THE ROUGE RIVER PROJECT
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Rouge River National Wet Weather Demonstration Project

Wayne County, Michigan

FIELD SAMPLING PLAN
2007 Baseline Water Quality Sampling

RPO-WMGT-FSP29

March 2007

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Prepared by:
Chris Catallo, Task Manager — Date: 4/24/2007

Reviewed by:
Dean Tuomari, Field Services and Water Quality Analysis Coordinator
Water Quality Division
Wayne County, Department of Environment — Date: 4/24/2007

Reviewed by:
Carl Johnson, RPO Studies Manager — Date: 4/24/2007

Accepted by:
Kelly A. Cave, P.E., Director,
Water Quality Division
Wayne County, Department of Environment — Date: 4/24/2007

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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 addresses 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

In the year 2007, the Rouge River National Wet Weather Demonstration Project (Rouge Project) continues to restore and protect designated water uses through a watershed-based management approach. The Rouge Project is also providing solutions to other urban watersheds throughout the country on how to restore polluted urban waterways. The Rouge Project was initiated in 1992 by the Department of the Environment, Wayne County, Michigan. The Rouge River Watershed in Southeast Michigan is largely urbanized, spans approximately 466 square miles, is home to more than 1.4 million people in 48 communities and three counties, and is a tributary to the Detroit River. Multi-year federal grants from the United States Environmental Protection Agency (EPA) and additional funding from local communities support this cooperative effort between federal, state and local agencies. These grants are managed by Wayne County.

The Rouge Project originally focused on the control of combined sewer overflows (CSOs) in the watershed. In 1994, the project expanded to a holistic approach to consider the impacts from all pollution sources and use impairments in a receiving water. In March of 1995, a storm water management strategy based on the application of watershed-wide management approaches for the Rouge River was developed. The Michigan Department of Environmental Quality (MDEQ), Wayne County, and representatives of the Rouge Project Office, and communities in the Rouge Watershed worked jointly to develop a watershed-based general storm water permit that was issued statewide in 1997 under the National Pollutant Discharge Elimination System (NPDES). EPA approved this permit as meeting the requirements of the Phase II storm water regulations for municipal discharges issued under the Clean Water Act.

Because the Rouge watershed is so large and involves so many stakeholders, the communities chose to subdivide the watershed into seven subwatersheds. Subwatersheds give a means for focusing the local resources to address local problems due to the interest people have in their immediate surroundings. Within each subwatershed, advisory groups formed to develop watershed management plans required under the general storm water permit. These completed plans are being implemented through a unique partnership of local agencies and communities, state agencies, non-profit organizations, businesses and citizens. The seven subwatershed plans identified alternative steps needed to address remaining problems associated with storm water, combined and sanitary sewers overflows, failing septic systems, and non-point sources. The goals, action steps, and measures tailored to individual subwatersheds have established a strong foundation to guide existing and future cooperative efforts to fully restore the impaired uses of the river. Coordination of the efforts of the seven subwatershed groups was initially accomplished by a watershed-wide steering committee, which evolved into the Rouge River Watershed Local Management Assembly.

In August 2003, the Rouge River Watershed Local Management Assembly (Assembly of Rouge Communities) formed to continue the restoration of the Rouge River Watershed. The Assembly of Rouge Communities is a volunteer organization of the local municipal governments (e.g., cities, townships, and villages) and the three counties (e.g., Wayne, Oakland and Washtenaw) located in part or totally within the watershed of the Rouge River located in southeast Michigan. It formed following nearly two years of discussion between the communities and the three counties that recognized the substantial reduction of federal support to Wayne County for the

Rouge River National Wet Weather Demonstration Project that funded water quality restoration activities since 1992.

Membership in the Assembly of Rouge Communities, under the terms of a Memorandum of Agreement, is limited to cities, townships, villages and counties in the watershed that have storm water management responsibilities under a state-issued discharge permit. Enabling legislation to allow the Assembly of Rouge Communities to become a legal entity was signed into law as Public Act 517 of 2004 on January 3, 2005. The Assembly of Rouge Communities transitioned into a legal entity, the Alliance of Rouge Communities, in December 2005.

Using the watershed approach requires a number of tools, such as a comprehensive sampling and monitoring program, various types of water quality and water quantity modeling, and a geographic information system. The Rouge Project has aggressively invested in these tools to develop the necessary holistic watershed management strategy. These innovative, readily transferable tools are being shared with other cities and state agencies.

The Rouge River National Wet Weather Demonstration Project is a success using any of several measures of achievement. Major progress has been made in the control of pollution being discharged to the Rouge River. For example, combined sewer overflow (CSO) pollutant loads to the river have cut by 90 to 100 percent during most events. In previous years, certain water quality standards were often violated at many places in the watershed. Now, the majority of the waters in the Rouge River watershed meet many standards. Coupled with water quality improvements, the ecosystem health continues to improve as well, as demonstrated by several measures, including increased sightings of fish and wildlife along the river since 1999. Improvements in the water quality and removal of contaminated sediment in Newburgh Lake resulted in the recent lifting of the fish consumption advisory for some species of fish in the lake.

The Rouge Project has a very extensive web site that contains technical reports, maps, and other project details. That site can be accessed at www.rougeriver.com.

ABSTRACT

This Field Sampling Plan (FSP) provides a detailed description of the ongoing sampling and monitoring efforts for the 2007 Baseline Monitoring Program being conducted on behalf of the Rouge River National Wet Weather Demonstration Project and the Alliance of Rouge Communities. The goals of the 2007 sampling program include: implementing monitoring required in individual community storm water permits; maintaining the historical database and tracking trends in the Rouge River; tracking progress on Rouge restoration efforts; and providing data to assist in implementing other Rouge Watershed restoration efforts (i.e., "hot spots" for illicit discharge elimination).

Monitoring and sampling scope, methods, sites, duration, and sample handling for the 2007 season (May-October) are described. Standard operating procedures (SOPs) ensure that the sampling is of acceptable quality and will yield information and data that are useable and technically defensible. This FSP is used for both staff training and reference.

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1.0 INTRODUCTION.

1.1 TASK DESCRIPTION AND OBJECTIVES. The Rouge River National Wet Weather Demonstration Project (Rouge Project) includes environmental monitoring efforts to be used for monitoring trends, analysis of control measures and for decision-making efforts. This Field Sampling Plan (FSP) addresses the Water Quality Sampling Program for 2007. The Rouge River monitoring program for 2007 is being conducted by the Alliance of Rouge Communities (ARC) and the Rouge River National Wet Weather Demonstration Project (Rouge Project). It is a continuation of the work effort that was initiated in 1993.

The primary objective of the Water Quality Sampling Program is to collect water quality samples and to perform water quality measurements at monitoring locations in the Rouge River and tributaries. Continuous measurements for rainfall, level and flow rate, and ambient water quality will also be obtained at selected locations throughout the Rouge River Watershed. Both wet and dry weather surveys are planned in 2007. This sampling will be performed in the Main 3-4 Stormwater Management Area (SWMA) in accordance with a Five-Year Monitoring Plan for the Rouge River Watershed (Cave, 2002). After sampling and monitoring in 2007 the Five-Year Sampling Plan will have been completed. Table 1.1 shows the sampling schedule for the five-year period. All of the planned sampling in the Main 3-4 SWMA will be completed in 2007.

Table 1.1
Five-Year Sampling Schedule

SWMA	2003	2004	2005	2006	2007
Main 1-2	X	X			
Upper		X			
Middle 1			X		
Middle 3			X		
Lower 1				X	
Lower 2				X	
Main 3-4					X

The primary uses of the data collected as part of the Water Quality Sampling Program are:

- Performing water quality monitoring on behalf of the Rouge Project and Alliance of Rouge Communities (ARC) as identified in and required by their community storm water permits;

- Maintaining the historical database and tracking trends in the Rouge River;

- Continued development of the instream flow and water quality data set (with combined sewer overflows (CSOs) now partially controlled and water management programs progressing) to determine trends in water quality conditions;

- Improved overall understanding of the physical, chemical and biological processes in the river; and

- Tracking progress on Rouge restoration efforts; and providing data to assist in implementing other Rouge Watershed restoration efforts.

The time frame for most of the intermittent sampling activities under this 2007 Water Quality FSP will be May through October of 2007. Continuous rainfall, level/flow, and dissolved oxygen (DO)/temperature monitoring will also be conducted from May through October.

Section 1.2 of the FSP presents an overview of the sampling program. Water quality parameters that will be analyzed under the Water Quality Sampling Program are presented in Section 1.3. Section 1.4 presents the roles and responsibilities of the personnel involved with the program. Section 2.0 presents a summary of the Data Quality Objectives and the overall quality assurance objectives for the baseline water quality sampling program. The network of sampling locations and proposed sampling frequency are presented in Section 3.0. A description of the required sampling equipment and a summary of sampling methods are presented in Section 4.0. A summary of required field documentation is presented in Section 5.0. Standard identification protocols for designating samples are presented in Section 6.0. Sample handling and shipping procedures are presented in Section 7.0.

This FSP is intended to provide an overview of the Water Quality Sampling Program for 2007. Detailed, step-by-step procedures that must be followed by members of the sampling team are presented in the Standard Operating Procedures (SOPs) that are referenced throughout this FSP.

1.2 OVERVIEW OF MONITORING STUDIES. The Water Quality Sampling Program includes the following types of monitoring studies:

- Continuous in-situ water quality measurements (DO and temperature);

- Intermittent wet and dry weather water quality surveys;

- Continuous river level and flow measurements; and

- Continuous precipitation (rainfall) monitoring in the watershed.

A brief description of each type of monitoring study and the types of field activities that will be required are presented below.

1.2.1 Continuous In-Situ Water Quality Measurements. Continuous in-situ water quality measurements for DO and temperature will be conducted by the United States Geological Survey (USGS), under contract with the Wayne County and ARC, at two sites from May through October in 2007. This will require installation and/or maintenance of specially designed instruments consisting of a multi-parameter probe and a data logger. The instrument will record continuous measurements of DO and temperature at 15-minute intervals during both dry and wet weather periods. The continuous water quality monitors are periodically recalibrated and serviced, and the data are regularly downloaded.

