Monitoring Manual for NPDES MS4 TMDL Waterbodies in the Lower Grand River Watershed

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History and Overview

The Lower Grand River Organization of Watersheds (LGROW) was officially formed in 2009 to provide basin-wide oversight, implement watershed-wide initiatives, and prioritize water quality concerns within the Lower Grand River Watershed. The mission of LGROW is to: "D*iscover and restore all water resources and celebrate our shared water legacy throughout our entire Grand River Watershed community".* Further, LGROW's vision for the watershed is stated as: "S*wimming, drinking, fishing, and enjoying our Grand River Watershed: Connecting water with life".* The core values of LGROW include:

- *Watershed activities are diverse, inclusive, and collaborative*
- *Watershed efforts are sustainable and of high quality*
- *Watershed images and messages create a widely shared sense of legacy and heritage*
- *Watershed methods and products are holistic and employ a systems approach*
- *Watershed organization and programs evaluate progress and reward success*

LGROW is managed by a Board of Directors which includes public and private sector representatives from within the watershed. Several committees support the mission, vision and values of LGROW.

The Data Information and Procedures (DIP) committee is one of the committees that has been established to support LGROW. Its goal is to collect data about the watershed as well as be a clearinghouse for information about the watershed. The DIP committee has previously supported LGROW by assisting in the development and review of Watershed Management Plans as well as providing support in the development of the Illicit Discharge Elimination Plan. Recently and in anticipation of the new NPDES stormwater permits, the DIP committee has refocused its efforts to include watershed monitoring.

This Watershed Monitoring Manual has been developed by members of the DIP committee to specifically address the TMDL waterbodies with the regulated MS4 communities. The Manual is intended to be a technical reference document that can be easily used by MS4 communities to further support and validate effectiveness of BMP implementation.

Project Partners

The DIP committee consists of many regional partners throughout West Michigan. Table 1 lists the primary partners and their organizational affiliations:

Table 1. Dip Committee Members

Member	Organization
Aaron Vis	City of Wyoming
John Koches	Grand Valley State University
Joe Slonecki	City of East Grand Rapids
Craig Bessinger	City of Ferrysburg
Jim M. Beke	City of Kentwood
Amanda St. Amour	MDEQ
Roger Belknap	Village of Spring Lake
Dana Strouse	MDEQ
Angie Latvaitis	Kent County Drain Commissioner's office
Wendy Ogilvie	Grand Valley Metro Council
Bonnie Broadwater	Grand Valley Metro Council
Dan Taber	City of Grand Rapids
Sara Simmonds	Kent County Health Department

Goals & Objectives

Over the last decade, a number of organizations have collected water quality data throughout the Lower Grand Watershed. These data collection activities have included grade-school children participating in World Water Monitoring Day, DEQ macroinvertebrate studies, and City of Grand Rapids River Run Sampling to name a few. While the data collected served each organization's specific goals (i.e. education, compliance, etc.), there lacked a collaborative, regional and definitive approach to assessing and monitoring watershed health.

In 2014 and in an effort to support the overall mission and vision of LGROW, members of the DIP Committee realized that it was necessary to reliably and accurately measure progress and achievements within the Lower Grand Watershed. The Watershed Management Plan (WMP) developed by LGROW and approved by the Michigan Department of Environmental Quality (DEQ) provides an outline of methods of measuring progress and was used as the basis for developing the specific objectives below.

Recognizing that a new NPDES permit would likely require some sort of watershed monitoring, the DIP Committee adopted a goal of measuring progress and

achievements in the Lower Grand River Watershed. Given the need to address the TMDLs, the DIP committee determined that it would be to the benefit of LGROW if this was done in a collaborative, uniform manner throughout the watershed. The following objectives were further developed and are listed in order of importance:

1. Determine Water Quality Standard (WQS) and Total Maximum Daily Load (TMDL) compliance.
2. Evaluate municipal stormwater runoff controls and practices (BMPs)

The objectives are further explained and defined as follows:

Objective 1. Determining WQS and TMDL compliance.

The new NPDES permit application requires MS4s to address TMDLs specific to water bodies within their urbanized area. The pollutants to address for the MS4s within the Lower Grand River Watershed include *E. coli* and biota/sediment (total suspended solids).

