ROUGE RIVER REPORT CARD

DECEMBER 1999

A Publication of the
ROUGE REMEDIAL ACTION PLAN
ADVISORY COUNCIL

Thank You

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An electronic copy of this Report Card is available on the Stormwater and Remedial Action Plan Unit Homepage, under “related documents”. The homepage can be accessed at: http://www.deq.state.mi.us/swq.

ROUGE RIVER RAP
REMEDIAL ACTION PLAN

1999 Rouge River Watershed Report Card

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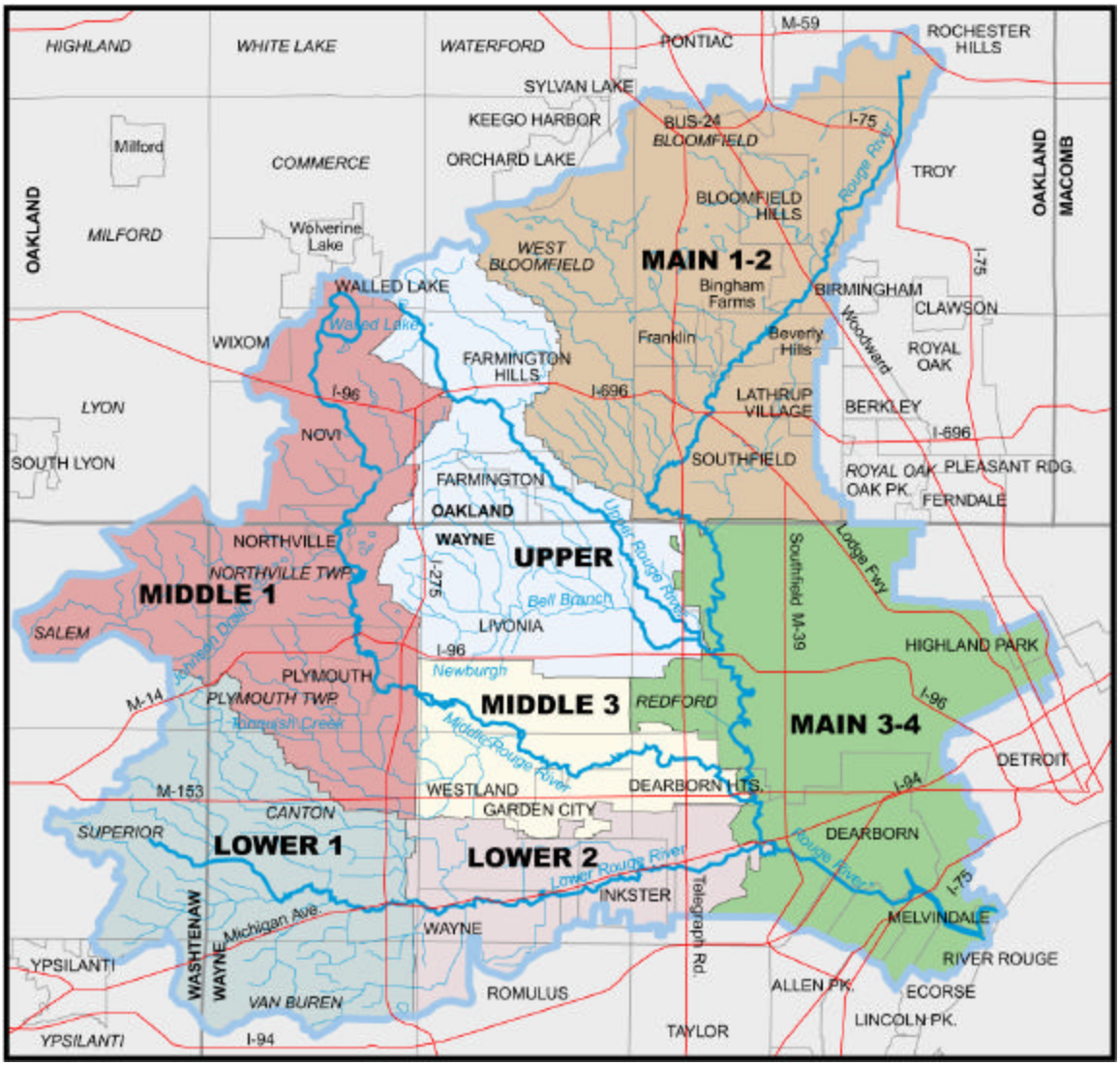
Rouge River Watershed Area Map



Introduction

Why a Report Card?

The *Rouge River Watershed Report Card* is a tool to evaluate both the condition of the river as well as the success of efforts to protect and restore it. One of its main goals is to stimulate thinking and encourage stakeholder participation in the Remedial Action Plan (RAP) revision process. The Report Card is also a tool that local communities may use as a guide when developing their subwatershed management plans. Report Card recommendations may be prioritized and adapted based on decisions made in each subwatershed.

In the late 1980's the original RAP, a nine-volume watershed planning tool, was developed with considerable public input. However, it was a technical document and sometimes difficult to read. The focus of the RAP was to address the concerns of the International Joint Commission regarding rivers that were negatively impacting the Great Lakes. The Rouge Report Card is focused on basic concepts and indicators. It redirects attention to restoring the Rouge at the local level, such as the subwatershed management planning effort required under the MDEQ Voluntary General Stormwater Permit (see Indicators 3,17). The Report Card, developed by the Rouge River RAP Advisory Council (RRAC), provides the opportunity to relay technical information about the Rouge River in an easy-to-read format, as well as provide critical watershed information to direct future restoration efforts.

The Report Card is intended to:

- Provide a brief description of current conditions and progress being made based on specific environmental and performance indicators
- Suggest important environmental and performance indicators that should be evaluated and managed watershed–wide and within each subwatershed
- Help subwatershed stakeholders ask themselves key environmental questions as they begin their watershed planning process under the general storm water permit
- Be updated and published as needed

Why a *Watershed* Report Card?

Many of the current federal and state efforts to improve and protect water quality are based upon a watershed approach focusing more on geographic boundaries defined by drainage areas instead of political boundaries. This approach provides a flexible, coordinated framework that aligns public and private efforts with targeted problems in a watershed. The guiding principles of this approach are stakeholder partnerships, a geographic focus, and sound scientific data. It has been shown that involving the public in watershed planning and decision making generates a high level of support and long term success. Using a watershed approach ensures the most equitable balancing of environmental protection, economic prosperity, and quality of life issues. We need to keep in mind that we all live upstream and/or downstream in a watershed and that each individual action has an effect somewhere in that watershed.

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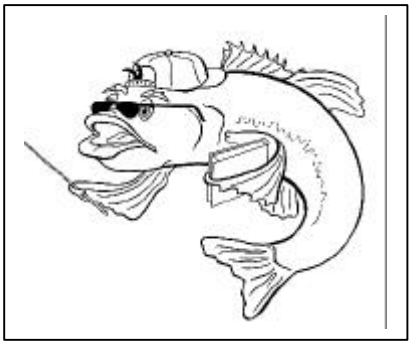
How to Read This Report Card



The *Report Card* is organized into five chapters:

- Caring for Water – The Rouge River
- Caring for Nature – Habitats and Wildlife
- Caring for Community – People
- Restore What is Degraded – Restoration Projects
- Take Responsibility for the Rouge – Stewardship

The first three chapters review the condition of the Rouge watershed and the community's relationship to it: How clean is the water? How are the fish species doing? Is there public awareness throughout the watershed? Each chapter assesses a variety of components that affect the health of the river, such as Stormwater Management, Public Understanding, and Wetlands. The final two chapters search out actions being taken to restore the Rouge: Are successful restoration projects underway? Are businesses and institutions becoming good stewards of the River? Are the efforts going to be sustainable?

The *Report Card* offers an overall picture of progress by covering "Where We Were" and "Where We Are." By suggesting statements for "Where We Want To Be" and "How To Get There", the authors hope to generate thought, encourage discussion, and invite participation in the RAP Revision and Subwatershed Management Planning processes.

Indicators

An indicator is one measure of health that points to the condition of an entire system. In the *Report Card* the overall health and progress within the watershed is rated by 18 indicators. The indicators are interconnected. For instance, eliminating combined sewer overflows (Indicator 2) would lead to major improvements in public health protection (Indicator 4) and reductions in visual evidence of raw sewage (Indicator 15). In addition, it would also lead to improvement of the water quality for riparian and stream habitat (Indicators 7 and 12), increase frog and fish populations (Indicators 9 and 10), which in turn would encourage the public's responsible use and enjoyment of the Rouge (Indicator 15) and lead to more restoration projects (Indicator 16).

Targets

Each indicator is accompanied by targets or "Where We Want To Be" statements. These targets will be finalized by the RAP Revision Process and will serve as short and long-term goals.

In a few of the target date sections, a question mark replaces a date. In those places, either there is not enough information regarding analysis of the current data or funding sources have not been identified. The question mark reflects the evolving nature of this

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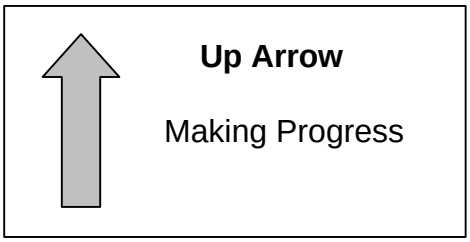
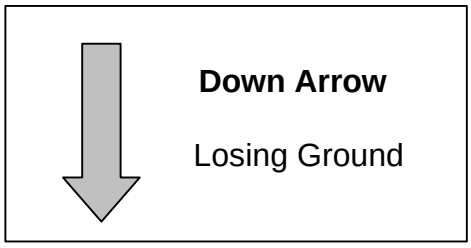
Report Card. As subwatershed management plans develop, specific target dates can be determined.

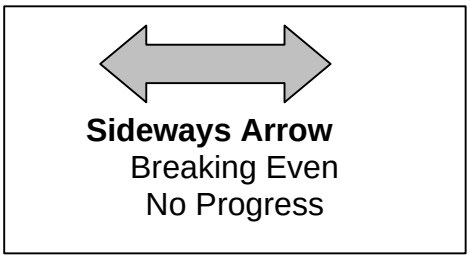
In order to achieve success with the long-term targets, the short-term and medium-term targets must be achieved first. For example, Indicator 4, Public Health (Bacteria), has a long-term goal of restoring the Rouge River so that it is safe for human use. In order to reach that target successfully, the short-term target of putting programs in place to locate illicit discharges and minimize the failure of onsite sewage systems, must first be met. Following the success of the short-term goal, the medium-term target of reducing sources of bacteria carried to the River must be met.

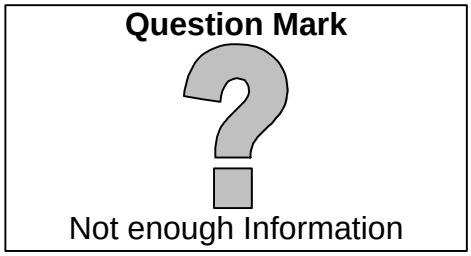
Evaluating Progress

In the *Report Card*, we judge progress wherever possible by determining how much has been accomplished since development of the original 1989 RAP. Additionally, we examine the history of the Rouge, in some sections we look back to pre-settlement times, and in others, back to the creation of the Federal Clean Water Act. If data is known, we measure trends of improvement or decline in the specified indicator areas. If not enough data has been collected, a question mark is used.









Introduction

Looking Ahead: *A Community Effort*

It is important to the success of our restoration and preservation efforts to have one common shared goal. The vision statement for this Report Card and the RAP Revision is as follows:

> *The Rouge community is cooperating to enhance the quality of life of all watershed residents, by protecting and restoring the River, providing clean, healthy, and safe recreational opportunities, and encouraging a thriving and diverse fish and wildlife population.*

As work continues in the Rouge River Watershed, local governments, agencies, citizens, institutions, and businesses are acknowledging their responsibility and are agreeing to work together to implement programs that further protect and restore the River. Please come and join us! **(See pg. 41 for KEY ROUGE CONTACTS)**

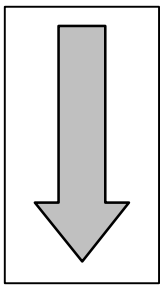
Readers Please Note: Within each INDICATOR, under "Where We Want To Be" and "How To Get There" are statements intended as suggestions only. The actual goals, target dates, recommendations, and actions will be established via the ongoing Voluntary General Storm Water Permit Watershed Management Planning efforts and the RAP Revision process.