1.2.2 Intermittent Wet and Dry Weather Surveys. A minimum of five wet weather events and 15 dry weather surveys are to be monitored in the Main 3-4 SWMA as designated in the Five-Year Monitoring Plan. Wet and dry weather water quality surveys will be conducted using manual grab sampling and selected measurements with portable water quality monitors. In wet weather, manual grab sampling will occur at three stations in the Main 3-4 SWMA during a minimum of five different rain events. Under dry weather conditions, manual grab sampling will occur at three stations in the Main 3-4 SWMA.

For sampling purposes, wet and dry weather conditions are defined in Section 3.2.2.

1.2.3 Continuous Level/Flow Measurements. River level/flow monitoring is required to estimate pollutant loadings relative to samples collected. Continuous water level recorders will be maintained at eight sites by the USGS. Sutron Accubar® pressure transducers, Sutron Accububble gages, or Handar Shaft encoders are used to monitor water level continuously. An established rating curve is used to compute flow. Periodic calibration and maintenance of instream water level recorders and direct stream flow measurements, required for stream rating curves, will be performed by USGS staff.

1.2.4 Continuous Precipitation Monitoring. Rainfall will be continuously monitored by agencies other than the Rouge Program Office (RPO) using recording rain gages at 21 locations within the watershed. Field crews will remotely access the rain gages approximately every two weeks to retrieve data, and will conduct quarterly site visits to verify proper equipment operation and calibration.

1.3 SAMPLING PARAMETERS. Water quality analyses will include the parameters presented in *Table 1.2*. Water quality parameters have been grouped according to the following series:

Series A: Oxygen Demand: five-day carbonaceous biochemical oxygen demand ($CBOD_5$),
Nutrients: total phosphorus (TP) and ammonia (NH_3), and

Solids: total suspended solids (TSS).

Series B: *Escherichia coli* (*E. coli*) bacteria.

Series C: In-situ field measurements and portable equipment measurements for DO and temperature.

Each dry weather survey sample and each discrete sample within each wet weather survey will be analyzed for Series A and B parameters, while Series C parameters are measured with a portable water quality monitor. Visual observations of aesthetics will also be made whenever a sample is taken and recorded on a field form. However, aesthetic data will only be available in hard copy. Continuous water quality monitors will also record Series C parameters.

Table 1.2
Sampling Parameters

Series Designation	Parameter	Abbreviation
Series A	Carbonaceous Biochemical Oxygen Demand (5- day)	$CBOD_5$
	Ammonia as Nitrogen	NH_3-N
	Total Phosphorus as Phosphorus	PHOS_T
	Total Suspended Solids	TSS
Series B	*Escherichia coli*	*E. coli*
Series C	Dissolved Oxygen[1]	DO
	Temperature[1]	TEMP

Notes: [1] Parameter observed or measured in the field using a portable or continuous monitoring probe

1.4 ROLES AND RESPONSIBILITIES. *Table 1.3* presents the roles and responsibilities of key personnel involved with the 2007 Water Quality Sampling Program for the Rouge Project and the ARC, and other key people related to the sampling effort. *Table 1.4* provides relevant telephone numbers for personnel involved with all aspects of the Water Quality Sampling Program. It should be noted that personnel assignments might change during the sampling program.

Table 1.3
Program Organization and Responsibility

Title/Role	Contact	Responsibility
Work Plan Manager	Colleen Hughes, CDM	Work Plan Management
Monitoring Task Manager	Chris Catalfio, CDM	Monitoring Technical Lead. Event selection, staffing and coordination. Data management, processing and review.
Monitoring Technical Advisor	Ed Kluitenberg, CDM	Monitoring Technical Advisement
Wayne County Department of the Environment Coordinator	Dean Tuomari, WCDOE Patrick Cullen, WCDOE	Coordination of WCDOE field staff
Applied Science, Inc.	Andy Wood	Field staff
USGS Coordinator	Steve Blumer, USGS	Coordination of level and flow monitoring, and water quality monitoring at the permanent sites.
Laboratory QA/QC Coordinator	Chris Catalfio, CDM	Review of Analytical Data
Laboratory Contact, Paragon Laboratories, Inc.	John Spurr, Paragon	Laboratory Analysis
Laboratory Contact, e-Lab Analytical, Inc.	Ann Preston, e-Lab	Laboratory Analysis

Table 1.4
Program Personnel Telephone Numbers

Titles/Roles	Name	Office Phone	Office Fax	Pager / Cell	Home Phone
Work Plan Manager	Colleen Hughes, CDM	(734) 213-5444	(734) 213-5775	(734) 353-0138	
Monitoring Task Manager	Chris Catalfio, CDM	(734) 326-3936	(734) 326-4421		(734) 453-1023
Monitoring Technical Advisor	Ed Kluitenberg, CDM	(734) 213-5444	(734) 213-5775	(734) 476-1108	(734) 485-5714
Wayne County Department of Environment	Dean Tuomari Patrick Cullen Sue Thompson Noel Mullett Matt Best	(734) 326-3936 (734) 326-3926 (734) 326-3936 (734) 326-3926 (734) 326-3926	(734) 326-4421 (734) 326-4421 (734) 326-4421 (734) 326-4421 (734) 326-4421	(313) 999-6253 (313) 999-6267 (313) 999-6266 (313) 999-6260 (313) 999-6264	
Applied Science Inc.	Andy Wood, ASI	(313) 567-3990	(313) 567-3750	(517) 214-1621	(734) 812-4979
Paragon Laboratory	John Spurr	(734) 462-3900	(734) 462-3911		
e-Lab Analytical, Inc.	Ann Preston	(616) 399-6070 x 525	(616) 399-6185	(616) 218- 5574	
USGS Contact	Steve Blumer	(517) 887-8922	(517) 887-8937		
Laboratory QA/QC	Chris Catalfio, CDM	(734) 326-3936	(734) 326-4421		(734) 453-1023

2.0 DATA QUALITY OBJECTIVES.

The overall Quality Assurance/Quality Control (QA/QC) objective for the Water Quality Sampling Program is to ensure that the sampling data generated are of documented quality for the purposes of the Rouge Project and the ARC. The intended uses of data collected under the Water Quality Sampling Program are presented in Section 1.1. *Table 2.1* presents specific objectives and data uses for each type of sampling to be performed. For each series of parameters, *Table 2.1* also specifies appropriate analytical levels and standard operating procedures (SOPs) that must be followed by field crews to achieve the QA objectives. Rainfall data are not discussed in Section 2 as this monitoring activity is not being performed or funded by the Rouge Project or the ARC. The rainfall data are collected by agencies other than the Rouge Project or the ARC that perform their own QA/QC activities before providing the data to the Rouge Project.

2.1 DATA QUALITY OBJECTIVES.

The analytical levels outlined for the Water Quality Sampling Program are derived from the United States Environmental Protection Agency (USEPA) Region V "Content Requirements for Quality Assurance Project Plans" *(R5-QAS-93-001)*. This USEPA guidance document references various analytical levels that provide an indication of the level of QA/QC associated with each type of sampling activity. The three analytical levels that relate to the activities performed under this program element are: Level 1 - Field screening which primarily involves manual measurements and observations; Level 2 - Field analyses, which, for the purposes of this project, includes in-situ water quality measurement and flow measurement. This data, by its nature, must be generated in the field, yet undergoes extensive QA/QC review; and Level 3 - Engineering, including laboratory analyses with quality control documentation which may be less than the complete QA protocol under the USEPA Contract Laboratory Program (USEPA, 2006).

The data quality objectives presented in this FSP for the Water Quality Sampling Program are related primarily to field activities. Laboratory QA/QC requirements are not addressed in this FSP, however it is necessary for field crews to be aware of the QA/QC objectives so that appropriate samples are submitted for laboratory analyses. Field crews will also be responsible for collecting various QA/QC samples as described in the SOPs for specific sampling activities.

2.2 QUALITY ASSURANCE OBJECTIVES.

Quality assurance objectives for measurement data are usually expressed in terms of Precision, Accuracy, Representativeness, Completeness, and Comparability (also known as the PARCC parameters). In order to achieve these objectives, data must be: (1) of known quantitative statistical significance in terms of precision and accuracy for the levels measured of the specific parameters analyzed in this project; (2) representative of the actual site in terms of physical and chemical conditions; (3) complete to the extent that necessary conclusions may be reached; (4) comparable to previous and subsequent data and other studies. *Table 2.2* presents a summary of QA/QC data that will be collected during the Water Quality Sampling Program relative to the PARCC parameters. Brief descriptions of the QA/QC data that will be collected to assess each PARCC parameter

are provided in the following paragraphs. Detailed procedures for collection of QA/QC samples are presented in the SOP for each sampling activity.

Table 2.1
Data Quality Objectives

Type of Sampling Activity	Overall Study Objectives and Data Uses	Parameters Analyzed	Appropriate Analytical Levels	Standard Operating Procedures to be Followed to Achieve Data Quality Objectives	SOP Number
Continuous In-situ water quality measurements	Identify water quality and trends in each SWMA.	Series C	Field Analyses (DQO Level 2)	Wagner, R. J., Mattraw, H. C., Ritz, G. F., and Smith, B. A. "*Guidelines and Standard Procedures for Continuous Water Quality Monitors: Site Selection, Field Operation, Calibration, Record Computation and Reporting",*USGS WRIR 00-4252, 2000.	USGS/WRIR 00-4252
Grab sampling during dry and wet weather	Identify dry and wet weather water quality and trends in each SWMA.	Series A Series B Series C	Laboratory Analyses (DQO Level 3) Field Analyses & Observations (DQO Level 2)	Dry Weather Survey In-Stream Field Sampling Wet Weather Survey In-Stream Field Sampling Grab Sample Protocol Laboratory Coordination Aesthetics Observations	RPO/ASI-FLD-0602A RPO/ASI-FLD-0603A
Flow Measurements	Identify stream flow and trends in each SMWA and estimate pollutant loads.	Stage Flow	Field Analyses (DQO Level 1 & 2)	Rantz, S. E. et al. "*Measurement and Computation of Streamflow: Vol. 1, Measurement of Stage & Discharge; Vol. 2, Computation of Discharge",* WSP 2175, 1982.	USGS/WSP 2175