Objective 2. Evaluate municipal stormwater runoff controls and practices (BMPs)

The new NPDES permit application requires MS4s to develop and evaluate Best Management Practices (BMPs). BMPs are developed specific to each community, and each BMP is designed to remove certain pollutants from entering a waterbody. A separate BMP Manual has been prepared that identifies numerous structural and operational BMPs, yet the effectiveness of these BMPs is best determined through attentive monitoring. The monitoring locations and sampling and analytical procedures identified later in this manual provide a solid foundation for BMP evaluation. The sampling and analytical procedures identified can be further used in various illicit discharge detection and verification processes if needed.

Other Considerations

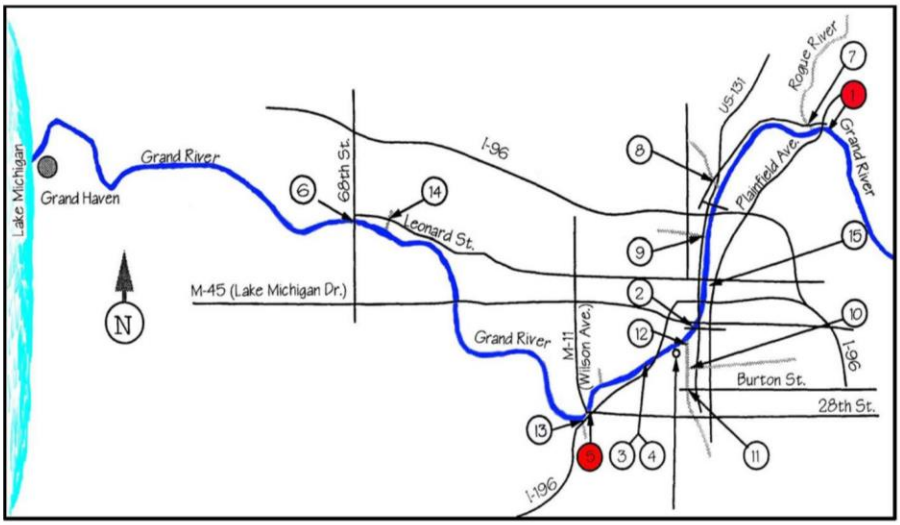
The DIP Committee recognizes that there are a number of things that can be monitored or tracked to achieve the above objectives. Yet, the ensuing parameters, protocols and information reflects a balance of current needs/wants and available resources. As other resources, needs, concerns, and funding becomes available it is likely that this monitoring effort will become more robust and inclusive.

Sampling Locations

Historical Sampling Information

Throughout the decades, the DEQ, USGS, numerous local municipalities and a number of non-profit groups have sampled the Grand River and associated tributaries at a variety of locations. The DIP Committee reviewed a number of historical sampling locations at various sites both on the Grand River and within several of the sub watersheds and found that the only consistently sampled locations are those used by City of Grand Rapids on the Grand River since 1988. The following map and table depicts the locations that Grand Rapids has used and currently uses:

Figure 4. Historical Sampling Sites



Grand River	Tributaries
1. Northland Dr. Bridge	7. Rogue River at West River Drive
2. Wealthy St. Bridge	8. Mill Creek at West River Drive
3. Railroad Bridge South	9. Indian Mill Creek at Turner
4. Railroad Bridge North	10. Silver Creek at Croften / Roy
5. Wilson (M-11) Bridge	11. Plaster Creek at Burton (Plaster 1)
6. Eastmanville (68th Ave.) Bridge	12. Plaster Creek at the Grand River (Plaster 2)
	13. Buck Creek at Chicago Drive
	14. Deer Creek
	15. Coldbrook Storm Drain

Sampling Location Selection Criteria

Sampling site selection is a critical component of the watershed monitoring manual. Given the infinite number of locations where samples could be taken from, the DIP Committee has developed the following guidelines for determining appropriate sampling locations:

- Consideration of the sampling objective.

- Identification of a sampling location that has been used previously by a regulating agency or as part of a grant.
- Location access throughout all types of weather conditions (e.g. high water events, inclement weather, etc.

