rouge River have created a new hydrologic system with the potential to support significant fish communities. Canton Township also recently constructed a regional storm water wetland adjacent to the south side of Fellows Creek and the Green Drain in Flodin Park. Streambank and in-stream habitat enhancements were installed along the stream corridor. This feature has provided a significant value in reducing flow variability in Fellows Creek while also enhancing habitat opportunities. In addition, numerous residential detention basins have been retrofitted and enhanced for improved flow control and water quality as well as increased habitat opportunities. The vegetation and native buffers planted in and around both regional basins and privately-owned basins adjacent to stream corridors has tremendously increased habitat value and presence of a variety of wildlife.

Numerous detention basin enhancements have been constructed adjacent to the Lower Rouge tributaries that have included installation of native wetland vegetation and construction of riparian buffers. These enhancements improve storm water runoff quality entering the local streams thus improving habitat opportunities for aquatic communities. In addition, the native vegetation in the detention basins also enhances habitat opportunities. One detention facility was reconstructed to support fish communities in the basin adjacent to Fowler Creek.

Detention Basin Habitat Enhancement

6.7 LOWER 2 STORM WATER MANAGEMENT AREA

As with the Lower 1 reach of river, the addition of increased base flow from the YCUA outfall has transformed the Lower 2 SWMA. The new hydrologic configuration has the potential for up to 29 species with angling opportunities for seven species including smallmouth bass, walleye, and northern pike. Continued attention to rehabilitation of this branch will be well worth the effort.

Wayne County Rain Garden at Commerce Court

Numerous streambank stabilization projects as well as projects to eliminate combined sewer overflows (CSOs) have been completed in this SWMA. Woody debris management techniques and installation of native plants have provided positive habitat enhancements throughout the corridor. Downspout disconnection programs along with the CSO projects have had a significant improvement in water quality as well as reduced flow variability in the river.

7.0 Component E: Sites for Habitat and Population BUI Delisting

The stakeholders of the Rouge River Watershed have collectively invested millions of dollars and thousands of hours in time in achieving restoration of the river. The success of these efforts has been documented through improved water quality, enhanced fish and wildlife populations and increased recreational use. The Rouge River National Wet Weather Demonstration Project began the restoration of the Rouge River by focusing on CSOs and subsequently storm water runoff, illicit connections and enhancing public education about water resources.

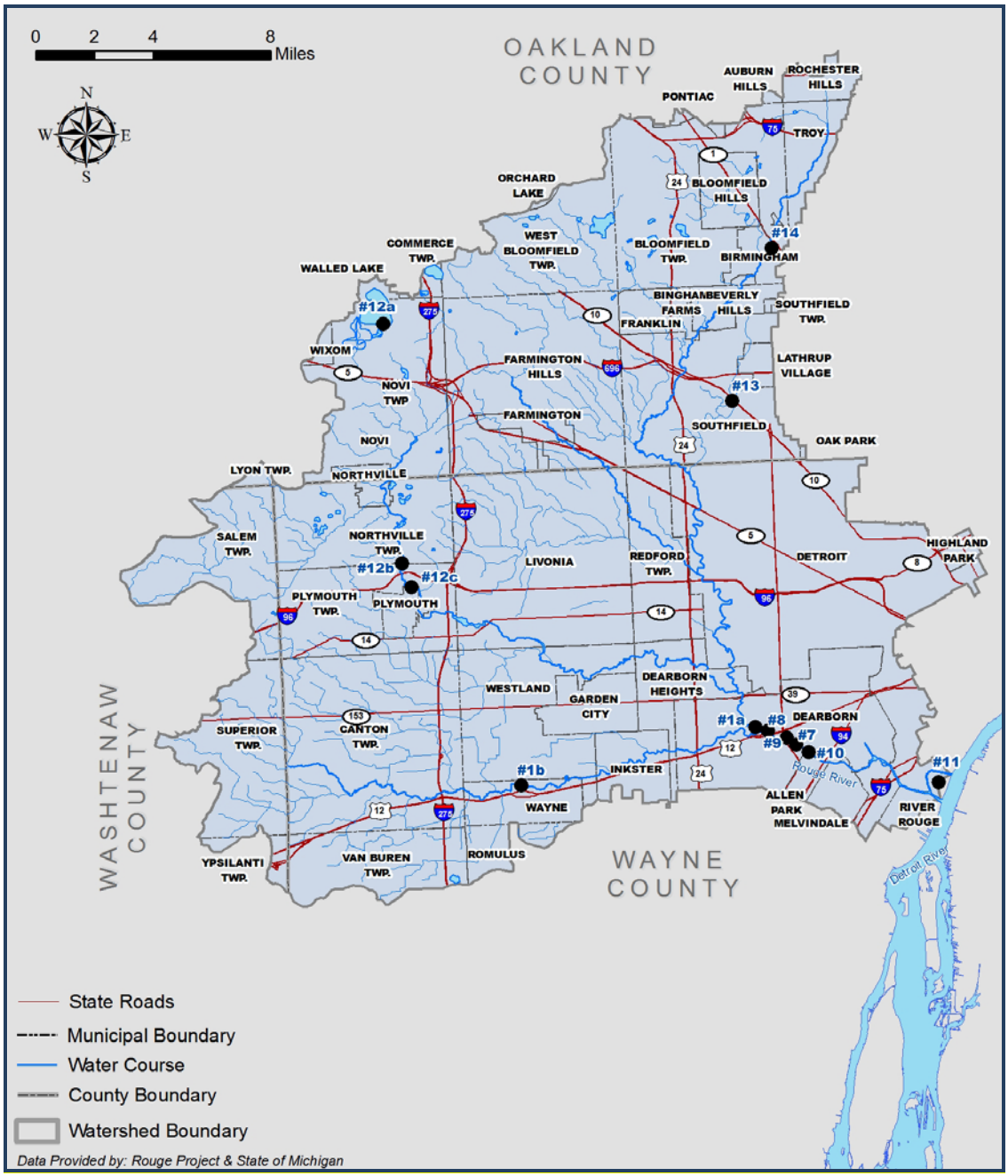
While these are significant achievements, efforts remain ongoing to work towards restoration, but to also work towards quantifying when delisting of specific BUIs may occur. It's important to note that delisting of the BUIs described in this report does not require complete restoration of the river, but rather marks a milestone in achieving progress for improved habitat and population conditions.