Table 2.2
Quality Control/Quality Assurance Criteria

Type of Sampling Activity	Precision	Accuracy	Representativeness	Completeness	Comparability
Continuous In-situ water quality measurements.	Comparison with portable field instruments	Maximum of 5% or 0.3 mg/L (whichever is greater) difference between measured and calibration value	Proper site selection and standard operating procedures (SOPs) Monitoring conducted through several seasons.	Valid time series data during at least 90% of monitoring period Valid time series at 100% of the monitoring sites.	Field crew training Standard operating procedures Documentation of field activities Use of standard instrumentation Comparison of data to other nearby sites Comparison of data to historic data at same site
Grab sampling during dry and wet weather	Field Duplicates (1 in 20) Field Splits (1 in 20)	Field Blanks (1 per survey)	Proper site selection and sample collection procedures (SOPs) Targeting small, medium, and large wet weather events – seasonally distributed if possible. Seasonal distribution of dry weather surveys.	Samples collected according to FSP protocols at all grab sampling locations with valid results for at least 90% of samples collected.	Field crew training Standard operating procedures Documentation of field activities Use of lab standard analyses
Flow Measurement	Stage checked against known reference point during each site visit Flow checked with second measurement when not in line with known rating curve for site.	Stage accurate to within 0.01 feet. Flow accurate to within 5% at most sites; but up to 10% at selected sites or when complicated by factors such as ice.	Proper site selection and standard operating procedures (SOPs) Monitoring conducted year-round.	Valid time series data during at least 90% of monitoring period Valid time series at 100% of the monitoring sites.	Field crew training Standard operating procedures Documentation of field activities Use of standard instrumentation Comparison of data to other nearby sites Comparison of data to historic data at same site

2.2.1 Precision. Precision is a measure of mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. Field duplicate samples will provide a measure of the contribution to overall variability of field-related and to some extent laboratory-related sources. For the manual grab sampling surveys, field duplicates and field splits will be collected at a target frequency of one in 20. The precision of the continuous in-situ water quality probes is assessed by the USGS by making comparisons to calibrated portable field instruments. The USGS checks the precision of stage measurements against a known reference point during each site visit. They also check the precision of flow measurements by repeating any flow measurements that are not in line with the established rating curve for a site.

2.2.2 Accuracy. Accuracy is a comparison of a measured value with a known or "true" value. Accuracy is also a measure of the bias in a system. QC criteria for accuracy are primarily related to laboratory results of analyses of method blanks, reagent/preparation blanks, and matrix spike/duplicate samples that will not require collection of additional samples in the field. For the manual grab sampling surveys, accuracy will also be assessed by collection of one field blank during each survey. The USGS will assess accuracy of the continuous in-situ water quality probes and stage and flow measurements in accordance with their standard procedures.

2.2.3 Representativeness. Representativeness is the degree to which data accurately and precisely represents the true value of a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition, intended to be characterized. In general, the representativeness of the water quality data collected under the Water Quality Sampling Program will be ensured as a result of careful consideration of: proper design of the monitoring network, selection of appropriate field methodologies, proper sample preparation, preservation and handling, selection and execution of appropriate analytical methodology, and proper sample identification and reporting of results. Representativeness criteria are presented in *Table 2.2* for monitoring of wet and dry weather events to ensure that sampling is performed during "representative" hydro-meteorological conditions. Representativeness criteria for the USGS continuous water quality, stage and flow measurements are also included in *Table 2.2.*

Wet weather sampling will target a range of rainfall events. Rainfall events are defined as follows: small, 0.25-0.49 inches; medium, 0.50-0.99 inches; large, ≥1.0 inch. *(Note: two small, two medium, and one large rainfall event will be targeted in each SWMA.)* Representativeness criteria also apply to the temporal distribution of samples during a wet weather event at a particular location. In order to be representative, samples must be collected during the rising limb, peak flow, and recession limb of the storm hydrograph. Since it is not possible to predict storm characteristics in advance with any great certainty, it may be necessary to accept monitoring data from a limited number of events that do not completely meet the representativeness criteria. The seasonal distribution of wet weather events will also be representative. For example, if sampling is planned for a total of five

wet weather events and most of the sampling period falls in the summer months, the seasonal distribution (if possible) will be one spring event, three summer events, and one fall event.

Dry weather grab sampling will be preceded by a minimal 48 to 72-hour period with no rainfall, e.g., there is no measurable change in river level or less than 0.10 inches of rainfall in 24 hours during the 48 to72 hours preceding the sampling. To represent seasonal distribution, dry weather sampling will be performed during three 30-day periods that are distributed throughout the monitoring season.

2.2.4 Completeness. Completeness is measured by the amount of valid data expressed as a percentage obtained from a measurement system compared to the amount expected under normal conditions. The target completeness criteria for the continuous water quality, stage and flow measurements will be to produce valid times series data at least 90 percent of the time at each site. The target completeness criteria for spatial coverage will be to have at least 80 percent of the monitoring sites provide valid synoptic data. At a particular location, the completeness criterion for a grab sample during a wet weather event is to collect 90 percent of the targeted sampling frequency.

2.2.5 Comparability. Comparability is the confidence with which one data set can be compared to another. Comparability may be assessed by comparing sampling methodology, analytical methodology, and units of reported data. The comparability of water quality data collected at various locations under the Water Quality Sampling Program is not an issue since identical sampling, analytical, and reporting methodologies will be used at all sites. The water quality data will be compared with historical data collection efforts in the Rouge River and elsewhere. Documentation will ensure that the Water Quality sampling data set is correctly comparable to other data sets.

3.0 SAMPLING LOCATION AND FREQUENCY.

This section describes the overall design of the water quality sampling network. Due to reductions in budget that began in 2006 the water quality sampling program has been reduced from previous years. The logical basis for the sampling site selection process is summarized in Section 3.1. The actual sampling site selections are presented in Section 3.2. Sampling frequency may vary by parameter series and type of monitoring station. A summary of sampling interval protocols is described in Section 3.3.

3.1 RATIONALE FOR SITE SELECTION.

Selection of sampling site locations was an iterative process that was jointly performed by various Rouge Project work plan managers with input from community representatives. A brief summary of the rationale for sampling site selection is presented below.

3.1.1 Continuous In-Situ Water Quality Measurement Locations.

The sites were chosen based on the availability of historic data for comparison purposes, and based on feedback from community representatives. Locations for continuous in-situ water quality measurements were chosen in the middle and downstream end of the Main 3-4 SWMA. These monitoring locations will also continue to support the CSO evaluation efforts. These two stations are part of the long-term monitoring network for tracking water quality trends in the watershed.

3.1.2 Intermittent Wet and Dry Weather Survey Locations.

Three locations in the Main 3-4 SWMA will be sampled in both dry weather and wet weather conditions in 2007. Two of the three wet weather sites are also part of the continuous monitoring network established for the Rouge Project. Site selection was also based on the following criteria: collection of well-mixed, representative samples is feasible; field personnel can readily access the site; and the field work can be performed with few safety concerns.

3.1.3 Continuous Level/Flow Measurement Locations.

Continuous level/flow monitoring will occur at eight locations. All of these locations were monitored in the 2006 season except for Rotunda Drive (US8). They were selected to best represent downstream boundary conditions for each of the SWMAs or were previously part of the USGS monitoring program.

3.1.4 Continuous Precipitation Monitoring Locations.

Continuous precipitation or rainfall monitoring will occur at 21 rain gages. These were originally selected to provide a good distribution of rainfall pattern throughout the watershed, while supporting aspects of the Rouge Project CSO basin evaluations. The network includes 11 rain gages that are part of the permanent monitoring network, seven rain gages that support CSO basin evaluations, and three rain gages that are part of the Detroit Water and Sewerage Department (DWSD) network.

3.2 SAMPLING LOCATIONS AND FREQUENCY. The sampling locations selected for *in-situ* water quality, wet and dry weather surveys, and level/flow measurements are presented in *Table 3.1,* and are organized by their location along the Rouge River. River segments include the Main, Upper, Middle, and Lower Rouge River. Within each river segment, sampling locations are presented in an upstream-to-downstream order. A brief description of the overall sampling network is presented below.

3.2.1 Continuous In-Situ Water Quality Measurement Locations. Continuous in-situ water quality measurements will be collected at two sites. Field IDs for the two sites are US7 and US8. Approximately six months of data will be collected at these sites, from May 2007 through October 2007. The locations of these continuous in-situ water quality sites are described in *Table 3.1* and are mapped in *Figure 3-1*.

3.2.2 Intermittent Wet and Dry Weather Instream Survey Locations. In 2007 grab sampling will be conducted at instream locations in the Main 3-4 SWMA during both wet and dry weather conditions from May through October. Actual sampling events may include events that begin at the end of April or beginning of November. Sampling locations are described in *Table 3.1* and mapped in *Figure 3-2*.

Five wet weather events are targeted in 2007 in the Main 3-4 SWMA. Wet weather surveys will be performed at three stations , 5 Mile Road (G43), Plymouth Road (US7), and Rotunda Drive (US8). The five selected rain events are defined as follows: two rainfall events of 0.25 to 0.49 inches precipitation; two events of 0.50 to 0.99 inches; one event greater than or equal to 1 inch. If possible at least seven samples will be collected at each station to adequately define the hydrograph for each event.

Fifteen (15) dry weather surveys will be scheduled so that five surveys occur during each of three, 30-day periods. Dry weather surveys will be performed at 5 Mile Road (G43), Plymouth Road (US7), and Rotunda Drive (US8). Dry weather is defined as a period with no more than trace rainfall amounts (<0.10 inches per day for 48 to 72 hours preceding the dry weather survey) or no measurable change in river level. The surveys will be scheduled in three groupings such that each set of five surveys will occur within a 30-day period. The three groupings will be distributed throughout the monitoring season. The starting time of the surveys will vary slightly with the sunrise, but dry weather surveys will generally be performed between the hours of 6:00 AM to 10:00 AM when the dissolved oxygen is expected to be at minimum concentrations for the day. Visual observations of river aesthetics will also be recorded as in previous years.