Selected Sampling Locations

The DIP Committee has determined that the sites used by the City of Grand Rapids provide a good perspective of the Grand River immediately surrounding the City of Grand Rapids, but are not enough to assess the waters with TMDLs. Thus, in addition to the sites currently identified above, the following sites will be monitored at an access site near their confluence with the Grand River.

Table 2. TMDL Monitoring Sites

Water Body	Monitoring Site	Location	Parameter(s)
Sand Creek	Luce Street, SW	Tallmadge Township	Total Suspended Solids
York Creek	North Park Street, NE	City of Grand Rapids	Total Suspended Solids
Unnamed tributary	Grand River Drive, NE	Ada Township	*E. coli* and Total Suspended Solids
Plaster Creek	Freeman Avenue, SW	City of Grand Rapids	*E. coli* and Total Suspended Solids
Buck Creek	Chicago Drive, SW	Grandville	*E. coli*
Bass River	Bass Drive	Allendale Township	*E. coli* and Total Suspended Solids
Strawberry Creek	Stony Creek Avenue, NW	Comstock Park	*E. coli* and Total Suspended Solids

Data Quality

During the DIP Committee review of existing data, it became apparent that, although there was a significant amount of data available, much of it was either collected by unskilled samplers (i.e. school groups) or analyzed via methods not approved by the EPA or done by certified laboratories. To achieve the objectives identified above, the DIP Committee strongly felt that a defined, standard set of sampling and analytical procedures needed to be developed such that the resulting data was of similar quality as that expected of wastewater and drinking water facilities and be scientifically sound. For any data to be considered valid and used as a measurement of the objectives mentioned in this manual, the DIP Committee requires that:

1. Samples are collected by personnel trained in water, wastewater or stormwater sample collection and have a strong understanding of sampling and analytical procedures.
2. Analytical methods used are approved by the EPA, Standard Methods (SM), American Society for Testing and Materials (ASTM), or the United States Geological Survey (USGS) and that laboratories used are certified either by the EPA or State of Michigan.

Watershed Monitoring Parameters

Following is a brief description and breakdown of parameters connected to each objective.

Parameters Related to Objective 1

Objective 1 relates to determining WQS and TMDL Compliance within the Lower Grand Watershed. The DIP Committee reviewed all the TMDLs within the Lower Grand River Watershed, and found the following:

- *E. coli*
- Total Suspended Solids

Parameters Related to Objective 2

The second objective identified by the DIP is to establish an indicator that measures water quality improvements, and relate that to the effectiveness of BMP implementation. The following table references these parameters and associated method numbers that will be used to measure changes in water quality:

Table 3. Watershed Monitoring Parameters and Method Associations

Parameter	EPA Method	Standard Methods
E. coli	1604	SM 9222 &/or 9223*
Total Suspended Solids (TSS)	160.2	

* Method used to analyze sample must produce a quantifiable number not just a positive/negative confirmation. Coliform density is reported as counts per 100 mL water sample.

Sampling Procedures

The DIP Committee recognizes that the generation of quality, usable data begins with properly trained sampling staff, the use of approved analytical methods, and rigorous quality control. Rather than develop detailed standard operating procedures and analytical methods, the DIP Committee intends to utilize the skill sets of existing

partners currently involved in water/wastewater/stormwater sampling and analysis as the foundation for the monitoring program. Many of the details below have been taken from the 2009 EPA Industrial Stormwater Monitoring and Sampling Guide Document (#EPA 832-B-09-003) and the 1992 EPA NPDES Storm Water Sampling Guidance Document (#EPA 833-B-92-001), as officially referenced at the end of this manual. Other documents include the Standard Operating Procedures from the Florida Department of Environmental Protection (http://www.dep.state.fl.us/water/sas/sop/sops.htm).

Sampler Qualifications

Those who will collect samples should consist of personnel who are familiar with the sampling locations, sampling equipment and analytical methods. Personnel should have been previously trained in wastewater, drinking water, or stormwater sample collection such that an adequate understanding of proper sampling procedures is known. Ideally, staff should be used who understand the stormwater program, potential pollutant sources, monitoring and reporting requirements, principles of (cross) contamination, as well as general health and safety procedures. These staff should also understand and follow all quality assurance quality control techniques as mandated by the laboratory performing the analytical procedures to ensure valid data.