Indicator 1: Sanitary Sewer Overflow (SSO)

Sanitary Sewer Capacity and SSOs appear to be a significant problem, again.

Where We Were:
The 1989 RAP identified major SSO problems due to inadequate sewer capacity in many areas of the watershed and established the primary RAP goal: "Protect public health by the elimination of discharges of untreated sewage and the control of discharges of toxic substances to the Rouge River." The RAP also identified the pollution control goal: "Eliminate all wet weather overflows from separate sanitary systems"; and recommended major sewer improvement projects with an estimated cost of $313 million *(pg. Viii RAP Executive Summary)*. These projects included the Evergreen-Farmington (E/F), North Huron Valley/Rouge Valley (NHV/RV), the First Hamilton Relief Sewer projects and Pump Station 2A. Other improvement projects identified included the Western Townships Utility Authority and the Walled Lake/Novi sewer improvement projects. The *1994 RAP Update* identified that most of these improvements have been completed and nearly all separate sewer overflows were believed to have been eliminated at a cost of over $543 million.

Where We Are:
Sanitary Sewer Overflows are recognized as a national problem. In the Rouge, between January and August 1998, 49 SSOs were reported to the MDEQ as a result of 9 different wet weather events. In a report to the Federal Court, dated May 17, 1999, MDEQ confirmed that there are still areas within the Rouge watershed where discharges of untreated sewage are occurring. Most of these SSOs are associated with combined sewer separation projects that are still being monitored for certification that separation had been adequately completed. Sometimes, because of separation, a CSO has become an SSO (although at a much smaller volume because of the major retention of stormwater volumes). Thus, there may be more SSOs but the situation has not necessarily worsened. Some SSOs are associated with internal hydraulic problems within municipal collection systems and/or the inability of the communities to discharge their contract capacity to the county interceptor systems. The SSO sites are generally not the same sites that were originally investigated in the mid-1970s that resulted in the Abatement Orders made by the State leading to the NHV/RV and E/F Correction/improvement programs. In total, the report identified 37 known SSO sites from 11 different communities within Wayne and Oakland Counties.



Where We Want to Be:

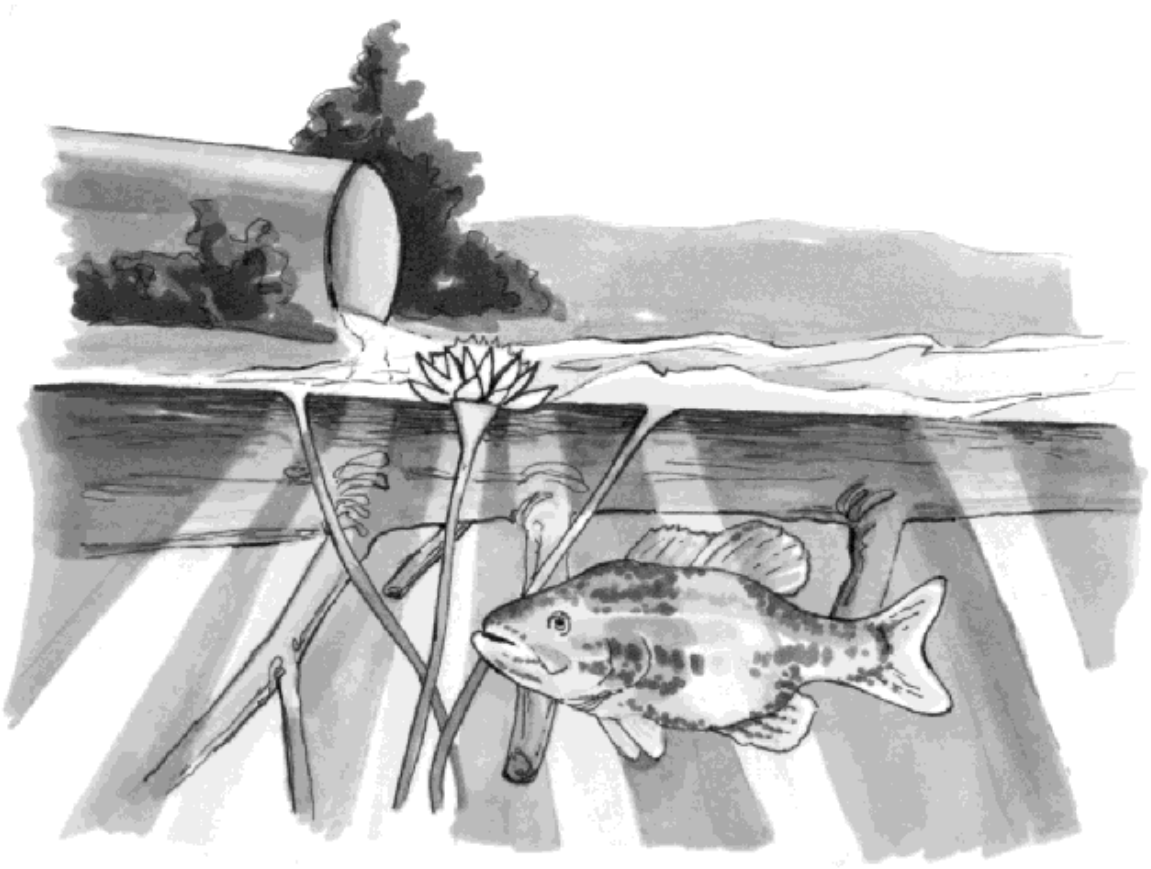
By **2000:** Flow monitoring and evaluation of the sanitary sewer overflow areas will be completed.

By **2002:** Long-term SSO control strategies will be developed and tied into subwatershed management plans. To the extent possible, cost-effective sewer improvement projects will be, and have been, occurring to eliminate SSOs as soon as possible without waiting for completion of a "grand plan" or strategy.

By **? :** Basis of design, plans and specifications, and construction will be completed for all necessary sanitary sewer improvements to eliminate at least 75% of all SSOs throughout the entire Rouge Watershed (See Indicator 2).

How to Get There:

- MDEQ must clarify and enforce SSO reporting requirements. Local communities and county agencies must comply with and identify all known SSO outfalls.
- MDEQ, communities and counties must work cooperatively to answer the questions: Where and why are SSOs occurring? Is development occurring faster than collection and treatment system capacity? Have CSO separation projects resulted in more SSO discharges?
- MDEQ must develop, negotiate, and issue Orders of Abatement and/or issue NPDES permits to correct SSOs.
- MDEQ, EPA, counties, and local communities must work together to secure adequate funding for the timely implementation of cost-effective improvement projects.



Caring For Water - the Rouge River

Indicator 2: Combined *Sewer Overflow (CSO)*

The first phase of CSO control is nearly complete! Questions remain: "Can Phase II be completed by 2005? What will Phase III involve?"

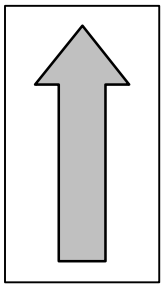
Phase I includes numerous sewer separation projects and construction of "demonstration basins" of various capacities to help determine what constitutes "adequate treatment" of CSOs to meet Phase II and Phase III goals.

Phase II includes providing adequate treatment to protect public health and eliminate raw sewage at all CSO discharges in the Rouge Watershed.

Phase III includes providing adequate treatment to comply with the Michigan Water Quality Standards at times of discharge for all CSO discharges in the Rouge Watershed.

Where We Were:
In 1989, combined sewers served approximately 20% of the watershed (or 59,316 acres). One-hundred fifty-seven (157) outfalls discharged an estimated 7.8 billion gallons per year of raw sanitary sewage and storm water; impacting 89 of the 127 miles of main river channel. Results from these discharges indicated severe drops in dissolved oxygen, unsafe levels of bacteria, sanitary waste, odors, and sediment. The 1989 RAP established the goal: "To eliminate all combined sewer overflows to the extent practicable" and recommended that a phased approach to CSO control be implemented. The estimated price tag for all CSO control was $500 million.

Where We Are:
The six sewer separation projects are complete, and nine of the eleven proposed Phase I CSO demonstration basins are in operation. Since operations commenced, these demonstration basins have treated over 700 million gallons and completely captured for treatment 400 million gallons of combined sewage. When all Phase I projects are complete, over 27,000 acres of CSO area and 83 outfalls will be controlled or eliminated. Forty-four (44) miles of the River will no longer be impacted by untreated CSO discharges and nearly $400 million will have been spent on construction of CSO basins and sewer separation projects. The price tag for Phase II is currently estimated at $700 million. Considerable effort and resources have been expended by the Detroit Water and Sewerage Department (DWSD), Wayne and Oakland Counties, the CSO communities, and MDEQ in trying to get a better handle on the capacity and complexity of the Greater Detroit Regional sewage collection system. Through these efforts, a regional model (the GDRS) and a Rouge River model have been developed. These models have been and will be critical in developing and evaluating the long-term CSO and SSO control strategies throughout the region.



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Where We Want to Be:

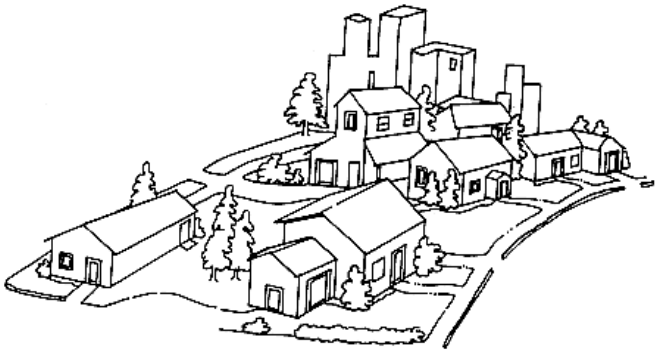
By **2001:** All Phase I CSO demonstration basins will be in operation; performance assessment and monitoring of Phase I CSO facilities and separation projects will be completed; final evaluation reports and the design criteria for future facilities will be selected. CSO control projects and strategies will be clearly integrated with subwatershed management plans (see Indicator 3). Adequate funding/financing will be secured for construction.

By **2005:** Based on existing permit dates, construction of the City of Detroit (DWSD) facilities, upstream of the Ford Rouge Complex plus Baby Creek, will be completed.

By **2008:** The City of Dearborn has completed construction on all phases of its CSO control program. Significant improvements in bacteria level, dissolved oxygen concentrations, and macroinvertebrate communities will be documented as a result of CSO, SSO, and stormwater control projects.

By **? :** The City of Detroit (downstream of the Ford Rouge Plant), and the Cities of Dearborn Heights, Inkster, and Redford Township will have completed construction on phases of their CSO control program in the Rouge River Watershed. Funding and resources will be secured to ensure proper operation and maintenance of facilities and collection systems.

How to Get There*:*



- Communities and counties complete construction of Phase I facilities.
- MDEQ, the CSO communities, and counties must complete the performance monitoring and instream impact evaluations necessary to identify and reach consensus regarding adequate treatment to achieve Phase II and III goals.
- MDEQ must continue to monitor and maintain compliance with CSO NPDES permits and schedules and negotiate permit amendments as appropriate.
- MDEQ, EPA, counties, and local communities must work together to secure adequate funding for the timely implementation of cost-effective projects.

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Indicator 3: Stormwater Management

Although CSO and SSOs remain as top priority pollution sources, stormwater runoff is also a major contributor to the problems throughout the watershed.

Stormwater, and the pollutants it carries, is of major concern for the Rouge River and its tributaries. The huge volume of polluted water that runs off urban pavements creates numerous problems such as streambank erosion, streambed scouring, flooding, and property damage. Polluted stormwater runoff contains bacteria, heavy metals, nutrients, oil and grease, pesticides, and soil particles that negatively impacts the river's health (see Indicators 4,5,6). Minimizing the impacts of development is critical to the restoration of the Rouge River.

