



# Rouge River National Wet Weather Demonstration Project

Wayne County, Michigan

## TASK PRODUCT MEMORANDUM

Progress Report on Evaluation of NPS Control  
from Wetlands

Nonpoint Work Plan No. WETL1, Task No.

RPO-NPS-TPM53.00

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### Rouge River National Wet Weather Demonstration Project

#### MISSION STATEMENT

The mission of the Rouge River National Wet Weather Demonstration Project is to demonstrate effective solutions to water quality problems facing an urban watershed highly impacted by wet weather and develop potential solutions and implement projects which will lead to the restoration of water quality in the Rouge River. The project will address both conventional and toxic pollutants to:

- \$ provide a safe and healthy recreational river resource for present and future generations;
- \$ re-establish a healthy and diverse ecosystem within the Rouge River Watershed;
- \$ protect downstream water resources such as the Detroit River and Lake Erie; and
- \$ help ensure compliance with federal, state and local environmental laws which protect human health and the environment.

This will be accomplished through the development, implementation and financial integration of technical, social and institutional frameworks leading to cost-efficient and innovative watershed-based solutions to wet weather problems. This watershed-based national demonstration project will provide other municipalities across the nation facing similar problems with guidance and potentially effective solutions.

## PREFACE

The Rouge River and its watershed are a primary source of pollution to the Great Lakes. The Clean Water Act of 1972 intended to make waterways "fishable and swimmable" by 1972. Although that goal has not been reached, great progress has been made in improving water quality in most waterways. The Rouge River Remedial Action Plan (RAP) provided a basis for which The Rouge River National Wet Weather Demonstration Project (Rouge Project) efforts were created: it identified the major sources of pollution and measured the relative contributions of each. The RAP is the continuing foundation for the Rouge Project and presents a framework for addressing the problems within the Rouge River by looking beyond treatment and focusing instead on prevention methods.

The Rouge Project was established under the initial Rouge Grant 1 from the United States Environmental Protection Agency, Region 5, and enabled Wayne County to initiate a comprehensive watershed-wide pollution-control approach that addresses combined sewer overflow (CSO), stormwater management, and other nonpoint source controls through the application of innovative technologies, progressive financial and institutional arrangements, and creative public involvement and education programs.

Rouge Grant 2 provides the framework for the progression and implementation of Project goals as Wayne County continues its mission to develop potential solutions and implement projects which will lead to the restoration of water quality in the Rouge River. The Project will address both conventional and toxic pollutants to:

- \$ provide a safe and healthy recreational river resource for present and future generations;
- \$ re-establish a healthy and diverse ecosystem within the Rouge River Watershed;
- \$ protect downstream water resources such as the Detroit River and Lake Erie; and
- \$ help ensure compliance with federal, state, and local environmental laws which protect human health and environment.

This will be accomplished through the development, implementation, and financial integration of technical, social, and institutional frameworks leading to cost-efficient and innovative watershed-based solutions to wet weather problems. This watershed-based national demonstration project will provide other municipalities across the nation facing similar problems with guidance and potentially effective solutions.

Under Rouge Grant 2, the Rouge Project will build on lessons learned from Grant 1 efforts and focus on further integration of the goals of the overall Mission. To this end, Rouge Grant 2 concentrates on the following key Project areas:

- \$\$ Watershed Management** will continue under Rouge Grant 2 with the development and evaluation of wet weather and stormwater alternatives, the planning of long-term monitoring

programs, and the ongoing efforts to enhance instream water quality, monitor rain and flow levels, interpret data analysis, and present recommendations.

**\$\$ Nonpoint Source Pollution Control** will provide for the stormwater management, permit applications, and development of financial and institutional alternatives for wet-weather watershed management in concert with enhanced efforts to establish institutional partnerships. Toward the goal of institutional partnering, several community projects will be undertaken with watershed communities. Additional efforts include the inventory of wetlands and measurement of pollutant loads from abandoned dumps and air deposition with possible remediation of some sites.