Health and Safety

Hazardous Weather

Sampling should never occur during unsafe weather conditions, which includes flooding events, lightening storms, hail storms, high winds, etc. Every attempt should be made to conduct the sampling event at least 2 days (48 hours) after a rain event of at least 0.5" or greater such that a representative sample can be obtained of ambient conditions.

Chemical, Physical and Biological Hazards

Chemical hazards that may be encountered primarily include the preservatives used in sample collection containers for sample preservation. Review of applicable Safety Data Sheets (SDS) should be done to follow appropriate safety procedures.

A number of physical hazards include traffic hazards, slippery slopes and lifting hazards. Sampling personnel should be aware of their surroundings at all times and exercise prudent use of appropriate safety equipment.

Sampling personal may encounter ticks, mosquitoes, poison ivy, rodents, etc. as biological hazards. Proper repellants should be used if the sampling location has indications of these hazards.

Safety Equipment

Sampling personnel should be aware of their surroundings and hazards potentially involved. Some appropriate safety equipment should include:

- Cell phone or other communication equipment
- Safety glasses
- Traffic cones
- Insect or poison ivy repellent
- Gloves

Confined Spaces

It is not anticipated that sampling will be conducted in confined space. If that should occur, the confined space protocol that the organization the sampler is from shall dictate the confined space procedures.

Sampling Preparation

Prior to initiating a sampling event, personnel should review proposed sampling sites, weather, past weather, equipment, etc. to verify that they are properly prepared. It is a good idea to develop a sampling equipment checklist to ensure that all equipment, containers, and paperwork are available.

Documentation

Sampling personnel should document their sampling event within a field notebook or field sheets. Sampling personnel must also secure the proper Chain of Custody sheets as further described in that section. Documentation must be retained for at least 3 years.

It is the responsibility of the certified laboratory used to retain appropriate SOPs, calibration information, and QA/QC program information as required both by the certifying agency and/or as required by internal controls.

Identification and Labeling

Personnel should consult with the certified laboratory for proper sampling identification and labeling procedures. In general, samples should be identified by using the site identification as determined by the DIP Committee. Other relevant information should include date, time, sampler, preservative, required test, sample type, and any special handling instructions.

Sample Collection and Handling

The laboratory and analytical methods used will dictate how a sample should be collected and handled. Refer to individual methods prior to sample collection to

properly understand appropriate requirements. Generally, guidelines established in 40 CFR 136 should be followed (http://www.epa.gov/region9/qa/pdfs/40cfr136_03.pdf).

Containers, Volume and Preservative

Each analytical method will have specific containers, preservatives, and holding times associated with that method. Following is a list of recommended containers and preservatives for each parameter. Note that specific laboratories and methods may have different requirements.

Table 4. General Container, Volume, and Preservation Information

Parameter	Bottle Type	Recommended Sample Volume	Preservative
E. coli	Sterilized Plastic	at least 100mL	Sodium Thiosulfate
Total Suspended Solids (TSS)	Pre-cleaned HDPE	1L	None

Sample Handling and Hold Time

Generally, samples collected must be cooled to 4 degrees C upon collection. Temperature and pH are field measurements and not necessarily collected for laboratory analysis. Refer to the sample collection SOP for specific handling instructions.

Collection Technique

Grab Sampling

A specific procedure has been developed on the proper procedure for collecting a grab sample, and is located in Attachment 1. For this monitoring plan, staff will use the procedures for collecting *E. coli* and sediment samples.

Flow Monitoring

At this time, flow monitoring is not part of the watershed monitoring effort. However, the USGS maintains seven (7) flow monitoring station on the Grand River and a number of others within the Lower Grand Watershed. These can be accessed at any time at www.waterdata.usgs.gov. The following table lists the station number and station name.