Table 3.1
2007 Monitoring and Sampling Locations (Upstream to Downstream Order)

Field ID	Site ID	SWMA ID	Location Description	Continuous Water Quality Monitoring Location[1]	Continuous Level/Flow Measurement Location	Intermittent Wet (W) and Dry (D) Weather Sampling Locations[2]
US4	M1007260	Main 1-2	Maple Road (USGS)		X	
US5	M1007261	Main 1-2	Beech Road (USGS)		X	
US6	M2004041	Main 1-2	Evans Ditch at 9 Mile Road (USGS)		X	
G43	M2003543	Main 3-4	5 Mile Road west of Lahser Road			Dry, Wet
US7	M2003045	Main 3-4	Plymouth Road (USGS)	X	X	Dry, Wet
US8	M3009637	Main 3-4	Rotunda Drive	X	X (level only)	Dry, Wet
US3	U1003042	Upper	Shiawassee Road (USGS)		X	
US2	D3003043	Middle 3	Inkster Road (USGS)		X	
US1	L2003044	Lower 2	John Daly Road (USGS)		X	

[1] Series C parameters measured at 15 minute intervals
[2] Series A, B, and C parameters sampled for 15 dry weather sampling surveys and multiple times during five wet weather events.

Figure 3-1

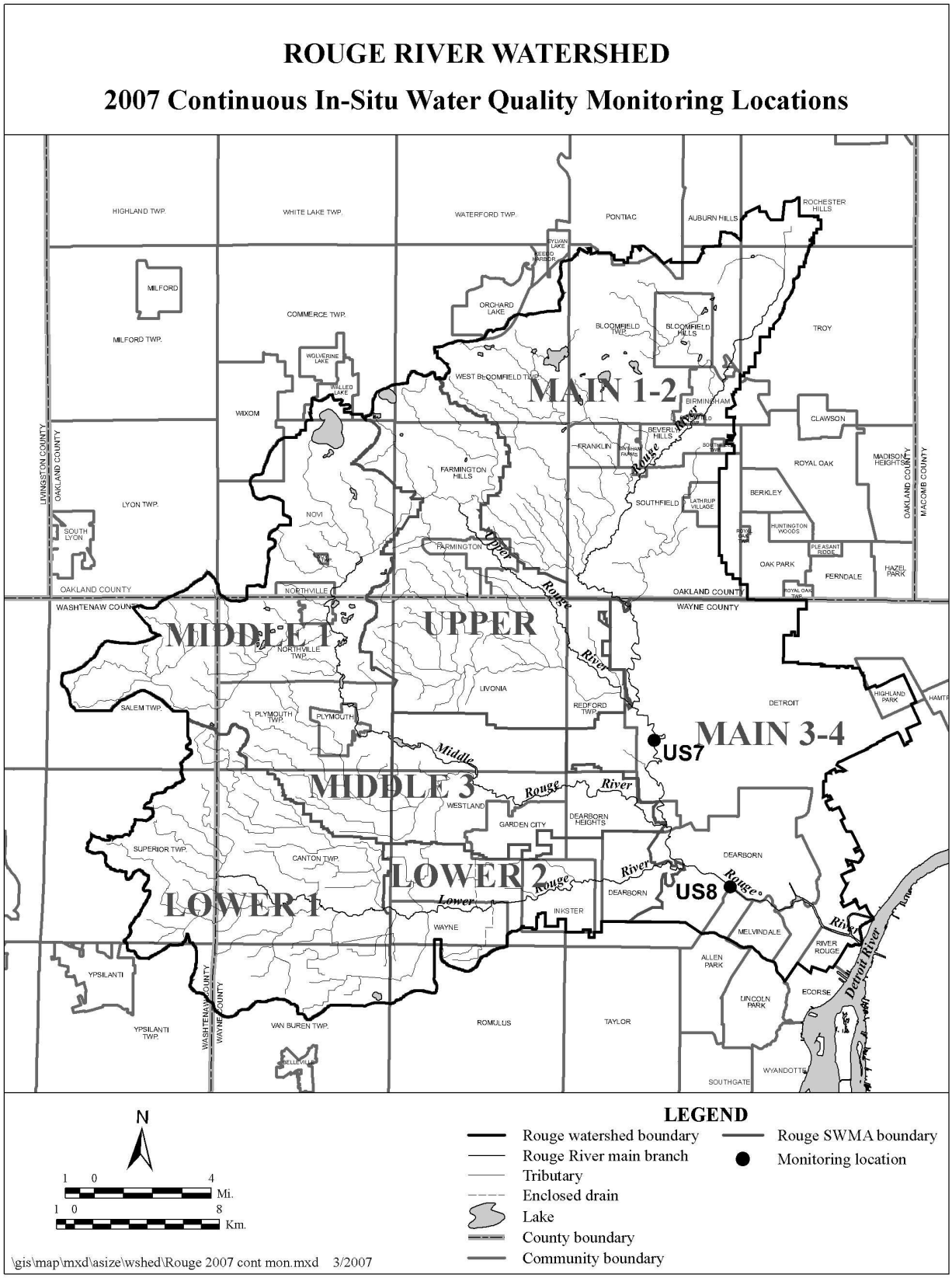
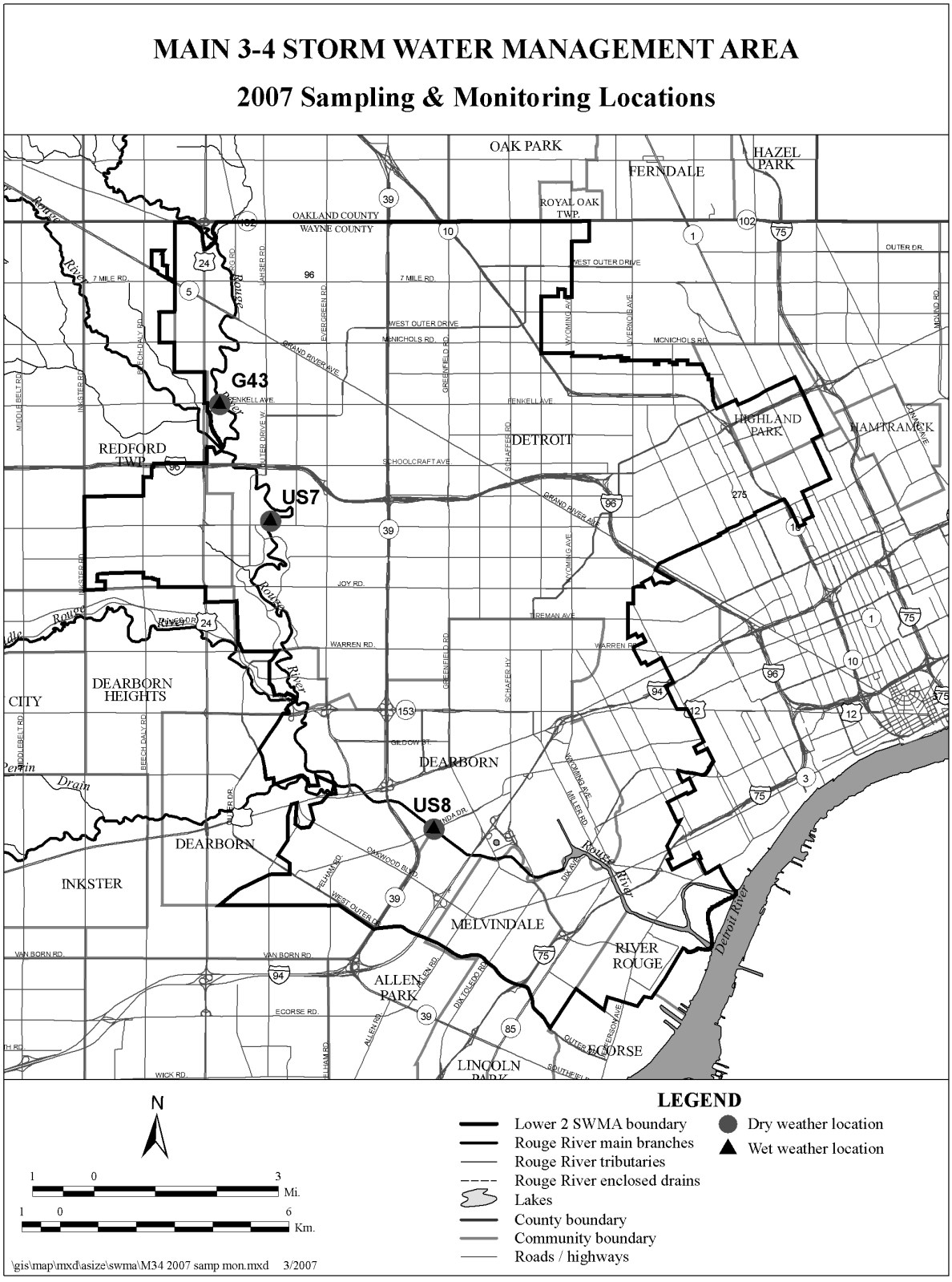

ROUGE RIVER WATERSHED
2007 Continuous In-Situ Water Quality Monitoring Locations
MAIN 1-2
MIDDLE 1
UPPER
MAIN 3-4
MIDDLE 3
LOWER 2
LOWER 1
US7
US8
HIGHLAND TWP.
WHITE LAKE TWP.
WATERFORD TWP.
PONTIAC
AUBURN HILLS
ROCHESTER HILLS
MILFORD
MILFORD TWP.
COMMERCE TWP.
ORCHARD LAKE
BLOOMFIELD TWP.
BLOOMFIELD HILLS
TROY
WOLVERINE LAKE
WALLED LAKE
WEST BLOOMFIELD TWP.
WIXOM
BIRMINGHAM
CLAWSON
FRANKLIN
BEVERLY HILLS
ROYAL OAK
MADISON HEIGHTS
FARMINGTON HILLS
SOUTHFIELD
BERKLEY
LYON TWP.
NOVI
HUNTINGTON WOODS
FARMINGTON
OAK PARK
FERNDALE
HAZEL PARK
SOUTH LYON
NORTHVILLE
LIVINGSTON COUNTY
OAKLAND COUNTY
WASHTENAW COUNTY
WAYNE COUNTY
MACOMB COUNTY
NORTHVILLE TWP.
LIVONIA
REDFORD TWP.
DETROIT
HIGHLAND PARK
SALEM TWP.
PLYMOUTH TWP.
PLYMOUTH
WESTLAND
GARDEN CITY
DEARBORN HEIGHTS
DEARBORN
SUPERIOR TWP.
CANTON TWP.
INKSTER
WAYNE
MELVINDALE
RIVER ROUGE
ALLEN PARK
YPSILANTI
YPSILANTI TWP.
VAN BUREN TWP.
ROMULUS
TAYLOR
ECORSE
LINCOLN PARK
WYANDOTTE
SOUTHGATE
BELLEVILLE
Rouge River
Middle Rouge River
Upper Rouge River
Lower Rouge River
Detroit River
N
1 0 4 Mi.
1 0 8 Km.
\gis\map\mxd\asize\wshed\Rouge 2007 cont mon.mxd 3/2007
LEGEND
Rouge watershed boundary
Rouge River main branch
Tributary
Enclosed drain
Lake
County boundary
Community boundary
Rouge SWMA boundary
Monitoring location