**\$\$ CSO Construction Coordination** will continue to monitor the construction of CSO demonstration projects established under Grant 1. Additional planning and assistance will allow project coordinators to make additional recommendations on the design criteria of future CSO abatement facilities.

**\$\$ Public Involvement and Information** will reach and interact with more stakeholders, institutions, and regulatory agencies, thus fostering a renewed understanding and continued commitment to reducing pollution, and continuing the transfer of watershed management approaches way beyond the project. It will be the central mechanism for transmittal of the Project's Decision Support System tools, processes, and information necessary for sustaining a watershed management support system directly to varied audiences both within and outside the Rouge watershed.

Additional information on the Rouge River Project is available from many sources, including the Wayne County Department of Environment (WCDOE) and the Rouge Program Office (RPO).

## ABSTRACT

The Rouge Project is a federally funded initiative with the objective of developing demonstration projects to evaluate a variety of urban nonpoint source pollution reduction best management practices (BMPs) for the Rouge River Watershed. These demonstration will in sum improve the quality of storm water runoff to the Rouge River. The function of wetland filtration for water quality improvement has been recognized as one potential BMP.

Wetlands increase storm water detention capacity, increase storm water attenuation, moderate low flows, and improve water quality by removing nutrients, sediments and metals. The goal of the WETL-1, wetland demonstration project, was to evaluate the effectiveness of wetlands in the treatment of storm water. The wetland demonstration project utilized existing, enhanced, and created wetlands to demonstrate the value and effectiveness of wetlands in treating storm water runoff. Future evaluations will identify pollutants removed by the demonstration wetlands, the efficiency of the removal processes and the effects of sediments on this removal efficiency.

This document summarizes the WETL-1 demonstration project activities including wetland designs, operation and maintenance activities, monitoring results and potential benefits of the implementation activities for the Rouge River wetlands wet weather management demonstration system.

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## 1.0 INTRODUCTION.

**1.1 DESCRIPTION OF THE PROJECT.** The Rouge Project is a federally funded initiative with the objective of developing a wet weather management plan for the Rouge River watershed. The project includes a variety of demonstration projects which, in sum, will improve the quality of storm water runoff to the Rouge River. The projects include a variety of urban nonpoint source pollution reduction best management practices (BMPs) including structural controls, source controls, treatment of impoundment sediments, detention basins, public participation and wetland treatment. This report summarizes the activities associated with the demonstration project, *Evaluation of NPS Control from Wetlands*.

**1.2 PURPOSE OF THE WETLANDS PROJECT.** Although past storm water management designs utilized natural wetlands to treat storm water, regulatory agencies discourages this approach. This position is primarily a function of jurisdictional policy implemented against poorly designed systems that have traditionally impaired the functional uses of natural wetlands. There is a lack of research on the quantity and quality of storm water that natural wetlands are capable of treating without being negatively impacted. Constructed wetlands in contrast, are being built specifically for treating point source discharges and storm water runoff. Consequently there is no intention of replicating ecological functions other than water quality treatment. Only a few examples of wetland BMPs occur in the Rouge River Watershed.

The Rouge River National Wet Weather Demonstration Project included a demonstration of nonpoint source control from the use of existing, restored and created freshwater wetlands (WETL-1). The overall nonpoint source pollution control strategy of WETL-1 consisted of demonstrating 1) a site selection strategy that emphasizes the potential for integrated solutions, *Selection of Appropriate Wetland Nonpoint Source Pollution Abatement Locations* (RPO-NPS-TM36.00) 2) a basis for design development that accounts for wetland habitat protection and water quality improvement goals, *Conceptual Design of Wetland Management Systems* (RPO-NPS-TM37.00), 3) biological and water quality monitoring program unique to wetland habitats, *Wetland Biological Monitoring Program* (RPO-NPS-TM), 4) the construction and operation of several wetlands providing nonpoint source pollution control sites and the operation and maintenance program for the wetland systems *Operation and Maintenance Manual Nonpoint Work Plan (WETL-1), Task No. 3* (RPO-NPS-TM37.00). The current status of the wetland project of the Rouge River Wet Weather Demonstration Project is that site selection, design development, monitoring plans and construction documents have been completed. Construction of the wetland projects was virtually completed in November 1996 and preliminary water quality monitoring data will be available during the summer of 1997.