Table 5. USGS Flow and Station Information

Station	Station Name	Watershed

Number		
04109000	Grand River at Jackson	Upper Grand
04111000	Grand River near Eaton Rapids	Middle Grand
04113000	Grand River at Lansing	Middle Grand
04114000	Grand River at Ionia	Lower Grand
04118105	Grand River at Ada	Lower Grand
04119000	Grand River at Grand Rapids	Lower Grand
04119055	Plaster Creek at 28th Street	Lower Grand/Plaster Creek
04117500	Thornapple River near Hastings	Lower Grand/Thornapple
04118000	Thornapple River near Caledonia	Lower Grand/Thornapple
04118500	Rogue River near Rockford	Lower Grand/Rogue River

Sampling Frequency

Sampling frequency will occur, at a minimum, two times during every permit cycle. The first sampling event will be initiated within 2 years of when the MS4 permits are issued for the communities in the Lower Grand River Watershed.

Certified Laboratories

As was previously mentioned, samples collected by LGROW members for watershed monitoring purposes must be analyzed using laboratories certified by either the EPA or the State of Michigan for the previously listed parameters. Certified laboratories are required to develop and maintain a quality assurance plan which details quality control procedures specific to each method (http://water.epa.gov/scitech/drinkingwater/labcert/index.cfm, http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156-11433--,00.html).

These plans and certification status should be reviewed by the organization collecting the samples to verify their program. Additionally, the DIP Committee and LGROW will maintain a listing of certified laboratories.

Quality Assurance / Quality Control Procedures

Calibrations and Verifications

The laboratory maintains all relevant quality assurance/quality control procedure documentation. This documentation is subject to review during certification audits and is thus assumed to be in good order. However, certain field instruments require routine calibration and recordkeeping. For field instruments such as those measuring pH, temperature or dissolved oxygen, a calibration logbook must be maintained. This logbook must include, at a minimum, the date and time of the calibration/verification/maintenance; value of standard or buffer used; instrument reading and indication of pass/fail; name of analyst performing calibration/verification/maintenance.

Chain of Custody

Each laboratory used will have its specific chain of custody and will provide the sampler with the appropriate document. A sample chain of custody is included in Attachment 2. In general, the sampler must note the sample ID, date and time of sample collection, matrix (water), analysis requested, preservative used, and relevant contact information. Some laboratories may require other field measurements such as pH, temperature or dissolved oxygen on their chain of custody.

Duplicates, Equipment and Field Blanks

In general, each laboratory dictates the amount of duplicates needed to properly maintain their certification. Proper communication is important with each laboratory to ensure that the appropriate amount of duplicate samples is collected. In general, it is a good rule to take one duplicate sample per 20 samples collected (EPA Region 3 guidance (http://www.epa.gov/region3/esc/qa/pdf/blanks.pdf)).

If field equipment is used in sample collection (i.e. automated sampler, sampling jug, etc), an equipment blank must be collected at least once per 20 samples per parameter, with a minimum of one per day whichever is more frequent. Equipment blanks are used to ensure that equipment used is free from contamination resulting from improper cleaning.

Field blanks should also be collected at least once per 20 samples per parameter, with a minimum of one per day, whichever is more frequent. Field blanks are collected to verify that field conditions do not contribute to sample contamination.

Equipment and field blanks must be collected at a site using analyte free (purified) water. For equipment blanks, the water is poured over/through the collection device

and collected in the appropriate sample container. For field blanks, a sample of analyte free water is poured into the appropriate sample container.

References.

Florida Department of Environmental Protection. 2014. Online: http://www.dep.state.fl.us/water/sas/sop/sops.htm).

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NEMI (National Environmental Methods Index). www.nemi.gov

Standard Methods for the Examination of Water and Wastewater, 20th Edition, Method 2320 B, APHA, 1998.

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Michigan Department of Environmental Quality (MDEQ) 2015. Online: http://www.michigan.gov/deq/0,1607,7-135-3307_4131_4156-11433--,00.html).

Attachment 1

Watershed Sampling & Handling Procedures for

Stream Chemical/Nutrient Monitoring

I. Purpose/Scope

This procedure will be a guidance document for the sample collection and handling of surface water samples collected within the Lower Grand River Watershed as part of a watershed monitoring effort organized by the Lower Grand River Organization of Watersheds (LGROW). This document will be used in two ways. First, it will be used to list procedures for the collection, preservation and handling of samples thereby eliminating variability between field sampling techniques. Secondly, this document will be used as a reference source for field technicians as well as a training manual for new field staff.