Figure 3-2
Main 3-4 SWMA 2007 Intermittent Wet and Dry Weather Survey Locations



3.2.3 Continuous Level/Flow Measurement Locations. Instream level and flow measurements will be conducted at eight locations throughout the watershed from May through October 2007. These include the two locations where continuous in-situ monitoring is performed (US7 and US8), plus an additional six stations, US1, US2, US3, US4, US5, and US6. No primary flow measurement devices will be installed; all flow measurements will be computed from an established stage-discharge relationship using the continuously recorded water level (stage). All locations are permanent USGS gaging stations with established stage-discharge relationships with the exception of Rotunda Drive (US8) where backwater effect from the Detroit River has prevented the development of a stage-discharge curve. The level and flow measurement sites (which are continuous in-situ monitoring locations) are described in *Table 3.1* and are mapped in *Figure 3-3*.

3.2.4 Continuous Precipitation Monitoring Locations. Rainfall monitoring in the watershed for the 2007 season will be conducted by three agencies at 21 sites. These sites include 11 gage stations which are part of a permanent network: Rain gages R11 through R14 are operated by Wayne County, and rain gages R15 through R21 are operated by Oakland County. Three additional gages R37 through R39 are operated by DWSD and will be added in 2007. There are also seven rain gages associated with individual CSO basins as described below.

Year-round precipitation monitoring will be performed throughout the monitoring season at seven sites in the drainage areas of CSO basins. Rain gages R30, R31, R32 and R33 will be operated by Oakland County in or near the drainage areas of the Acacia Park, Bloomfield Village and Birmingham CSO basins. Rain gages R27 through R29 will be operated by Wayne County in or near the drainage areas of the Dearborn Heights, Inkster and Redford CSO basins.

All rain gages, which are part of the permanent network, and all Oakland and Wayne County CSO basins' rain gages are listed in *Table 3.2*, and their locations are mapped in *Figure 3-4*.

Figure 3-3

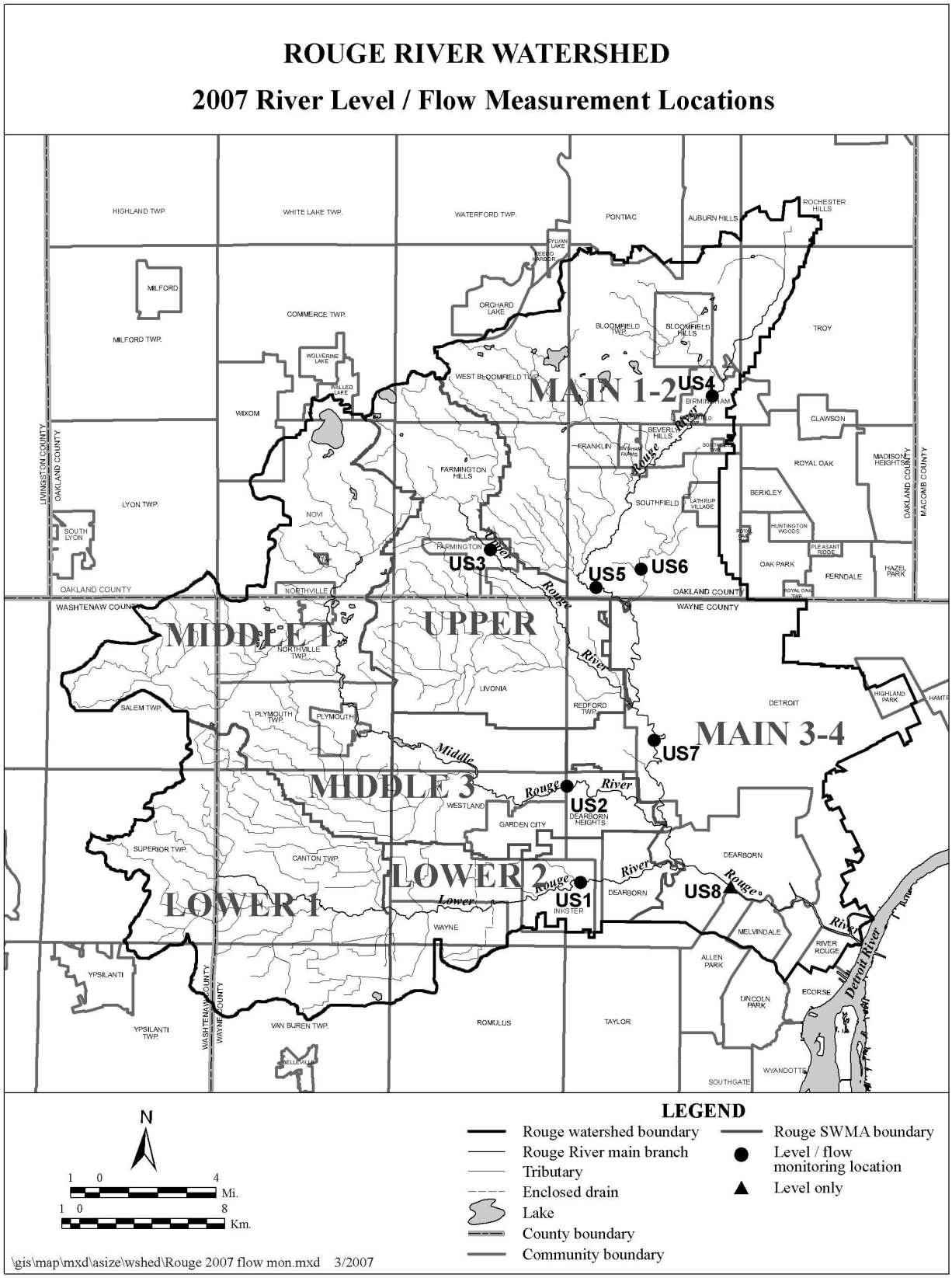

ROUGE RIVER WATERSHED
2007 River Level / Flow Measurement Locations
MAIN 1-2
MIDDLE 1
UPPER
MAIN 3-4
MIDDLE 3
LOWER 2
LOWER 1
US1
US2
US3
US4
US5
US6
US7
US8
HIGHLAND TWP.
WHITE LAKE TWP.
WATERFORD TWP.
PONTIAC
AUBURN HILLS
ROCHESTER HILLS
MILFORD
MILFORD TWP.
COMMERCE TWP.
ORCHARD LAKE
BLOOMFIELD TWP.
BLOOMFIELD HILLS
TROY
WOLVERINE LAKE
WALLED LAKE
WEST BLOOMFIELD TWP.
WIXOM
FRANKLIN
BEVERLY HILLS
CLAWSON
ROYAL OAK
MADISON HEIGHTS
BERKLEY
SOUTHFIELD
ATHRUP VILLAGE
FARMINGTON HILLS
LYON TWP.
NOVI
SOUTH LYON
FARMINGTON
HUNTINGTON WOODS
PLEASANT RIDGE
OAK PARK
FERNDALE
HAZEL PARK
LIVINGSTON COUNTY
OAKLAND COUNTY
MACOMB COUNTY
WASHTENAW COUNTY
NORTHVILLE
NORTHVILLE TWP.
SALEM TWP.
PLYMOUTH TWP.
PLYMOUTH
LIVONIA
REDFORD TWP.
DETROIT
HIGHLAND PARK
WESTLAND
GARDEN CITY
DEARBORN HEIGHTS
SUPERIOR TWP.
CANTON TWP.
DEARBORN
INKSTER
WAYNE
MELVINDALE
RIVER ROUGE
ALLEN PARK
ECORSE
LINCOLN PARK
YPSILANTI
YPSILANTI TWP.
VAN BUREN TWP.
ROMULUS
TAYLOR
WYANDOTTE
SOUTHGATE
Rouge River
Middle Rouge River
Upper Rouge River
Lower Rouge River
Detroit River
N
1 0 4 Mi.
1 0 8 Km.
\gis\map\mxd\asize\wshed\Rouge 2007 flow mon.mxd 3/2007
LEGEND
Rouge watershed boundary
Rouge River main branch
Tributary
Enclosed drain
Lake
County boundary
Community boundary
Rouge SWMA boundary
Level / flow monitoring location
Level only