Where We Were:

The 1989 RAP identified stormwater as a major contributor to use impairments in 8 of the 11 subwatersheds. The RAP also recommended that all communities and subwatersheds develop and implement stormwater management plans, and that MDEQ issue municipal stormwater permits by 1993. This recommendation failed to materialize because no regulatory framework existed that a regional, or watershed, stormwater management program required.

Where We Are:

The finalized EPA Phase II Stormwater Rules indicate that essentially all communities, highway departments, and some institutions in the Rouge Watershed will be required to obtain stormwater permits. An innovative approach called the Michigan Voluntary General Stormwater Permit has been developed by the MDEQ in cooperation with the Rouge communities, with support from Federal Judge John Feikens and the Rouge Demonstration Project. The Voluntary Permit will meet the requirements of the EPA Phase II Rules. The Permit implements the 1989/90 RAP recommendation for stormwater permits and management plans. Forty-three (43) communities, counties, and agencies, representing over 95% of the watershed land area, have applied for general stormwater permit coverage. The MDEQ is in the process of issuing Certificates of Coverage to these applicants and all permittees have initiated implementation of their public education and illicit discharge elimination plans as required by the permit. The original 11 subwatersheds have been modified to reflect seven stormwater (subwatershed) management areas (see Subwatershed Map, page ii). The communities and agencies from within these seven subwatersheds are meeting regularly, are participating on the RRAC and on the Rouge Steering Committee, and are initiating efforts to develop the subwatershed management plans as required by their permit.

Washtenaw County has in place a nationally recognized stormwater detention ordinance, Wayne County is in the process of implementing similar standards, and many of the communities have their own ordinances to better manage their stormwater. In order to promote cooperation and consistency and avoid duplicity, discussions to identify and implement improvements to these ordinances are occurring.

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Where We Want to Be:

By **2000:** All communities will be implementing their illicit discharge elimination and public education plans.

By **2002:** All communities will have completed subwatershed management plans and will be implementing stormwater pollution prevention initiatives.

By **2005:** Communities will have local and regional processes in place to retain stormwater runoff and utilize best management practices in public worksprojects.

How to Get There*:*

- Working as partners, communities, counties, and other public entities need to incorporate best stormwater management practices in their ordinances as well as their design and construction requirements.
- Develop a uniform stormwater detention ordinance that addresses both stormwater runoff quantity and quality, and can be used by each community.
- Implement the stormwater permit requirements by involving the public in decisions about protecting the River, and identify and eliminate illicit discharges to the River.

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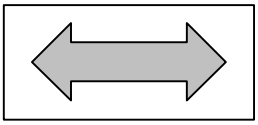
Indicator 4: **Public Health - Bacteria**

Bacterial levels throughout the Rouge River watershed are too high for safe human contact.

Where We Were:
For much of the latter half of this century the Rouge River has been considered unsafe for human contact, a conclusion also reached in a 1987 study completed by the Wayne County Department of Public Health. As a result, official public health warnings, encouraging people not to swim or come in contact with the River were issued. Sources of bacteria contributing to the problem were identified as, sanitary sewer overflows (SSOs), combined sewer overflows (CSOs), failing septic systems, illicit connections, and animal waste in stormwater runoff. The 1989 RAP established the goal: "Make the Rouge River safe for total body contact recreation, to the greatest extent practicable."

Where We Are:

Although significant volumes of raw sewage have been eliminated, most of the Rouge River still does not meet the Michigan water quality criteria for human contact during dry or wet weather conditions. Forty-nine (49) of the 80 bacteria sampling sites sampled from 1993 to 1996 have consistently exceeded the E. coli bacteria standard for total body contact during dry weather. Contributing sources of bacteria remain; SSOs, CSOs (see Indicators 1, 2), failing septics, illicit connections, improper disposal of travel trailer waste, and animal waste. Failure rates of septic systems in some communities of Oakland County were documented at 39 to 52% and 21% in Wayne County. Since 1987, 9% of the 4,000 industrial/commercial businesses tested by Wayne County's illicit connections program have been found to have illicit discharges.

On the bright side, more than 60 of the 157 CSO outfalls have been controlled or eliminated. The new CSO basins have reduced the volume of overflows (from the outfalls they control) by 60 to 80%. The few remaining overflows from these basins receive treatment and disinfection. Results of samples collected from the new CSO treatment basins indicated that they have not increased fecal coliform bacteria counts in the river. One segment of the river along the Middle Rouge River, downstream of Newburgh Lake, has had bacterial levels low enough (during dry weather) to be acceptable for canoeing.

Where We Want to Be:
Water quality has improved so that people's health will not be at risk. They will have a safe and pleasurable experience.

By **2002:** Watershed management plans will be developed that identify specific goals and actions to obtain, or maintain, water quality standards for human use within each subwatershed.

By **?:** 75% of the sampling stations will have demonstrated the river is safe for partial body contact during dry weather.

By **?:** All sampling stations will have demonstrated the river is safe for total body contact during both dry and wet weather sampling.

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How to Get There*:*

- Aggressive implementation of Public Education Plans required under the Voluntary General Storm Water Permit.
- Extend sewer systems into isolated problem areas already surrounded by sewered areas.
- Ensure adequate sewer system capacity available for wet weather flows in proposed new sewered areas.
- Implement illicit discharge elimination plans required by the Voluntary General Storm Water Permit.
- Implement evaluation and management programs for Onsite Sewage Disposal Systems (OSDS).
- Evaluate management of OSDS to determine if more frequent routine inspections are warranted.
- Build additional and more accessible locations for disposal of OSDS waste by septage haulers.
- Continue construction of CSO controls.
- Determine the cause of SSOs and develop a plan to prevent them including a preventative maintenance program.
- Develop techniques to locate illicit discharges in residential areas.
- Present educational programs on topics such as proper disposal of travel trailer and pet waste and problems associated with feeding wildlife.
- Develop a watershed-wide plan for addressing sewer hook-up and OSDS repair hardship cases.

Caring For Water - the Rouge River

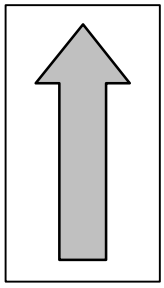
Indicator 5: Public Health - Toxic Chemicals and Fish Consumption Advisories

Toxic chemicals, although present throughout much of the river, do not pose a public health threat. Fish consumption advisories for PCBs may be eliminated in a few years.

Except for localized sediment deposits in the lower portion of the Main Branch, potentially harmful concentrations of toxic chemicals (e.g., metals, polychlorinated biphenyls [PCBs], etc.) are not present in most of the watershed. Existing fish consumption advisories for PCBs may be eliminated in a few years. Consumption advisories for mercury, however, will be in effect statewide for the foreseeable future. Recent water quality sampling indicates that toxic chemical concentrations in the Rouge are minimal.

Where We Were:
Although early small-scale industrial centers were scattered throughout the watershed, most large-scale industrial development – steel making, petroleum refining, etc. – was restricted to the lower portion of the Main Branch. A notable exception was the discharge of PCBs, oils, and metals to Newburgh Lake on the Middle Branch, which contaminated the water, fish, and sediments. The 1989 RAP identified toxics as a major problem in the Rouge River and established the primary RAP goal: "Protect public health by the elimination of discharges of untreated sewage and the control of discharges of toxic substances to the Rouge River." The RAP also identified the "Water Quality" goal: "Determine and eliminate causes of elevated PCB levels in fish in the Lower Main Rouge, the Middle Rouge, and the Lower Rouge."

Where We Are:
Toxic chemical concentrations in the water and sediment in most of the watershed are moderate to low, and are not high enough to cause toxic effects in humans or aquatic animals. There continues to be permitted industrial dischargers within the watershed, but fewer than in 1989. Most are in compliance with their permits. Contaminated sediments in Newburgh Lake have been removed, and the fish consumption advisory for PCBs in the Middle Branch should be removed in the near future. The consumption advisory for mercury will likely remain, due to continuing atmospheric deposition of mercury. Known remaining contaminant "hot spots" are restricted to the lower portion of the Main Branch, downstream of Michigan Avenue, where the sediments are contaminated with PCBs, oils, metals, and polycyclic aromatic hydrocarbons (PAHs). During the summer these sediments also exhibit a strong oxygen demand, and apparently release toxic amounts of ammonia. The extent of contaminant inputs from old landfills, dumps, and stormwater is largely unknown. Public awareness is increasing regarding the proper procedures required for safe and environmentally acceptable disposal of hazardous and toxic chemicals.



Where We Want to Be:
By **2002**: Subwatershed management plans will be developed that identify specific goals and actions for reducing and/or eliminating the discharge and source of toxic substances.

Caring For Water - the Rouge River

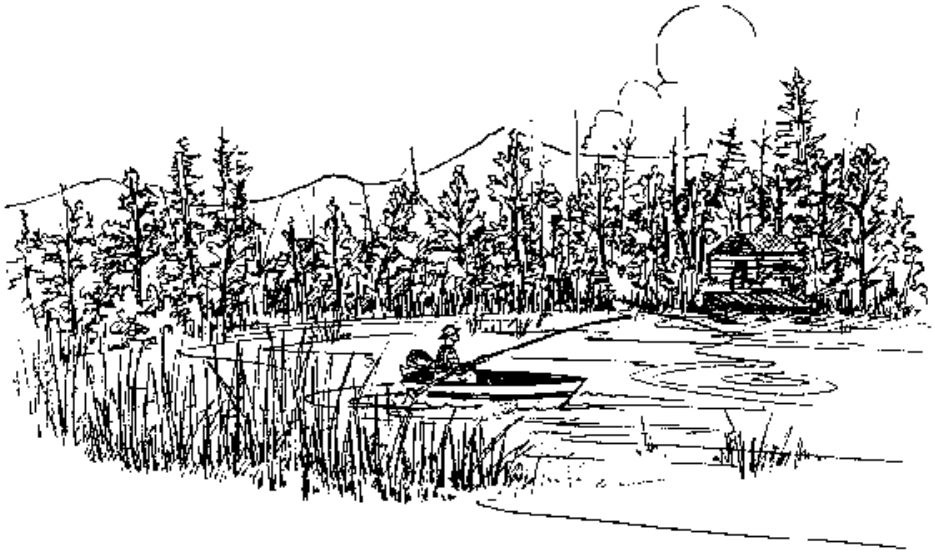
By **2002:** Fish consumption advisories for PCBs in Newburgh Lake and the Middle Rouge River will be removed.

By **2007:** Remaining sediment "hot spots" will be eliminated in all subwatersheds of the Rouge River.

By **? :** Fish consumption advisories for PCBs will be removed from all subwatersheds of the Rouge River.

How to Get There:
Contaminated sediment in the lower portion of the Main Branch – from the concrete channel area downstream of Michigan Avenue, and from specific hot spots downstream of the turning basin, should be removed by the Army Corps of Engineers, MDEQ, communities, and potentially responsible parties (PRPs).

- Regulatory authorities and communities should continue implementation of existing contaminant detection and elimination programs, including illicit connection surveys (counties and communities), resident and caged fish monitoring (MDEQ), the Toxics Release Inventory (U.S. EPA), and the NPDES permitting program (MDEQ).
- The communities and MDEQ should encourage waste separation, reduction, and recycling, especially of plastics and batteries destined for incineration.
- Institute additional actions to minimize discharges of mercury, including collection of wastes from dentists and hospitals.
- Spend 25% of the Clean Michigan Initiative money re-developing brownfield sites within urban areas to help stem sprawl.
- Increase the amount of recyclable mercury by 50% and reduce mercury emissions from industries by 95%.



Caring For Water - the Rouge River

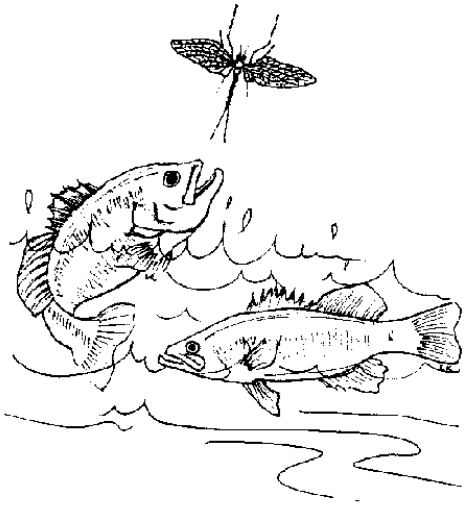
Indicator 6: **Water Quality - Aquatic Life**

Unfortunately, pollution-tolerant species of fish and aquatic insects still dominate in much of the watershed.