The intent of the WETL-1 project was to increase storm water detention capacity by utilizing wetlands in the Rouge River watershed. Wetlands increase storm water attenuation, moderate low flows, and improve water quality by removing nutrients, sediments and metals.

The future goal of this demonstration project is to evaluate the effectiveness of the demonstration wetlands in the treatment of storm water. This evaluation will include identification of pollutants removed by the demonstration wetlands, the efficiency of the removal processes and the effects of sediments on this removal efficiency. Ultimately, the demonstration project will compare the pollutant removal effectiveness of different types of wetlands:

- \$ An existing forested wetland;
- \$ An enhanced mixed forested, open water and scrub wetland system;
- \$ Newly created emergent wetland; and,
- \$ A mature created emergent/shrub/scrub wetland system.

**2.0 IMPLEMENTATION OF THE WETLAND PROJECT.** The basis for design of nonpoint source pollution control sites that use wetlands, regardless of whether the wetlands are existing, restored or created, presents an integrated approach that accounts for wetland ecology, wetland hydrology, water quality considerations, watershed characteristics and surrounding land use. Utilizing these guiding principles, a selection process was initiated to identify appropriate sites for wetland demonstration projects. A total of 25 sites (9 constructed, 13 existing, and 3 CSO) were considered as potential NPS Abatement locations. Five Areas were selected (3 existing and 2 constructed wetlands) as prudent and feasible for further consideration. Technical Memorandum, **A Selection of Appropriate Wetland Nonpoint Source Pollution Abatement Locations** (RPO-NPS-TM36.00) is available at the RPO for review. These Areas are located within the City of Inkster, north of Michigan Avenue between Inkster and Henry Ruff Roads. A created wetland built approximately eight years ago in West Bloomfield Township has also been selected to evaluate and compare its effectiveness with newly created wetlands.

**2.1 WETLAND DESIGN SUMMARY.** The design of the wetland projects as nonpoint source pollution control sites incorporated features that allows manipulation of storm water flow quantity and duration, and allows for the direct comparison of the effectiveness of nonpoint source pollution control in existing and created wetlands receiving storm water runoff from a single watershed. Design criteria for each of the wetland areas were developed from modeled hydrological data in combination with characteristics of the available treatment area. The wetland creation and enhancement areas contain similar design elements that provide comparable experimental data which can be related to known design parameters. These elements include the incorporation of a sediment forebay to filter the large particles before the storm water enters the wetland system; treatment of "first flush" for most storm events; designed discharge outlets to the Rouge River with monitoring capabilities; and, intermediate monitoring points where applicable. The contributing storm sewer area for each area has been defined and modeled so that the effect of a given wetland area on water quality and quantity can be determined. The influence of directly adjacent land is assumed to be negligible.

**2.2 WETLAND CONSTRUCTION SUMMARY.** Construction documents and specifications for the construction of these projects were completed in November 1995. Bidding and award of the projects allowed construction to begin in February, 1996. Construction was substantially complete in December 1997. The construction schedule for these projects was exceeded by approximately five months. Various reasons accounted for project delays including; spring flooding of the Rouge River, vandalism of power supply panels, delays in equipment orders, unknown utilities encountered, land owner disputes and contractor delays due to poor coordination with subcontractors. Planting of macrophytic tubers was completed in May 1997. The macrophytes planted included, but was not limited to, arrowhead; bulrushes; smartweed, pondweeds; wild iris; and pickerelweed. There has been good establishment of wetland plants in Area 3 West. However, in Area 1 goose predation has been a continuing problem.