II. Apparatus & Equipment

Refer to the attached Sampling Preparation Checklist

III. Reagents & Consumable Materials

- Preservation acids: Refer to specific method used, but generally H2SO4, HNO3, 1:1 HCl
- Coliform bottles w/Sodium Thiosulfate (brand name ex. IDEXX)
- Various size HDPE Precleaned Wide Mouth Bottles
- Sterile latex/nitrile gloves
- Bottle Labels

IV. Sampling Event Preparation

Prior to initiating a sampling event, collectors will obtain a sufficient supply of sample bottles, a cooler w/ice packs and field data sheets. Refer to the attached Sampling Preparation Checklist and Summary for specific preparatory information.

V. Sample Collection.

All sampling should occur upstream from the samplers physical location to avoid possible contamination. Record the date, weather and temperature on the data sheet (see attached).

A. Basic Water Sampling Procedure

1. At the sampling location (or prior to collection) date and label the sampling bottles.
2. Wade into the water to mid-stream or if water is too deep or flowing too fast use an appropriate sampling device and attached rope to collect sample*.
3. Face in the upstream direction and avoid any sediment disturbed from your stream entry. Hold the bottle in such a manner as to avoid water from passing over samplers hand before collection.
4. For bottle samples (*E. coli & Fecal Coliform, see Part VII,B.*), remove the cap from the sampling bottle and fill the bottle approximately ¼ full of water. Do this at an arms-length distance in front of where you are standing, again making sure not to disturb the sediments. Shake the bottle, rinsing down the insides of the bottle, and empty the rinse water behind where you are standing. Repeat the bottle rinse 2 more times.
5. Fill the bottle to near the top and screw on the cap.
6. Preserve samples & fill out field data sheet with required information.
7. See Tables for specific test requirements and parameters.

B. *E. coli* & Fecal Coliform sampling
1. Take Residual Cl_2 reading (if needed).
2. Put on a pair of sterile gloves.
3. Open the sterile sample bottle by removing the safety seal and the cap making sure not to touch the inside of the bottle or cap.
4. Dip (DO NOT submerge) the bottle and fill w/ at least 100mL of sample making sure not to lose any preservative in the process. Cap bottle and swirl to mix sample.
5. Fill out field data sheet with required information.

VI. Sample Handling

If required, once field tests (pH, Temperature, DO) are complete that sample may be discarded back into the stream or body of water. For other parameters add appropriate preservative for requested analysis (see parameter tables) and place samples in cooler with ice packs. Fill out chain of custody form and deliver samples and COC to laboratory staff within sufficient hold times.

VII. Interferences

The likelihood of contamination due to increase contact with the water is greater with bank sampling or wading out into the watercourse to sample. As such, special care is required to prevent and minimize sampling error. Select a point along the river bank where the current flow is pronounced. This will most often occur at the outside bend in the stream. Do not sample in stagnant water. Always face upstream during the

collection. If the bottom is soft and the stream is slow moving stand quietly to allow current to sweep away disturbed sediments or move slowly upstream during collection.

VIII. Routine Maintenance

Thermometers and Cl_2 meters should be certified or calibrated with a certified instrument yearly. pH & DO probes need to be calibrated every 24hrs with the slope, time and temperature tracked for QA purposes.

IX. Quality Control

Samples should only be analyzed by a laboratory with an approved QAQC plan in place. An integral part of any quality assurance program includes field QC samples. They are particularly valuable for evaluating the effectiveness of sampling strategies and estimating the precision and accuracy of results.

A. Field blanks

Field blanks are samples of distilled water that demonstrate the cleanliness of sample bottles, preservatives, equipment, and the sample handling procedures. Deionized water is taken in the field and poured into sample bottles at the same time as when field samples are being preserved. When preparing the field blank any preservative added to investigative samples should also be added to blank samples.

B. Equipment blanks

Equipment blanks are samples of distilled water that demonstrate the cleanliness of the sampling equipment. Deionized water is taken in the field and poured through the sampling instrument and collected into the appropriate sampling bottles. Preservative is added as the analysis dictates.