Figure 3-4

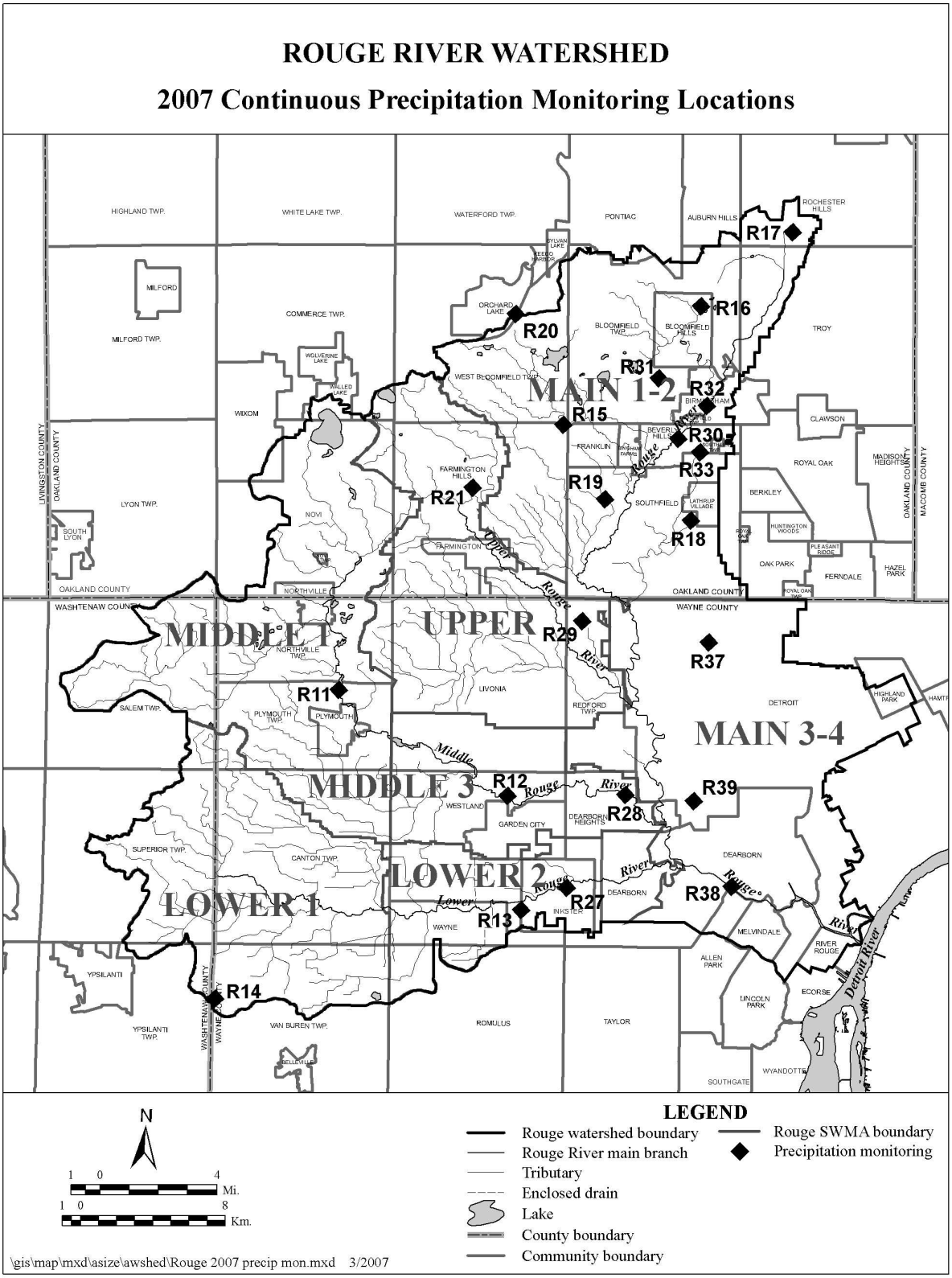

ROUGE RIVER WATERSHED
2007 Continuous Precipitation Monitoring Locations
MAIN 1-2
MIDDLE 1
UPPER
MAIN 3-4
MIDDLE 3
LOWER 2
LOWER 1
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R27
R28
R29
R30
R31
R32
R33
R37
R38
R39
HIGHLAND TWP.
WHITE LAKE TWP.
WATERFORD TWP.
PONTIAC
AUBURN HILLS
ROCHESTER HILLS
MILFORD
MILFORD TWP.
COMMERCE TWP.
ORCHARD LAKE
BLOOMFIELD TWP.
BLOOMFIELD HILLS
TROY
WEST BLOOMFIELD TWP.
WIXOM
FARMINGTON HILLS
FRANKLIN
BEVERLY HILLS
BIRMINGHAM
CLAWSON
ROYAL OAK
MADISON HEIGHTS
BERKLEY
SOUTHFIELD
LATHRUP VILLAGE
HUNTINGTON WOODS
PLEASANT RIDGE
OAK PARK
FERNDALE
HAZEL PARK
LYON TWP.
NOVI
SOUTH LYON
FARMINGTON
NORTHVILLE
NORTHVILLE TWP.
SALEM TWP.
PLYMOUTH
PLYMOUTH TWP.
LIVONIA
REDFORD TWP.
DETROIT
HIGHLAND PARK
WESTLAND
GARDEN CITY
DEARBORN HEIGHTS
DEARBORN
SUPERIOR TWP.
CANTON TWP.
INKSTER
WAYNE
MELVINDALE
ALLEN PARK
RIVER ROUGE
ECORSE
LINCOLN PARK
YPSILANTI
YPSILANTI TWP.
VAN BUREN TWP.
ROMULUS
TAYLOR
SOUTHGATE
WYANDOTTE
BELLEVILLE
LIVINGSTON COUNTY
OAKLAND COUNTY
WASHTENAW COUNTY
WAYNE COUNTY
MACOMB COUNTY
Rouge River
Middle Rouge River
Upper Rouge River
Lower Rouge River
Detroit River
N
1 0 4 Mi.
1 0 8 Km.
LEGEND
Rouge watershed boundary
Rouge River main branch
Tributary
Enclosed drain
Lake
County boundary
Community boundary
Rouge SWMA boundary
Precipitation monitoring
\gis\map\mxd\asize\awshed\Rouge 2007 precip mon.mxd 3/2007

Table 3.2
2007 Continuous Precipitation Monitoring Locations

Field ID	Site ID	Location Description
R11	D2003021	Phoenix Park Located 14973 Northville Rd. (S. of Six Mile)
R12	D3003022	Merriman Yard 7651 Merriman Rd. - S. of Ann Arbor Trail
R13	L2003023	Henry Ruff Yard 3501 Henry Ruff - S. of Michigan Ave.
R14	L1003024	Willow Run Airport Fire Station Van Buren Township
R15	M1003031	Walnut Lake #1 Pump Station 7498 Inkster Rd., Franklin
R16	M1003032	Bloomfield Open Hunt 405 E. Long Lake - Bloomfield Hills
R17	M1003033	Rochester Hills Sanitary Lift Station Grant Rd., Rochester Hills
R18	M2003034	City of Southfield - Civic Center Southfield
R19	M1003035	25515 Clara Lane Southfield
R20	M1003036	Orchard Lake Village 3957 Orchard Lake Rd.
R21	U1003037	I-696 Pump Station & 12 Mile Rd. Farmington Hills
R27	L2009230	Inkster CSO Basin Inkster Road North of Michigan Avenue
R28	D3009231	Dearborn Heights CSO Basin East of Telegraph / South of Hines Drive
R29	U1009232	Redford Fire Station No. 1 Northeast Corner of Beech-Daly and Pickford
R30	M1009233	Acacia Park CSO Basin North of Lincoln Drive
R31	M1009234	Bloomfield Stormwater Retention Basin Bloomfield Club Court, East of Lahser
R32	M1009235	Birmingham CSO Basin Birmingham
R33	M2009601	Beverly Hills Village Office 18500 West 13 Mile Road
R37	M3009736	Southfield Freeway and Curtiss Road (DWSD gage PG09)
R38	M3009737	Rotunda Drive between Southfield Freeway and Greenfield Road (DWSD gage PG10)
R39	M3009738	Warren Road and Artesian Street (DWSD gage PG34)

4.0 SAMPLING METHODS.

This section describes the sampling methods that will be used for the Water Quality Sampling Program. Brief descriptions of the equipment are provided including continuous in-situ water quality monitors and river level recorders. The operation of the sampling network is also summarized below.

4.1 SITE INSPECTION. Preliminary site inspections will be conducted at each grab sample location to ensure that well-mixed representative samples will be collected. The site inspection will also review safety and access for field crews.

4.2 EQUIPMENT INSTALLATION. No new sampling or monitoring equipment will be installed during the 2007 season. The USGS will use their standard procedures for deploying continuous water quality monitors at the same sites and using the same housings as in prior years.

4.3 EQUIPMENT CONFIGURATION. The general configuration of the sampling equipment is provided below. All continuous water quality, level and flow monitoring in 2007 is being performed by the USGS.

4.3.1 Continuous In-situ Water Quality Monitors. The USGS will use "YSI 6 Series Multiparameter Water Quality Monitors" to perform the continuous in-situ water quality measurements for DO and temperature. Data collection for DO and temperature will be performed by the USGS. The measurements are recorded in a digital format at user specified time intervals. In this project the data logging will occur at 15-minute intervals.

Installation. Water quality monitors are installed inside protective tubing that runs on the stream bank down to the river bank. At the river bank the tubing extends a short distance into the river. The monitor is lowered down the tubing until the probe extends just beyond the end of the tubing. The exact tubing location and elevation are selected to prevent the sonde from being damaged by floating debris, to provide good water circulation past the probes, and to ensure that the probes are submerged at all times. Locations that have shallow baseflows (e.g., less than 1.0 foot) require installation of the probes at an elevation relatively close to the streambed. Close proximity to the streambed may result in higher exposure to solids and sensor fouling may occur more rapidly requiring more frequent maintenance. For installations where rapid fouling is found to occur the frequency of maintenance/calibration checks will be increased.

Operation. The water quality instruments will require regular servicing and calibration. Servicing includes checking the calibration drift, re-calibration of the instrument, downloading of logged data, replacing power supply, checking for vandalism, and other maintenance as required. Servicing, calibration and data retrieval will be performed by USGS staff according to their procedures.

4.3.2 Continuous Level Recorders. Level monitoring will be performed by the USGS. Sutron Accubar pressure transducers, Sutron Accububble gages, or Handar Shaft encoders are used for level measurement. These are connected to either Sutron model 8210, 8200, or 8400 data loggers. The relationship between level (stage) and flow rate measurements (i.e., rating curve) are developed/maintained by the USGS and will be used to calculate the flow rate externally.

Installation. Continuous level recorders are installed in accordance with standard USGS procedures. The locations are generally chosen at sites where a reliable rating curve can be developed. Instream locations which are backwater affected during storm events will be avoided since backwater affected sites do not have a constant rating curve which can be applied.

Operation. Servicing, calibration and data retrieval for the level recorders is performed by the USGS using their standard procedures. Equipment adjustments may be necessary at times to reset the level reading to match the level based on a known reference point at the site.