### **3.0 OPERATION AND MAINTENANCE.**

- 3.1 OPERATION AND MAINTENANCE REQUIREMENTS.** The operation and maintenance of this wetland demonstration project has require an effort for inspections of earthwork, landscaping, structural components and other aspects of distribution system. This task is being provided by the construction contractor as part of the contract. An *Operation and Maintenance Manual* (RPO-NPS-TPM37.00 ) was prepared for the wetland projects. Activities include: checking outlet structures for clogging; checking banks for erosion; checking sedimentation forebays; checking on the performance of the pump; general maintenance of the site. A written summary of Operations and Maintenance activities will be provided on an annual basis.
- 3.2 OPERATION AND MAINTENANCE ACTIVITIES.** Operation and maintenance monthly activities included regulating water elevation in wetland system to ensure appropriate water depths for plant propagation; removal of logjams in the river that caused flooding and erosion around sampling manhole; sampling manholes have been vandalized resulting in the replacement of center rings; pump station inspection required maintenance of strainer screen, and general mowing around pump station and sampling manholes. The created wetland (Area 1) has been significantly impacted be goose predation. Programs to discourage goose predation are being considered including landscape buffers, goose grids and a **Ado nothing@** program. Recommendations will be made on a preferred program. Monthly reports are submitted to Wayne County documenting operation and maintenance activities.

## 4.0 MONITORING ACTIVITIES.

### 4.1 BIOLOGICAL MONITORING.

**4.1.1 Vegetative Sampling.** To record the existing status of the vegetation in a way that would permit long-term changes to be measured, a sampling transect was established in each of the two monitoring areas. The locations of the transects were chosen to represent typical conditions in the forested floodplain. Square meter plots were established at 50 foot intervals along each transect. The eastern transect (Transect 2) currently has nine plots, and the western transect (Transect 3-East) has ten plots. White PVC stakes were used to permanently mark the center of each plot.

Within each plot, the overall percent coverage was estimated, and all vascular plant species (higher plants) were recorded (including those whose canopies extended over the plot). The relative abundance of each species was estimated using the following scale of 1 to 5:

- 1 = 0-20 percent coverage
- 2 = 20-40 percent coverage
- 3 = 40-60 percent coverage
- 4 = 60-80 percent coverage
- 5 = 80-100 percent coverage

A photograph was taken of each plot. When standing water was present in a plot, its depth was recorded.

Data was recorded in hardcover field notebooks, which are stored in the project master file. They will be permanently stored in the file at the completion of the project.

**4.1.2 Vegetation Data Analysis.** The wetland indicator ranking system developed by the U.S. Fish and Wildlife Service was used to help assess the degree to which the vegetation in the wetlands consisted of wetland species. Under this system, each species has been classified into one of the following five ranks: OBL (obligate wetland species), FACW (facultative wetland species), FAC (facultative species), FACU (facultative upland species), and UPL (upland species). OBL species occur in wetlands >99 percent of the time; FACW species occur in wetlands >66 percent of the time; FAC species occur in wetlands 50 percent of the time; FACU species occur in wetlands <33 percent of the time; and UPL species occur in wetlands <1 percent of the time.

Assigning a numbered ranking order to the wetland indicator codes provides a basis for quantitatively determining the degree to which the vegetation at a particular site consists of wetland species. The following ranking assignments were made:

UPL            5

FACU-4	
FACU	3
FACU+	2
FAC-	1
FAC	0
FAC+	-1
FACW-	-2
FACW -3	
FACW+	-4
OBL	-5

The average of these numbers serves as an index for evaluating the wetland affinity of the vegetation at a site. When the average is greater than zero, the vegetation primarily consists of non-wetland species (i.e., those ranging from FAC- to UPL), whereas a negative average indicates a prevalence of wetland species (those ranging from FAC+ to OBL).