Water quality for aquatic life is fair to good in much of the Rouge headwater streams, but is significantly degraded in the lower portions of the watershed. High concentrations of phosphorous, turbidity, and low dissolved oxygen concentrations interfere with reproduction and survival of fish and macroinvertebrates. Highly variable stream flows also impact aquatic life in the river (see Indicator 12).

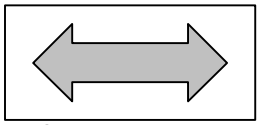
Where We Were:

The 1989 RAP established the "Water Quality" goal: "Reclaim the Rouge River to meet designated uses through the eventual achievement of Water Quality Standards, to the greatest extent practicable." Prior to settlement and urbanization, water quality and quantity in the Rouge River were sufficient to support healthy populations of aquatic insects, fish, and wildlife. Game fish such as pike and panfish were abundant in the River, and sensitive wildlife species such as mink and birds of prey were common. The food chain was anchored by pollution-intolerant macroinvertebrate species such as mayfly and caddisfly nymphs.



Where We Are:

Undeveloped headwater regions and several small tributaries still exhibit relatively high water quality and healthy aquatic life. Although significant improvements have occurred since the passage of the Clean Water Act, the aquatic life in most of the Rouge is still dominated by pollution tolerant fish (carp, suckers) and macroinvertebrate species (midges, worms) (see Indicators 10,11). Sightings of pollution sensitive aquatic life are rare. Specific problems include elevated phosphorous concentrations, low dissolved oxygen concentrations in the warmer months (especially in the Main Branch), sedimentation that smothers habitat, and excessive turbidity during rainstorms. Low dissolved oxygen levels are caused by a number of sources including CSOs, SSOs, failing septic systems, and illicit connections (see Indicators 1,2,3,4): Removal of streamside vegetation has created increases in summer stream temperatures, amplifying the dissolved oxygen problem. Streambank erosion and inadequate



construction site erosion control cause excessive turbidity. Toxic chemicals are not a problem in most of the watershed, except for contaminated sediments in the very lower portion of the Main Branch. Highly fluctuating stream flow is also a major problem (see Indicator 12).

Where We Want to Be:

By **2002:** Plans and ordinances will be implemented that protect and preserve habitat areas that exhibit healthy aquatic life and contribute to high water quality. A riparian tree and re-vegetation program will be established to lower stream temperatures. Plans will be developed for reducing and monitoring turbidity by aggressively enforcing soil erosion ordinances at construction and farm sites. Rouge parkland managers will be leading by example using eco-friendly watershed management practices.

By **2005:** Dissolved oxygen levels will be improved, nutrient sources will be reduced, and contaminated sediments will be addressed. Bioengineering techniques will be the predominant method used to address eroding stream banks.

By **? :** River water quality will be restored so that it meets or exceeds water quality standards for dissolved oxygen, nutrients, and toxic substances in 90% of the river, 100% of the time. Appropriate water temperatures will be maintained throughout the watershed (see Indicator 7).

How to Get There*:*

- Local communities and agencies must develop, implement, and enforce Subwatershed Management Plans (including the Pollution Prevention Initiative), and ordinances that decrease stream flow variations, nutrient inputs, soil erosion, chemical contaminants, and increase dissolved oxygen concentrations.
- MDEQ, counties, agencies, and communities must ensure that CSOs, SSOs, illicit connections, leaking septic systems, polluted stormwater runoff are controlled and/or eliminated.
- MDEQ, communities, counties, and agencies should work together to remove sediments from the concrete channel and eliminate or modify existing fish passage barriers (i.e., dams) where feasible.
- MDEQ, permittees, academia, and Friends of the Rouge should work together to establish a watershed-wide certified volunteer monitoring program. Priority monitoring points can be identified in each community, and factors to be monitored and methods to be used can be decided. Community teams of 8-12 volunteers can be trained and certified.
- All parties must work together to educate the public and businesses on best management practices to prevent the addition to the river of nutrients, sediment, toxic chemicals, and organic matter that uses up oxygen (see Indicators 13, 18).

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Indicator 7: Riparian Corridor

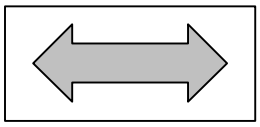
Much of the riparian corridor exists within public lands – continued protection, restoration, and improved management of the riparian corridor will be critical to river restoration and protection efforts.

The riparian corridor consists of natural areas, such as wetlands, woodlands, and meadows, that are adjacent to rivers or streams. These areas are valuable because they provide fish and wildlife habitat, corridors for wildlife migration, stream bank protection, water quality protection, flood storage, and recreational and educational opportunities.

Where We Were:
Recognizing the importance of the riparian corridor, the 1989 RAP established the "Resource Development" goal: "Preserve lands adjacent to the Rouge River such as wetlands and floodplains that are needed to enhance the river's water quality and recreation potential."

Prior to European settlement, the riparian corridor was extensive and continuous. It supported fish and wildlife species as well as provided a broad floodplain for the retention and movement of floodwater. During agricultural development, streamside trees and shrubs were often stripped to create more room for farm fields. When urban development followed, more streamside trees and shrubs were removed, portions of the floodplain were filled, and the degraded streams were often channelized or piped to move water more efficiently downstream.

Where We Are:
Fortunately, much of the Rouge River's floodplain has been left intact; over 116 miles of Rouge River are within public parklands or other recreational areas and much of this is still forested. Unfortunately, the management/maintenance practices of public and private riparian landowners often favor the removal of streamside vegetation and mowing right to the edge of the river. In addition, the extent and continuity of the floodplain and riparian corridor is being reduced and fragmented; only 42% (393 miles) of the total 912 miles of Rouge River streams and tributaries have a significant band (>100 feet buffer) of riparian vegetation (WCRPO GIS analysis).



Although the extent of riparian habitat in the Rouge River has been disturbed over the years, some stretches of the river corridor are still sufficiently intact to help support a healthy river ecosystem. This is true in the headwater areas where lack of development and recent resource protection efforts are combining to preserve more of the river corridor. This is also true in the more developed, downstream subwatersheds where much of the riparian corridor has been preserved in parklands. Opportunities exist to maintain and improve the ability of these areas to function as floodplain and floodwater storage areas in order to provide critical fish and wildlife habitat, and recreational resources.

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Where We Want to Be:
Preserve healthy riparian areas and restore damaged streamside habitats within the watershed.

By **2002:** The goal of "No net loss" of riparian corridor will be established and pilot projects will be underway to promote riparian corridor revegetation, restoration, and maintenance. An inventory of the riparian corridor will be performed and a base line map will be produced.

By **2005:** Management plans will be implemented that identify and prioritize critical habitat and riparian corridor revegetation/restoration projects.

By **2010:** An additional 75 miles of 100-200 foot wide riparian corridor habitat will be established.

How to Get There:
- Develop and implement land use planning ordinances and purchase development rights, to ensure proper management of the riparian areas, including the 100-year floodplain.
- Citizens, agencies, businesses, and municipalities implement restoration projects at all streams in the watershed. Encourage the use of native plant species whenever possible in planting programs.
- Create and implement an education program for the public that sets explains the benefits of maintaining and restoring the riparian corridor. Provide education regarding the importance of preserving all existing forested floodplains in the watershed (see Indicator 13).

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Indicator 8: Wetlands, Woodlands, and Meadows

Significant losses have occurred but tremendous opportunity still exists!

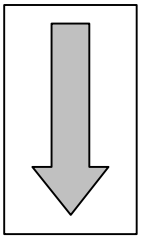
Wetlands, woodlands, and meadows in the watershed contribute greatly to the biodiversity of southeast Michigan and provide many benefits. These areas provide fish and wildlife habitat as well as supply food, cover, and breeding sites that are essential to maintaining biodiversity. Wetlands and other vegetated areas trap sediment and nutrients that would otherwise pollute the river. They also provide floodwater storage and reduce the velocity of floodwater. Where woodlands occur along a section of stream, trees shade the river, thus moderating stream temperatures. Tree root systems stabilize stream banks and help prevent erosion. These habitats decrease the amounts of pollutants entering the river by eliminating the need for high maintenance mowing regimes and the applications of herbicides, fertilizers, and pesticides. Wetlands, woodlands, and meadows increase infiltration of storm water into the soil, thus minimizing overland runoff and river flooding.

Where We Were:
The Rouge River watershed, comprised of portions of Wayne, Oakland, and Washtenaw Counties, was extensively covered by wetlands before European settlement. As settlement proceeded, people viewed wetlands as "useless swamps" and "wasted land."

While estimates of the amount of original forest cover vary, most experts believe as much as 80% of the watershed was forested prior to European settlement. In the previous two centuries, land has been cleared to make way for agriculture, roads, commercial/industrial uses, and residential communities.

The amount of pre-settlement land that was prairie or meadow is unknown. Traditionally, meadows have been ignored or perceived as land waiting to be developed, farmed, or mowed.

Where We Are:
Analysis based on 1995 MIRIS land use/land cover data indicates that only approximately 4.2%, or 12,425 acres, of the watershed is wetlands. The majority of wetland loss can be attributed to agricultural drainage, urban development, and road construction. In recent decades, there has been a greater understanding of the ecological value of preserving wetlands for floodwater storage and for protecting biodiversity. Recognizing this, several headwater communities have created wetland ordinances to protect wetlands from development or other disturbances.



The 1995 MIRIS analysis of land use in the watershed indicates that 7.4 %, or 22,127 acres, is presently forested or shrub land. More woodlands remain in the headwaters than in other areas. While many communities have created ordinances to protect trees, development pressures continue to threaten woodlands, including forested wetlands.

Based on 1995 MIRIS land use analysis the Rouge watershed currently has 5.1%, or 15,151 acres of meadows. Much of this land occurs in the rapidly developing headwater areas of the watershed. In developed areas, the majority of open spaces such as parks,

schoolyards, and corporate campuses are being managed as frequently mowed, highly manicured lawns.
Throughout the watershed there are opportunities to protect existing habitat areas as well as create and restore wetlands, woodlands, and meadows. This can be done by re-establishing natural drainage and revegetating areas with native species. These activities will benefit both stormwater management (floodwater storage) and habitat restoration efforts (biodiversity).

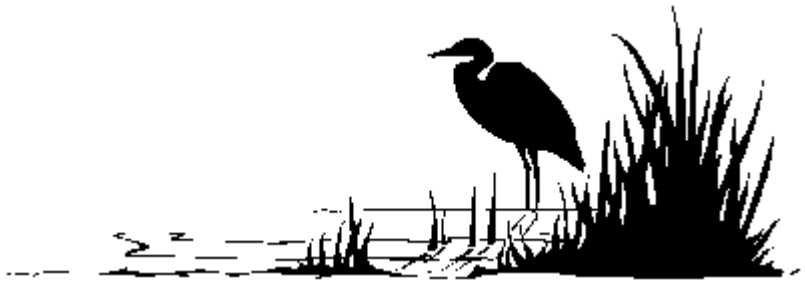
Where We Want to Be:
The Canadian Wildlife Service suggests that healthy watersheds have 10% of their land area as wetland. The International Joint Commission's Areas of Concern program has targeted 30% forest cover for healthy watersheds, while the World Wildlife Fund has suggested 25%. For portions of the Rouge this may be difficult to attain. Still, in a highly urbanized watershed, there are ways to promote the positive effects of natural landscapes including increasing the amount of tree and meadow cover within urban communities. Meadows should not replace woodlands or wetlands in a regenerating watershed, but should be protected or created where possible to increase stormwater infiltration and establish critical links between habitats.

By **2002:** The goal of "No net loss" of wetlands, woodlands, and meadows will be established and pilot projects will be underway to promote wetlands, woodlands, and meadows creation, restoration, and management. An inventory of wetlands, woodlands, and meadows will be performed in each subwatershed.

By **2005:** Management plans will be developed that identify and prioritize critical habitat and re-vegetation/ restoration projects.