Rating Curve Development. At each site with a continuous level recorder the USGS develops and frequently updates a rating curve relating level to flow. Flow measurements are made by the USGS using a Price AA current meter, a Price Pygmy current meter, or a Sontek Flowtracker.

4.3.3 Rain Gages. Rainfall monitoring in the watershed for the 2007 season will be conducted by three other agencies. Tipping bucket rain gages will be used by these agencies to measure and record precipitation amounts. Rainfall is collected in a standard 12-inch National Weather Service (NWS) cylinder. Rainfall collected in the cylinder is funneled into a tipping bucket mechanism. The funnel is screened to keep out debris. The bucket tips when a volume equivalent to 0.01 inch of water over the cylinder orifice has accumulated. The bucket tips cause a 0.1-second switch closure, which is recorded by an external data logger. The tip also brings a second bucket into position under the funnel, ready to fill and repeat the cycle. After the rainwater is measured, it drains out through the base of the rain gage. Screens to prevent insect entry cover the drain holes.

Installation. Each of the agency rain gages have been located with the following considerations in mind. The most accurate measurements are taken in sheltered areas that block wind and eddy currents in the vicinity of the rain gage. Fences or other objects can act together to serve as an effective windbreak. As a general rule, the heights and distances of the windbreak objects should be uniform. Their height above the rain gage should not exceed about twice their distance from the rain gage location. Since it is not always possible to select sites that provide adequate protection from adverse wind effects, an open site away from isolated objects may also be used.

Operational Considerations. Servicing, calibration and data retrieval for the rain gages will be performed by the agencies that own the rain gages in accordance to their standard

procedures. The agencies that own the rain gages include: Wayne County, Oakland County, and DWSD.

4.4 OPERATION OF THE SAMPLING NETWORK. Operation of the sampling network will involve: manual sampling during dry and wet weather conditions, activities to prepare for and respond to wet weather events including preparation and calibration of hand-held monitoring instruments, laboratory coordination, and data collection, review and processing.

4.4.1 Manual Sampling Methods. Manual sampling methods refer to procedures that must be performed by field crews who will be present at selected sampling locations during sampling events. The field crews will be responsible for: 1) making observations relative to the quality of the water in the river or of discharges; 2) manually collecting samples from a specified location; and 3) measuring in-situ water quality parameters with a portable instrument.

Field Observations. Field observations made of the water quality will include notes on color, turbidity, odor, and floating debris, including the presence of debris collected along the banks and the appearance of vegetation along the banks. Field crews will be instructed to document any conditions that may explain anomalies in the sampling data.

Grab Sample Collection. Grab samples will be collected for laboratory analysis according to the protocols described in Section 3.2.3. Grab samples will be collected at a representative location in the flow stream identified for each site. Grab samples will be collected in a clean container, and then transferred to proper laboratory bottles. Grab samples collected for biological parameters will be collected directly into a sterile sampling container. Detailed procedures for grab sample collection are presented in the following Rouge Project SOPs: *Dry Weather Survey In-Stream Field Sampling* RPOFLD-0602A (Wayne County Rouge Program Office, 2007) and *Wet Weather Survey In-Stream Field Sampling* RPO/FLD-0603A (Wayne County Rouge Program Office, 2007).

In-situ Measurements. Water quality parameters will be measured with a portable water quality unit that measures values of DO and temperature. Water quality parameters will be measured at a representative location in the flow stream identified for each site.

4.4.2 Sampling Response. Sampling response to wet weather events will require significant coordination between field crews, laboratories, and weather forecasting. The duration and magnitude of the wet weather event is expected to vary from 30 to 72 hours. Dry weather events will follow a dry period (<0.1 inch/day rainfall) of at least 48 to 72 hours or no measurable change in river level. The event selection criterion is described in Section 2.2.3.

Laboratory Coordination. Laboratory supplies and readiness to accept samples must be coordinated with each laboratory. Laboratory bottle stocks need to be available for

collected samples. Laboratories must be prepared to receive samples, as they are collected, regardless of time of day, or day of the week.

4.4.3 Data Collection. Data collection for continuous DO, temperature, level and flow will be performed by the USGS. The USGS reviews the data and produces datasets in final form. The RPO receives the datasets from USGS, reviews the data, and prepares them for database input. Flags will be attached to the data as necessary. Identified corrective actions needed for field installations will also be communicated to field staff based on data review. Data collection for rain gages is performed by the agencies that own the rain gages. These agencies review the data and provide final data sets to the RPO.

4.4.4 Routine Inspection and Maintenance. The sampling and monitoring equipment will require regular maintenance and calibration. Site visit schedules for various types of equipment are identified below in *Table 4.1*.

Table 4.1
Equipment Inspection Intervals

Equipment Type	Servicing Interval
Continuous water quality monitors (USGS)	Every two weeks, or more often if needed for selected sites.
Pressure Transducers, Accububble gages, or Handar Shaft encoders for recording water levels (USGS)	Every seven weeks, minimum.
Rain gages (Oakland County, Wayne County, DWSD)	Varies between agencies, but every two weeks is recommended as a minimum.

5.0 FIELD DOCUMENTATION.

Proper documentation of all field activities is essential to ensure that data quality objectives are achieved. Field crews will be encouraged to document unusual or anomalous conditions that may later be useful for data interpretation and analyses. The forms described below are those that will be used by the RPO for dry and wet weather grab sampling. Additional forms will be used by other agencies for documenting water quality, level and flow (USGS) and rainfall sampling procedures (Wayne County, Oakland County, DWSD).

5.1 FIELD DATA COLLECTION FORMS.

The data for this project will include field measurements and analytical sampling. Most field data recording and record keeping will be made on standard forms.

A standard numbering format for each of the forms will be based on the following classification:

Classification	Coding
Site Assessment	100
Event Procedures	200
Equipment Servicing	300
Laboratory	400
Data Handling	500

Some of the forms developed by the RPO are listed below. Several of the listed forms may be used for the dry and wet weather sampling planned in 2006.

5.1.1 Site Assessment Forms.

These forms will be used to screen potential sampling locations and assess conditions at candidate sites. The forms include:

FORM - 101 Instream Grab Sampling Point Evaluation Sheet
FORM - 104 Instream Water Quality Data Sheet

5.1.2 Event Procedures Forms.

These forms will be used by RPO to document sample collection activities. These forms include:

FORM – 208B Sampling Crew Log, Grab DO/Temp Results Log, and River Aesthetics Field Observation Worksheet

5.1.3 Equipment Servicing/Calibration/Programming Forms.

These forms will not be used in 2007 because no automatic sampling equipment is planned for use.

5.1.4 Laboratory Forms.

All requests for sample bottles and event notification will be made by e-mail to the appropriate contact at each laboratory along with a follow-up telephone call. Chain-of-Custody forms are laboratory specific and should be obtained from all laboratories to which samples will be submitted prior to sampling.

5.2 SAMPLE CUSTODY AND DOCUMENTATION. Sample chain-of-custody protocols shall be maintained through the receipt of the sample containers, sample collection, transfer between personnel, shipment to the laboratory, and final disposal of the sample. The purpose of the protocols and procedures established in the FSP is to ensure that the integrity of the samples, from collection to analysis, is maintained. The sample custody shall be properly documented to provide a mechanism for tracking each sample submitted for laboratory analysis.

5.2.1 Chain-of-Custody Protocols. Chain-of-custody procedures are established to provide sample integrity. Sample custody protocols will be based on procedures as described in the "Rouge Project Sampling Quality Assurance Project Plan, June 1996."

A sample is under a person's custody if it meets the following requirements:

- It is in the person's possession.
- It is in the person's view after being in the person's possession.
- It was in the person's possession and it was placed in a secure location.
- It is in a designated secured area.

The sample packaging and shipment procedures summarized below will assure that the samples will arrive at the laboratory with the chain-of-custody intact.

5.2.2 Chain-of-Custody Field Procedures. Chain-of-Custody field procedures are as follows:

a. The field crew member(s) will be personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible will handle the samples.

b. Sample labels will be filled out using waterproof ink for each sample.

c. All bottles will be labeled with sample numbers and locations. The sample number will be designed as described in Section 6.0.

d. The samples will be delivered to the appropriate laboratory for analytical work. Split samples will be delivered directly by the field staff to the QC laboratory, or will be picked up by the laboratory staff from the field facility. The RPO laboratory coordinator will review all field activities to determine whether proper custody procedures were followed, and decide if additional samples are required.

5.2.3 Transfer-of-Custody and Shipment Procedures. Transfer-of-Custody and Shipment Procedures are as follows:

a. Samples requiring shipment will be accompanied by a properly completed chain-of-custody form. The sample numbers and locations will be listed on the chain-of-custody form. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the record. This record documents transfer-of-custody of samples from the sampler to another person, to/from a secure storage area, and to the laboratory.

b. Samples will be properly packaged for shipment and dispatched to the appropriate laboratory for analysis with a signed custody record enclosed in each sample shuttle (cooler). Samples that are shipped via commercial carrier, will be secured with strapping tape in at least two locations prior to shipment to the laboratory.

c. All shipments will be accompanied by the chain-of-custody record identifying the contents. The original record will accompany the shipment. A copy will be retained by the sampler and returned to the project files.

d. Commercial carriers, such as Federal Express, are not required to sign off on the custody form. The chain-of-custody forms will be placed in a resealable plastic bag and sealed inside the sample cooler following the cooler packing and sealing procedures. Refer to Section 7.0 for details in sample handling and shipping.

6.0 SAMPLE DESIGNATION.

All sample bottles should be pre-labeled on the bottle, not the cap, to identify the sample for laboratory analysis. Sample labels should include type of sample (grab or composite), sampler's name, date, time, and location. Sample identification will use the following format:

Sample Numbering Scheme:

SSSYMMDDHHmmTTT

Where:

SSS = Station Number/Location Identifier
(Can be up to 8 identifiers, typically 3-4. Example: G45; G461)
Y = Last digit of Year
MM = Month two digits (01-12)
DD = Day two digits (01-31)
HH = Hour (Military Time) two digits (01-24)
mm = Minute two digits (00-59)
TTT = Type of sample (Note: ## denotes sample number, series, or set)

- G## = Grab Water Sample
- A## = Automatic Sampler Water Sample
- S## = Soil/Sediment Sample
- L## = Landfill/Leachate Sample
- #81 = Field Duplicate
- #86 = Field Blank
- #87 = Split Sample

Example: L05806081025G00

This sample is from monitoring site number L05 (Military Rd.), collected on June 8, 1998. It is a grab sample taken at 10:25 a.m.