The Technical Committee identified a series of projects and initiatives that, once implemented and monitored according to site plans, should result in delisting the *Degradation of Fish and Wildlife Populations* and *Loss of Fish and Wildlife Habitat* BUIs. These projects are listed as follows, while Figure 7-1 presents a general location map of the proposed projects. Detailed descriptions of each project and initiative are described further in this chapter. Please note that some project initiatives are not reflected specifically on the map for which a footnote is then denoted.

The following projects, when implemented, will work towards delisting the AOC for habitat and population BUIs:

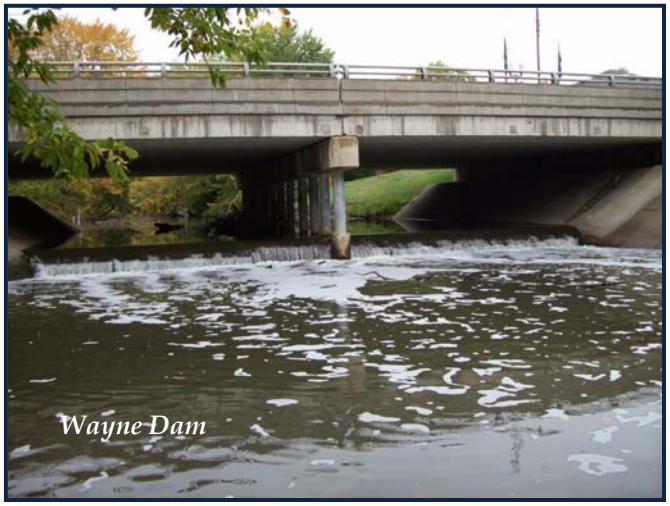
1) Fish Passage and Dam Modification – Feasibility Study and Implementation
2) Green Infrastructure (GI) – Assessment and Visioning
3) Green Infrastructure – Implementation
4) Green Infrastructure – Land Cover Monitoring
5) Natural Areas Program Management Feasibility Study
6) Green Corridors
7) Concrete Channel Modifications/Enhancements for Habitat and Fish Populations
8) Michigan Avenue and Evergreen Road Storm Water Treatment and Habitat Restoration
9) Tournament Players Golf Course Storm Water Treatment and Wetland Restoration
10) Oakwood Common Oxbow Restoration
11) Fordson Island Habitat Restoration
12) Lakes and Impoundments – Feasibility Study & Restoration
13) Evans Creek Constructed Wetland
14) Booth Park Streambank Stabilization

Figure 7-1: Project Sites to Work towards Habitat and Population BUI Delisting



1) FISH PASSAGE AND DAM MODIFICATION – FEASIBILITY STUDY AND IMPLEMENTATION

Description: The MDNR 1998 Fisheries Assessment identified two dams that are impediments to the Rouge AOC's fishery. These are at Wayne Road in Wayne on the Lower Rouge and at the Henry Ford Estate in Dearborn on the mainstem of the Rouge River. Removing or providing fish passage at these sites would be extremely helpful in achieving the delisting targets for the Rouge River by reconnecting the Rouge River AOC to the Detroit River and Lake Erie ecosystem.



The Henry Ford Estate dam is approximately 8 miles upstream of the Rouge River's confluence with the Detroit River and the first upstream dam from the mouth of the Rouge River,. The next upstream dams along the Middle and Upper Branches of the Rouge are 18 and 36 miles from the confluence, respectively. The dam at Wayne Road on the Lower Branch is about eight miles upstream of the Henry Ford Estate dam but since the Lower Branch splits off from the Main Rouge downstream of the Henry Ford Estate, fish can travel from the Detroit River to the Wayne Road dam unimpeded and salmon spawn there in the fall. A fish passageway at the Henry Ford Estate and removal/modification of the dam at Wayne Road would increase aquatic diversity throughout the upper and lower portions of the Main Branch and the Lower Branch, not only for fish species, but also for macro-invertebrates, mussels and other aquatic life forms. Fish species that have been identified at the Henry Ford Estate dam include small mouth bass, white suckers, walleye, redhorse suckers, northern pike and steelhead.

The Army Corp of Engineers has been studying the feasibility of providing fish passage around the Henry Ford Estate dam. The chosen alternative would be most effective in allowing passage of small fish species as well as warm and cold water fish species (USACE, 2003).

This project would provide funding to perform the feasibility study for the removal/modification of the dam at Wayne Road on the Lower Branch and provide

financial support for its removal as well as provide financial support for the fish passage around the Henry Ford Estate dam.

Timetable: While these projects have been actively discussed amongst stakeholders, the timing for implementation is anticipated to be within the next five years.