By **2007:** 50% of the implementation of the management plan will be completed. Measurable increases in wildlife will be documented in currently existing and new habitat areas (Indicators 9,10, 11), and flooding and bank erosion will be significantly reduced (Indicator 12).

By **2010:** The preservation of **?** acres, the creation of **?** acres and the restoration of **?** acres of wetlands, woodlands, and meadows will be accomplished.



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How to Get There:

- As part of their long-range watershed management plans, all communities and subwatersheds should evaluate their existing wetland, woodland, and meadow resources for restoration opportunities.
- Communities should develop and implement land use planning ordinances, and land preservation programs that prevent misuse of these natural habitat areas and their resources.
- Promote comprehensive integration of these elements into subwatershed management plans.
- Citizens, agencies, businesses, particularly landscaping designers and nurseries, and municipalities should be educated and encouraged to plan and organize projects using native species.

- In order to increase ecological function and biological diversity there should be additional restoration efforts in areas where forests and meadows have been removed or disturbed.
- Restoration efforts should be made to target public and private landowners to assess their management practices, to examine landscape preferences, and aid in the identification of alternative landscape options that promote ecological health.
- Urban tree planting should occur through groups such as the Greening of Detroit and active National Arbor Day Foundation Tree City USA programs.
- Preservation of native soils, or enrichment of altered soils, is an important element in the protection of water quality within the watershed. Topsoil stripped during new residential and commercial development should be left on site to reduce sedimentation, increase infiltration of water, and promote the development of deep root systems to reduce the need for artificial irrigation.
- Federal, State, and Local interests should actively support the Southeast Michigan Greenways Initiative.
- Adopt weed ordinances that allow persons to manage their property as backyard wildlife habitats, following the guidelines of the National Wildlife Federation.

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Indicator 9: **Wildlife: Birds, Frogs and Toads**

Many birds and amphibians make their home in the Rouge River Watershed. Their presence, absence, and abundance will be the true indicator of success.

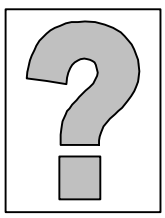
What happens to, and on, the land determines the quality of the water. The diversity of species and the number of individuals provide a good indicator of habitat quality across a landscape. Some species are habitat specialists and their presence or absence is a meaningful indicator of the health of associated habitat types. Other species are "area sensitive." Their success requires large areas of contiguous habitat.

Many frogs and other amphibians make their home in the Rouge River watershed. Due to their sensitive nature, their presence or absence is a meaningful indicator of both water quality and the presence of quality habitat. Frogs indicate the presence of clean, still waters, which all amphibians need during their egg and tadpole stages. As adults, frogs spend much of their life foraging food between wetland and upland habitats; consequently, their presence represents the existence of important linkages, or “corridors”, between quality wetland and upland habitats.

Where We Were:
Approximately 135 species of birds have been identified as having had nesting populations within Wayne County and that number may be considered representative of the bird populations expected to be in the watershed.

Good historical data do not exist on past frog populations within the Rouge Watershed. But since frogs are impacted by urban development, the watershed undoubtedly had more frogs in the past than it does today. Anecdotal reports from long-time residents note a decline in frog and toad populations in recent decades.

Where We Are:



Compared to the period 1880-1915, 82 of those 135 bird species have significantly decreased breeding populations or no longer breed in Wayne County. (Craves, J.A., *Historical Changes in the Breeding Bird Populations of Wayne County*, *Michigan.* Rouge River Bird Observatory, University of Michigan-Dearborn, in press.)

According to the results of the “1998 Frog and Toad Survey”, sponsored

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by Friends of the Rouge, populations of the Wood and Western Chorus Frog, the Spring Peeper, and the American Toad still exist in much of the Middle 1 Subwatershed. Professional observations from recently constructed and enhanced wetlands along the Lower Rouge River in Inkster also indicate the presence of a number of frog and toad species.

Where We Want to Be:

By **2001:** Survey methods will be established, funding will be secured, volunteers will participate, and efforts will be publicized in each subwatershed to complete inventories consistently. This will insure comparable data and allow population trends and distribution over time to be identified.

By **2005**: Baseline monitoring data for frogs, including, the Wood Frog, Western Chorus Frog, Spring Peeper, and American Toad in each of the Rouge Subwatersheds will be completed. In order to measure the success of Rouge restoration and protection efforts realistic goals for frog and toad distribution will be established in each subwatershed. Goals may range from “Maintaining the presence of…” to "Reestablish the presence of …in select locations…”

By **2007**: Bird breeding data that indicate increases in both population size and target species richness will be documented to verify improved habitat conditions. Frog and toad data will be documented that indicates successful Rouge protection and restoration efforts.

By **? :** Goals for birds and amphibian populations will be realized.

How to Get There:

- MDNR/MDEQ, academia, nonprofit organizations, local communities, and agencies support the establishment of a network of volunteer birders who will consistently provide data to a survey coordinator. The survey coordinator will compile, summarize, and present the data for both evaluation and educational purposes.
- MDNR/MDEQ, academia, nonprofit organizations, local communities, and agencies continue the volunteer “Frog and Toad Survey” initiated in the Middle 1 Subwatershed and expand into all subwatersheds. Compile this data as well as other existing data sources into a comprehensive data set for use in subwatershed management planning.
- Local communities and agencies should institute appropriate land-use planning and site plan design that promotes the restoration and protection of high quality habitats (see Indicators 7,8,12).

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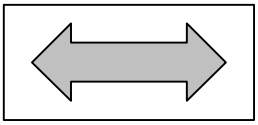
Indicator 10: **Fish**

More fish inhabit the Rouge River than people realize and for such an urbanized river the potential for improvement is exciting!

Fish are among the best overall measures of a river's health because their presence indicates successful functioning of many complex variables including stream flow, water temperature, water quality, and channel habitat.

Where We Were:
Historically, over 60 species of fish have been documented in the watershed. Species such as northern pike, white sucker, largemouth bass, walleye, channel catfish, white and black crappie, and various sunfish were present. Several other species were found in neighboring streams and were most likely present in the Rouge. Some of these species include lake sturgeon, muskellunge, white bass, lake whitefish, walleye, smallmouth bass, and yellow perch. All of these species are still present in the area and could return to the Rouge provided habitat, water quality, and connectivity within the river and to the Great Lakes is restored.

Where We Are:
The overall fishery is still considered poor. In 1995, over 50 species of fish were identified in the watershed. Those historical species missing are generally the larger, more desirable gamefish species such as walleye and smallmouth bass, and water quality sensitive species such as certain minnows, darters, and sculpins. The downstream, larger reaches of the Rouge River have the greatest potential for developing recreational sport fisheries. Because of the size and shape of the Rouge River watershed, game fish populations in these reaches would serve as important sources for seasonal migration to the upstream tributary branches and their headwaters. Furthermore, close proximity to the Detroit River (and migratory Great Lakes fishes) gives these lower sections of the Rouge an even greater fishery potential than would otherwise be predicted. Fish communities in headwater streams of the Rouge are in relatively good condition. Fish communities in the lower, downstream portions of the Rouge are severely degraded and appear strongly limited by poor water quality. (Reference: *Rouge River Assessment: Fisheries Division Special Report 22;* Jennifer Beam and Jeff Braunscheidel, September 1998) Base flow enhancement has dramatically increased the fishery potential of the Lower Rouge River. Continued attention to rehabilitation of this branch will be well worth the effort. Observed (1994) water temperatures are consistent with targets for a restored fish community. Continued monitoring is recommended. The surprising cool and stable temperatures in much of the river depend on careful maintenance of the riparian shading (see Indicator 7). Existing hydrologic (flow) regimes show typical effects of urban basin development: elevated storm flows and reduced baseflows. Most of the gaged sites in the Rouge have storm flow yields two to three times greater than would be typical in Michigan rivers that provide prime habitat for the identified target fish species. Significant, watershed-wide



reductions in stormwater runoff are necessary to achieve fisheries rehabilitation targets. (Reference: *Ecological Targets for Rehabilitation of the Rouge River;* P. Seelbach, et.al, 1998) Fish consumption advisories remain in effect for PCBs and mercury (see Indicator 5). Johnson Creek has been re-designated as a cold water fishery and may be supporting stocked brown trout.

Where We Want to Be:

By **2002:** Watershed management plans will be developed and are being implemented that identify specific goals and actions for maintaining existing fish communities, and achieving fisheries rehabilitation targets for each subwatershed.

By **2005:** A balanced fish population will be restored to the Middle Branch of the Rouge River, including Newburgh Lake. Management activities will be identified and implemented to realize the fisheries potential of the Lower Rouge River.

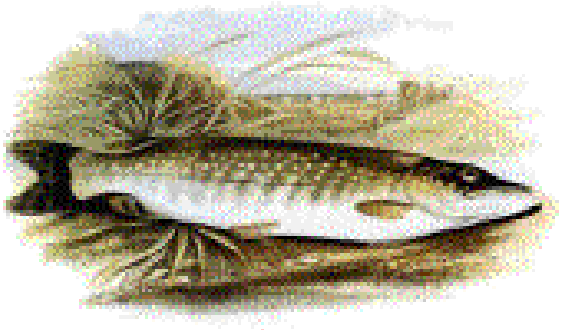
By **2007:** Fisheries will be improved by allowing the return of game fish that were unable to access the upper portions of the watershed by providing fish passage at the Ford Fair Lane Estate dam. Other impediments such as the paved channel downstream of Michigan Avenue will be mitigated.

By **? :** Healthy fish populations in the Middle Branch, including brown trout in Johnson Creek, will be maintained; a balanced fish population will be restored to the Lower, and Main Branches.

By **? :** A restored fishery will be established consistent with subwatershed rehabilitation targets and typical of similar southern Michigan river systems.

How to Get There:

- Continue implementation of water quality restoration and protection programs, including the CSO program and the implementation of the General Stormwater Permit .
- Evaluate the results of the investigations conducted by MDNR Fisheries, the University of Michigan, and the RPO. All local agencies and subwatersheds perform the evaluation, and then identify specific fisheries targets and actions.
- Implement local programs and practices that protect headwater streams where good fisheries already exist.
- Modify or eliminate dams or other fish migration barriers, reduce watershed wide stormwater runoff, and develop instream fish habitat improvement projects
- MDNR must work actively and cooperatively with all subwatershed management groups to identify and implement fisheries management actions and strategies for each subwatershed.



Indicator 11: **Benthos**

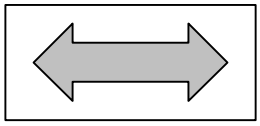
Benthos are often the best indicator of water quality and the overall health of an aquatic system.

Benthos, the community of biological organisms found on the bottom in rivers or lakes, is often the best indicator of long-term water quality and a reflection of the overall health of an aquatic system. Benthic organisms fulfill basic needs of the aquatic community similar to the way terrestrial organisms (insects, worms, snails, and other small plant and animal species) support land-based communities. Benthic populations respond to positive and negative changes in the aquatic environment and those changes are often the first indication of problems or evidence of the successful restoration of water quality.

Where We Were:

The benthic community typically found in a watershed like the Rouge River is highly variable with specific organisms dominating particular sections of the stream, depending upon the amount of current, turbidity, substrate, and nutrients. Benthos in the slower moving, silty bottom, turbid lower sections of the Rouge would normally contain macroinvertebrates such as burrowing mayflies, dragonfly nymphs, alder fly larvae, some small worms, and a mix of small and large mollusks. The benthic species gradually change as the bottom materials shift from silt to sands and gravel upstream and as the current increases. In headwater areas of the Rouge, information about the original, natural benthic community is entirely speculative. Most biologists, however would be inclined to state that the original benthic community very likely included a more sensitive and diverse biological community than is currently present, including more species of mayfly, caddisfly, and stonefly.

Where We Are:



Lower Mainstream of the Rouge: Large portions of the lower Rouge River are devoid of significant benthos. Substantial channelization and the concrete lining of a portion of the lower river has essentially eliminated habitat needed to support a viable benthic community. Even in areas of the lower river that have not been channelized or dredged, the poor condition of the bottom sediments limits the survival of all but the most tolerant species. While the water quality has substantially improved in the lower river over the last two decades, without habitat restoration the river's benthic community may not recover.