Example: G91806130330G87

This sample is from grab sampling site G91 (Venoy Road), collected on June 13, 1998. It is a quality control split sample taken at 3:30 a.m.

The chain-of-custody form has a column for indicating the sample designation. It is very important that the number is entered correctly.

7.0 SAMPLE HANDLING AND SHIPPING.

The section describes sample handling and shipping. Methods and procedures will be in accordance with those specified in a USEPA or other standard reference.

7.1 SAMPLE HANDLING. All water samples collected will be placed in the appropriate sample bottles, with preservative if necessary, and stored in an ice chest or refrigerator immediately after collection. If chemical coolant packs are used, they will be stored in separate plastic bags. The samples will be delivered to the analytical laboratory in a timely manner to allow analyses within the required holding times.

7.2 ANALYTICAL METHODS. *Table 7.1* summarizes dry and wet weather analytical parameters for the samples to be collected in 2007. *Table 7.1* also presents a summary of sample handling requirements including:

- Volume of sample
- Type of sample container
- Preservative
- Holding time (maximum for sample delivery to laboratory)

Field crews must be familiar with and carefully follow these requirements. Failure to do so may result in rejection of analytical data.

7.3 QUALITY ASSURANCE/ QUALITY CONTROL. To ensure the accuracy of the data collected, Quality Assurance/Quality Control (QA/QC) procedures will be followed. Automatic monitoring and water quality sampling instruments may be utilized for this program with supplemental grab sample collection. Resulting samples will be transported for laboratory analysis. Associated field and laboratory protocols are discussed herein. No automatic samplers are planned for use in 2007.

7.3.1 Field Procedures. SOPs for dry and wet weather surveys will be provided to all field personnel. Proper training for all field kits used and field instruments used will be provided prior to the beginning of the sampling season.

7.3.2 QA/QC Samples. QA/QC samples will be generated in the field. The labeling system described in Section 6 will be used to ensure that QC samples are blind. This is to ensure that the laboratory will not be able to differentiate the field QA/QC samples from the original samples. Therefore, the QA/QC samples will be handled as if they were original samples by the laboratory.

Table 7.1
Sample Volumes, Containers and Preservatives
Sample Series A and B

Bottle Type	Optimum Bottle Volume	Minimum Bottle Volume	Parameter	Preservative	Hold Time
Series A					
Polyethylene	1000 ml	850 ml	$CBOD_5$	4 °C	48 hours
Polyethylene	1000 ml	250 ml	NH_3, PHOS_T	H_2SO_4, 4 °C	48 hours
Polyethylene	1000 ml	500 ml	TSS	4 °C	48 hours
Series B					
Sterile Polyethylene	100 ml	100 ml	*E. coli*	4 °C	6 hours

The following QA/QC samples will be submitted for analysis:

- Field blanks
- Field duplicates
- Split samples

Field Blanks. Field blanks will be employed to determine potential sample contamination during:

- Field collection
- Handling
- Shipment
- Storage
- Laboratory handling and analysis of samples

The field blanks are created by filling sampling containers with reagent-grade distilled water in the field and handling them with procedures identical to those used for the original samples. Field blanks for each parameter will be prepared. One field blank should be prepared for each survey.

Field Duplicates. Field duplicates will be used to assess natural sample variability, or variability attributable to:

- Field collection
- Sample handling
- Shipment and storage methods
- Laboratory handling and analysis

Field duplicates are created by filling grab sample containers at the same location at the same time. If a larger container is used to collect the sample from the river the samples for the duplicate sample and the original sample should be filled from the same river sample container. Duplicate samples for grab sampling will be prepared and analyzed at a frequency of one per 20 samples collected.

Split Samples. Split samples will be utilized to verify accuracy of laboratory analysis between laboratories. Split samples will be prepared in the field by splitting a volume of sample and delivering to separate laboratory facilities. Production laboratories will analyze one of the samples and the QC laboratory will analyze the other sample. Split samples will be prepared and analyzed at a minimum frequency of one per 20 samples collected.

APPENDIX A
ACRONYMS

Acronym/Abbreviation	Definition
ARC	Alliance of Rouge Communities
ASI	Applied Science, Inc.
$CBOD_5$	5-day carbonaceous biochemical oxygen demand
CDM	Camp, Dresser and McKee
CLP	Contract Laboratory Program
CSO	Combined Sewer Overflow
DO	Dissolved Oxygen
DPW	Department of Public Works
DQO	Data quality objective
DWSD	Detroit Water and Sewerage Department
E. coli	*Escherichia coli* (bacterium)
EPA	Environmental Protection Agency
FSP	Field Sampling Plan
H_2NO_3	Nitric Acid
H_2SO_4	Sulfuric Acid
MDEQ	Michigan Department of Environmental Quality
MG	Milligram
ML	Milliliter
NH_3	Ammonia
NWS	National Weather Service
OC	Oakland County
PARCC	Precision, Accuracy, Representativeness, Completeness, Comparability
PHOS_T	Total Phosphorus
PVC	Polyvinyl Chloride
QA/QC	Quality Assurance/Quality Control
RAP	Remedial Action Plan
RPO	Rouge Program Office
SOP	Standard Operating Procedures
SWMA	Storm Water Management Area
TP	Total Phosphorus
TSS	Total suspended solids
USEPA	United States Environmental Protection Agency
USGS	United States Geological Survey
WC	Wayne County
WCDOE	Wayne County Department of Environment
WCDPH	Wayne County Department of Public Health
YSI	Yellow Springs Instruments

APPENDIX B
REFERENCES

REFERENCES

Cave, K., 2002. Wayne County Department of the Environment Watershed Management Division Memorandum to Rouge Subwatershed Advisory Groups Facilitators, MDEQ Acceptance of 5 Year Monitoring Plan for Rouge Watershed".

Rantz, S. E. et al. "*Measurement and Computation of Streamflow: Vol. 1, Measurement of Stage & Discharge; Vol. 2, Computation of Discharge",* WSP 2175, 1982.

United States Environmental Protection Agency, *"Content Requirements for Quality Assurance Project Plans"*, R5-QAS-93-001.

United States Environmental Protection Agency (USEPA) Test Methods, 2006. On-line Web site accessed April 2006 at: http://www.epa.gov/epaoswer/hazwaste/test/main.htm

Wagner, R. J., Mattraw, H. C., Ritz, G. F., and Smith, B. A. "*Guidelines and Standard Procedures for Continuous Water Quality Monitors: Site Selection, Field Operation, Calibration, Record Computation and Reporting",*USGS WRIR 00-4252, 2000.

Wayne County Rouge Program Office, *"Abandoned Dump Site Leachate Sampling"*, Field Sampling Plan, RPO-NPS-FSP09.00, October 1994.

Wayne County Rouge Program Office, *"Algal Survey"*, Field Sampling Plan, RPO-WMGT-FSP14.00.

Wayne County Rouge Program Office, *"Baseline Water Quality Sampling"*, Field Sampling Plan, RPO-SAM-FSP00.05.

Wayne County Rouge Program Office, *"Baseline Water Quality Sampling"*, Field Sampling Plan, RPO-SAM-FSP 01.07, April 1994.

Wayne County Rouge Program Office, *"1997 Baseline Water Quality Sampling"*, Field Sampling Plan, RPO-WMGT-FSP18.00.

Wayne County Rouge Program Office, *"1998 Baseline Water Quality Sampling"*, Field Sampling Plan, RPO-WMGT-FSP19.00, July 1998.

Wayne County Rouge Program Office, *"2004 Baseline Water Quality Sampling"*, Field Sampling Plan, RPO-WMGT-FSP26.00, March 2004.

Wayne County Rouge Program Office, *"2005 Baseline Water Quality Sampling"*, Field Sampling Plan, RPO-WMGT-FSP27.00, April 2005.

Wayne County Rouge Program Office, *"2006 Baseline Water Quality Sampling"*, Field Sampling Plan, RPO-WMGT-FSP28.00, April 2006.

Wayne County Rouge Program Office, *"Bathymetric Surveys"*, Field Sampling Plan, RPO-NPS-FSP03.00, October 1994.

Wayne County Rouge Program Office, *"Benthic Macroinvertebrate Survey"*, Field Sampling Plan, RPO-WMGT-FSP15.00.

Wayne County Rouge Program Office, *"Biological Monitoring and Habitat Survey"*, Field Sampling Plan, RPO-SAM-FSP13.00.

Wayne County Rouge Program Office, *"Dry Weather Survey In-Stream Field Sampling"* RPOFLD-0602A, March 2007.

Wayne County Rouge Program Office, *"Field Sampling Plan: 1996 Baseline Water Quality Sampling"*, Field Sampling Plan, RPO-WMGT-FSP 17.00.

Wayne County Rouge Program Office, *"Habitat"*, Field Sampling Plan, RPO-WMGT-FSP16.00.

Wayne County Rouge Program Office, *"Impoundments Limnological Studies"*, Field Sampling Plan, FSP-MOD-FSP06.00, June 1995.

Wayne County Rouge Program Office, *"Nonpoint Source Storm Event Monitoring Program"*, Field Sampling Plan, RPO-SAM-FSP11.00, December 1994.

Wayne County Rouge Program Office, *"Sediments Oxygen Demand Study"*, Field Sampling Plan, RPO-MOD-FSP07.00, June 1995.

Wayne County Rouge Program Office, *"Stream and Dam Reaeration Studies"*, Field Sampling Plan, RPO-MOD-FSP05.00, June 1995.

Wayne County Rouge Program Office, *"Surrogate Basins"*, Field Sampling Plan, RPO-CSO-FSP08.00, June 1995.

Wayne County Rouge Program Office, *"Wetland Biological Monitoring Program"*, Field Sampling Plan, RPO-NPS-FSP12.00, August 1994.

Wayne County Rouge Program Office, *"Wet Weather Survey In-Stream Field Sampling"* RPOFLD-0603A, March 2007.