An additional way the vegetation was analyzed was to use the Floristic Quality Assessment program developed by the Natural Heritage Program of the Wildlife Division of the MDNR. This program was fully explained in Field Sampling Plan (RPO-NPS-FSP12.00) for the Rouge Project. Briefly, the program assigns a value from zero to 10 to each plant species that occurs in Michigan. These values, called *coefficients of conservatism*, attempt to represent the *estimated probability that a plant is likely to occur in a landscape relatively unaltered from what is believed to be a presettlement condition*. Weedy species are assigned a value of zero, while highly conservative species are assigned a value of 10; most plants fall somewhere in between. By averaging the coefficients of conservatism of all the species in a plot (or transect), and then multiplying this average by the square root of the number of native species in the plot (or transect), an index called the *Floristic quality index* (FQI) is obtained. This index can be used for charting changes in species quality over time. Such a change could, for instance, be produced by a significant increase in water input to the Lower Rouge floodplain woods.

The results of 1996 monitoring indicate that the new stormwater retention system has had no discernible impact on vegetation in the floodplain thus far, other than the conversion of some forested areas to planted grass - a consequence of construction activities. The composition of plant species in the transect plots in 1996 was essentially the same as in 1995. Consequently, the wetland indicator averages of the vegetation (which are indirect measures of hydrology) were unchanged from 1995. A complete accounting of the biological monitoring survey results are available for review from the RPO in a document entitled *Task Product Memorandum, Wetland Biological Monitoring Program - 1996, Nonpoint Work Plan No. WETL1, Task No. 5 (RPO-NPS-TPM48.00)*.

**4.1.3 Water Quality Monitoring.** Water quality monitoring of the wetlands was initiated in the spring and summer of 1997. Currently four wet weather events have been collected for Area 3 west and one wet weather event was completed for Area 2. These samples have been analyzed and are going through quality control program. Data summary of the initial monitoring results should be available by October of 1997.

## **5.0 BENEFITS OF THE WETLANDS.**

**5.1 PRELIMINARY ASSESSMENT OF BENEFITS.** Assessments of the benefits relative to these wetland system will be provided on an annual basis for five years in separate biological and water quality monitoring report. Two annual biological monitoring reports, RPO-NPS-TPM36.00 and RPO-NPS-TPM36.01 have been prepared to develop baseline information. Monitoring of the water quality parameters started in June 1997. Initial data results are not yet available to be reported. Preliminary assessments indicate that the hydrology of the existing forested wetlands may be slightly modified during the duration of the study. In anticipation of altered hydrology, a tree survey was completed as part of the biological monitoring report. All trees greater than six inches were surveyed using GPS technology. The trees identified exhibit a wide range of tolerance to inundation. Therefore, it is not anticipated that the altered hydrology will greatly affect the wetland areas. The volume of water flowing through the systems will not be significantly different from the preconstruction condition. However, the wetlands will be monitored closely to ensure the existing function and structure are not impaired.

## **6.0 COSTS OF THE WETLANDS PROJECT.**

**6.1 COSTS.** Costs associated with the construction and monitoring of the existing wetland projects were borne by money made available through RPO Demonstration Funds as approved by the EPA Region V, MDEQ, and Wayne County. In addition to the two forested wetland areas, two created wetlands were developed under grant money designated for wetland creation within the Rouge River watershed. The money was designated under an MDEQ permit which required Waste Management of Michigan, Inc. (WMI) to provide Wayne County a grant to create wetlands within the Rouge River watershed for the purpose of providing water quality improvement to the Rouge River (RPO-NPS-TM35.00). The created wetlands have been designed to function in perpetuity and will be monitored as required by MDEQ. In addition to monitoring the success of the wetland creation, all of the wetlands will be monitored for water quality improvement by the Rouge Project under separate work plans.