Mid-Reaches of the Rouge: Areas below CSO and SSO discharges are dominated by pollution tolerant benthic species where adequate substrate or habitat exists to support them. In many areas, excessive flows and shifting sediments limit the benthic community. Upstream of the CSOs and SSOs water quality is better; however, due to their scouring effects, peak flood flows remain a physical limitation on the development of the benthic communities.

Headwater Areas: Significant portions of the headwater areas still support a diverse benthic community, including fairly pollution sensitive species of caddisflies and mayflies. Since many areas are impacted by the rapid development occurring in the headwaters, efforts should be directed to minimize these changes.

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Where We Want to Be:

By **2002:** Watershed management plans will be developed and are being implemented that identify the use of benthos monitoring as a method of evaluating success of restoration and protection efforts for each subwatershed.

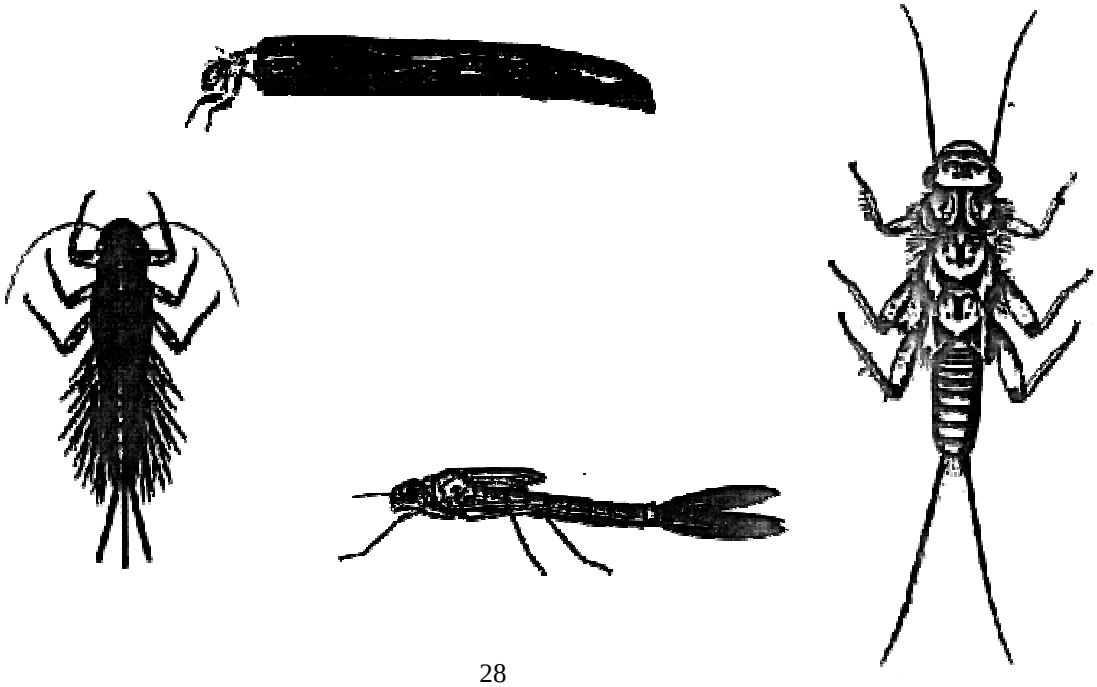
By **2005:** Significant improvements in benthic communities will be occurring in river stretches downstream of water quality improvement projects such as CSO elimination/reduction and stormwater management activities.

By **2007:** It will be reported that the benthic communities inhabiting the Rouge River are recovering and pollution sensitive species are becoming more abundant and widespread.

By **?:** Desirable benthic communities will be restored upstream of the concrete channel and are similar in species composition to those benthic communities reported in other Southern Michigan waters. Flow fluctuations watershed-wide will be stabilized.

How to Get There:

- Implement BMPs to stabilize flow fluctuations, remove contaminated sediments from the lower portion of the Main Branch, and reduce sediment inputs from road crossings, steambank erosion, and construction sites.
- Continue efforts and commitments to control SSOs, CSOs and stormwater.
- MDEQ, academia, nonprofit organizations, local communities, and agencies continue the professional staff and volunteer monitoring efforts initiated by Friends of the Rouge and expand into all subwatersheds.



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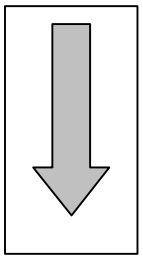
Indicator 12: **Stream Flow and Habitat**

Expected improvements in water quality will be negated without significant reductions in flooding and stream velocities. Flow regime plays a crucial role in many aspects of a river's health. (See Indicators 3, 6, 10,11)

Where We Were:
Recognizing that stream flow acting on the valley creates (or destroys) habitat, the 1989 RAP established the "Resource Development" goal: "Improve the natural hydraulics of the river system"; and the "Pollution Control" goal: "Reduce the impact of increased, high flow stormwater discharges that cause scouring, erosion, and sedimentation in the stream channel." In the pre-settlement period, the Rouge River Watershed contained abundant wetlands and areas of permeable soils that reduced the frequency and intensity of floods caused by snowmelt and rainstorms. The river has always been subject to some flooding, particularly in the lower portions of the watershed due to the soil types and relatively low gradient. However, many of the headwater areas historically had relatively stable flows and clear, cool water as was evidenced by the siting of the federal whitefish and trout hatchery in Northville, Michigan in the late 1800's in the headwaters of the Middle Branch of the Rouge.

Where We Are:
Fortunately, much of the River's natural floodplain still exists as parklands and in certain areas of the headwaters and tributaries, riparian habitat quality is relatively good. Unfortunately, habitat quality overall is poor in most of the watershed. Urbanization of the watershed has significantly increased the amount of impermeable surfaces through the development of residential, commercial and industrial buildings, parking lots, and roads. Wetland areas for the storage of water have also been significantly reduced. Stormwater and snowmelt, once infiltrated into the ground or was stored in wetlands, now flows rapidly, with increasing force to the river, creating severe flooding, erosion, and sedimentation



The frequency, duration, intensity, and volume of flood flows have steadily increased in the Rouge and threatens to vertically disconnect the river from its floodplain. The volume and velocity of flood flows increases bank erosion, property damage, and sedimentation, and literally scours the bottom of the river destroying aquatic habitat. Total annual volumes in the river have nearly doubled in some areas; peak flows have more than doubled as more and more of the total flow occurs immediately following storm events or major snowmelts. Summer base flows are much lower as a result and further limit the available aquatic habitat and intensify water quality problems. Without a significant reduction in flood volumes and velocities, property damage will continue and the restoration of aquatic habitat and preferred fish populations will not be possible in many subwatersheds, this in spite of improvements expected in water quality. Without direct actions to increase stormwater storage and infiltration, rapid urbanization in the remaining undeveloped headwaters will destroy existing healthy areas while increasing flooding, flow velocities, and related problems downstream.

Caring For Nature - Habitats and Wildlife

Where We Want to Be:

By **2001**: Subwatershed flow management plans will be developed and implemented to address the increased frequency of flooding, to maintain the river's connectivity to it's floodplain, and to identify and protect critical groundwater recharge and wetland areas.

By **2002:** Runoff from new developments and new road construction will be reduced through the use of on-site retention, created wetlands, and increased use of swales and other best management practices (BMPs). Pilot projects such as off-channel storage of stormwater will be completed in already developed areas.

By **2005:** There will be widespread acceptance and application of BMPs by commercial, residential, and industrial site designers. The natural flow regimes in headwater areas will be preserved.

By **2010:** The trend of increased frequency, duration, and intensity of flood flows will be reversed. Property damage and bank erosion will be significantly reduced. Desirable fish and benthic populations will be returned in areas previously devoid of their presence.

How to Get There*:*

- Adopt consistent, countywide ordinances requiring on-site retention for stormwater for new developments.
- Update local ordinances to incorporate BMPs for controlling stormwater runoff in both developed and developing areas of the watershed.
- MDEQ, MDNR, communities, and agencies identify targeted stream segments in subwatershed management plans where intensive efforts will be made to restore stream hydraulics needed to reduce flooding, bank erosion, and support preferred aquatic organisms.

- MDEQ, MDNR, communities, and agencies identify and maintain existing wetlands and floodplains that provide natural stormwater detention. Fund efforts to create and restore wetlands.
- MDEQ, MDNR, and permittees establish stream monitoring programs to evaluate the effectiveness of stormwater management.
- Local communities and agencies establish educational training for residential, commercial, and industrial site developers, designers, and owners on the availability of BMPs and the management of property to reduce runoff and increase infiltration.

Caring For Community - People

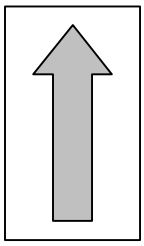
Indicator 13: Public Understanding and Community Stewardship

Many residents of the watershed believe the Rouge River is an important part of the community and the environment in which they live. Increasing public understanding will show everyone what role they can play in restoring the River.

Stewardship requires accepting moral responsibility for the careful use of natural and human resources, such as land, water, air, time, talent, and money, especially with respect to the principles or needs of a community. There are three keys steps needed in the public awareness process: 1) Citizens must be aware they live in the Rouge Watershed, 2) Citizens need to be informed about actions they can take to improve watershed health, and 3) Citizens must be motivated to move from "understanding" to action.

Where We Were:
Many people have seen value in the Rouge over the years. At the turn of this century, towns were founded along its banks. In later years, it was used for recreation. However, years of abuse and misuse (CSOs, floodplain fill, and illegal dumping) caused the Rouge River to become seriously degraded. The Rouge River was written off as a lost cause until the early 1970's when "Rescue the Rouge" cleanups were held for a few years. A number of groups and citizens then formed the "Rouge Basin Coalition" in the mid-1970's, which led to the formation of the Rouge River Watershed Council. Citizen interest began to wane, but thanks to the founding of the Friends of the Rouge (FOTR) in 1986, the development of the 1989 RAP, and river stewardship by public officials, positive attention was re-focused on the river. The 1989/90 RAP established the "Implementation Process" goal: "Educate and involve the public to build understanding and support for restoration of the Rouge River."

Where We Are:



A 1993 random sample in the Rouge Watershed shows a moderate level of awareness. At that time, 68% of the people were at least somewhat familiar with the Rouge and its network of rivers and streams running through Southeast Michigan. 42% incorrectly believed that industrial waste flowing into the river contributes most to the problems in the Rouge River. It is not known, however, how many residents have deliberately taken steps to protect the environment and contribute to the Rouge River clean up. In 1998, 2,500 people volunteered their time at 20 locations during Rouge Rescue. In 1998 approximately 100 citizen volunteers participated in the Friends of the Rouge Frog and Toad Survey. That number grew to 400 during the 1999 survey. Other citizen-based groups such as Friends of Tarabusi Creek, Friends of Johnson Creek, Holliday Nature Preserve Association, Southeast Michigan Land Conservancy, and Sierra Club-South East Michigan Group have demonstrated their commitment and stewardship to the Rouge. The Public Education Plan and Public Participation Process (elements of the Voluntary Stormwater Permit) are just beginning to get underway and should increase public understanding and stewardship.

Caring For Community - People

Where We Want to Be:

By **2000:** Over 2,500 people will be participating in the annual River Day activities, and hundreds of others will be participating in year round river stewardship activities.

By **2002:** 80% of the Rouge River watershed citizens will know that stormwater goes directly in to the river and is a major source of pollution. All Rouge communities will have implemented a viable river education program, which includes the public education activities developed under the Voluntary General Stormwater Permit.

By **2002:** 50% of the Rouge River communities will have sponsored Rouge River Appreciation Days.

By **2002:** Managed land use will be recognized as the key to accomplishing watershed goals.

How to Get There:

- Implement Public Education and Public Participation plans as part of the Voluntary General Stormwater Permit.
- Form partnerships between communities, FOTR, and other educational and stewardship organizations.
- Encourage Increased media participation in watershed issues.

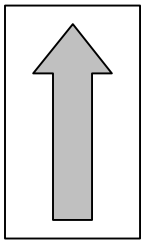
Caring For Community - People

Indicator 14: *School-Based Education*

Children hold the key to the future.