C. Duplicates

Field duplicates are two independent samples taken from one sampling point. The main purposes of field duplicates are to measure the total variability of samples including analytical variability and field variability.

Sampling Preparation Check List	
Preparation Day Before:	Completed
Collect supplies/equipment (see equipment list below)	
Check stream sampler rope and handle	
Calibrate field monitoring equipment to verify operation (DO, pH and conductivity)	
Load supplies in vehicle (bottles, samplers and coolers)	
Day of River Run:	Completed
Calibrate field monitoring equipment and complete the calibration worksheet (DO, pH and conductivity)	
Load field monitoring equipment and ice packs for coolers	
Collect samples and record field measurements	
Deliver samples to the designated "Sample Receiver"	
Perform verification checks on field monitoring equipment after sample collection (DO, pH and conductivity)	
Clean VOC bailers	

Supplies/Equipment List	Quantity
Field Monitoring Equipment & Supplies	
DO and pH meter w/ 15 meter cords	1
Disposable BOD bottle w/ DI water (to check DO probe)	1
Conductivity meter w/5 meter cords	1
1 L plastic bottle (to measure conductivity)	1
*Portable DO Meter (Back-up equipment - 1 available)	*
*Back-up pH meter	*
Sampling Equipment	
Stream sampler	1
River bailers (organics sample collection - site specific)	2
*BOD sampler (Back-up equipment - 2 available)	*
Miscellaneous	
Bench sheet/clipboard	1
Indelible pen	1
coolers (for BODs, E. coli, fecal coliform, organics)	
Ice packs for coolers	
Spare set of AAA batteries	
Bottles - (bottle descriptions on back)	
"TSS" round 1000 mL plastic bottle	
120 mL Sterile Coliform Sample bottles	

*Notation for back-up equipment and supplies - used if in-stream measurements not taken

Table 1. Sampling Procedures for Dissolved Oxygen (DO)

Collection Technique using hand-held meter – *in situ* field measurement	Meter should be kept in gentle motion through the water column while a reading is being taken. Excessive turbulence should be avoided to minimize presence of air bubbles in the water, near the measurement cell. Allow several minutes for the meter to stabilize. Ideally measurements should be made about 10 cm below the water surface (and then about 10 cm above the sediment surface); however, this is not always possible in shallow water bodies. A mid water column reading will be sufficient in these cases.
Unit of Measurement	mg/L (dissolved oxygen concentration) or % (saturation)
Analysis Method	EPA Method 360.1
Comments	This test must be performed in the field.

Table 2. Sampling Procedures for pH

Collection Technique using hand-held meter – *in situ* field measurement	Meter should be kept in gentle motion through the water column while a reading is being taken. Allow several minutes for the meter to stabilize. Ideally, measurements should be made about 10 cm below the water surface (and then about 10 cm above the sediment surface); however, this is not always possible in shallow water bodies. A mid water column reading will be sufficient in these cases.
Sample collection technique for laboratory analysis	Unfiltered Sample
Volume	125 mL
Container	HDPE, Bottle cap must have a Teflon liner, Use new pre-cleaned bottles
Collection Technique	Direct collection into sample bottle or transfer into a sample bottle from collection vessel. Ensure sample bottle is pre-rinsed three times with sample water (3 × 20mL) before final collection.
Treatment to assist preservation	Refrigerate at 1–4°C, do not freeze
Filling Technique	Excessive turbulence should be avoided to minimize presence of air bubbles near the measurement cell or in the sample. Fill container completely to the top to exclude air. The sample must be free of air bubbles. Cap tightly.
Maximum sample holding time and storage conditions	Analyze directly as soon as possible after sample is collected and preferably in the field, but within 6 hours if the sample is refrigerated at 1–4°C, do not freeze.
Unit of Measurement	Standard pH Units
Analysis Method	EPA Method 150.1
Comments	It is preferable to perform this test in the field, in situ.