Funding Estimate: $3,000,000

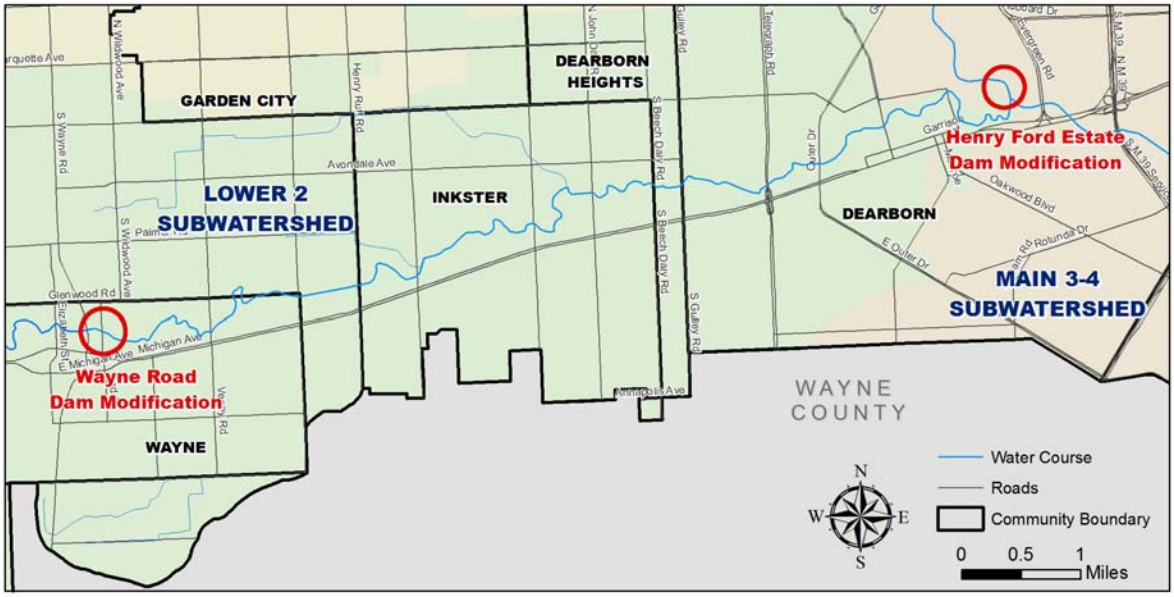
Potential Stakeholders: Wayne County Department of Environment, Friends of the Rouge, Alliance of Rouge Communities, Army Corps of Engineers, University of Michigan-Dearborn, Henry Ford Estate, City of Wayne, City of Dearborn.

Indicators and Monitoring: Fish population monitoring upstream of the two dams as outlined in the delisting targets.

Evaluation Process based on Indicators: Building upon and relying on the watershed monitoring efforts of Friends of the Rouge, Wayne County and the ARC would collaborate with the MDNR to add fish monitoring to the suite of parameters being monitored for watershed management progress evaluation.

Public Involvement: The RRAC and ARC committee structure will be used to publicize the project. The process for the project design and permitting will be used as a mechanism for public involvement. Reports and project profiles will be developed, press releases will be issued and State of the Watershed workshops and conferences will be implemented throughout the duration of the project to bring attention to and build awareness of the importance of reconnecting the Rouge AOC (ecologically) to the Detroit River and Lake Erie AOC's and to provide information on the progress of ecological restoration.

Figure 7-2: Location of Henry Ford Estate and Wayne Road Dams



2) GREEN INFRASTRUCTURE (GI) - ASSESSMENT & VISIONING

Description: Using the 2008 Leaf Off aerial imagery dataset obtained by USGS and process by the Alliance of Rouge Communities for use with CITYgreen© software a comprehensive assessment and analysis of the Rouge AOC will be performed to quantify the following:

- Area (acres) of public parkland available for conversion to Grow Zone or Reforestation,
- Area of public school properties available for conversion to Grow Zone or tree planting,
- Area of public impervious parking available for porous pavement retrofitting
- Area of public facility roof top available for conversion to green roof

With these areas quantified, a stakeholder involvement visioning and cost benefit analyses will be conducted for each type of public property to identify the costs and benefits in both economic and environmental terms of implementing these green infrastructure capital improvement projects.

Timetable: 2010 – 2011

Funding Estimate: $100,000

Potential Stakeholders: If funding can be secured. Wayne County Department of Environment/Alliance of Rouge Communities, school districts and other public institutions.

Indicators and Monitoring: Land cover percentages of tree canopy, open space/scattered trees, meadow/grow zone, impervious, urban bare and water will be determined via remote sensing and GIS technologies.

Evaluation Process based on Indicators: Removing the BUIs for Fish and Wildlife Populations and the Fish and Wildlife Habitats is about achieving a better balance between the "green" infrastructure and the "gray" impervious infrastructure. The percent composition of the land cover types will be monitored over time to evaluate progress towards achieving this better balance by realizing the Rouge WMP goals of increasing the tree canopy, open space/scattered trees, meadow/grow zone land cover types by decreasing the percentages of the impervious and urban bare land cover types.

Public Involvement: The RRAC and ARC committee structure will be used to plan and implement the project. Reports, press releases and State of the Watershed conferences will be developed, issued and implemented throughout the duration of the project to bring attention to and build awareness of: 1) the importance of green infrastructure to delisting the AOC; 2) what the GI goals are for the watershed; and 3) project assessment results.

3) GREEN INFRASTRUCTURE - IMPLEMENTATION

Description: The 2008 Rouge River Watershed Management Plan Update has outlined a long-term (30 years) storm water runoff volume reduction target for the entire AOC of approximately 300 million cubic feet, with a short-term target of 10% of the total estimate. Storm water runoff volume control can be achieved through numerous types of green infrastructure or low-impact development technologies. Examples of these types of projects include grow zones, rain gardens, bioswales, infiltration basins, storm water basin retrofits, green roofs and pervious pavement. While not typically described as a best management practice, increasing tree canopy coverage provides storm water runoff volume reduction. Other mechanisms with which to reduce volume include capture and reuse of storm water runoff. Initial priority areas for implementation of these strategies include the following:

- Public parkland available for conversion to grow zone or reforestation;
- School properties available for implementation of schoolyard habitats with conversion of turf/impervious areas to grow zone or trees as one type;
- Public impervious parking available for porous pavement retrofitting; and
- Public facility roof top available for conversion to green roof.

Timetable: 2009-2030

Funding Estimate: $50,000,000

Potential Stakeholders: Wayne County Department of Environment/Alliance of Rouge Watershed Communities, schools, school districts and other public institutions.

Indicators and Monitoring: Land cover percentages of tree canopy, open space/scattered trees, meadow/grow zone, impervious, bare urban land and water will be compared before and after implementation of the selected management strategies. At the same time, volume control estimates will be documented and tracked through the CITYgreen© mechanism.

Evaluation Process based on Indicators: Removing the BUIs for fish and wildlife populations and the fish and wildlife habitats is about achieving a better balance between the "green" infrastructure and the "gray" impervious infrastructure. The volume reduction achievements will be monitored over time to evaluate progress towards meeting the long-term targets.