Where We Were:
Friends of the Rouge (FOTR) began the Rouge Education Project (REP) in 1987. A Rouge River Advisory Group was formed to help guide the development of this program. The advisory group consisted of local officials, teachers, curriculum coordinators, FOTR, water resource professionals, and educators from the University of Michigan's School of Natural Resources. Initially, 16 schools participated in the project and at its inception it was the only school-based water monitoring program in the United States to employ a computer network for the sharing of data.

Where We Are:
Today, the Rouge Education Project has engaged more than 200 teachers and 20,000 students from over 112 Rouge Watershed schools. A FOTR Resource Center has been established on the campus of Henry Ford Community College through a partnership between FOTR, HFCC, and the City of Dearborn Heights. To date, 30,000 Rouge Activity Books and 10,000 Rouge Posters have been distributed to watershed schools. In addition, about 1,200 fifth-graders from around the watershed attended the first and second annual Rouge River Water Festival at the University of Michigan-Dearborn.



U of M-Dearborn is building an Environmental Interpretive Center that will focus much of its educational programming on the Rouge River Watershed. Ford Motor Company is sponsoring schoolyard naturalization programs throughout Dearborn and Westland and will be expanding the program to other communities. Dearborn Schools are using EPA grant funding to restore Rouge floodplain at Ford Field and installing an interpretive trail for community education.

Where We Want to Be:

By **2001:** 25 new Ford-sponsored schools will be participating in the schoolyard naturalization program and other corporate-sponsored programs will be in place.

By **2002:** Partnerships will be formed between FOTR, local government, local school districts, and centers of higher education that ensure the stability and expansion of the REP to 75% of the schools in the watershed.

By **2005:** Some form of Rouge River specific environmental education will be integrated into the curriculum/lesson plans of all Rouge River Schools.

How to Get There:

- School administrators must recognize, support, and implement school-based education programs such as the REP, and integrate watershed education into their school's curricula.
- Communities incorporate the REP into their Public Education and Subwatershed Management Plans.
- Increase corporate sponsorship of FOTR-REP and schoolyard naturalization projects.

Caring For Community - People

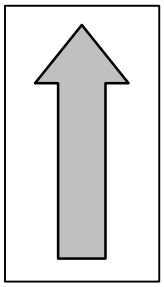
***Indicator 15*: Recreational Use and Aesthetics**

The Rouge River has the potential to become a tremendous recreational resource and "quality of life" community asset.

Many people enjoy a "private place" of their own within the public environment of a watershed or a riverbank. Places where you go on your own to just sit and watch the world go by. Places where you can get your world back together. Places where you can relax and enjoy the quiet peace of a rambling stream in the midst of the busy mainstream of our lives. Places where the world stops for just a moment and we can return to the innocence of our childhood. These places are unique to each of us and are the reason we need to restore the Rouge River to its rightful heritage as a truly great urban river.

Where We Were*:*
Earlier in the century the Rouge River was an aesthetically pleasant place to visit. Many recreational activities, such as picnicking, canoeing, fishing, and swimming were safe to do. With the onset of industrial use and urban sprawl the river degraded to the point of becoming a non-viable recreational resource. It became polluted, developed unpleasant odors, contained abundant trash, and had increasing turbidity. During a 1993 survey, 25% of those interviewed indicated that they were very familiar with the Rouge River watershed and its network of rivers and streams. When asked what recreational use should be earmarked for the Rouge River, respondents mentioned fishing, canoeing, and bird watching.

Where We Are:



Today, with the implementation of pollution control measures, recreational use is making a comeback. More than 75 miles of the Rouge River flows through parkland, making it one of the most publicly accessible rivers in the state. In addition, the Rouge Watershed has 300 parks, 20,000 acres of parkland, 27 nature preserves, and over 400 lakes, impoundments, and streams. Three trout derbies are held annually in the Rouge River and canoeing occurs along a stretch of the Middle Rouge River. A golf course with adjoining created wetlands has been built near the Rouge River in Inkster. In addition, the Newburgh Lake restoration project, completed in 1998, allowed recreational use such as fishing and boating to be returned to the lake. In 1998, through a partnership between the Rouge Program Office (RPO), Friends of the Rouge (FOTR), and the Rouge River Remedial Action Plan Advisory Council (RRAC), a Rouge Recreation Map and Index was created to show all the recreational opportunities available within the Rouge River Watershed.

Where We Want to Be:
Recreational use and enjoyment of the Rouge is a multi-stakeholder concern, and should be expanded through partnerships. The more people can enjoy the Rouge River, the more likely they are to support efforts to protect it.

By **2005:** Public access will be increased by expanding a natural hiking trail network. A main trail system will be complimented by soft, ECO-Trails in

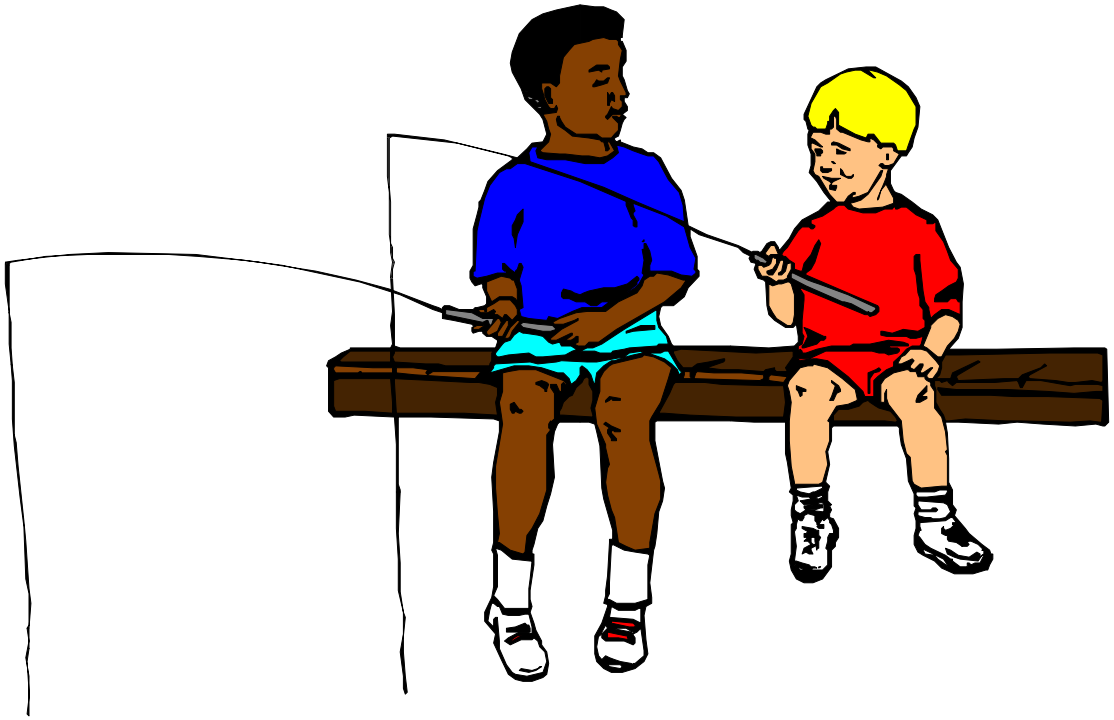
some sensitive natural areas of public land in the Rouge's smaller streams and creeks.

By **2005:** Water quality and habitat improvements will have created more fishing opportunities and three more annual fishing derbies will be occurring.

By **? :** Canoeing opportunities will be expanded to the area downstream of Nankin Lake.

How to Get There:

- Encourage county parks and recreation administrators to increase public access to the river through the construction of trail systems and active and strong support of the Southeast Michigan Greenways Initiative.
- As part of their Public Participation Plan, communities can recruit businesses, institutions, government and citizen organizations, and recreational groups to work together on restoration projects and programs.
- Encourage the MDNR-Fisheries Division and local governments to work in partnership to create fish habitat, thus increasing fishing opportunities.



Restore What is Degraded

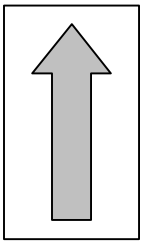
Indicator 16: **Restoration Projects**

Rouge River Restoration projects have been steadily increasing over the last several years.

Examples of these projects include streambank stabilization, sediment removal, enhanced fish habitat, wetlands, uplands, and meadow restoration, and log jam management.

Where We Were:
For many years, restoring the Rouge River and it's watershed seemed nearly impossible. The water, floodplain, wetlands, and other associated habitats were severely degraded from pollution and development. Many residents of the watershed felt that there was no hope of protecting or restoring the Rouge River.

Where We Are:
Today, the annual Rouge Rescue has expanded into "River Day" which is a day designated for river stewardship and restoration activities for the Rouge, Huron, Clinton, and Detroit Rivers. One hundred pollution control and restoration projects are underway. Notable habitat and restoration projects include Newburgh Lake restoration; stream bank and fish habitat improvements in Southfield, Farmington, Dearborn and Detroit; creation of Inkster wetlands; and abandoned dump remediation in Dearborn Heights.



Where We Want to Be:

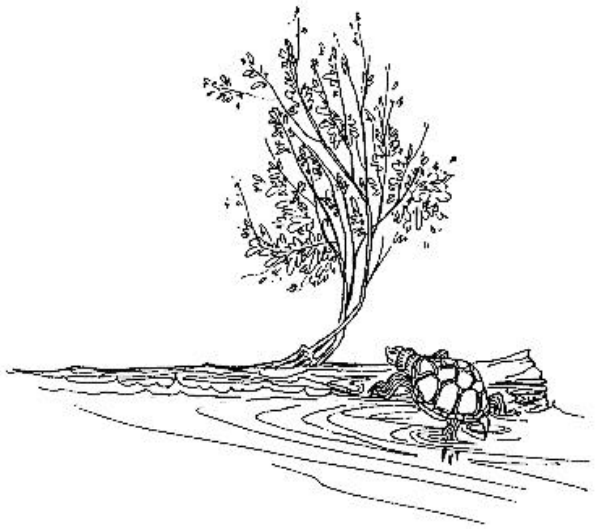
By **2002**: Partnerships will be formed, a log jam woody debris management plan will be created, and implementation will have immediately begun.

By **2010:** 10-15 miles of streambank will be stabilized using bioengineering techniques.

By **2010:** 200 major and minor revegetation and restoration projects will be completed.

How to Get There:

- Within subwatershed management plans, communities and agencies should identify and commit to implement specific restoration projects (See Indicators 7 & 8).
- Innovative mechanisms need to be created to effectively deal with obstructive log jams and other debris.
- Alternative mechanisms need to be developed and implemented to stabilize streambanks and restore other habitats.



Take Responsibility for the Rouge - Stewardship

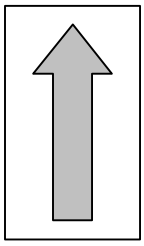
Indicator 17: Local Government Leadership

Local governments are stepping up to the plate by obtaining and implementing their Voluntary Stormwater Permits.

Local government leadership is needed to complement the stewardship efforts of individuals, environmental groups, and businesses. Local government leadership is a prominent part of the Rouge River restoration effort. A major goal is for local governments to work within their regulatory and statutory obligations while actively supporting the stewardship efforts within the Rouge River Watershed. It is also important that local governments implement voluntary actions to restore the Rouge River, such as the Voluntary General Stormwater Permit.

Where We Were:
In the 1989 RAP, concerns about water pollution were largely focused on the need for expansion of the Detroit wastewater treatment plant and the need for controlling combined sewer overflows (CSOs) in Detroit and several other communities along the Rouge River. For many of the communities, the problems seemed remote and distant from their back yards. Concerns about stormwater were largely based on the need for public safety and flood control; stormwater quality was not a high priority concern. However, the 1989 RAP foresaw the growing concern of stormwater management, SSOs, illicit discharges, and failing septic systems, and recommended stormwater management plans and permits for local and county governments.

Where We Are:
Local government leadership is being demonstrated through membership in seven Subwatershed Advisory Groups (SWAGs) throughout the watershed. SWAGs have been formed to provide a structure for local governments to collaborate efforts between communities in each subwatershed. The goals of the subwatershed groups include improving water quality, protecting property values, and enhancing recreational opportunities and aesthetic appeal of the river within their subwatershed.