Table 3. Sampling Procedures for Temperature

Collection technique using hand-held meter – *in situ* field measurement	Thermometer should be kept in gentle motion through the water column while a reading is being taken. Allow several moments for the reading to stabilize. Ideally, measurements should be made about 10 cm below the water surface (for surface measurements).
Unit of Measurement	Degrees Celsius (°C)
Analysis Method	EPA Method 170.1
Comments	This test must be performed in the field.

Table 4. Sampling Procedures for Total Suspended Solids (TSS)

Sample Requirements	Unfiltered Sample
Volume	1 L
Container	HDPE, Use new pre-cleaned bottles
Collection Technique	Direct collection into sample bottle or transfer into a sample bottle from collection vessel. Ensure sample bottle is pre-rinsed three times with sample water (3 × 20 mL) before final collection. It is important not to increase the turbidity of the water while collecting a sample, so do not disturb the bottom or the aquatic plants
Treatment of assist preservation	Refrigerate at 1–4°C, do not freeze
Filling Technique	Excessive turbulence should be avoided to minimize presence of air bubbles in the water. Fill to the shoulder of bottle.
Maximum sample holding time and storage conditions	Analyze directly as soon as possible after sample is collected, but within 7 days if the sample is refrigerated at 1–4°C, Do not freeze
Unit of Measurement	mg/L (mg total suspended solids/L)
Analysis Method	EPA Method 160.2
Comments	Take care not disturb bottom sediments or plants during collection.

Table 5. Sampling Procedures for Total Phosphorus

Sample Requirements	Unfiltered Sample
Volume	200 mL
Container	250mL HDPE, Use new pre-cleaned bottles
Collection Technique	Direct collection into sample bottle or transfer into a sample bottle from collection vessel. Ensure sample bottle is pre-rinsed three times with sample water (3 × 20 mL) before final collection.
Treatment to assist preservation	Preserve to pH >2 with H2SO4 or 1:1 HCl (laboratory dependent), Cool 4°C
Filling Technique	Fill to just below neck of bottle
Maximum holding time and storage conditions	28 days, Refrigerate 1-4°C, dark
Unit of Measurement	mg/L (mg phosphorus/L)
Analysis Method	EPA Method 365 series
Comments	Sample preservation laboratory dependent

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Table 6. Sampling Procedure for Microbial Analysis

For example, total plate count, total coliforms, fecal coliforms, or E. coli. (Escherichia coli).

Sample Requirements	Unfiltered Sample
Volume	For each parameter tested, at least 100 mL of sample is required.
Container	Sterilized plastic w/Sodium Thiosulfate. Use new sealed bottles.
Collection Technique	Keep sterilized sample bottle closed until it is ready to be filled Carefully remove seal & container cap, do not contaminate inner surface of bottle and cap. Do not rinse sample container with sample. Direct collection into sample bottle or transfer into a sample bottle from collection vessel. Replace cap immediately.
Treatment to assist preservation	Sodium Thiosulfate. Store in the dark and refrigerate at 1–4°C. Do not freeze.
Filling Technique	Fill to below shoulder of bottle and facilitate mixing by shaking. Do not overfill as preservative will be lost.
Maximum holding time and storage conditions	Sample should be analyzed within 6 hours for compliance or 24 hours for routine monitoring. Keep cool at 1–4°C but do not freeze.
Analysis Methods	SM 9000 series
Comments	Method used to analyze sample must produce a quantifiable number not just a positive/negative confirmation. Coliform density is reported as counts per 100 mL water sample.

Attachment 2

LOWER GRAND RIVER ORGANIZATION OF WATERSHEDS

CHAIN OF CUSTODY RECORD

Client Name:				**P.O./Ref #:**									
Contact Person & Address:				**Phone #/Fax#/e-mail:**									
Sample Comments:		**Preservatives→** **A: None pH ~7** **B: HNO3 pH<2** **C: H2SO4 pH<2** **D: 1:1 HCl pH<2** **E: Na2S2O3** **F: Other (note)**		**Preservative:**									
				Requested Analysis									
Field Sample ID		**Sample Date**		**Sample Time**	**Matrix**	**Number of Bottles**							
1													
2													
3													
4													
5													
6													
7													
8													
9													
Sampler Name (Print):		**Relinquished by:**				**Relinquished by:**							
Sampler Signature:		**Received by:**				**Received by:**							