Public Involvement: Public involvement activities will be project-specific; however, the RRAC and ARC community structure will be utilized to continue promoting green infrastructure implementation.

4) GREEN INFRASTRUCTURE - LAND COVER MONITORING

Description: The Rouge AOC has experienced a tremendous loss of natural areas/habitat. These habitat areas with their requisite vegetation establish the watershed's green infrastructure. Using remote sensing and GIS technology and software the land cover within the Rouge AOC will be monitored over the long-term to evaluate progress towards achieving Green Infrastructure land cover targets identified within the 2008 Rouge River Watershed Management Plan (WMP). Through this project leaf-on digital aerial imagery will be obtained classifying the Rouge AOC land cover into tree canopy, open space/scattered trees, meadow/grow zone, impervious, urban bare and water for use in CITYgreen© software analyses. This new dataset will be compared to the 2002 and 1991 land cover datasets released by American Forests under contract to the Michigan Department of Natural Resources (MDNR) as part of the *Southeast Michigan Urban Ecosystem Analysis: Calculating the Value of Nature* (American Forest, 2006) to establish a new baseline of existing conditions and to assess the land cover (habitat) changes that have occurred within the various Rouge AOC storm water management areas. The dataset would allow the AOC stakeholders to assess development and/or restoration projects in terms of the green infrastructure benefits at both the micro (small scale projects) to macro (regional scale initiatives) scales.

Timetable: It is anticipated that this project would occur over approximately two years (2010).

Funding Estimate: $200,000

Potential Stakeholders: Wayne County Department of Environment/Alliance of Rouge Communities (ARC), MDNR and American Forest, Inc. might also be project partners

Indicators and Monitoring: Land cover percentages of tree canopy, open space/scattered trees, meadow/grow zone, impervious, urban bare and water will be determined via remote sensing and GIS technologies.

Evaluation Process based on Indicators: Removing the BUIs for Fish and Wildlife Populations and the Fish and Wildlife Habitats is about achieving a better balance between the "green" infrastructure and the "gray" impervious infrastructure. The percent composition of the land cover types will be monitored over time to evaluate progress towards achieving this better balance by realizing the Rouge WMP goals of increasing the tree canopy, open space/scattered trees, meadow/grow zone land cover types by decreasing the percentages of the impervious and urban bare land cover types.

Public Involvement: The RRAC and ARC committee structure will be used to plan and implement the project. Reports, press releases and State of the Watershed conferences will be developed, issued and implemented throughout the duration of the project to bring attention to and build awareness of: 1) the importance of green infrastructure to delisting the AOC; 2) what the GI goals are for the watershed, and 3) project assessment results.

5) NATURAL AREAS PROGRAM MANAGEMENT FEASIBILITY STUDY

Description: Wayne County is the single largest riparian corridor landowner in the Rouge River AOC (approximately 4,200 acres of riparian corridor) and has spent hundreds of millions of dollars in federal grant funding over the last 20 years to help restore the river. Many of the most recent projects have been green infrastructure grow zone projects that re-establish a more natural/native landscape within the parklands managed by the county. This project would provide funding to perform an institutional assessment and implement organizational changes to establish a Natural Areas Program Management unit within local and county governments. This will ensure the ongoing success of the implemented projects and continued improvement of riparian corridor management activities and techniques by the county and other agencies that will ultimately allow for improving and sustaining fish and wildlife populations in the Rouge River AOC.

Timetable: 2011 – 2012

Funding Estimate: $75,000

Potential Stakeholders: Wayne County Department of Environment, Wayne County Public Services, Wayne County Park, Alliance of Rouge communities, local communities.

Indicators and Monitoring: Site integrity plant and wildlife surveys, infiltration, macroinvertebrate and geomorphic monitoring as well as land cover monitoring.

Evaluation Process based on Indicators: Building upon and relying on the watershed monitoring efforts of Friends of the Rouge, Wayne County and the Alliance of Rouge Communities (ARC), projects will be evaluated based on land area converted to upland grow zones, schools and students involved, as well as physical, chemical and biological improvements realized onsite and throughout the Rouge AOC.

Public Involvement: The RRAC and ARC committee structure will be used to plan, implement and publicize the project. Reports and project profiles will be developed, press releases will be issued and State of the Watershed workshops and conferences will be implemented throughout the duration of the project to bring attention to and build awareness of the importance of managing the riparian corridor as natural areas and to provide information on the progress of ecological restoration.

6) GREEN CORRIDORS

Description: Extension of the Main 1-2 Rouge Green Corridor project initiative across the AOC to include the Lower, Middle and Upper branches of the Rouge River would result in an overall planning and restoration approach between neighboring stakeholders that would seek to develop consistent priorities for restoration implementation.

The Main 1-2 Rouge Green Corridor (RGC) project was completed in 2006 as part of a larger partner-based initiative that includes the Cities of Birmingham, Beverly Hills, Southfield, the Southeast Oakland County Water Authority, Oakland County Planning & Economic Development Services, Oakland County Drain Commissioner, Friends of the Rouge, and the Oakland Land Conservancy, now the Six Rivers Land Conservancy. The project aimed to assist the RGC communities in undertaking a community-based planning and communications "branding" approach to create and promote a unique identity for a specific and distinct riparian greenway corridor along the Rouge River in the Main 1-2 SWMA. This approach was developed to engage citizens, riparian businesses and riparian homeowners in identifying with and taking ownership of their local riparian corridor assets. The project provided local communities with tools to identify and facilitate the promotion, protection and enhancement of the Rouge Green Corridor as a unique community asset in the Rouge River Watershed. The project was limited to the Main 1-2 SWMA and has proven to be successful in educating the public.

Deliverables included RGC Identity Posters, self-guided tour maps and RGC signage in the target area. In addition, prioritizing restoration efforts and focus areas along the corridor would also be important for the local stakeholders. As focus areas in other areas of the Rouge River Watershed are further identified and prioritized through this mechanism, coordinated funding sources may be secured.

Timetable: It is anticipated that this types of overall project will take place within the next five years.

Funding Estimate: $250,000

Potential Stakeholders: The PAC will work to find a sponsor for this project. Potential stakeholders include the Wayne County Department of Environment, Alliance of Rouge Communities, local stakeholder groups and local neighboring communities along each branch of the river.

Indicators and Monitoring: As this project focuses on developing overall coordinated initiatives across the AOC, indicators of its success will be reflected in the participation by AOC stakeholders and their respective involvement in helping to identify and prioritize focus areas.

Evaluation Process based on Indicators: The coordinated green corridor approach will be evaluated based on priorities set in the project and the overall stakeholder involvement.

Public Involvement: Project stakeholders will both publicize the project in their newsletters, in the press and through Internet-based media. In addition, the community public education efforts, through RRAC and the ARC, may be utilized, as feasible, for project public promotion.

7) CONCRETE CHANNEL MODIFICATIONS/ENHANCEMENTS FOR HABITAT AND FISH POPULATIONS

ROUGE RIVER CHANNEL RESTORATION, UPPER AND LOWER SECTIONS

Description: Approximately 2.3 miles of concrete-lined channel exists, between Michigan Avenue and I-94, in the eight-mile long Gateway Partnership area of the Rouge River. This represents approximately one-half of the USACE's flood control project completed in the mid-1970's. The flood control project reduced the channel length from 5.8 miles to 4.2 miles through realignment and straightening. Restoration of this portion of the river would include restoration of riparian shoreline and submerged habitat through the removal of hardened shoreline and inclusion of habitat features such as submerged rock overhangs, willow overhangs and re-creation of clusters of emergent aquatics (i.e. cover habitat) on select riparian littoral shelf locations.

Timetable: It is anticipated that this project will occur within the next ten (10) years.

Funding Estimate: 15,000,000

Potential Stakeholders: RRAC, Wayne County Department of Environment, Alliance of Rouge Communities, U.S. Army Corps of Engineers, the Rouge Gateway Partnership,, including the cities of Dearborn, Melvindale and Allen Park.

Indicators and Monitoring: Indicators would include the various habitat types constructed as part of this project, including the riparian and submerged areas. Monitoring of these indicators is anticipated to include annual vegetation monitoring for a period of time determined through the design process as well as types of wildlife observed during monitoring periods.

Evaluation Process based on Indicators: Removing the BUIs for Fish and Wildlife Populations and the Fish and Wildlife Habitats is about achieving a better balance between the "green" infrastructure and the "gray" impervious infrastructure as mentioned in previous project descriptions. The evaluation process will be in the establishment of a diverse native vegetation and wildlife population from this project.

Public Involvement: The RRAC committee structure would be utilized to promote public involvement activities. At the same time, the project design process would include significant permitting that would entail a public involvement/comment period. Promotion could also be considered through the ARC committee structure with press releases and other communication documents.

8) MICHIGAN AVENUE AND EVERGREEN ROAD STORM WATER TREATMENT AND HABITAT RESTORATION (USACE, 2003)

Description: Storm water runoff from Michigan Avenue, Evergreen Road and a significant developed area to the north is discharged directly to the Rouge River, contributing to erosion on the south side of the river and increasing non-point source pollution loading, including oil and grease, silts and nutrients to the river. Two alternatives are under consideration.

The first alternative consists of restoring the floodplain forest and shoreline habitat that was once present. The actual planting composition would be determined by the extent of excavation and grading in the upstream and downstream restoration areas. Storm water runoff from Michigan Avenue and Evergreen would be routed to create marsh areas suitable to support the constructed wetland hydrology. Key features would include the following:

- Plant floodplain and upland forest where gaps exist;
- Restoration of habitat functions provided by high marsh, low and deep marsh, floodplain shrub/scrub and upland forest;
- Management of exotic and/or nuisance plant species through the project area;
- Implementation of a habitat management and maintenance program; and
- Improvement of the storm water treatment of roadway runoff.

The second alternative incorporates substantial improvements to fish and wildlife resources and substantial water quality improvements. A series of filtration marshes that would collect and treat water from the tributary area would be fully integrated with the successful creation of freshwater marsh and wet prairie and restoration of floodplain forest and shoreline habitat. Two constructed wetlands are proposed on the north and south sides of the Rouge River.

Inlet and outlet control structures will be constructed to manage the volume of storm water routed through the constructed wetlands. A sediment forebay area will be incorporated with an inlet control structure to trap coarse sediment before entering the wetland. Each constructed wetland will be designed using a two-tiered, meandering flow path to provide a diversity of depths to promote diversity of wetland plants and extend the retention time for treatment of pollutants. Inclusion of a micropool area near the outlet control structures will provide a low and deep marsh habitat and ensure cooler temperatures for the water discharged to the Rouge River. Key project components include:

- Excavation of the project area to facilitate construction of a storm water treatment system, maximizing storm water treatment efficiency and allowing for the creation of submerged and emergent herbaceous and/or shrubby wetlands;
- Planting of existing and historic floodplain and uplands forests;
- Control of nuisance species within the project area;
- Design and use of a long-term habitat management and maintenance program; and

- Education/demonstration of storm water treatment alternatives within the Rouge River Basin.

Timetable: While this project has had some preliminary reviews, it is anticipated that design and construction timeframes would be on the order of 5 – 10 years, depending on funding availability.

Funding Estimate: $2,500,000

Potential Stakeholders: RRAC, Wayne County Department of Environment, Alliance of Rouge Communities, U.S. Army Corps of Engineers, Rouge Gateway Partnership, other local communities and groups.

Indicators and Monitoring: Project-specific monitoring would include those components outlined in the habitat management and maintenance program. It is anticipated that a level of annual vegetation monitoring would be included. In addition, a level of storm water volume and water quality control will be achieved through management of the runoff from Michigan Avenue, Evergreen Road and adjacent developments. Monitoring river quality following completion of the project will demonstrate effective management of this excess storm water runoff. At the same time, storm water volume control may be monitored through updates through the CITYgreen© mechanism described previously.

Evaluation Process based on Indicators: Indicators described above including storm water volume, water quality and vegetation/habitat will determine the restoration success. Long-term evaluation is consistent with the delisting targets previously described.

Public Involvement: The RRAC committee structure would be utilized to promote public involvement activities. At the same time, the project design process would include significant permitting that would entail a public involvement/comment period. Promotion could also be considered through the ARC committee structure with press releases and other communication documents.

9) TOURNAMENT PLAYERS GOLF COURSE STORM WATER TREATMENT AND WETLAND RESTORATION (USACE, 2003)

Description: A significant wetland area is located adjacent to the Detroit Water and Sewer Department's Hubbell-Southfield underground storm water basin and the Tournament Player's Club (TPC) Golf Course in the City of Dearborn. The site is located south of Michigan Avenue, east of Evergreen Road and adjacent to the Rouge River Flood Control Project. The wetland is in a deteriorating condition due to high normal pool elevations and lack of fluctuations in the hydro-period. The objectives of a proposed storm water treatment and habitat restoration project at this site include the successful creation and restoration of upland/wetland herbaceous and forested habitat. In addition, this alternative includes restoration of fishery habitat that will be fully integrated with storm water treatment functions and passive recreation opportunities. Specific project features include:

- Interception and pre-treatment of storm water runoff through a system of spreader swales combined with wet meadow overland flow prior to the discharge to a series of freshwater emergent marsh retention systems;
- Creation of a series of interconnected emergent marsh system that will retain storm water for an appropriate duration to provide for substantial removal of nutrients and dissolved solids;
- Creation and restoration of floodplain forest, emergent marsh and wet meadow through a systematic planting and seeding program and hydro-period modification; and
- Management of exotic and/or nuisance vegetation and animal species.

Timetable: While this project has had some preliminary reviews, it is anticipated that design and construction timeframes would be on the order of 5 – 10 years, depending on funding availability.

Funding Estimate: $5,500,000

Potential Stakeholders: RRAC, Wayne County Department of Environment, Alliance of Rouge Communities, US Army Corps of Engineers, Rouge Gateway Partnership, Hertigate Golf Group and other local groups.

Indicators and Monitoring: Indicators would include restoration of native vegetation species along with storm water runoff volume and river water quality. Monitoring river quality following completion of the project will demonstrate effective management of this excess storm water runoff. At the same time, storm water volume control may be monitored through updates through the CITYgreen© mechanism described previously.

Evaluation Process based on Indicators: Indicators described above including storm water volume, water quality and vegetation/habitat will determine the restoration success. Long-term evaluation is consistent with the delisting targets previously described.

Public Involvement: The RRAC committee structure would be utilized to promote public involvement activities. At the same time, the project design process would include significant permitting that would entail a public involvement/comment period. Promotion could also be considered through the ARC committee structure with press releases and other communication documents.

10) OAKWOOD COMMON OXBOW RESTORATION (USACE, 2003)

Description: The Flood Control Project straightened the natural river alignment in this area and effectively created an oxbow wetland behind the Oakwood Common senior residence development community and adjacent to the Tournament Player's Club (TPC) Golf Course. This wetland is hydrologically isolated from the river and has partially filled with sediment. Three (3) alternatives have been considered with the most challenging being a complete reconnection of the oxbow to the Rouge River Channel. While detailed feasibility studies, funding availability and public involvement may ultimately select one of the three alternatives, each of which provides habitat restoration, this project description focuses on the complete reconnection alternative. Hydraulic reconnection of this area with the Rouge River would require dredging to provide adequate flow-through characteristics. Native upland and wetland planting would be installed along the existing shoreline and the reconnected oxbow. The plantings would effectively enhance recreation, provide erosion control, improve storm water management and enhance ecological habitat functions. Numerous fish will benefit from the hydraulic reconnection, including largemouth bass, bowfin and numerous sunfishes.

Timetable: While this project has had some preliminary concepts, it is anticipated that design and construction timeframes would be approximately 5 – 10 years, depending on funding availability.

Funding Estimate: $20,000,000

Potential Stakeholders: RRAC, , Wayne County Department of Environment, Alliance of Rouge Communities, U.S. Army Corps of Engineers, Rouge Gateway Partnership, other local communities and groups.

Indicators and Monitoring: Indicators would include restoration of native vegetation species along with storm water runoff volume and river water quality. Monitoring river quality following completion of the project will demonstrate effective management of this excess storm water runoff. At the same time, storm water volume control may be monitored through updates through the CITYgreen© mechanism described previously.

Evaluation Process based on Indicators: Indicators described above including storm water volume, water quality and vegetation/habitat will determine the restoration success. Long-term evaluation is consistent with the delisting targets previously described.

Public Involvement: The RRAC committee structure would be utilized to promote public involvement activities. At the same time, the project design process would include significant permitting that would entail a public involvement/comment period. Promotion could also be considered through the ARC committee structure with press releases and other communication documents.

11) FORDSON ISLAND HABITAT RESTORATION (USACE, 2003)

Description: Fordson Island is located in the City of Dearborn, just downstream of the Turning Basin on the southwest side of the river. Ongoing negotiations between the property owner and Wayne County have created an opportunity for possible riparian and upland habitat creation/restoration, public recreation and access to the Rouge River. The project objectives include successful restoration of the onshore and offshore habitat of a small island in the Rouge River and providing improved public access and passive recreation opportunities for the local community.

The U.S. Department of Justice and EPA have a consent decree with Marathon Ashland Petroleum LLC, which involves a supplemental project on Fordson Island with an estimated cost of $3.5 million. The anticipated work involves restoration, removal of equipment and environmental assessments. Marathon Ashland Petroleum currently owns a majority of the island and is in the process of transferring this land to Wayne County.

Specific project features important to the success of this project include:

- Removal of solid waste, construction materials and abandoned boats along the shoreline of the island;
- Shoreline restoration with a herbaceous, emergent riparian shelf that is interspersed with pockets of willow overhangs to benefit the adjacent fishery and existing wading bird roost site;
- Creation of upland and wet meadows that are dominated by native grass and shrub species and maximization of passive recreation interaction with pollinator and avian species;
- Restoration and enhancement of forested and scrubby wetland that currently occurs on the island and provides habitat to wading bird species;
- Creation of reef habitat in deep water on the Rouge River side of the island to improve fishery opportunities in the immediate project area;
- Development of an interpretive trail to describe the importance of urban habitat restoration of fish and wildlife species; and
- Management of exotic and/or nuisance vegetation and animal species throughout the project area.

Further investigations to determine federal interest in this project would look at the deepening of the channel west of Fordson Island to determine whether commercial or recreational vessels will use and benefit from the deepening. An evaluation of "incremental depths" to dredge the channel would be needed to determine the greatest achievable benefits versus cost in addition to determining the locations for greatest habitat benefits.

Timetable: While this project has had some preliminary reviews, it is anticipated that design and construction timeframes would be approximately 5 – 10 years, depending on funding availability.

Funding Estimate: $3,500,000

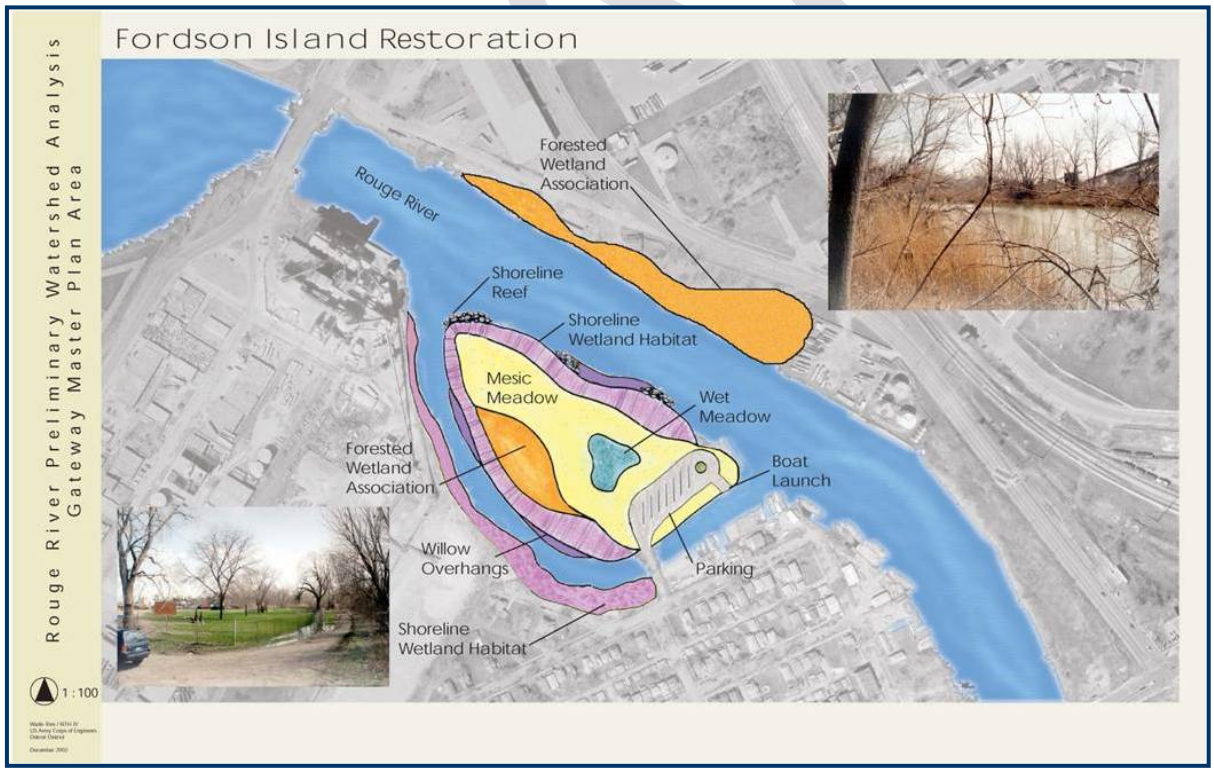
Potential Stakeholders: RRAC, Wayne County Department of Environment, Marathon Ashland Petroleum LLC, U.S. Army Corps of Engineers, Alliance of Rouge Communities and other local communities or groups.

Indicators and Monitoring: Indicators would include restoration of native vegetation species along with storm water runoff volume and river water quality. Monitoring river quality following completion of the project will demonstrate effective management of this excess storm water runoff. At the same time, storm water volume control may be monitored through updates through the CITYgreen© mechanism described previously.

Evaluation Process based on Indicators: Indicators described above including storm water volume, water quality and vegetation/habitat will determine the restoration success. Long-term evaluation is consistent with the delisting targets previously described.

Public Involvement: The RRAC committee structure would be utilized to promote public involvement activities. At the same time, the project design process would include significant permitting that would entail a public involvement/comment period. Promotion could also be considered through the ARC committee structure with press releases and other communication documents.

Figure 7-3: Fordson Island Restoration



12) LAKES AND IMPOUNDMENTS – FEASIBILITY STUDY & RESTORATION

Description: A number of lake restoration projects, including Newburgh and Carpenter lakes, have been completed within the watershed with demonstrated improvements in both fish and wildlife habitat and populations. Other lakes and impoundments across the watershed have significant habitat and recreational potential provided a level of restoration will take place. The extent of restoration for these impoundments would be determined during an initial feasibility study followed by implementation of restoration techniques. Lakes or impoundments for consideration would include, at the least, Walled, Nankin Phoenix and Wilcox lakes.

First, an overall evaluation of lakes in the AOC would be completed to prioritize restoration opportunities based on criteria such as environmental, economic and public involvement factors. Environmental factors for feasibility evaluation would include topics such as level of water quality improvements, extent of benefits provided in working towards the delisting targets, storm water runoff quality and quantity management and the public education value achieved by providing improvements in the local water resources.

Restoration practices for each lake would be determined during this initial feasibility study. Techniques for consideration would include all or some combination of the following: dam/impoundment structural modifications, sediment removal, removal of exotic fish and vegetation species, fish and wildlife habitat enhancements, aesthetic and recreational opportunities, shoreline restoration/stabilization, riparian buffer modifications/conversion to green infrastructure and installation of additional storm water management strategies to control runoff from adjacent areas.

Timetable: As the remaining lakes and impoundments are prioritized, it is anticipated that lake restoration projects would occur over the next decade as funding permits.

Funding Estimate: $30,000,000

Potential Stakeholders: RRAC, Wayne and Oakland counties; Alliance of Rouge Communities; Friends of the Rouge and other local groups and stakeholders.

Indicators and Monitoring: Project-specific monitoring would include documenting fish populations both before and after restoration, documenting changes in water quality and enhancements in native riparian habitat.

Evaluation Process based on Indicators:

Public Involvement: The RRAC committee structure would be utilized to promote public involvement activities. At the same time, the project design process would include significant permitting that would entail a public involvement/comment period. Promotion could also be considered through the ARC committee structure with press releases and other communication documents.

13) EVANS CREEK CONSTRUCTED WETLAND

Description: Evans Creek (also known as Evans Ditch or Evans Branch) is a natural headwater stream tributary to the Rouge River, located in the Rouge River's Main 1-2 Subwatershed. A portion of Evans Creek is located within the campus of Lawrence Technological University. The goal of this implementation project is to create a much needed wetland treatment system in this subwatershed and improve the water quality of Evans Creek by intercepting and treating storm water from the Rummell Drain. The project includes construction of approximately two acres of offline treatment wetlands on the LTU campus, immediately adjacent to the creek and just below the Rummell Drain outlet. This project will provide management of both storm water flow and volume. Due to the large upstream watershed, this project will target flow capture for events of approximately 20% of the first flush (0.5 inches) design event size. The wetland treatment cells will also allow for re-introduction of organisms into the creek by providing aquatic habitat. Alone, this proposed facility can become an example of the kind of Best Management Practice that can remediate (as opposed to "restore") urban streams. As the first of a series of similar facilities, this project could have a significant impact on the channel. In addition, there is another seasonal tributary of Evans Creek on LTU Campus that is a seasonally wet grass swale. This manicured grass channel drains a small portion of the Northwestern Service Drive with most of the service drive draining into a curb and gutter system and being piped into a regional detention facility. This area could be excavated to create stormwater treatment wetlands with drainage from Northwestern being re-routed into the wetland for inline storage and treatment.

Timetable: Design and construction of this project is anticipated to take two years.

Funding Estimate: $750,000 - $1,200,000

Potential Stakeholders: The PAC will work to find a sponsor for this project. Potential stakeholders include Lawrence Technological University and the City of Southfield.

Indicators and Monitoring: Project evaluation will include performance metrics for changes in stream flows and water surface elevations, water quality improvements and wetland vegetative cover. Depth and flows will be continuously measured with the two staff gages/pressure transducers in Evans Creek (the only two on the creek), and one in the South Wetland Cell. Macroinvertebrate surveys and a wetland plant coverage assessment will be conducted approximately nine months after the project has been constructed. Water quality samples will be deployed at the stream and wetland outlet stations both during pre-construction and post construction. During this time, individual timed grab samples from each of the monitoring stations will be analyzed for dissolved oxygen (DO), conductivity, *E. coli*, temperature, total suspended solids (TSS), nutrient, and pH.

Evaluation Process based on Indicators: Performance metrics will include pre- and post-construction improvements in peak flows and water surface elevations and upstream, downstream and wetland outlet pollutants. Success will be defined as finding 1) a statistically significant difference in the pre- and post-construction averages; 2) finding macroinvertebrates and 3) delineating 90% coverage of the planted wetland species. Other

indicators to evaluate project success will include number of students working on the wetland, and the number of public tours every year.

Public Involvement: Project stakeholders will both publicize the project in their newsletters, in the press and through Internet-based media.

14) BOOTH PARK STREAMBANK STABILIZATION

Description: Booth Park, a four-acre park located along the Rouge River, is a highly visible and highly utilized city park in the downtown business district of Birmingham. As the river flows downstream of North Old Woodward and through Booth Park, the floodplain width is drastically reduced by approximately 65%. As a result, the reach of river within Booth Park has produced significant stream bank erosion. This project would address one of the severe stream bank erosion sites and install a floodplain enhancement area within Booth Park. The severe stream bank erosion site located approximately 250 feet downstream of the North Old Woodward Bridge on the east side of the stream and the west side of North Old Woodward. The site is approximately 80 feet in length and has an 18-foot high stream bank with mostly bare soil and some trees and shrubs with exposed roots. Immediately across from the severe erosion site is the location of the proposed floodplain enhancement area. This area will provide additional floodplain width and storage by creating a secondary stream bank and re-grading the existing stream bank on the northwest side of the river. The site will be re-established with a combination of native vegetation and ledge rock walls. By expanding and enhancing the floodway bench, additional benefits will provide for the creation of vernal pools and enhancement of the riparian vegetation, a better connection to the park path system, and increased public awareness of the Rouge River.

Timetable: It is anticipated that this project will occur within the next five (5) years, depending on funding sources.

Funding Estimate: $300,000

Project Stakeholders: City of Birmingham, RRAC, Alliance of Rouge Communities, other local communities and stakeholder groups.

Indicators and Monitoring: Monitoring indicators should include water quality, habitat types, both in-stream and riparian areas, and macroinvertebrate populations.

Evaluation Process based on Indicators: Evaluation should reflect the changes documented in both water quality conditions and habitat conditions and macroinvertebrate populations.

Public Involvement: Project stakeholders will both publicize the project in their newsletters, in the press and through Internet-based media.

8.0 Reporting on Implementation of Habitat and Population Restoration Projects

The RRAC will take an active role in reporting any activities related to significant fish and wildlife restoration efforts. All progress on associated targets will be reported to MDEQ via the PAC support staff or PAC chair. Progress reports will be made on a semi-annual basis (every 6 months) in written format and discussed with the Rouge River AOC coordinator from MDEQ.

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