The MDEQ has developed a new Voluntary General Permit for stormwater management. The Voluntary General Permit was created as an alternative method for regulating stormwater runoff. Under this permit, communities can tailor their own programs of public education, illicit discharge elimination, and subwatershed planning to meet their own highest priority needs. Forty-three (43) of the Rouge River communities and agencies within the watershed have applied for the permit. Communities and organizations are also working cooperatively, and are moving towards implementing the Adopt-A-Stream program. With this program, year round analysis, maintenance, and protection of the watershed is possible, utilizing the community residents.

Where We Want to Be:
By **2002**: Local government will have recognized their pivotal leadership role in stormwater management with completion of the Voluntary General Stormwater Permit Watershed Management Plans and implementation of meaningful actions under their Stormwater Pollution Prevention Initiatives will have occurred.

Take Responsibility for the Rouge - Stewardship

By **2005**: Local governments will have established cooperative approaches with neighboring communities and regional agencies to sustain restoration and protection efforts.

How to Get There:

- In order to provide an implementation framework for leadership, all Rouge River communities should apply for the MDEQ Voluntary Stormwater General Permit.
- The public participation process needs to be effectively implemented to ensure that the stewardship goals of citizens, businesses and environmental groups will be integrated into the regulatory and statutory obligations of local governments.

Take Responsibility for the Rouge - Stewardship

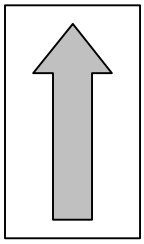
***Indicator 18: Business* and Institutional Stewardship**

Business and institutional stewardship is growing within the Rouge watershed.

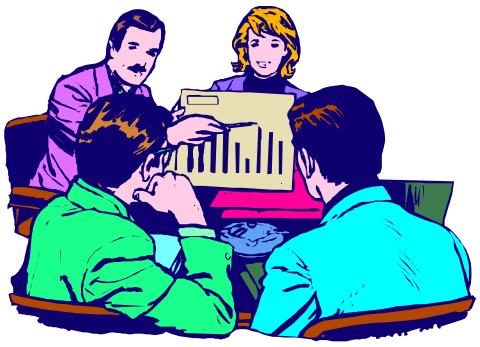
Attitudes and the perceptions about the Rouge River are becoming more positive and momentum is building. Awareness is growing regarding the role businesses and institutions play in the degradation as well as the restoration of the Rouge River.

Where We Were:
For most of the 20th century, industrial activities and discharges were a major contributing factor to environmental degradation in the Rouge River and southeast Michigan. Most of the industries along the Rouge River used river water in their industrial processes, as well as their sanitary sewer systems to carry away their liquid wastes. The river was severely polluted especially in the downstream reaches, where oil and other chemicals frequently floated on the water's surface and even caught fire.

Where We Are:
Today, major industrial discharges directly to the river are less than 2% of the pollutant sources to the Rouge. Major corporations are actively supporting and promoting stewardship efforts including the Sustainable Renaissance Project, the Rouge Education Project, recycling and pollution prevention, and habitat protection/restoration projects. Pollution control and prevention is being integrated into their daily activities. Small and medium-sized businesses are beginning to participate in pollution prevention initiatives such as Rouge Friendly Business programs, Community Partners for Clean Streams business recognition programs, and the Great Printers Project.



Institutions such as University of Michigan and Henry Ford Community College are partnering with Friends of the Rouge and local communities to establish Rouge River resource information and interpretive centers and programs. A consortium of U of M-Dearborn, Greenfield Village, Henry Ford Estate, Wayne County, local communities, Ford Motor Company, and other businesses are teaming up to explore and promote revitalization of the lower portions of the Rouge River. A fish ladder, interpretive trails, and boat tours linking historic sites along the Rouge River corridor are all aspects of the vision being promoted.



Where We Want to Be:
By **2002:** A 20% increase in the number of businesses and institutions that are recognized as River Friendly or as a Community Partner for Clean Streams will have occurred.

By **2002:** Local corporations and institutions will be sponsoring Employee Volunteer days for Rouge restoration projects.

By **2005:** Local universities and colleges will be taking a leadership role in providing community education regarding Rouge issues (See Indicator 14).

Take Responsibility for the Rouge - Stewardship

How to Get There:

- Local governments recruit businesses in their communities to take an active role in the Rouge Friendly or Community Partners for Clean Streams program being offered by Wayne and Washtenaw counties.
- Local governments partner with businesses to spend a portion of their community-support dollars on Rouge restoration projects.

Agencies and Organizations to Contact for More Information

Wayne County Department of Environment Noel Mullett, Jr. Rouge Project Technical Coordinator	(734) 326-4486
Michigan Department of Environmental Quality Cathy Bean, Rouge RAP Coordinator	(734) 953-1441
Friends of the Rouge Jim Graham, Executive Director	(313) 792-9900
Lower 1 Subwatershed Advisory Group Kelly Kelly, Canton Township	(734) 397-5438
Main 1 & 2 Subwatershed Advisory Group Phil Sanzica, Oakland County Drain Commission	(248) 858-1031
Middle 3 Subwatershed Advisory Group Kurt Heise, Dearborn Heights	(313) 277-7412
Upper Subwatershed Advisory Group Robert Beckley, Livonia	(734) 466-2655
Middle 1 Subwatershed Advisory Group Brad Sharp, Northville Township	(248) 374-2404
Lower 2 Subwatershed Advisory Group Jim Zoumbaris, Westland	(734) 467-3242
Main 3 & 4 Subwatershed Advisory Group Kurt Giberson, Dearborn	(313) 943-2085
Rouge River Executive Steering Committee Chuck Hersey, SEMCOG	(313) 961-4266
Rouge River RAP Advisory Council Staff Support	(734) 432-1291

Glossary of Acronyms and Terms

Aquatic/Riparian – collective terms for natural areas that exist adjacent to and within rivers or streams, such as grasses, shrubs, and water foliage.

BMP – Best Management Practices

Combined Sewer Overflow (CSO) – the release of untreated human sewage into streams or lakes when heavy rains cause combined sanitary and storm sewers to reach capacity and spill over before reaching the sewage treatment plant.

Contaminants – pollution.

Downspout disconnection – the practice of removing the downspout pipe, which collects rainwater from roof eavestroughs, from the storm sewer and redirecting the water onto the lawn or garden; this reduces the amount of stormwater reaching streams, and also puts less pressure on old combined sewers.

EPA – Environmental Protection Agency

Fecal coliform bacteria – not harmful in themselves, these bacteria indicate the presence of untreated sewage in water, which often contains other disease-causing bacteria or viruses.

Floodplain – the flat area beside the river, which stores excess water when the river floods.

Friends of the Rouge (FOTR) – a non-governmental organization founded in 1986 that has implemented programs, such as the Rouge Rescue, to help enhance the quality of the Rouge River

Geographic Information System (GIS) – a highly specialized computer-based data mapping system.

Groundwater – water below the land surface that feeds wells and springs and provides cool, clean water to streams.

Habitat – home; a place where certain groups of plants and animals live in balance.

HFCC – Henry Ford Community College

Illicit Connection (As described by the Voluntary Permit) – A pipe physically connected to the separate stormwater drainage system that 1) primarily conveys illicit discharges into the system or 2) is not authorized or permitted by the local authority (where a local authority requires such authorization or permit).

Illicit Discharge (As described by the Voluntary Permit – Any discharge (or seepage) to the separate stormwater drainage system that is not composed entirely of stormwater, except for those discharges specified in the General Permit, such as, waterline flushing, landscape irrigation runoff, diverted stream flows, rising groundwater, etc. Examples of illicit discharges include dumping of motor vehicle fluids, household wastes, grass clippings, leaf litter, or animal wastes, or unauthorized discharges of sewage, industrial waste, restaurant wastes, or any other non-stormwater waste into a separate stormwater drainage system.

Indicator – a sign; something measurable that provides information about a larger system of which it is a part.

Instream barrier – a structure in the water such as a weir or dam that prevents fish from swimming upstream to a river's headwaters to spawn.

Glossary of Acronyms and Terms

MDEQ – Michigan Department of Environmental Quality

MDNR – Michigan Department of Natural Resources

Meadow – an open habitat of grasses, shrubs, and pioneer species of trees such as poplars, that is home to songbirds and rodents and a favorite hunting ground of hawks and foxes; in nature meadows are either permanent prairies or transitional habitats that eventually become woodlands.

Michigan Resource Information System (MIRIS) – MIRIS provides for a land resource and current use inventory in the State and technical assistance on its use to municipalities, counties, and state government planning and resource management entities. It is the largest inventory of both aerial photographs and statewide geo-referenced data layers in Michigan. MIRIS also provides extensive computer mapping (data layer production) and GIS applications, database development, training and related services to governmental agencies and the private sector.

NPDES – National Pollutant Discharge Elimination System

Nonpoint source – a source of contaminantion that is not coming from a pipe or other human-made conveyance system.

Restoration – a hands-on project to improve water quality, control water quantity, or enhance habitats both in the water and on the land; good restoration projects achieve more than one of these goals, contribute to improving the health of the larger system, and usually involve partnerships between citizens' groups, government and business groups.

Remedial Action Plan (RAP) – Progress, Goals, and Recommendations made by the RRAC to assist all stakeholders and agencies in watershed management and the Rouge River National Wet Weather Demonstration Project.

Rouge Program Office (RPO) – A professional consultant office established by Wayne County to administer and help implement the Rouge River National Wet Weather Demonstration Project, USEPA Grant # X995743-02.

Rouge RAP Advisory Council (RRAC) – A public advisory counsel established by MDEQ. Membership includes citizens, businesses, environmental advocates, academia, local government, and other interested stakeholders.

Sanitary sewer – the underground sewer pipe that carries sewage from toilets and gray water from washing machines, showers, etc. to the sewage treatment plant.

Sanitary Sewer Overflow (SSO) – the overflow of sewage from separate sanitary sewer systems into the river.

Sediment – dirt; the silt that enters watercourses by natural erosion or construction activities. In large amounts, it is a pollutant, carrying toxic chemicals and metals with it, scouring stream bottoms, covering fish and insect habitat, and harming fish directly.

Source controls – practices that keep problematic substances out of the environment; for example, downspout disconnection keeps excess storm water out of streams, and hazardous waste collections help ensure old paint, batteries, solvents, etc. do not end up in stormwater or natural areas.

Storm sewer – the underground pipe that carries rainwater off pavements and roofs into a nearby stream.

Glossary of Acronyms and Terms

Stormwater – the rain water and snow melt that flows across land and into streams and lakes; in urban areas, stormwater is very dirty, carrying oil and grease, road salt, metals, contaminated sediment and many other pollutants into watercourses; in the Rouge River, stormwater is a major cause of water pollution.

Stormwater management – practices that prevent the excessive amounts of stormwater from rushing into waterways as well as treating it to improve its quality. Pollution prevention is also an important aspect of stormwater management.

Stream Flow – Measured as the volume of water. Flow variability and velocity have major impacts on streambanks, habitat, fish and other aquatic organisms.

Swimmable – a term signifying that water is safe for human contact - for wading and swimming but not drinking.

Target – a milestone to be aimed for in the future, for example, in this Report Card targets include implementing public education plans by the year 2000.

Voluntary General Stormwater Permit – created as an alternative, cost effective method of regulating stormwater which promotes community involvement. Obtaining this permit is voluntary at the present time.

Watershed – the land area that drains to a river and its network of tributaries.

Wetland – a soggy habitat such as a swamp, bog, or estuary that stores floodwaters and functions as a nursery to many species of fish, amphibians, and reptiles.

Woodland – a forest habitat with a diversity of native tree species and an under story of shrubs and herbaceous plants, that is home to a variety of birds and other animals.

Feedback on 1999 Rouge Report Card

NAME_____ PHONE_____

ORGANIZATION_____

Please provide your feedback on this product. Fax to MDEQ Surface Water Quality Division at (734) 953-1467 or mail to: MDEQ-SWQD, 38980 Seven Mile Rd., Livonia, MI 48152-1006. Thank you.

What did you find most useful about this document?

What did you find least useful or missing in this document?

Overall rating? (circle)
(lowest) 1 2 3 4 5 (highest)

Other comments: