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OHIO EPA - DSW
2009 FEB -4 PM 1:16

February 3, 2009

Mr. Jeff Reynolds
Ohio EPA, Division of Surface Water
Standards & Technical Support Section
50 West Town Street, Suite 700
P.O. Box 1049
Columbus, OH 43216-1049

Re: North Fork Massie Creek Level 3 Project Study Plan
Submitted for Consideration under the Division of Surface Water Credible Data Program

Dear Mr. Reynolds:

Enclosed for your review is the Project Study Plan for the North Fork Massie Creek Stream Restoration Project. This is being submitted on behalf of the Greene County Sanitary Engineering Department for your consideration pursuant to ORC 6111.53 and OAC 3745-4-05.

Please contact either Heather Dardinger (QDC #173) or Kelly McCutcheon (QDC #171) at (614)888-4953 if you have any questions or need additional information.

Very truly yours,

MALCOLM PIRNIE, INC.

Heather L. Dardinger
Project Environmental Scientist

Kelly L. McCutcheon
Project Environmental Scientist

Enclosures

cc: Jeffrey A. Hissong, Greene County Sanitary Engineering Department (w/encl.)

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Greene County Sanitary Engineering Department
667 Dayton-Xenia Road • Xenia, Ohio 45385

Quality Assurance and Quality Control Plan

OHIO EPA - DSW
2009 FEB -4 PM 1:16

North Fork Massie Creek Stream Restoration Project

Ohio Environmental Protection Agency
Level 3 Project Study Plan

February 2009

Report Prepared By:

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Contents

1. Project Management 1-1

1.1. Project Organization ... 1-1
1.2. Problem Identification and Background ... 1-2
1.3. Project Monitoring Objectives ... 1-3

2. Data Quality Objectives 2-1

2.1.1. Precision ... 2-1
2.1.1.1. Field Precision ... 2-1
2.1.1.2. Laboratory Precision ... 2-1
2.1.2. Accuracy ... 2-2
2.1.2.1. Field Accuracy ... 2-2
2.1.2.2. Laboratory Accuracy ... 2-2
2.1.3. Representativeness ... 2-2
2.1.3.1. Representativeness of Field Data ... 2-2
2.1.3.2. Representativeness of Laboratory Data ... 2-2
2.1.4. Comparability ... 2-3
2.1.4.1. Comparability of Field Data ... 2-3
2.1.4.2. Comparability of Laboratory Data ... 2-3
2.1.5. Completeness ... 2-3
2.1.5.1. Field Completeness ... 2-3
2.1.5.2. Laboratory Completeness ... 2-3
2.2. Training Requirements / Certification ... 2-3
2.2.1. Monitoring Personnel ... 2-3
2.2.2. Laboratories ... 2-4
2.3. Documentation and Records ... 2-4

3. Measurement and Data Acquisition 3-1

3.1. Sampling Process Design ... 3-1
3.2. Sampling Methods Requirements ... 3-1
3.3. Sample Handling and Custody Requirements ... 3-1
3.3.1. Sample Collection ... 3-1
3.3.1.1. Field Books ... 3-1
3.3.1.2. Field Identification System ... 3-2
3.3.1.3. Field Sample Handling ... 3-3
3.3.1.4. Field Sample Packaging and Shipment ... 3-3
3.3.1.5. Field Chain of Custody ... 3-3
3.3.2. Laboratory Chain of Custody ... 3-4
3.4. Analytical Methods Requirements ... 3-4
3.4.1. Analysis of Water Quality Samples ... 3-4
3.5. Quality Control Requirements ... 3-4
3.5.1. Field Quality Control Requirements ... 3-5
3.5.2. Laboratory Quality Control Procedures ... 3-5

3.5.3. Corrective Action 3-5
3.6. Instrument / Equipment Testing, Inspection, and Maintenance Requirements 3-5
3.6.1. Field Instrument Inspection and Maintenance 3-5
3.6.2. Laboratory Instrument Inspection and Maintenance 3-5
3.7. Instrument Calibration and Frequency 3-5
3.7.1. Field Instrument Calibration 3-6
3.7.2. Laboratory Instrument Calibration 3-6
3.8. Inspection and Acceptance Requirements for Supplies 3-6
3.9. Data Acquisition Requirements 3-6
3.10. Data Management 3-6

4. Assessment and Oversight 4-1

4.1. Assessment and Response Actions 4-1

5. Data Validation and Usability 5-1

5.1. Data Review, Validation, and Verification Requirements 5-2
5.2. Validation and Verification Methods 5-2
5.2.1. Verification 5-2
5.2.2. Validation 5-3
5.2.2.1. Validation of Field Data 5-3
5.2.2.2. Validation of Laboratory Data 5-3
5.3. Reconciliation with Data Quality Objectives 5-4
5.3.1. Precision 5-4
5.3.1.1. Field Precision 5-4
5.3.1.2. Laboratory Precision 5-4
5.3.2. Accuracy 5-5
5.3.2.1. Field Accuracy 5-5
5.3.2.2. Laboratory Accuracy 5-6
5.3.3. Representativeness 5-6
5.3.3.1. Field Representativeness 5-6
5.3.3.2. Laboratory Representativeness 5-7
5.3.4. Comparability 5-7
5.3.5. Completeness 5-7
5.3.5.1. Field Completeness 5-7
5.3.5.2. Laboratory Completeness 5-8
5.3.5.3. Overall Completeness 5-8
5.3.6. Data Limitations and Actions 5-8

Figures

Figure 1. Project Organization Chart
Figure 2. Project Location
Figure 3. Proposed Monitoring Locations

Tables

Table 1. Laboratory Analyses
Table 2. QA/QC Sample Requirements
Table 3. Laboratory Parameters, Laboratory Reporting Limits, Precision and Accuracy
Table 4. Laboratory Sample Container, Preservation and Holding Time Requirements
Table 5. Field Equipment Maintenance Procedures and QA Objectives

Appendices

Appendix A. Contact Information and Qualifications of Project Personnel
Appendix B. Laboratory Standard Operating Procedures
Appendix C. Field Standard Operating Procedures
Appendix D. Examples of Field Forms

1. Project Management

The purpose of this document is to describe the personnel, procedures, and methods for quality, accuracy and precision of data associated with the Greene County Sanitary Engineering Department's (GCSED) North Fork Massie Creek (NFMC) Stream Restoration Project (Project). Following the procedures outlined in this Quality Assurance and Quality Control (QA/QC) Plan will ensure that the project data meets Ohio EPA standards.

1.1. Project Organization

An organizational chart of key personnel for the Project is provided in Figure 1 at the end of the QA/QC Plan. All lines of communication and management activities will follow this organizational arrangement. The intent of the project organization is for Malcolm Pirnie to assist GCSED with short-term program development and sampling activities; in the long-term, GCSED intends to assume management of the project and all associated monitoring activities. Responsibilities of key project personnel are outlined below:

- Ohio EPA Qualified Data Collector (QDC) Program Reviewer
  - Review and approve the QA/QC Plan
- Director, GCSED
  - Direct all project activities in conjunction with the QA Manager
  - Responsible for final review and submittal of all project deliverables
- Malcolm Pirnie and/or GCSED Quality Assurance Manager
  - Oversee project activities to ensure compliance with QA/QC Plan methodology
  - Assist in an QA issues with field or laboratory questions as needed
  - Validate field and laboratory data and review results for compliance with QC criteria and Data Quality Objectives
  - Resolve any technical issues as needed
  - Prepare reports and other project deliverables
- Malcolm Pirnie and/or GCSED Field Team Leader
  - Direct all monitoring activities to ensure that all procedures are executed and documented properly
  - Responsible for collection and maintenance of equipment needed for monitoring activities
  - Submit all monitoring data generated to the QA Manager

Both the Quality Assurance Manager and Field Team Leader shall be a Level 3 Qualified Data Collector for Chemical Water Quality Assessment, as designated by Ohio EPA and in accordance with Ohio Administrative Code 3745-4-03. Contact information and documentation of QDC approval for project personnel is provided in Appendix A. All other personnel participating in the Project will be properly trained by the Field Team Leader in applicable field procedures and techniques for collecting, labeling, packaging, and shipping environmental samples.

The Montgomery County Environmental Laboratory (MCEL), located in Dayton, Ohio, will be primarily responsible for analysis of all water quality samples. The MCEL is a well equipped, Ohio EPA drinking water certified and wastewater testing facility staffed by nine full time employees. The MCEL meets the laboratory accreditation requirements of the Ohio Surface Water Volunteer Monitoring Program. Analyses will be carried out under the direction of Jim Davis, Laboratory Manager. The MCEL will be used for sample analysis until the Greene County Regional Laboratory (GCRL), located in Beavercreek, Ohio, has obtained appropriate accreditation to perform analyses under a Level 3 study plan. The GCRL analyses will be carried out under the direction of Rick Schran, Laboratory Manager. Contact information for both laboratories is provided in Appendix A. The Quality Assurance Plans and standard operating procedures for the laboratories are included in Appendix B.

1.2. Problem Identification and Background

The NFMC is a tributary of Massie Creek and lies within the greater Upper Little Miami River (ULMR) watershed in northeastern Greene County. The Project will focus on the headwaters of NFMC in the northeastern section of Greene County between river miles 5.9 to 9.6 (Figure 2).

According to the ULMR Total Maximum Daily Load (TMDL) report, the NFMC watershed is primarily impacted by nonpoint source issues such as sedimentation resulting from channelization and lack of riparian buffers. Nutrient enrichment from agricultural runoff is evidenced in the NFMC watershed by algal blooms and daytime supersaturated dissolved oxygen concentrations.

The TMDL report established a restoration target for instream phosphorus concentration within the ULMR watershed of 0.17 mg/L. This represents an approximate 60% reduction in phosphorus based on the median observed concentration at the most downstream point of 0.43 mg/L. Restoration activities on NFMC will involve natural channel design, and include stream bank stabilization, placement of instream structures, and restoration of vegetated riparian buffers. The purpose of the project is to reduce nonpoint source phosphorus loading by reducing the current sediment load and advancing a stable biological community that will provide higher nutrient assimilation capacity within the watershed.

1.3. Project Monitoring Objectives

In order to verify improvements in stream water quality, pre- and post-implementation monitoring will be performed. The primary objective of the project is to determine total phosphorus concentrations in the NFMC both pre- and post-construction. Project monitoring will include the following water quality measurements: total phosphorus, dissolved oxygen, temperature, pH, conductivity, and turbidity.

Each monitoring event will be comprised of field data collection, with sampling at each of the three identified sampling locations (Figure 3) followed by laboratory analysis and data validation. Field sampling activities will be conducted in accordance with standard operating procedures, included in Appendix C.

In addition to typical sampling events, wet weather sampling will be conducted in order to further characterize runoff events and determine the impacts on receiving water quality. Wet weather sampling will occur, at a minimum, at the most downstream sampling location. Wet weather sampling activities will be conducted in accordance with standard operating procedures, included in Appendix C.

Monitoring will occur during the months of May through October. Baseline pre-implementation monitoring will be conducted monthly beginning in May 2008. Wet weather sampling will occur at least once during the fall and/or winter of 2008 and at least twice during the spring of 2009. No monitoring will be conducted during project construction. Immediately following construction, post-implementation monitoring will occur every other month until vegetation is fully established. Depending on the significance of the wet weather sampling results, further wet weather sampling will occur seasonally through post-implementation monitoring. Once the system is fully restored and re-vegetated, sampling will occur monthly from May through October for a period of two years and then bimonthly for a period of three years. Perpetual monitoring will consist of annual sampling following the five-year post-implementation period. The monitoring schedule is outlined below:

- **Pre-implementation monitoring:** Monthly sampling at all locations from May 2008 until construction begins; monthly sampling will continue at upstream sampling location (Site #02) throughout project construction.
- **Post-construction monitoring:** Bimonthly sampling (May, July and September) until vegetation is fully established (3-5 years following construction).
- **Post-implementation monitoring:** Following full establishment of vegetation, monthly sampling from May through October for a period of two years and bimonthly sampling (May, July and September) for a period of three years.
- **Perpetual monitoring:** After five-year post-implementation period, annual monitoring will be implemented to evaluate the continued effectiveness of the restoration project.

2. Data Quality Objectives

Data generated during this project will be utilized to verify a reduction in total phosphorus concentrations in NFMC after restoration. Therefore, it is important to reduce uncertainty using appropriate measures. Data Quality Objectives (DQOs) are quantitative and qualitative statements and statistics that are used to interpret the degree of acceptability or utility of the data to the user. The data quality will be measured and evaluated in terms of the following criteria:

- Precision
- Accuracy
- Representativeness
- Completeness
- Comparability

2.1.1. Precision

Precision is a measure of the degree to which two or more measurements are in agreement; it can be used as an indicator of internal method consistency.

2.1.1.1. Field Precision

Field precision is demonstrated by the degree of mutual agreement between individual measurements or enumerated values of the same property of a sample, usually under demonstrated similar conditions. Precision of sampling methods is estimated by taking duplicate samples at the same or immediately adjacent sampling site.

For this project, field precision will be assessed through the collection and measurement of duplicate water quality samples at a rate of one duplicate per 10 or fewer analytical samples.

A summary of the duplicate samples to be collected is presented in Table 2 (presented at the end of the QA/QC Plan). In addition, Table 2 includes other quality control samples to be collected.

2.1.1.2. Laboratory Precision

Precision is also the measure of the reproducibility of analyses under a given set of conditions. Laboratory duplicates are used to determine the precision of the analytical method. Uncertainty due to natural variation and sampling error is calculated from two duplicate samples by relative percent difference. The equations to be used for precision in this project are presented in Section 5.3.1 of the QA/QC Plan. Precision control limits are

presented in the appropriate laboratory SOPs included in Appendix B. In addition, Table 3 includes the precision for each analytical parameter and matrices. These limits are subject to change periodically based on laboratory controls.

2.1.2. Accuracy

Accuracy is a measure of the bias of a method, i.e., the degree of agreement between an observed value and the known true value. A measurement is accurate when the value reported does not differ from the true value or known concentration of the spike or standard.

2.1.2.1. Field Accuracy

Since accuracy is the measurement of a parameter and comparison with the "true" value and the true values of environmental physicochemical characteristics cannot be known, use of a surrogate is required.

Accuracy of field measurements of water quality will be determined through use of field blanks. Field blanks will be collected by pouring distilled water directly into appropriate sample containers under normal field conditions. Field blanks will be required at a rate of one per 10 field samples (per Table 2).

2.1.2.2. Laboratory Accuracy

Laboratory accuracy is assessed through the analysis of laboratory control samples and the determination of percent recoveries. The equation to be used for accuracy in this project can be found in Section 5.3.2 of the QA/QC Plan. Accuracy control limits are given in Appendix B in the respective analytical SOPs. In addition, Table 3 includes the accuracy for each analytical parameter and matrices.

2.1.3. Representativeness

Data representativeness is defined as the degree to which data accurately and precisely represents a characteristic of a population, parameter, and variations at a sampling point, a process condition, or an environmental condition.

2.1.3.1. Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the sampling program is followed and proper sampling techniques are used. The sampling program to be used in this project is designed to provide for collection of water quality samples that are representative of the overall water quality conditions typical of the existing stream.

2.1.3.2. Representativeness of Laboratory Data

Representativeness of laboratory samples will be ensured by using the proper analytical procedures, meeting sample holding time criteria, and assessing field duplicate samples.

2.1.4. Comparability

Comparability is a qualitative parameter that expresses the confidence with which one data set can be compared to another. Comparability of data is maximized through the use of standard operating procedures in the field and the laboratory, standardized analytical methods, and consistent units of measure.

2.1.4.1. Comparability of Field Data

Comparability is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the sampling and measurement programs for water quality are followed and proper sampling techniques are used.

2.1.4.2. Comparability of Laboratory Data

Comparability of laboratory analytical data will be ensured through adherence to the procedures specified in this QA/QC Plan for analysis and reporting. Comparability is also dependent on meeting the other QA/QC objectives.

2.1.5. Completeness

Completeness is defined as the percentage of measurements made that are judged to be valid according to specific criteria and entered into the data management system. To achieve this objective, every effort is made to avoid accidental or inadvertent sample and/or data loss.

2.1.5.1. Field Completeness

Field completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The equation for completeness is presented in Section 5.3.5 of this QA/QC Plan. As discussed in Section 5, the Measurement Quality Objective (MQO) for field measurements will be 90 percent.

2.1.5.2. Laboratory Completeness

Laboratory completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. The equation for completeness is presented in Section 5.3.5 of this QA/QC Plan. As discussed in Section 5, the Measurement Quality Objective (MQO) for completeness will be 90 percent of the samples processed at the laboratory.

2.2. Training Requirements / Certification

2.2.1. Monitoring Personnel

All monitoring activities will be completed under the direction of the Field Team Leader, who shall be a trained scientist who is well versed with the applicable field procedures and techniques. This person shall be a Level 3 Qualified Data Collector for Chemical Water Quality Assessment, per Ohio EPA, and in accordance with rule OAC 3745-4-03.

All monitoring personnel will be provided instruction by the Field Team Leader on equipment calibration, sample collection, and field documentation.

2.2.2. Laboratories

Laboratories performing analysis for the project must meet the laboratory accreditation requirements of the Ohio Surface Water Volunteer Monitoring Program. Per these requirements, accreditation by one or more of the following organizations (or equivalent) is acceptable:

- U.S. Environmental Protection Agency
- Ohio EPA Voluntary Action Program
- National Environmental Laboratory Accreditation Program
- American Industrial Hygiene Association
- International Organization for Standardization

2.3. Documentation and Records

Documents and records that are generated during the various monitoring activities will play a critical role in determining the success of the Project. This section describes the records and reports that will be produced, types of data sheets that will be used, and requirements for final disposition of records and documents.

Documentation for water chemistry samples will include field forms, field books, laboratory data sheets, chain-of-custody forms, and technical papers. In addition, a digital photo catalog, including photos of specific sampling locations, riparian zone adjacent to the sampling location, and general land use in the immediate vicinity of the sampling location, will be completed.

All data collected will be entered into a spreadsheet and/or database created by GCSED and/or their representatives. Original or legible copies of all handwritten field and laboratory data sheets, chain-of-custody records, hard copies of electronic data, photographs and formal reports generated from data collection will be maintained in the project files for a period of 10 years. All water sample analyses, statistical analyses, and other water quality data generated will be submitted to the Ohio EPA.

3. Measurement and Data Acquisition

3.1. Sampling Process Design

Pre- and post-implementation water quality monitoring will be completed at each of the three project monitoring sites. Monitoring sites (Sites #01, 02, and 03) are shown on Figure 3 and are identified by a number and a location. These monitoring sites were selected based on representativeness of the overall stream segment and site access.

3.2. Sampling Methods Requirements

All sampling will be performed in accordance with applicable U.S. EPA and Ohio EPA standards. Field standard operating procedures (SOPs) that will be used to conduct water quality monitoring are provided in Appendix C.

3.3. Sample Handling and Custody Requirements

A key element of every site investigation is the integrity of the samples collected. If the samples have been mishandled, misused, or incorrectly documented at any point of the investigation, the results from the investigation may be compromised. Samples that will be sent to the lab will be tracked by a chain-of-custody. Along with a chain-of-custody, field data sheets and sample labels will be used to record information during the site investigation, including on-site personnel, field activities, photographs collected, sampling times and dates, weather conditions, etc.

3.3.1. Sample Collection

All sample documents shall be legibly written in ink. Any corrections or revisions to sample documentation shall be made by lining through the original entry and initialing any changes. The following sub-sections outline the sample documentation procedures that will be employed when conducting any field activities.

3.3.1.1. Field Books

The field logbook is a descriptive notebook detailing site activities. The field logbook will be comprised of the data sheets used during each sampling event and will document the following:

- Site name and number
- Names of personnel on site
- Dates and times for all entries
- Descriptions of all site activities

- Weather conditions and site observations
- Identification and description of samples and locations
- Records of photographs
- All relevant and appropriate information delineated in field data sheets and sample labels

3.3.1.2. Field Identification System

A label with a unique sample number will be attached to each sample container. This unique number will be used for sample identification and is part of a sample numbering system to be employed during data entry. This system will provide a tracking procedure to allow for retrieval of information about a particular sample. The sample identification shall consist of at least three components as described below.

- **Project Identification:** The first component consists of a four-letter designation to identify the project site. For this project, the project identification is NFMC, for North Fork Massie Creek.
- **Sample Location:** The second component identifies the sample location using a two-digit number. For this project, there are three sample locations, thus sample location number will be 01, 02, or 03.
- **Sample Type:** The third component, which identifies sample type, consists of the two-letter code "SW" for surface water sample.
- **Sample Identification:** A fourth component may be used to distinguish multiple samples collected at the same sample location, if needed. This will consist of a three-digit numerical code.
- **Quality Assurance / Quality Control Samples:** The samples will be labeled with the following suffixes:
  - FB – Field Blank

Duplicate samples will be numbered uniquely as if they were samples. A record of identification for duplicate samples will be maintained on the field data sheets. Other information recorded on the field data sheets shall include names of field personnel, date, stream name, general location, sample type, sampling method, and any other comments considered pertinent to the collection and analysis of the sample.

In addition to the particular sample identification number, every sample label will clearly identify the following additional information:

- Sampler's initials
- Date/time
- Analyses to be performed
- Preservation, if used.

Examples of sample identification numbers are given below:

- NFMC-01-SW-001: North Fork Massie Creek, Monitoring Site #1, Surface Water Sample No. 1
- NFMC-02-SW-FB: North Fork Massie Creek, Monitoring Site #2, Field Blank for Surface Water Sample

3.3.1.3. Field Sample Handling

Samples will be documented from the time of collection to the delivery of the sample at the laboratory. Field personnel will maintain custody of the samples until the samples are delivered to the laboratory or given to a carrier for shipment to the lab. Field personnel will be responsible for following the Sample Packaging and Shipping SOP until he/she has delivered or verified pickup of the samples.

All samples will be maintained in accordance with the Sample Packaging and Shipping SOP. A sample is under custody when it is:

- In a person's physical possession
- In view of that person after he/she has taken possession
- Secured by that person so that no one can tamper with the sample
- Secured by that person in an area that is restricted to authorized personnel

A chain-of-custody (COC) record must always be maintained from the time the sample is collected until final deposition. Every transfer of custody will be noted and signed for with a copy of the record being kept for each individual that endorsed it.

3.3.1.4. Field Sample Packaging and Shipment

When preparing sample containers for shipment, they will be securely sealed. Samples will then be placed in an appropriate transport container. All sample containers will be packed to maintain a temperature of 4°C ± 2°C. The Sample Packaging and Shipping SOP will be followed for all field samples collected for analysis.

3.3.1.5. Field Chain of Custody

Field COCs will be affixed to the underside of each transport container lid. The transport container lid will then be closed and affixed with custody seals accordingly. Custody seals on the transport container will be used to demonstrate that the transport container has not been opened or tampered with. The individual that has sample custody shall always sign, date, and affix the custody seal to the container in such a manner that it cannot be opened unless it is broken. When samples are not under the direct control of the responsible party, they will be stored in a container that will be affixed with a custody seal. Samplers will transport environmental samples directly to the laboratory with 24 hours of sample collection, or utilize an overnight delivery service within 24 hours of

collection. If it is not possible to transport samples within 24 hours, samples will be delivered to the laboratory before exceeding the designated method holding times (specified in Tables 4).

3.3.2. Laboratory Chain of Custody

The laboratory will perform lab custody procedures for sample receiving, sample log-in, sample storage, sample tracking during preparation and analysis, and storage of data in accordance with their SOPs. The laboratory manager will be responsible for ensuring that laboratory custody protocol is followed.

3.4. Analytical Methods Requirements

This section provides the approach and methods that will be used to analyze physical data that represent the quality of the restored stream.

3.4.1. Analysis of Water Quality Samples

Water quality samples that will be sent to the lab will be analyzed in accordance with the analytical methods outlined in the MCEL and GCRL SOPs, included in Appendix B. The specific analytical methods and reporting limits for each parameter are presented in Table 3.

Proper sample containers, preservation, holding times, and volumes for each analytical water quality parameter are outlined in Table 4 (located at the end of the QA/QC Plan). MCEL and/or GCRL will provide all sample containers and preservatives for this project to conform with the given analytical method requirements. All sample containers provided will be pre-preserved by the laboratory.

All sample containers provided by the laboratory will be cleaned according to U.S. EPA standards and QC documentation will be supplied with the sample containers and preservatives to verify their purity. The QC documentation shall be maintained by the laboratory.

3.5. Quality Control Requirements

The purpose of this section is to describe the system of technical activities that measures the attributes and performance of process against defined standards to verify that the information generated meets stated requirements.

The field quality control requirements found in Table 2 will be followed during this field investigation. Quality control samples, such as field blanks and duplicates, will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

3.5.1. Field Quality Control Requirements

Requirements for field quality control samples are listed in Table 2. Field blanks consisting of distilled water will be submitted to the analytical laboratory to provide the means to assess the quality of the data resulting from the sampling program. In addition, field quality control will be ensured by following the applicable SOPs (Appendix C).

3.5.2. Laboratory Quality Control Procedures

The laboratory QA Manager will be responsible for maintaining data precision and accuracy for the applicable water quality parameters. The laboratory will follow its own internal QA/QC procedures for blanks, duplicates, and laboratory control samples.

3.5.3. Corrective Action

When laboratory data sets do not meet Data Quality Objectives (DQO), laboratory personnel will, upon consultation with the QA Manager, determine the need for re-analysis.

3.6. Instrument / Equipment Testing, Inspection, and Maintenance Requirements

3.6.1. Field Instrument Inspection and Maintenance

All field equipment will be maintained following the procedures outlined in Appendix C. A summary of the maintenance schedule for commonly used field instruments is provided in Table 5 at the end of the QA/QC Plan. Equipment to be used during the field sampling will be examined by the Field Team Leader to certify that it is in operating condition prior to initial use. In the event that a problem is noted during the equipment examination, an entry into the field notebook will be made and the QA Manager notified in order to return the instrument to working service.

3.6.2. Laboratory Instrument Inspection and Maintenance

The preventative maintenance and corrective action procedures for the laboratories are included in Appendix B of the QA/QC Plan.

3.7. Instrument Calibration and Frequency

All field equipment will be calibrated following the procedures outlined in Appendix C. A summary of the calibration schedule for commonly used field instruments is provided in Table 5 at the end of the QA/QC Plan. In general, all instruments and equipment used to gather, generate, or measure environmental data will be tested and inspected with sufficient frequency and in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

3.7.1. Field Instrument Calibration

Field instruments will include a turbidity meter, pH/conductivity meter and a dissolved oxygen meter with a temperature probe. At a minimum, field instruments shall be calibrated once per day prior to use and then throughout the day as specified in the field SOPs. In the event that an internally calibrated field instrument fails to meet calibration/checkout procedures, the QA Manager will be notified and the instrument will be returned to the manufacturer for service.

3.7.2. Laboratory Instrument Calibration

Calibration procedures for a specific laboratory instrument will be in accordance with the appropriate analytical methodology employed. For a description of the laboratory instrument calibration procedures, refer to the analytical SOPs provided in Appendix B of the QA/QC Plan.

3.8. Inspection and Acceptance Requirements for Supplies

Supplies to be used during the field sampling will be examined upon receipt by the Field Team Leader or QA Manager to certify that they are in proper condition prior to initial use. This examination will include checking to ensure that the materials are in the proper condition for field use. In the event that a problem is noted with the supplies, an entry into the field notebook will be made and the QA Manager notified in order to return the product to the manufacturer for replacement.

3.9. Data Acquisition Requirements

USGS 7.5-minute topographic maps, aerial photography, and Geographic Information System (GIS) data may be used as part of the project monitoring activities to identify site locations, land-use activities and landscape features.

3.10. Data Management

Data collected in the field will be recorded on the appropriate field forms. If samples are collected by sampling personnel other than the Field Team Leader, field data sheets shall be provided to the Field Team Leader for review. All raw field data will be transferred to project-specific Microsoft Excel and/or Microsoft Access formats to organize and track incoming field data.

The laboratory QA Manager will be responsible for laboratory data management. The laboratory QA Manuals are included in Appendix B.

Data generated from the water quality sampling will be used to determine and characterize the water quality characteristics of the stream following restoration activities, and specifically, to characterize total phosphorus concentrations. All data sets received from the laboratory will be compared to field records, including chain-of-

custody forms and field data sheets, to ensure that all the samples of the data set are present and are reported under the correct sample designation. Each data set will also be reviewed to ensure that the correct data qualifiers and units have been included.

After data reduction into summary tables is complete, an independent reviewer (i.e. someone other than the person who reduced the data) will spot-check at least five values from the reduced data set against the hard copy for each sample. If any errors are found, the reduced data set will be further evaluated and the markup given to the reducer for correction and error analysis.

4. Assessment and Oversight

The purpose of this section is to describe internal and external checks that ensure that all elements of the QA/QC Plan are correctly implemented as prescribed; the quality of the data generated by implementation of the QA/QC Plan is adequate; and corrective actions, when needed, are implemented in a timely manner and their effectiveness is documented.

4.1. Assessment and Response Actions

The QA program under which this project will operate includes performance and system audits with independent checks of the data obtained from data gathering activities. The essential steps in the QA program for any organization participating in this project are as follows:

1. Identify and define the problem.
2. Assign responsibility for investigating the problem.
3. Investigate and determine the cause of the problem.
4. Assign and accept responsibility for implementing corrective action.
5. Implement the corrective action.
6. Verify that the corrective action has eliminated the problem.

Many of the technical problems that might occur can be solved on the spot by the staff members involved; for example, by modifying the technical approach, repairing instrumentation that is not working properly, or correcting errors or deficiencies in documentation. Immediate corrective actions form part of normal operating procedures and are noted in records for the project. Problems not solved this way require a more formalized long-term corrective action. In the event quality problems are identified, the QA Manager will determine whether attainment of acceptable quality requires either short- or long-term actions.

Performance audits will be conducted by the QA Manager for laboratory, field, and data processing activities. Performance audit techniques include, among other things, checks on sampling equipment, volume measurements, and the analysis of data quality using QC samples. For all project activities audits will be conducted to ensure adherence to the procedures outlined in the QA/QC Plan and associated SOPs. The monitoring team is responsible for ensuring that all necessary data are collected at each sampling site. The monitoring team is also responsible for verifying that field QC activities are performed and for performing or directing corrective action on field-related activities. The purpose

of this self-assessment will be to verify that sampling protocols were followed and analytical requirements were met.

The QA Manager and Field Team Leader will monitor the status of the project and examine the records to ensure that QA/QC Plan requirements are being fulfilled. Surveillance will be conducted by the Field Team Leader on each sampling day. This surveillance will include daily verification of:

- Agreement between recorded sample location identifications and actual locations visited;
- Complete instrument calibration records;
- Successful instrument calibration;
- Compliance with instrument calibration criteria;
- Completeness of field data forms;
- Collection of replicate samples (when necessary);
- Sample shipment to laboratory;
- Completed chain-of-custody documents; and
- Documentation of corrective action including follow up of corrective action and documentation of its effectiveness.

The QA Manager will review analytical data produced by the analytical laboratory with respect to DQOs and adherence to specified methodology. Deficiencies noted by the QA Manager will be addressed through corrective action described in previous sections. Questionable laboratory analytical data will be discussed with laboratory personnel to determine the need for repeating any analyses. Data quality checks will be conducted on laboratory data to determine:

- Attainment of DQOs;
- Application of proper analytical methodology;
- Internal consistency of analytical data;
- Compliance with sample holding times; and
- Completeness of chain of custody.

5. Data Validation and Usability

The purpose of this section is to state the criteria for deciding the degree to which each data item has met its quality specifications as described in Section 3. This decision will be based on an evaluation of the effect that each deviation from the QA/QC Plan will have on the usability of the associated data item, i.e. data verification, data validation, and data usability.

Data verification is the process of evaluating the completeness, correctness, and contractual compliance of a data set against the standard, SOP, or contract requirements. Data verification of field results will be performed by the project QA Manager. Data verification of laboratory results will be performed by the analytical laboratory.

Data validation is the analyte- and sample-specific process that extends the qualification of data beyond method, procedural, or contract compliance to determine the analytical quality of specific data sets. Data validation criteria are based on the measurement performance criteria of this project QA/QC Plan.

Data usability assessment is the process of evaluating validated data to determine if the data can be used for the purpose of the project. Data usability will include the following steps:

1. Individual data sets will be evaluated to identify the measurement performance/ usability issues or problems affecting the ultimate achievement of project DQOs.
2. An overall evaluation of all data generated for the project will be made.
3. The project-specific measurement performance criteria and data validation criteria will be evaluated to determine if they were appropriate for meeting project DQOs.

In order to perform the verification, validation and data usability assessment steps, complete data packages for the laboratory will include:

- Sample receipt and sample tracking information
- Chain-of Custody
- Tabulated data summaries
- Raw analytical data for field samples
- Calibration Summaries
- Field and Laboratory QA checks
- QC sample results

5.1. Data Review, Validation, and Verification Requirements

Criteria for compliance with field data collection procedures specified in the QA/QC Plan are as follows:

1. Calibration records for field instruments complete;
2. Calibration records indicate acceptable instrument calibration; and
3. Post calibration records indicate acceptable instrument stability.

Criteria for compliance with sample handling procedures specified in the QA/QC Plan are as follows:

1. Samples shipped to the laboratory to allow adequate time for analysis within prescribed holding times;
2. The sample numbering system identified samples using the specified sample numbering system;
3. Sample integrity maintained by ensuring that samples remain on ice at all times after collection as evidenced by temperature on arrival recorded by laboratory;
4. Sample forms and chain-of-custody documents complete; and
5. Samples remained in the possession of sampling personnel, laboratory personnel, or couriers at all times.

Criteria for compliance with analytical procedures specified in the QA/QC Plan are as follows:

1. Analytical methods reported in laboratory report match those specified in QA/QC Plan and chain of custody;
2. Reported times for analyses are within specified holding times;
3. Analytical data are internally consistent; and
4. QC summary complete with specified number of QC samples and QC results in compliance with DQOs.

5.2. Validation and Verification Methods

5.2.1. Verification

The QA Manager will verify the sample collection, handling and field procedures. These parameters will be compared to the requirements specified previously to ensure that sampling efforts met the goals for the monitoring stations.

For purposes of this study, data that have been verified as having been collected and analyzed according to the methods and procedures described herein will be assumed to be valid for the uses of the project.

1. Data will be reviewed and validated according to the following criteria:
2. Adherence to specified sampling design and procedures;
3. Correct and unambiguous sample identification and chain of custody;
4. Attainment of analytical DQOs;
5. Attainment of sample processing DQOs;
6. Documentation of proper measurement instrument calibration; and
7. Verified data entry.

Acceptance and rejection criteria will be based on performance characteristics (precision, accuracy, representativeness, completeness and comparability and will be segregated for 1) field sampling, 2) laboratory activities, 3) data entry, 4) data reduction, and 4) site assessment and interpretation. If performance measures are routinely exceeded, re-sampling may be triggered or corrective actions developed and implemented for particular aspects of the laboratory analysis.

5.2.2. Validation

The QA Manager shall perform data validation procedures for both field and laboratory operations as described below.

5.2.2.1. Validation of Field Data

Procedures to evaluate field data for this project primarily include checking for errors on the part of field crew members, including review of field data sheets and other field forms. This task will be the responsibility of the QA Manager, who will otherwise not participate in making any of the field measurements, or in adding notes, data or other information to the log book. One hundred percent of the field analytical data will be validated.

5.2.2.2. Validation of Laboratory Data

The laboratory data will be validated by the QA Manager, who is independent of the laboratory. Data validation will be performed on 100 percent of the data. Essentially, all technical holding times shall be reviewed and results of initial & continuing calibration will be reviewed and evaluated, including results of all blanks, duplicates, and laboratory control samples.

All laboratory forms summarizing this information will be checked as well. The overall completeness of the data package will also be evaluated. Completeness checks will be administered on all data to determine whether deliverables specified in the QA/QC Plan are present. At a minimum, deliverables will include sample COC forms, analytical results, QC summaries, and supporting data. The reviewer will determine whether all required items are present and request copies of missing deliverables.

5.3. Reconciliation with Data Quality Objectives

Analytical data will be assessed by the QA Manager who will review the results for compliance with the specified QC criteria. Data will be required to meet the Data Quality Objectives (DQO). The DQO process is used to establish acceptance criteria for data quality based on their intended use. These objectives are intended to determine if the data collected are acceptable for the end use and to set tolerable limits on the probability of making decision errors. To determine whether DQOs are met, Data Quality Indicators (DQIs) are used. Each DQI has a Measurement Quality Objective (MQO) that is the acceptance criteria for the project's data. The DQOs for this project are: precision, bias, accuracy, representativeness, comparability, completeness, and sensitivity. The definitions and the MQO are given in the following section.

5.3.1. Precision

Precision is the measure of agreement among repeated measurements of the same matrix under similar conditions. Precision will be determined through the use of field duplicates and matrix spike/matrix spike duplicates. The Relative Percent Difference (RPD) between the two results will be calculated and used as an indication of the precision of the analyses performed. The following formula will be used to calculate RPD:

$$RPD = \frac{(C_1 - C_2)}{(C_1 + C_2)/2} x100$$

Where:

- RPD = relative percent difference
- C_1 = larger of the two observed values
- C_2 = smaller of the two observed values

5.3.1.1. Field Precision

Precision of field sample measurements will be assessed by collection of duplicate samples. Duplicate water samples will be collected at a frequency of one duplicate per 10 analytical samples of the same matrix. The performance standard for RPD will be ±25 percent. The MQO for field precision will be 90 percent of parameters passing the acceptance criteria.

5.3.1.2. Laboratory Precision

Precision of laboratory measurements will be assessed by analysis of laboratory control samples. The performance standard will be defined in the analytical SOP. The MQO for laboratory precision will be 90 percent of parameters passing the acceptance criteria.

5.3.2. Accuracy

Accuracy is the general agreement of a measurement and the true value. In general, it includes precision and bias. Accuracy will be assessed through the analysis of quality control samples. Accuracy will be expressed as the percent recovery (%R) of an analyte that has been added to the environmental sample at a known concentration before analysis or percent difference (%D) from a standard reference material. Percent recovery is calculated according to the following equation.

$$\%R = 100x\frac{S-U}{C_{sa}}$$

Where:

- %R = percent recovery
- S = measured concentration in spiked aliquot
- U = measured concentration in unspiked aliquot
- C_{sa} = actual concentration of spike added

The following formula will be used for measurements where a standard reference material is used:

$$\%D = 100\left(\frac{C_m}{C_{rm}}\right)$$

Where:

- %D = percent recovery
- C_m = measured concentration of standard reference material
- C_{rm} = actual concentration of standard reference material

5.3.2.1. Field Accuracy

Accuracy will be assessed by collection of field blank samples. Field blanks will be distilled water that is poured directly into appropriate sample containers under normal field conditions. Field blanks will be collected at a frequency of one blank per 10 analytical samples.

The performance standard for blank samples is that no parameter should be measured in excess of the practicable quantitation limit (PQL). If parameters are detected that exceeded the PQL, all associated samples will be evaluated for false-positives due to contamination introduced in the field or laboratory. Ten times the blank concentration will be used for common contaminants (as determined by the validation guidelines); five times the blank concentration will be used for all other parameters. Associated sample

concentrations below these criteria will be qualified as non-detects. The MQO for field accuracy will be 90 percent of the parameters passing the acceptance criteria.

5.3.2.2. Laboratory Accuracy

Accuracy of the laboratory measurements will be measured by analysis of laboratory control samples. The performance standard will be defined in the analytical SOP. In general, when percent recoveries are outside of control limits, qualifications will only be performed on individual sample results. If it can be determined using informed professional judgment with other QC criteria that a systemic or matrix problem exists for all other samples of the analytical batch, all associated samples will be qualified as estimated. The MQO for laboratory accuracy will be 90 percent of parameters passing the acceptance criteria.

5.3.3. Representativeness

Representativeness is the degree to which data accurately and precisely represents a characteristic of a population, parameter variation at a sampling point, a process condition, or an environmental condition. Representativeness will be expressed as the percentage of samples that are collected following the sampling protocol or analyzed following the analytical protocol. The following formula will be used to calculate representativeness:

$$\%R = 100\left(\frac{V}{n}\right)$$

Where:

- %R = percent representativeness
- V = number of measurements that follow the standard protocol
- n = total number of measurements necessary to achieve a specified statistical level of confidence in decision making

5.3.3.1. Field Representativeness

The objective will assumed to have been met if the following items are successfully performed:

- The correct number and spacing of samples
- The acceptable collection of surface water samples

The MQO for field representativeness will be 90 percent of the samples follow the standard protocols.

5.3.3.2. Laboratory Representativeness

The objective will be assumed to have been met if the analytical QA/QC parameters and sample holding times are met and standard analytical protocols are followed. The MQO for laboratory representativeness will be 90 percent of the samples follow the standard protocols.

5.3.4. Comparability

Comparability is the measure of confidence that the measurements obtained can be compared to another and/or combined with other measurements to form a larger data set. Field and laboratory comparability will assumed to have been met if the samples are collected, preserved, stored and analyzed according to the standard protocols as specified in the QAPP.

5.3.5. Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions. Data completeness will be expressed as the percentage of valid data obtained from the measurement system. For data to be considered valid, it must not have been qualified as rejected or unusable. The following formula will be used to calculate completeness:

$$\%C = 100\left(\frac{V}{n}\right)$$

Where:

- %C = percent completeness
- V = number of measurements judged valid
- n = total number of measurements necessary to achieve a specified statistical level of confidence in decision making

5.3.5.1. Field Completeness

Completeness of sample collection will be assessed by number of samples collected and shipped to the laboratory per number of samples planned to be collected. The MQO for completeness will be 90 percent of the samples planned to be collected.

Completeness of field measurement will be assessed by number of measurements planned per number of measurements completed. The MQO for field measurements will be 90 percent.

5.3.5.2. Laboratory Completeness

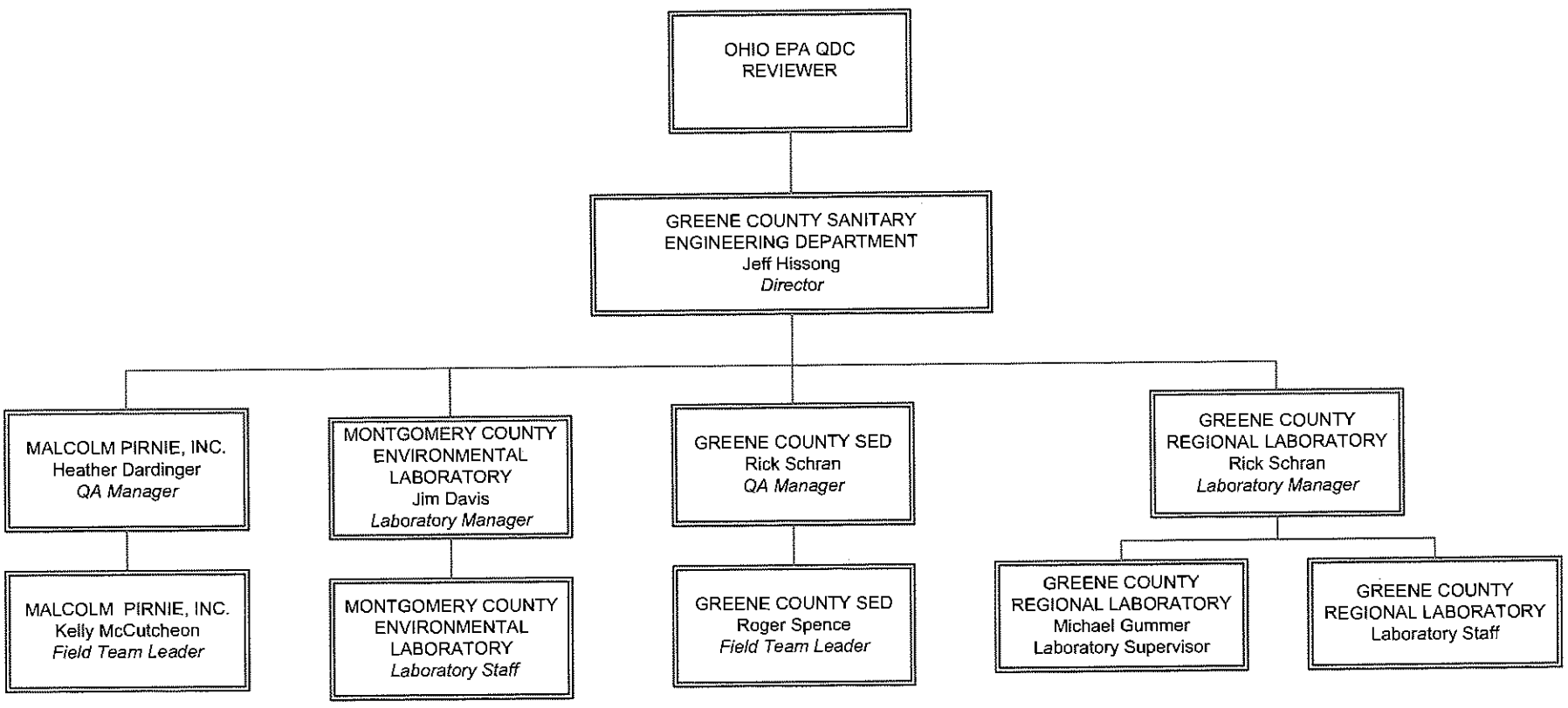
Completeness of laboratory analyses will be assessed by number of samples analyzed per number of samples shipped to the laboratory. The MQO for completeness will be 90 percent of the samples shipped to the laboratory.

5.3.5.3. Overall Completeness

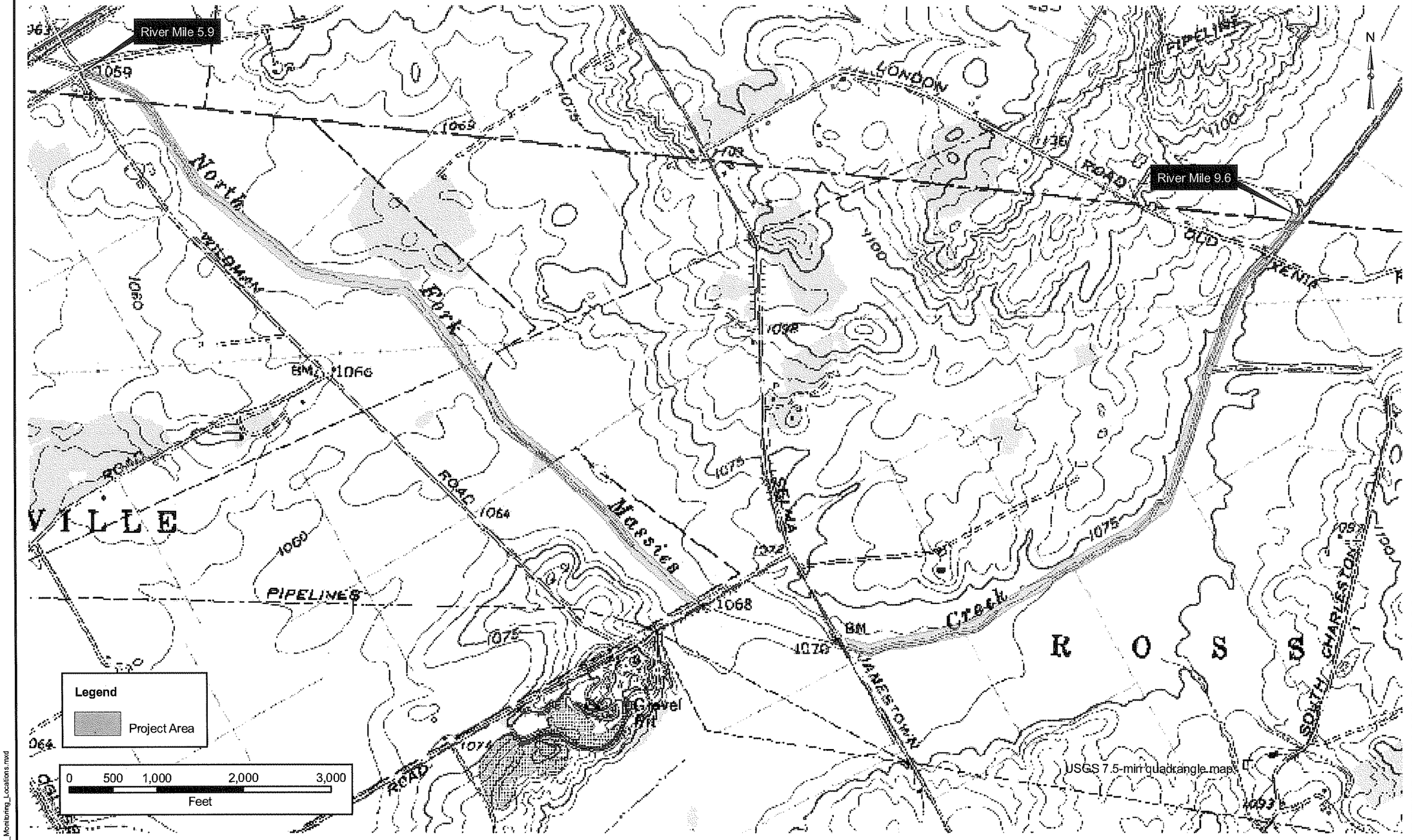
Completeness is the ratio of the number of valid sample results to the total number of samples analyzed with a specific matrix and/or analysis. The MQO for overall completeness will be 90 percent.

5.3.6. Data Limitations and Actions

Malcolm Pirnie will test and identify possible sources of error in the sampling and analytical procedures chosen. When a possible source of error is detected, corrective actions will be put in place as soon as possible to prevent errors from occurring again. These tests for error will be incorporated in the project to ensure that quality objectives are met.



MALCOLM PIRNIE	QUALITY ASSURANCE AND QUALITY CONTROL PLAN **GREENE COUNTY SANITARY ENGINEERING DEPT** **NORTH FORK MASSIES CREEK TOTAL PHOSPHORUS MONITORING**	**PROJECT ORGANIZATION**	**FIGURE 1**



GREENE COUNTY SANITARY ENGINEERING DEPARTMENT

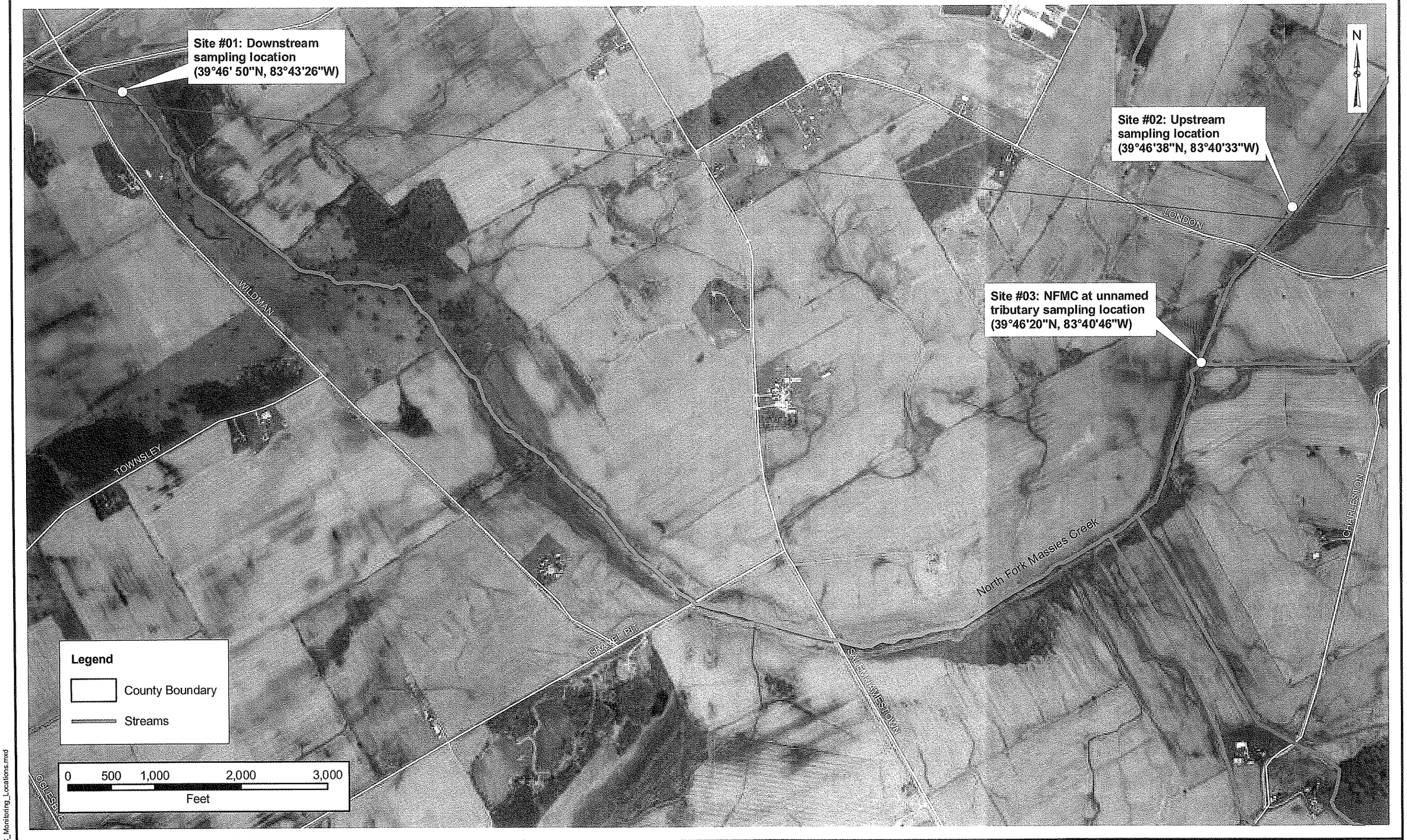
NORTH FORK MASSIE CREEK STREAM RESTORATION
TOTAL PHOSPHORUS MONITORING - QA/QC PLAN

PROJECT LOCATION

MALCOLM PIRNIE, INC.

FEBRUARY 2009
FIGURE 2

T:\3287019\GIS\NFMC_Monitoring_Locations.mxd



GREENE COUNTY SANITARY ENGINEERING DEPARTMENT

NORTH FORK MASSIE CREEK STREAM RESTORATION
TOTAL PHOSPHORUS MONITORING - QA/QC PLAN

SURFACE WATER SAMPLING LOCATIONS

MALCOLM PIRNIE, INC.

FEBRUARY 2009
FIGURE 3

T:\13287019\GIS\NFMC_MonitoringLocations.mxd

TABLE 1
North Fork Massie Creek Stream Restoration
Greene County Sanitary Engineering Department

Laboratory Analyses

LABORATORY	ANALYSES	METHOD(S)
Greene County Regional Laboratory	Total Phosphorus	SM 4500 P, B, E 19th edition
Montgomery County Environmental Laboratory	Total Phosphorus	SM 4500 P, B, E 19th edition

TABLE 2
North Fork Massie Creek Stream Restoration
Greene County Sanitary Engineering Department

QA/QC Sample Requirements

QC Sample	Frequency
Water Quality Samples	
Field Duplicate	One per ten samples per matrix or one per day, whichever is more frequent.
Field Blank	One per ten samples per matrix or one per day, whichever is more frequent.

Table 3
North Fork Massie Creek Stream Restoration
Greene County Sanitary Engineering Department

Analytical Parameters, Laboratory Reporting Limits, Precision and Accuracy

Laboratory	Chemical	Method	RL (mg/L)	Matrix Accuracy	Matrix Precision
Greene County Regional Laboratory	Total Phosphorus (TP)	SM 4500 P, B, E 19th edition	0.04	90-110	10%
Montgomery County Environmental Laboratory	Total Phosphorus (TP)	SM 4500 P, B, E 19th edition	0.10	90-110	10%

TABLE 4
North Fork Massie Creek Stream Restoration
Greene County Sanitary Engineering Department

Laboratory Sample Container, Preservation, and Holding Time Requirements [1]

Water

Parameter	Container/Lid[2]	Preservation[3,4]	Holding Time	Required Sample Volume
Total Phosphorus	P/P	Cool, < 4°C H_2SO_4 to pH<2	28 days	100-125 mL

1. More specific instructions for preservation and sampling are found with each analytical procedure provided in Appendix B. A general discussion on sampling water and industrial wastewater may be found in ASTM, Part 31, pages 72-82 (1976) Method D0-3370.
2. Plastic (P) or Glass (G)
3. Aqueous samples must be preserved at ≤6°C unless otherwise indicated, and should not be frozen unless data demonstrating that sample freezing does not adversely impact sample integrity is maintained on file and accepted as valid by the regulatory authority. It is not necessary to measure the sample temperature to three significant figures (1/100th of 1 degree); rather, three significant figures are specified so that rounding down to 6°C may not be used to meet the ≤6°C requirement. The preservation temperature does not apply to samples that are analyzed immediately (less than 15 minutes).
4. When any sample is to be shipped by common carrier or sent through the United States mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR Part 172). The person offering such material for transportation is responsible for ensuring compliance. The Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid, (HCl) in water, solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3) in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

TABLE 5
North Fork Massie Creek Stream Restoration
Greene County Sanitary Engineering Department

Maintenance Schedule and QA Objectives for Field Instruments

Instrument	Maintenance Required	Interval	Instrument Accuracy	Instrument Precision (Resolution)	Measurement Range
Conductivity/ pH Meter	Calibration	Daily [1]	pH: ± 0.01 SU Conductivity: ± 1% full scale	pH: 0.01 SU Conductivity: 0.01 mS	pH: 0.00 to 14.00 SU Conductivity: 0.00 to 19.99 mS
	Wipe down unit	After each use			
	Replace battery	When "LO BAT" appears on display			
Temperature/ DO Meter	Calibration	Daily [1]	Temp: ±0.2°C DO: ±0.3 mg/L; ±2% air saturation	Temp: 0.1°C DO: 0.01 mg/L; 0.1% air saturation	Temp: -5 to +45°C DO: 0 to 20 mg/L; 0 to 200% air saturation
	Wipe down unit	After each use			
	Replace battery	When "LO BAT" appears on display			
Turbidity Meter	Calibration	Daily [1]	±2% 0 to 100 NTU ±3% above 100 NTU	0.01 NTU/FNU 0.00 to 10.99 0.1 NTU/FNU 11.00 to 109.9 1 NUT/FNU 110 to 4000	0 to 4000
	Wipe down unit	After each use			
	Replace battery	When "LO BAT" appears on display			

Notes: (1) Calibrate at beginning and mid-day each day and as necessary during use.

North Fork Massie Creek Stream Restoration Project
Project Personnel and Qualified Data Collectors

The following people are participants in the North Fork Massie Creek Stream Restoration Project:

- Jeffrey Hissong, P.E., Director, Greene County Sanitary Engineering Department

  667 Dayton-Xenia Road, Xenia, OH 45385
  Phone: (937) 562-7450
  Fax: (937) 562-7465
  Email: jhissong@co.greene.oh.us

- Jim Davis, Laboratory Manager, Montgomery County Environmental Laboratory

  4257 Dryden Road, Dayton, Ohio 45439
  Phone: (937) 496-7051
  Fax: (937) 299-9042
  Email: DavisJI@mcohio.org

- Rick Schran, Laboratory and QA Manager, Greene County Regional Laboratory*

  422 Factory Road, Beavercreek, Ohio 45434
  Phone: (937) 562-7152
  Fax: (937) 426-6198
  Email: rschran@co.greene.oh.us

- Roger Spence, Field Team Leader, Greene County Regional Laboratory*

  422 Factory Road, Beavercreek, Ohio 45434
  Phone: (937) 562-7150
  Fax: (937) 426-6198

- Heather Dardinger, QA Manager, Malcolm Pirnie, Inc.*

  1900 Polaris Parkway, Suite 200, Columbus, OH 43240
  Phone: (614) 888-4953 Ext. 2716
  Fax: (614) 888-6295
  Email: hdardinger@pirnie.com

- Kelly McCutcheon, Field Team Leader, Malcolm Pirnie, Inc.*

  1900 Polaris Parkway, Suite 200, Columbus, OH 43240
  Phone: (614) 888-4953 Ext. 2744
  Fax: (614) 888-6295
  Email: kmccutcheon@pirnie.com

* Level 3 Qualified Data Collector; documentation attached.

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Columbus, OH 43216-1049

APR 16 2007

ENTERED DIRECTOR'S JOURNAL

CERTIFIED MAIL

Effective Date: April 16, 2007
Expiration Date: April 15, 2009

Richard Schran
Greene County Sanitary Engineering
422 Factory Road
Beavercreek, Ohio 45434

Re: Qualified Data Collector Approval, Surface Water Volunteer Monitoring Program

Dear Mr. Schran:

The Division of Surface Water Volunteer Monitoring (Credible Data) Program has reviewed your Qualified Data Collector (QDC) application. Pursuant to Ohio Revised Code (ORC) 6111.53 and Ohio Administrative Code (OAC) 3745-4-03, you are approved as a QDC for the following level and specialty:

QDC Level: 3
QDC Specialty: Chemical Water Quality Assessment
QDC number: 059

Please use this QDC number on all correspondence, study plans, etc. submitted to Ohio EPA.

As noted at the top of this letter, this status is effective as of the date of this letter and expires two years from that date. You may now submit study plans to the Volunteer Monitoring Program.

A renewal application must be submitted in accordance with OAC 3745-4-03(C). As provided in this rule, renewal of status is contingent upon active participation in the Volunteer Monitoring Program at the designated level and specialty. Lack of such participation will prevent you from renewing your status, but you may re-apply for initial QDC status.

I certify this to be a true and accurate copy of the official documents as filed in the records of the Ohio Environmental Protection Agency.

By: _____ Date: 4-16-07

Ted Strickland, Governor
Lee Fisher, Lieutenant Governor
Chris Korleski, Director

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OHIO E.P.A.
MAY 14 2008
ENTERED DIRECTOR'S JOURNAL

Effective Date: May 14, 2008
Expiration Date: May 13, 2010

CERTIFIED MAIL

I certify this to be a true and official documents as filed in the records of the Ohio Environmental Protection Agency.

By: _____ Date: 5-14-08

Roger Spence
Greene County, Sanitary Engineering
1398 Meadow Wood Drive
Fairborn, Ohio 45324

Re: Qualified Data Collector Approval, Surface Water Volunteer Monitoring Program

Dear Roger:

The Division of Surface Water Volunteer Monitoring (Credible Data) Program has reviewed your Qualified Data Collector (QDC) application. Pursuant to Ohio Revised Code (ORC) 6111.53 and Ohio Administrative Code (OAC) 3745-4-03, you are approved as a QDC for the following level and specialty:

QDC Level: 3
QDC Specialty: Chemical Water Quality Assessment
QDC number: 169

Please use this QDC number on all correspondence, study plans, etc. submitted to Ohio EPA.

As noted at the top of this letter, this status is effective as of the date of this letter and expires two years from that date. You may now submit study plans to the Volunteer Monitoring Program.

A renewal application must be submitted in accordance with OAC 3745-4-03(C). As provided in this rule, renewal of status is contingent upon active participation in the Volunteer Monitoring Program at the designated level and specialty. Lack of such participation will prevent you from renewing your status, but you may re-apply for initial QDC status.

As a reminder, your status is contingent upon the absence of any trespassing violation (within the previous five years) by you or any person sampling under your supervision. Always obtain land owner permission prior to sampling.

Additionally, collection (and retention) of aquatic biological samples (this includes fish, macroinvertebrates, mollusks, and shells) requires a collector's permit from the Ohio Department of Natural Resources/Division of Wildlife. Obtain this permit prior to collection of any biological samples.

State of Ohio Environmental Protection Agency

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MAY 14 2008
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CERTIFIED MAIL

Effective Date: May 14, 2008
Expiration Date: May 13, 2010

I certify this to be a true and accurate copy of the official documents as filed in the records of the Ohio Environmental Protection Agency.

By: _____ Date: 5-14-08

Heather Dardinger
Malcolm Pirnie, Inc.
1900 Polaris Parkway, Suite 200
Columbus, Ohio 43240

Re: Qualified Data Collector Approval, Surface Water Volunteer Monitoring Program

Dear Heather:

The Division of Surface Water Volunteer Monitoring (Credible Data) Program has reviewed your Qualified Data Collector (QDC) application. Pursuant to Ohio Revised Code (ORC) 6111.53 and Ohio Administrative Code (OAC) 3745-4-03, you are approved as a QDC for the following level and specialty:

QDC Level: 3
QDC Specialty: Chemical Water Quality Assessment
QDC number: 173

Please use this QDC number on all correspondence, study plans, etc. submitted to Ohio EPA.

As noted at the top of this letter, this status is effective as of the date of this letter and expires two years from that date. You may now submit study plans to the Volunteer Monitoring Program.

A renewal application must be submitted in accordance with OAC 3745-4-03(C). As provided in this rule, renewal of status is contingent upon active participation in the Volunteer Monitoring Program at the designated level and specialty. Lack of such participation will prevent you from renewing your status, but you may re-apply for initial QDC status.

As a reminder, your status is contingent upon the absence of any trespassing violation (within the previous five years) by you or any person sampling under your supervision. Always obtain land owner permission prior to sampling.

Additionally, collection (and retention) of aquatic biological samples (this includes fish, macroinvertebrates, mollusks, and shells) requires a collector's permit from the Ohio Department of Natural Resources/Division of Wildlife. Obtain this permit prior to collection of any biological samples.

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OHIO E.P.A.
MAY 14 2008
ENTERED DIRECTOR'S JOURNAL

CERTIFIED MAIL

Effective Date: May 14, 2008
Expiration Date: May 13, 2010

I certify this to be a true and accurate copy of the official documents as filed in the records of the Ohio Environmental Protection Agency.

By: _____ Date: 5-14-08

Kelly McCutcheon
Malcolm Pirnie, Inc.
1900 Polaris Parkway, Suite 200
Columbus, Ohio 43240

Re: Qualified Data Collector Approval, Surface Water Volunteer Monitoring Program

Dear Kelly:

The Division of Surface Water Volunteer Monitoring (Credible Data) Program has reviewed your Qualified Data Collector (QDC) application. Pursuant to Ohio Revised Code (ORC) 6111.53 and Ohio Administrative Code (OAC) 3745-4-03, you are approved as a QDC for the following level and specialty:

QDC Level: 3
QDC Specialty: Chemical Water Quality Assessment
QDC number: 171

Please use this QDC number on all correspondence, study plans, etc. submitted to Ohio EPA.

As noted at the top of this letter, this status is effective as of the date of this letter and expires two years from that date. You may now submit study plans to the Volunteer Monitoring Program.

A renewal application must be submitted in accordance with OAC 3745-4-03(C). As provided in this rule, renewal of status is contingent upon active participation in the Volunteer Monitoring Program at the designated level and specialty. Lack of such participation will prevent you from renewing your status, but you may re-apply for initial QDC status.

As a reminder, your status is contingent upon the absence of any trespassing violation (within the previous five years) by you or any person sampling under your supervision. Always obtain land owner permission prior to sampling.

Additionally, collection (and retention) of aquatic biological samples (this includes fish, macroinvertebrates, mollusks, and shells) requires a collector's permit from the Ohio Department of Natural Resources/Division of Wildlife. Obtain this permit prior to collection of any biological samples.

Appendix B
Laboratory Operating Procedures

Table of Contents

1. Greene County Regional Laboratory Quality Assurance Plan
2. Greene County Regional Laboratory Total Phosphorus SOP
3. Montgomery County Environmental Laboratory Quality Assurance Manual
4. Montgomery County Environmental Laboratory Total Phosphorus SOP

Quality Assurance Plan
Greene County Sanitary Engineering Department
Laboratory Division

Laboratory Manager *Richard A Schran*

Laboratory Supervisor *Michael J Gummer*

Date 9-7-07

(13) Data reduction, review, and reporting. This section could include discussion of the process used to do data assessment, evaluation of data completeness, comparability, and trends.

(14) Standard corrective action procedures for quality control failures.

(15) External and internal audits, accreditations, and certifications. This section should list all laboratory accreditations and certifications, and participation in inter and intra laboratory studies.

(16) Reports to management. This section should describe the various types of reports and meetings and their frequencies with management.

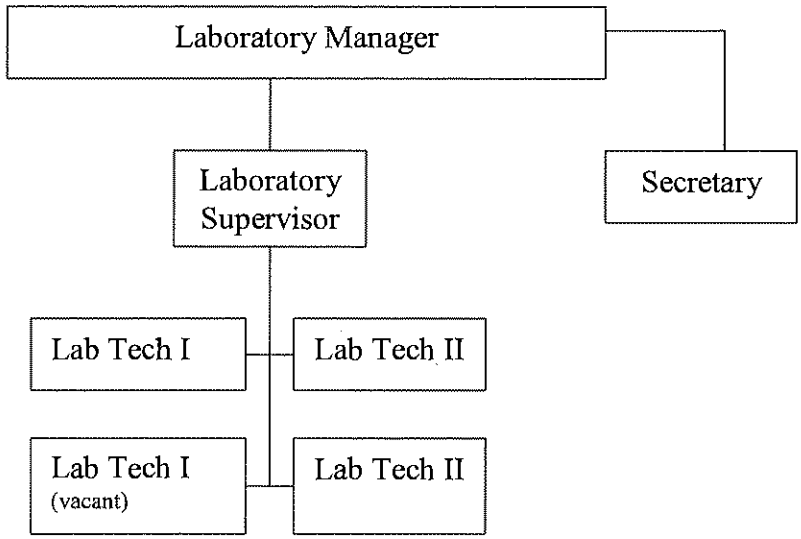
(17) Document retention and control. In this section, the lab should discuss its document retention schedule, storage, and retrieval procedures, including procedures for review and approval of revised lab documents (i.e., QAP and SOPs).

(18) Procedures for procurement and process control. This section should describe the laboratory's policy and procedures for the selection and purchasing of equipment and supplies it uses that affect the quality of the environmental tests and calibrations.

(19) Sample handling and analysis.

4.) Laboratory Organization and Responsibility

a) Organizational Tables



b) Position Descriptions

(Attached)

c) Training, education and experience of lab personnel

Richard A. Schran: BS Chemistry Wright State University, 1974; Class III Wastewater Treatment license issued by OEPA; Class III Water Treatment license issued by OEPA; Class IV Wastewater Laboratory license issued by OWEA. Thirty-two (32) years experience in laboratory operations and management.

Michael J. Gummer: BFA Wright State University, 1983; Class III Wastewater Treatment license issued by OEPA; Class III Water Treatment license issued by OEPA; Class III Wastewater Laboratory license issued by OWEA; thirty (30) years experience in wastewater laboratory operations and management.

Michael Kistler: Class I Wastewater Treatment license issued by OEPA; Class II Wastewater Laboratory license issued by OWEA; twenty-nine (29) years experience in wastewater and laboratory operations.

James Martin: BS Chemistry University of Dayton, 1974; Class II Wastewater Laboratory license issued by OWEA; thirty (30) years experience in laboratory operations and management.

Teresa Shinkle: Class I Wastewater Laboratory license issued by OWEA; twelve years experience in laboratory operations.

7.) Laboratory Equipment and Instrument Lists

See SOP for each method (example: Total Phosphorus)

Hach Co. DR/4000U Spectrophotometer
Model 48000-60
Serial #9508-120
With sipper modules Cat. No. 48090-06, 1cm path length

Market Forge Sterilmatic STM-E
Serial #73993
208v

Kimble digestion tube Folin-wu
Part #47125 50ml size
Calibrated to contain

Various Class A volumetric flasks and volumetric pipettes – set aside for total phosphorus use only

8.) Sample Receipt and Chain-of-Custody Procedures

a.) Samples are generally received in the sample prep room. Here the chain-of-custody is scrutinized to see that the sample is actually there in the proper container and is properly labeled. Usually a custom chain-of-custody is issued to the wastewater plant or other divisions involved in sample collection and transportation (see attached sheet for total P study).

b.) After the chain-of-custody has been accepted, a sample number is assigned to the sample. The number is obtained from the log-in notebook located in the Chem. lab at the west door.

c.) Samples which have been logged in are then subdivided into containers which

d.) are generally test specific. At this point preservative is added, the sample number is written on each container, the sample is stored in the Chem. lab refrigerator. Access to the Chem. lab is restricted and can be entered only with permission.

e.) Sample tracking is accomplished using the log-in notebook and the sample number which is on each container. The sample number is also placed on the chain-of-custody sheet at the time of log-in. Sample numbers are also used on lab bench sheets and finished reports.

f.) Samples are generally held for thirty (30) days after analysis (or until the expiration date). Liquid samples are generally disposed of by neutralization and rinsing down the lab drain.

9.) and 10.) Laboratory SOP for Total phosphorus including (10) calibration procedures

Attached.

17) Document Retention and Control

All lab bench sheets, print-outs, spreadsheets, etc. are maintained in our records storage room for at least ten (10) years. Potable bacteria records must be kept at least five (5) years. Records may be retrieved easily as test records are arranged by test, month and year.

All proposed changes to the QAP or a method SOP must be reviewed and approved by the laboratory Supervisor and lab Manager.

18) Procedures for Procurement and Process Control

When purchasing lab equipment, only major manufacturers with a proven track record of performance in the environmental area are considered for purchase. When seeking bids for equipment specifications are carefully written to insure an appropriate purchase. Supplies are purchased from reliable vendors who can insure fast delivery with high quality materials and provide a competitive price.

19) Sample Handling

See SOP for each method.

Standard Operating Procedure for:

Total Phosphorus

Greene County Sanitary Engineering Laboratory

Revised 11 April 2008

1 Identification of the test method

Total phosphorus by spectrophotometer (SM 4500 P, B, E 19th edition).

2 Applicable matrix or matrices

This method is suitable for the analysis of water samples collected from river, streams, lakes, and wastewater.

3 Detection Limit

The minimum acceptable detection limit is $\leq$ 0.04 mg TP/L.

4 Scope of the test method

This Standard Operating Procedure provides Greene County Sanitary Engineering laboratory personnel with guidance on the procedure for determining total phosphorus (TP) in surface water samples.

5 Summary of test method

5.1 All forms of phosphorus, including organic phosphorus, are converted to orthophosphate by an acid-persulfate digestion. The persulfate digestion procedure and phosphate determination follow SM 4500 P, B, E.

5.2 A 40 mL or smaller of a well-mixed water sample is combined with sulfuric acid and ammonium or potassium persulfate and heated to approximately 120 C in an autoclave. This quantitatively converts phosphorus compounds to orthophosphate.

5.3 The digested sample is then analyzed for orthophosphate based on its reaction with a combined reagent containing ammonium molybdate, antimony potassium tartrate, and ascorbic acid to form intensely-colored molybdenum blue.

5.4 The desired performance criteria for this measurement are:

a. Detection limit: $\leq$ 0.04 mg TP/L
b. Precision: $\leq$ 10%
c. Accuracy: $\leq$ 10%
d. Minimum Quantification Interval: 0.01 mg TP/L
e. Quantitation limit $\leq$ 0.08

6 Definitions

6.1 The definitions and purposes below are specific to this method, but have been conformed to common usage as much as possible.

6.2 Analytical batch: The set of samples processed at the same time to a maximum of 30 samples.

6.11 Method detection limit (MDL): The lowest level at which an analyte can be detected with 99 percent confidence that the anlayte concentration is greater than zero.

To calculate the MDL:
Prepare a solution with the concentration of TN near the estimated MDL ; Analyze seven portions of this solution over a period of at least three days; Include all sample processing steps in the determination; Calculate the standard deviation(s).

From a table of the on-sided *t* distribution select the value of *t* for 7 – 1 = 6 degrees of freedom at the 99% level. This value is 3.14. The product 3.14 times *s* is the desired MDL.

6.12 Relative Percent Difference (RPD): calculated as the difference between a sample and duplicate results, divided by the average of the sample and duplicate results, multiplied by 100%.

6.13 Quality control check sample (QCC) (or check sample): A sample containing analytes of interest at known concentrations (true values). The quality control check sample is obtained from a source external to the laboratory or is prepared from standards obtained from a different source than the calibration standards. The purpose is to check laboratory performance using test materials that have been prepared independently from the normal preparation process.

7 Interferences

7.1 No interferences are normally observed for copper, iron, or silicate. However, high concentrations of iron can cause precipitation of, and subsequent loss, of phosphorus.

7.2 Arsenate may interfere when present at concentrations higher than phosphorus.

7.3 Sample turbidity and natural color may interfere. Turbidity may be removed by centrifugation or filtration after digestion.

7.4 Phosphate absorbed on glass surfaces may affect measurements at low phosphate levels. Use of acid-washed glassware dedicated to this analysis prevents this interference.

7.5 A number of sources suggest that there is a problem with deposition of reaction products on cell windows. Some methods incorporate a surfactant to minimize this effect.

10.6 Heating unit: Use an autoclave capable of heating samples from 119-121 °C (15 PSI). Must have a slow exhaust setting.

11 Reagents and standards

11.1 De-ionized water (DI): Use de-ionized water that has been prepared using a mixed bed ion exchange and organic purification tanks. Use this water for all procedures. The de-ionized water on top in the chemical laboratory is acceptable.

11.2 Sulfuric acid, 11N: *Cautiously* add 310 mL concentrated sulfuric acid to an equal volume of water. CAUTION: This mixture will become very hot. Dilute to 1L.

11.3 Antimonyl potassium tartrate solution: Dissolve 0.3 g $K(SbO)C_4H_4O_6 - ½ H_2O$ (antimony potassium tartrate hemihydrate) in about 50 mL water and dilute to 100 mL. Store at 4 °C in a dark bottle. This solution is available commercially, such as Ricca Chemical Co. catalog #5872-16.

11.4 Sulfuric acid 5N: *Cautiously* add 70ml to 300 ml DI water. Dilute to 1L.

11.5 Ammonium molybdate reagent: Dissolve 4 g $(NH_4)_6Mo_7O_{24}$-$4H_2O$ in 100 mL de-ionized water. Store at 4 °C in a plastic bottle. Note: This solution (4% (w/v) ammonium molybdate) is commercially available, such as Ricca Chemical Co., catalog #556-16.

11.6 Ascorbic acid, 0.1M: Dissolve 1.76 g ascorbic acid in de-ionized water and dilute to 100mL. This solution is stable for approximately 1 week if stored at 4 °C.

11.7 Combined reagent: Mix the above reagents (11.2 – 11.5) in the following portions for 100mL of the mixed reagent. 50 mL 5N H_2SO_4 (11.2), 5 mL antimony potassium tartrate (11.3), 15 mL ammonium molybdate (11.4), and 30 mL ascorbic acid (11.5).

a. Each solution should be at room temperature before mixing.
b. Add in the specified order and mix continually, as each reagent is added.
c. If turbidity forms in the combined reagent, shake and let stand for a few minutes until turbidity disappears before proceeding.

Table 2. Prepartation of calibration standards for Total Phosphorus analysis.

Solution	**mL intermediate solution (11.11)**	**Final mL**	**Concentration (mg total P/L)**	**Use**
LRB	(de-ionized water)	--------	0.00 mg P/L	Calibration blank
RLS	1.0	50	0.05 mg/l TP	Reporting level std.
C-1	1.0	50	0.05 mg/l P	Calibration standard
C-2	2.0	50	0.10 mg P/L	Calibration standard
C-3	5.0	50	0.20 mg P/L	Calibration standard
C-4	10.0	50	0.50 mg P/L	Calibration standard
C-5	15.0	50	0.75 mg P/L	Calibration standard
CCC	10.0	50	0.50 mg P/L	Continuing calibration check
*QCC #1	Hach 0.326 mg/l std	50	25 ml of std.	Quality control check
*QCC #2	Hach 326 mg/l std	50	5ml of std.	Quality control check

LRB = Lab Reagent Blank; C = Calibration standard; LCC = Laboratory Control Check; QCC = Quality Control Check *QCC solutions are prepared using alternate phosphate standard solution, i.e., not the same standard used to prepare the calibration standards.

12 Sample collection, preservation, shipment, and storage

12.1 Samples are collected in 120 – mL disposable bottles or 120 ml whirl-pak plastic bags and preserved with concentrated sulfuric acid (H_2SO_4) to pH<2 – CAUTION: highly corrosive; will cause chemical burns to exposed skin, wear protective gloves.

12.2 Sample bottles are stored on ice for transport to the laboratory at <4 C.

12.3 Preserved and refrigerated samples can be stored for up to 28 days.

13 Quality control

13.1 Quality control program: The minimum requirements of the quality control program for this analysis consist of an initial demonstration of laboratory capability, and the periodic analysis of laboratory reagent blanks and other laboratory solutions as a

Table 3. Quality control solution and acceptable ranges.		
Solution	**Acceptable Range**	**Comments**
LRB	$\leq$ 0.005 mg TP/L	Ideally less than or equal to the required detection limit
LCC	0.45 – 0.55 mg TP/L	Within $\pm$ 10% of the true value
QCC #1	0.293 – 0.359 mg TP/L	Within $\pm$ 10% of the true value
QCC #2	2.93 – 3.59 mg TP/L	Within $\pm$ 10% of the true value
AMP *	0.180 – 0.220 mg TP/L	Within $\pm$ 10% of the true value

* A nutrient QC standard from APG may be used following manufacturer's directions.

13.4 With each sample batch of ten samples, the following should also be run (acceptance criteria noted):

Table 4. Quality control samples and acceptance criteria.	
Solution	**Acceptance Criteria**
LRB	Ideally < 0.01 mg TP/L
LCC	0.45 – 0.55 mg TP/L
Lab Duplicate	Greater of $\pm$ 20% or $\pm$ 0.05 mg TP/L
Field Duplicate	Greater of $\pm$ 20% or $\pm$ 0.05 mg TP/L
Matrix spike solutions	Both 100 $\pm$ 20% recovery

14 Calibration and standardization

Calibration: Obtain a standard curve by plotting absorbance of standards (including the reagent blank) versus concentration. The data will be fit to a linear equation using the phosphorus data sheet spreadsheet.

15 Procedure

15.1 Preparation of laboratory-fortified matrix (LFM): Prepare LFM samples using 30-mL aliquots of a water sample (or a smaller aliquot diluted to 10mL) from the same sample. Spike each with 5.00 mL phosphate intermediate standard solution. (This should increase observed concentration by 0.25 mg/L.) Carry through the sample preparation and analysis procedure (15.3 and following).

b. Where: C_{sample} is the concentration in the original water sample, and $C_{analysis}$ is the concentration of the solution as determined in (16.1), $V_{aliquot}$ is the volume of the sample diluted to 30mL used in (15.2.a). This is done automatically in Total P spreadsheet.

16.3 Reporting results: Results should be reported to 0.01 mg TP/L precision.

16.4 The evaluation of MDL and precision require calculation of standard deviation. Standard deviations should be calculated as indicated below, where n = number of samples, x = concentration in each sample. Note: This is the sample standard deviation calculated by the STDEV function in Microsoft Excel.

$$s = \left[\frac{\sum x^2 - \frac{(\sum x)^2}{n}}{n-1} \right]^{1/2}$$

16.5 Calculation of recoveries: Recovery of matrix spike solutions shall be calculated as indicated below, where S = concentration observed for spiked sample, U = concentration observed for un-spiked sample, and 0.25 is the concentration increase expected upon spiking. Both S and U are concentrations based on (16.1), i.e., not adjusted for dilution of an aliquot. This is done automatically on the Total P spreadsheet.

$$\% \, recovery = \frac{S - U}{0.25}$$

17 Computer hardware and software

17.1 An excel spreadsheet has been designed to function as a data sheet which will calculate concentrations and recoveries.

18 Method performance

18.1 The desired performance criteria for this measurement are:

a. Detection limit: $\leq$ 0.04 mg TP/L
b. Precision: $\pm$ 10%
c. Accuracy: $\pm$ 10%
d. Minimum Quantification Interval: 0.01 mg TP/L
e. Minimum Quantification level. $\leq$ 0.08.

19 Pollution prevention

19.1 All wastes from these procedures shall be collected and disposed of according to existing waste policies within the MSU Chemistry Department.

21.6 If there is sufficient volume of sample remaining for all samples, the analytical batch may be re-analyzed. Quality control data from the first run must be recorded on the control charts.

21.7 If data are unacceptable for any reason, the analyst should review their analytical technique prior to conducting this analysis again.

22 Waste management

22.1 The waste generated in this method is hazardous because of a low final pH. The samples may be neutralized by the addition of water in accumulation container (e.g., a large beaker or flask). Add sufficient amounts of water to adjust the pH to between 2 and 12.5. When the pH is > 5 (for acidic wastes) the solution can be discarded in the laboratory drain followed by an equal volume of water.

22.2 Outdated chemicals are discarded following the procedures of the Greene County Sanitary Engineering Department Laboratory Division.

23 References

23.1 Standard Methods for the Examination of Water and Waste Water, Method 4500-P, Phosphorus, APHA, 19th Edition, 1995, B. Sample Preparation, and E. Ascorbic Acid Method.

23 Tables, diagrams, flowcharts and validation data

24.1 Tables can be found within this document. There are no diagrams, flowcharts or validation data.

Laboratory Quality Assurance Manual
Little Miami Phosphorus TMDL
Montgomery County Environmental Laboratory

MONTGOMERY COUNTY

Effective: April 1, 2008

3/27/2008
QA Officer (ACTING) **Approval Date**

3/27/08
Lab Manager **ApprovalDate**

SANITARY ENGINEERING DEPARTMENT
4257 DRYDEN ROAD
DAYTON, OHIO 45439-1431

1. Quality Assurance Policy

Montgomery County Environmental Laboratory is an environmental analytical support service facility for the Sanitary Engineering Department. Services are provided to the Water Reclamation Division, Field Operations Division, and Engineering Services Division. Water Reclamation includes the Municipal, Industrial Pretreatment Program (MIPP). Field Operations include Wastewater Collection and Water Supply & Distribution. The Engineering Services Division includes Inspection.

The Montgomery County Environmental Laboratory (MCEL) is a well equipped, OEPA drinking water certified and wastewater testing facility staffed by nine full-time employees. The management and staff are committed to providing quality analytical services meeting the needs of the residents and customers of Montgomery County, Ohio. This Quality Assurance Manual for the Little Miami Phosphorus TMDL has been specifically designed to ensure the production of technically sound, legally defensible data of proven quality in a timely manner.

It is the responsibility of each member of the Montgomery County Environmental Lab to support the quality assurance program in principle and detail. Each staff member is responsible for their own work. All work must be done with the highest level of integrity and professional competence. Each member must be alert to problems or sources of error that could compromise the quality of technical work.

B. Position Descriptions

Laboratory Manager – The Lab Manager is responsible for overseeing the day to day operations of the Environmental Laboratory. The Lab Manager is the final authority on all issues dealing with data quality and has the authority to require that procedures are amended or discontinued, or analyses suspended or repeated. He has the authority to discipline employees on the grounds of dishonesty, incompetence, or non-compliance with QA procedures.

His responsibilities include: Developing and implementing a QA program that ensures all data generated in Montgomery County Environmental Laboratory are scientifically sound, legally defensible, and of known precision and accuracy; Maintaining records and archives of all QA/QC data, PE results, audit comments, and inquiries concerning data quality; Coordinating certification programs within the Environmental Laboratory.

Senior Chemists – The Senior Chemists are responsible for the operation of advanced analytical instrumentation that includes ICP, GFAA, and CVAA. They are also the key backups for the Chemists and Laboratory Technicians.
The Senior Chemists take turns acting as the sample custodian. The sample custodian is responsible for receiving samples into the laboratory and entering them into the Laboratory Information System (LIMS). The sample custodian is also responsible for approving completed data in LIMS and transferring data to other databases for evaluation by end users.

Senior Chemists are also assigned one of three other critical functions in the laboratory: QA Officer, Safety Officer, and IT Officer

> QA Officer – is responsible for overseeing the laboratory's Quality Assurance Program. The QA Officer administers the blind Performance Testing Program, reviews Method Detection Limit Studies, helps write, review and approve Standard Operating Procedures and QA related documents, and oversees the training records.
>
> Safety Officer – is responsible for overseeing the laboratory's Safety Program. The Safety Officer conducts routine safety inspections, Conducts in-house safety training, reviews and updates the laboratory's Chemical Hygiene Plan (CHP), conducts

C. Training, Education, Experience, and Certification of Lab Personnel

NAME / TITLE	EDUCATION	LAB EXPERIENCE / YEARS IN POSITION	EPA DW CERTIFICATION
Jim Davis Environmental Lab Manager	B.S. Geology, University of Dayton, 1989	19 years/2 years	Not Applicable
Cuong Nguyen Senior Chemist [2]	B.S. Environmental Health, Wright State University, 1985	23 years/17 years	Bacteria Trace Metals,
Nina Fouts Senior Chemist 2	B.S. Chemistry, Wright State University, 1983	25 years/15 years	Bacteria Trace Metals,
Rick Pennington Senior Chemist [2]	B.S. Biological Sciences, Wright State University, 1987	20 years/14 years	Bacteria Trace Metals,
Shindi Mahal Chemist [1]	B.S. Chemistry, 1965 B.S. Education, 1966 Punjab University, India	31 years/16 years	Bacteria Chemistry
Tony Miley Chemist [1]	B.S. Biology, Bowling Green State University, 1986	21 years/13 years	Bacteria Chemistry
Stephanie Lohman Laboratory Technician [1]	B.S. Biology, University of Dayton, 2000	7years/2 years	Bacteria Chemistry
Tonya Wyant Laboratory Assistant	LPN, Miami Valley Career Technical center, 2002	2 years/1 year	In Training
Cherie Ambrose Laboratory Assistant	B.S. Marine and Environmental Science, 1993	12 years/1 year	In Training

[1] Phosphorus Trained

[2] In Phosphorus Training

External Training

The staff is encouraged to attend related training courses, seminars, workshops and meetings. These are made available to staff on a regular basis. Discretion must be used in assigning the number of staff members that may attend training. Among items considered are cost and a current workload. Usually, no more than two (2) staff members may attend a given program. Those attending will relay all pertinent information to the rest of the staff upon return. The entire staff may be required to attend safety, computer training or other work related training.

Technical literature and periodicals are available to the staff to keep current with technology and methodology.

E. Training Records Retention

All training records are to be submitted to the QA Officer and Laboratory Manager for approval. The QA Officer is responsible for maintaining and archiving all training records. Training records are maintained for at least 12 years. All Performance Testing results are evaluated by the QA Officer and the Laboratory Manager. The Performance Testing results are posted on the Laboratory's Intranet site for review by the entire department. The results are also automatically submitted directly to the Ohio EPA by the firm that provided the blind performance testing samples.

3. Data Quality Objectives

Precision - The laboratory objective for precision is to meet the precision demonstrated for these analytical methods on similar samples and to meet data for these analyses published by the US EPA. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike duplicate samples. The required precision for duplicate samples greater than 2 times the reporting is 10 % RPD.

Accuracy - The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for these analytical methods on similar samples and to meet the recovery data published by the US EPA. Accuracy is defined as the degree of bias in a measurement system. Accuracy is documented on the basis of recovery of matrix spikes. Accuracy may also be documented using laboratory control samples. The required accuracy for sample spikes is $\pm$ 25 % of the expected spike recovery. The required accuracy for laboratory control samples sucb Laboratory Fortified Blanks and Quality Control Standards is $\pm$ 10 % of the expected spike recovery.

Reporting Limit – The standard reporting limit for Total Phosphorus is 0.10 mg/L. This reporting limit is for wastewater, drinking water and stream sampled matrices. This is based on 0.10 mg/L being the lowest calibration standard used as part of the calibration curve. A lower reporting limit may be achieved by using a larger sample cell.

B. Sample Login

The sample custodian logs the sample into Aspen LIMS; login numbers are based on the year, month, day and the number of samples received. The first four digits represent the year. The next two digits represent the month. The 7th and 8th digits represent the day received. The last three digits represent the sequentially numbered sample. For instance a sample number of 20080115005 is the 5th sample received on January 15, 2008. When a sample is logged into LIMS, the following minimum information is entered:

- Date sampled.
- Time sampled.
- Date received.
- Time received.
- Sample Collector.
- Sample ID/Location.
- Preservation/Bottle Type
- Any field testing results.
- Required Test(s)
- Any notations regarding the sample condition is noted as a comment in the computer and on the custody forms

If samples are received too late in the day to be logged in the LIMS they are properly stored to maintain preservation until the following morning when the receiving process will continue.

C. Sample Security

The laboratory has electronic locks on all entrances to the lab that are locked 24 hours a day, 7 seven days a week. Only authorized Montgomery County employees have access to the laboratory and samples. The hallways outside the laboratory are monitored 24 hours a day, 7 seven days a week by video surveillance. The property is secured during non-operating hours by a 6 foot fence that requires a pass card to access the parking lot. .

D. Sample Storage

After samples have been properly preserved as described in Section 8 of the analytical SOP, they are stored in refrigerators that are maintained between 0 and 6°C. The temperatures are monitored and recorded on a daily basis. If a refrigerator begins to fluctuate outside of the required temperature range, samples are transferred to one of the back up refrigerators until the fluctuating refrigerator is repaired or replaced. Samples are stored until their hold times are expired as listed in Section 8 of the Analytical SOP. .

9. Preventative Maintenance and Documentation

A. Location of Instrument Manuals

The instrument manuals for both the primary and backup spectrophotometers are stored in the drawers directly beneath the instruments. The instrument manual for the sterilizer (autoclave) is stored in the drawer beneath the sterilizer in the drinking water lab.

B. Schedules for Performance of Routine Equipment Maintenance

The sterilizers require that the thermometers and timers be verified/calibrated on a quarterly basis and documented. The sterilizers are cleaned as needed. DI water is added for each use of the sterilizer. The spectrophotometers have very little maintenance too them. The windows in the light path are cleaned as needed. The lamp is replaced whenever it burns out or longer can generate the required intensity to analyze samples.

C. Availability of Spare Parts

Spectrophotometers have very few user replaceable parts. The lab stocks extra lamps and uses disposable 1 cm cells. These are stored in the cabinets near the spectrophotometer. Due to the danger involved with the use of sterilizers, the lab only stocks extra door seals. These are stored in the cabinet underneath the sterilizer. All other repairs and parts replacements are left to trained contractors to repair.

D. Maintenance Contracts

Maintenance Contracts are not available on the instrumentation used for Phosphorus analysis. To insure that the analysis can be completed, the laboratory has two spectrophotometers for analysis and three sterilizers for sample prep. The laboratory also works with Marston Technical Service to repair instruments/equipment not covered by maintenance contracts.

10. Internal Quality Control Checks

Internal Quality Control Checks are detailed primarily in the Section 9 of the Analytical SOP.

Method Detection Limit (MDL) Studies are conducted following the procedures in 40 CFR Part 136 Appendix B. MDL studies are conducted on an annual basis, whenever an new analyst begins analyzing samples for a procedure, or when significant changes have occurred in the procedure. Method Detection Limit and Reporting Limit are not interchangeable. Reporting Limit must be a value that is greater the MDL.

MDL Procedure

Make a rough estimate of the detection limit using one of the following:

a) Previous MDL study results.
b) Information provided in analytical methods
c) Response of low level calibration standards.

Reporting

The analytical method used must be specifically identified by number and method title. The date of the study, instrument ID and the name of the analyst(s) performing the analysis must be included. The sample matrix, date of calibration and the standard (ID# and concentration) used must be documented. The MDL for each analyte must be expressed in the appropriate method-reporting units. Report the mean analyte level with the MDL. If a laboratory standard or a sample that contained a known amount analyte was used for this determination, also report the mean recovery. If the level of analyte in the samples was below the determined MDL or exceeded 10 times the MDL of the analyte in reagent water, do not report a value for the MDL.

11. Data Reduction, Review, and Reporting

Data Reduction and Validation

Analytical data generated within MCEL is extensively checked for accuracy and completeness.

Data Reporting

Data reduction is the process of converting raw data to mg/L, mg/kg, etc. to final reporting units using the following guidelines regarding significant figures and rounding. Solid samples are reported on a dry weight basis unless otherwise requested.

Significant Figures

Data is reported to one significant figure at the detection (reporting) limit and incremented with each decade of concentration to a maximum of three significant figures.

For example, if a detection limit for a method is 20 ppb (0.02 ppm)
A result of 26 ppb is reported as 30 ppb (0.03 ppm)
A result of 261 ppb is reported as 260 ppb (0.26 ppm)
A result of 2609 ppb is reported as 2610 ppb (2.61 ppm)
If the detection limit were 5 ppb (0.005 ppm) the results of the previous examples would be
A result of 26 ppb is reported as 26 ppb (0.026 ppm)
A result of 261 ppb is reported as 261 ppb (0.261 ppm)
A result of 2609 ppb is reported as 2610 ppb (2.61 ppm)

Standard Operating Procedures. The analyst reviews the data to ensure:

The SOP has been followed exactly; any variation to the SOP has been noted on the bench sheet and the Lab Manager or QC Officer has been notified.The written SOP procedure has been followed for all calculations. Adequate information is shown on a bench sheet to allow reconstruction of final analytical results.

Analysis information is correct, when

1. Holding time is documented
2. Lab identification is correct
3. Appropriate dilutions have been made
4. Results have been entered correctly
5. Result reported in appropriate significant figures

All QC data is within established control limits; this includes blanks, calibration checks, duplicates, and spikes. Any corrective action must be successfully completed and samples not bracketed with acceptable QC are rerun. Spikes with unacceptable recoveries must be diluted and rerun. QC trends must be recorded.

Coded data is explained.

Raw data is filed and readily available for any inquiries.

Analyst initials and dates the data sheet indicating completeness and accuracy.

Data is entered in the Aspen.

Samples that are unusual in appearance or result should be noted on the bench sheet and the Lab Manager notified. The Lab Manager must be notified when data indicates a permit violation or is inconsistent with historical data.

Level II.

The second level of review is peer review. A second lab analyst looks over the data and double checks the calculations. If they do not find any mistakes, they initial and date the bench sheet. The second lab analyst reviews the data to ensure:

- QC data complete
- Correct use of significant figures
- No transcription errors.
- Calculations are double-checked.
- Proper units -check for omission of units or incorrect units.

Montgomery County Environmental Laboratory Participates in two blind Performance Testing programs administered by an NVLAP accredited provider (Water Study and DMRQA). We are currently using Analytical Products Group as our provider. Both programs provide samples for Phosphorus analysis.

The Water Study program is used to maintain our OEPA Drinking Water Certification and is analyzed twice a year. Performance testing samples are analyzed once in the first half of the year and once in the second half of the year. Analysts are assigned various parameters and are evaluated on their performance.

The DMRQA program is use to support our NPDES testing. It is analyzed once a year during the summer. Analysts are assigned various parameters and are evaluated on their performance.

Internal Performance Audit is an independent check, by the Lab Manager with assistance from the QA Officer to evaluate the data produced by the laboratory's analytical system. The performance audit verifies the ability of the lab staff to quantify compounds in blind check samples. The QA officer maintains current QC data sheets and certified values. These blind samples are analyzed as part of a routine. Blind QC samples are indicators of the analysts' ability, the procedure, and the instrumentation. If Blind QC samples do not fall within the limits established by the provider or within in house limits establishcd by the manufacturer, an investigation is begun to determine the source of the problem. Any problems encountered are reported by the Lab Manager to upper management.

Internal Performance Audit Schedule	
Audit	*Frequency*
Written or oral SOP review	annually
Control chart review	annually
blind QC samples	with each Performance Testing sample minimum

If an analyst fails to maintain proficiency and no specific cause can be determined, the analyst will discontinue the analysis; a training review is initiated after which the analyst will be retested. If the Blind QC sample is a acceptable the analyst may begin to analyze samples again. Continuing performance problems will be reflected in the employee performance appraisal and handled by management.

Systems Audit is a qualitative on-site inspection and review of a laboratory's QC system. It covers all of the QC elements of the Quality Assurance Program and is conducted to verify that the lab has the necessary facilities, staff, and procedures to generate acceptable data. System audits are conducted annually by the Lab Manager with assistance from the QA Officer. The audits include examination of the following areas;

- instrumentation and laboratory space.
- manpower.
- chain-of-custody procedures.

If a significant Quality Control or Quality Assurance issue occurs as determined by the QA Officer and/or the Laboratory Manager, at a minimum, it is reported in writing immediately to the Deputy Director of Sanitary Engineering in the form of an electronic mail notification. Examples of significant issue may include: permit violation, missed holding times, instrument malfunction, reporting error that requires a corrected report to the OEPA, or any suspect data results.

15. Document Retention and Control

Documentation is the proof that data is defensible against any inquiry, legal or otherwise. Analytical records include the procedures and methods that each analyst follows and the subsequent data, quality control data, bench sheets, calibration curves, calculations, printouts, and data outputs that each analyst generates whether on paper or electronically. Analytical records must be complete. Recording of data must be done consistently and accurately. All data must be recorded in ink and any changes should be made by crossing out the original entry with one line and substituting the new value. This change must be initialed and dated. Inspection and periodic review by the lab manager shall be carried out to insure that proper documentation is being achieved.

Accurate and complete documentation of analytical and procedural information is an important part of the QA program. A countywide records retention program is in place with lab records maintained in accordance with regulatory requirements. The MCEL relies on a combination of computer backup, computer data archiving and paper copy storage systems. These include storage and backup of analytical data on computers using Aspen, Operator 10 software and storage of manual data entry documents such as bench sheets, control charts, bound logbooks, and 3-ring storage binders.

All records are safeguarded and securely stored.

Specific record retention times are:

- All records for wastewater reclamation must be retained for three years.
- Microbiology records must be retained for five years.
- Public water systems must retain records of compliance samples for ten years.
- Lead and copper records must be retained for 12 years.
- Data which may be part of a legal action may have to be maintained for a longer period of time.

Specific procedures for securing records including location of records and storage times are defined here.

- Laboratory Notebooks

  Bound notebooks have been provided to all staff for recording experiments, method development information and observations regarding unusual occurrences in the analysis of samples. Each page in the laboratory notebook shall be initialed and dated as information is entered.

- Laboratory Bench Sheets

  Laboratory bench sheets are used to record information from routine laboratory

Receiving

It is the responsibility of the laboratory assistant to receive shipments and to date the material when received once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to ensure that the purchase meets the quality level specified in the SOP and meets any applicable specifications described below. Material Safety Data Sheets are kept in the receiving area. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

Specifications

There are many different grades of analytical reagents available to the analyst. All methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, it may be assumed that it is not significant in that procedure and, therefore, any grade reagent may be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a SOP. If dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals unless noted otherwise by the manufacturer or by the reference source method.

Wherever possible, standards must be traceable to NBS/NIST standards, and records to that effect are maintained in the area in which the standard is to be used.

Water used in the preparation of standards or reagents must be of at least ASTM Type II. Type II water has been processed through activated carbon to remove organics and a reverse osmosis system; it must have a resulting resistivity of greater than 1.0 megaohm-cm at 25 °C

Purchasing Instruments, Equipment and Software

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, the analyst makes a supply request to the Lab Manager. If they agree with the request, the Lab Manager contacts the appropriate vendors for price quotations and specifies instrument features. Based on this information and previous experience, a decision is made as to which one can best satisfy the requirements. Major purchases must also be approved by Sanitary Engineering Management prior to purchasing.

Upon receipt of a new or used piece, it is given a short name, such as HP-20, assigned an asset number, and added to the equipment list maintained by the Finance Department. Its capability is assessed to determine if it is adequate or not for the specific application. For instruments, a calibration curve is generated, followed by MDLs, and other relevant criteria. For software, its operation must be deemed reliable and so stated in the instrument's maintenance logbook. Evidence of all verifications should be filed at the instrument and QA officer. Certificates supplied by the

STANDARD OPERATING PROCEDURE #137499-23.1
Montgomery County Environmental Laboratory

MONTGOMERY COUNTY

Title: Total Phosphorus (Aqueous)

Effective: April 1, 2008

3/27/2008	3/27/08
QA Officer Approval (ACTING) **Date**	**Lab Manager Approval Date**

1. SCOPE AND APPLICATION
   - 1.1 This procedure covers the determination of total phosphorus in drinking, surface waters, domestic and industrial waste waters.
   - 1.2 The default reporting limit is 0.10 mg/L.
2. SUMMARY OF METHOD
   - 2.1 Ammonium molybdate and antimony potassium tartrate react in an acid medium with dilute solutions of phosphorus to form an antimony-phospho-molybdate complex. This complex is reduced to an intensely blue-colored complex by ascorbic acid. The color is proportional to the phosphorus concentration.
   - 2.2 The color is analyzed on a spectrophotometer at 880 nm.
3. DEFINITIONS
   - 3.1 Total Phosphorus (P)--all of the phosphorus present in the sample, regardless of form, as measured by the persulfate digestion procedure.
4. INTERFERENCES
   - 4.1 Arsenates react with molybdate reagent to produce a blue color similar to that formed with phosphate. Concentrations as low as 0.1 mg/L interfere with the phosphate determination.
   - 4.2 Hexavalent Chromium and NO_2^- interfere to give results roughly 3 % low at 1 mg/L and 10-15 % low at 10 mg/L.
5. SAFETY
   - 5.1 This method may involve hazardous materials, operations and equipment. This method does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed toe, nonabsorbent shoes are a minimum.
6. EQUIPMENT AND SUPPLIES
   - 6.1 The following items are recommended for performing this procedure. Equivalent items should only be used when they result in an improvement in quality, efficiency, productivity, or cost. An item can be considered equivalent if with its use, the analytical and QA/QC requirements in this

month

7.3.10 Calibration standard and alternate source QC: See preparation table in Section 17. Standards/QC shall be prepared fresh each use.

7.3.11 Laboratory Fortified Matrix (LFM): Prepare by pipetting 100 uL of the Stock Phosphorus solution (100 mg/L) into 25 mL of chosen sample matrix. True value is 0.40 mg/L.

8. SAMPLE COLLECTION, PRESERVATION, SHIPMENT, AND STORAGE

8.1 Sample containers are to be clean, acid-rinsed, plastic or glass screw-top (250-1000 mL).

8.2 If the analysis cannot be performed the day of collection, the sample should be preserved to a pH of <2 by the addition of 2 mL conc. H_2SO_4 per liter, and refrigeration at $\leq$6 °C. Note: place 100-125 mL of sample in a 6 oz whirl-pak bag, add 0.2 mL of concentrated H_2SO_4 for preservation.

8.3 Holding time is 28 days if preserved.

9. QUALITY CONTROL

9.1 Method Detection Limits (MDL)

9.1.1 Please see the Quality Assurance Plan for the procedure for performing an MDL study.

9.1.2 An MDL study must be completed prior to beginning analysis and annually there after. If in the judgment of the analyst, a change in performance caused by either a change in instrument hardware or operating conditions the MDL study shall be repeated.

9.2 Quality Control Sample (QCS)

9.2.1 With each preparation batch of 10 samples or less (excluding QC), analyze a standard made from an alternate source. The concentration should be approximately half the concentration of the high calibration standard. Use 5 mL of the 2.5 mg/L Alternate source standard to 25 mL DI. True value is 0.50 mg/L.

9.2.2 A QCS shall be analyzed before and after the samples it was prepared with.

9.2.3 Recovery of the QCS must be within 90-110 % for analysis to be acceptable.

9.2.4 See Section 7 for preparation instructions and Section 17 for final concentrations.

9.3 Laboratory Reagent Blank (LRB)

9.3.1 The LRB is reagent grade water that has all of the same reagents added to it as a digested sample would have. The LRB is digested along with samples at a frequency of 1 per batch up to 10 samples.

9.3.2 The LRB must be less than the MDL or less than 1/2 of the reporting limit, whichever is greater.

9.3.3 If the acceptance limits can not be met, redigest all effected samples associated with the LRB.

9.4 Laboratory Fortified Blank (LFB)

9.4.1 The QCS will act as the LFB. Please the Section about the QCS for details.

9.5 Duplicate

9.5.1 Perform a duplicate analysis of a representative sample to verify replication of work at a rate of one duplicate per ten samples.

9.5.2 For samples with an average of greater than the Reporting Limit, duplicate determinations must have RPD of <10 %, if it does not, the analysis should be repeated to confirm.

9.5.3 For potable samples and samples that are typically clean, a Laboratory Fortified Matrix Duplicate may be analyzed instead of a Duplicate.

10. CALIBRATION AND STANDARDIZATION

10.1 For all determinations, allow spectrophotometer to warm up period of not less than 20 minutes.

10.2 For initial and daily operation, calibrate the instrument according to the instrument manufacturer's recommended procedures using the calibration blank and calibration standards prepared at four or more concentrations within the usable linear dynamic range of the analyte. The calibration blank and standards must go through the digestion process. The points should be spread evenly across the calibration range.

10.3 The curve must have a correlation coefficient (r^2) equal to or greater than 0.995. If the curve fails to meet this criterion, reanalyze to confirm. Repeat digestion of standards and all associated samples if correlation coefficient is not equal to or greater than 0.995.

10.4 Calibration curves are valid for three months after analysis as long as the Quality Control Standard analyzed immediately after calibration is acceptable (+/- 10 %) and with the digestion batches is acceptable. Each analyst is required to have their own calibration curve.

10.5 Preparation of Curve and associated QC is described in Section 17.

11. PROCEDURE

11.1 Glassware Preparation

11.1.1 Glassware required for this procedure is prepared for use by rinsing with a solution of 1 part HCl and 1 part DI water three times followed by three rinses with DI water. Glassware is air dried.

11.1.2 No phosphate based detergents shall be used to clean glassware for Phosphorus analysis. Glassware shall be dedicated for this Phosphorus analysis only.

11.2 Digestion

11.2.1 Place 25.0 mL of H_2SO_4 preserved sample (or suitable dilution for wastewater samples) into corresponding 50 mL graduated digestion tubes.

11.2.2 Label all calibrants, samples, and QC with moisture resistant ink before autoclaving.

11.2.3 Add 1 mL 11N H_2SO_4 to each cylinder.

11.2.4 Add 0.4g of ammonium persulfate, place caps on top of digestion tubes, and invert to mix.

11.2.5 Place samples and standards into autoclave. Loosen caps before autoclaving

11.2.6 Autoclave at 119-121°C for 30 minute cycle on slow exhaust. Total autoclaving time is approximately 65 minutes.

11.2.7 Remove samples from the autoclave and allow to cool to room temperature. Caution: samples are very hot.

11.3 Analysis

11.3.1 To the digested samples, add 1 drop phenolphthalein indicator and 10 N NaOH drop wise until a pink color develops.

11.3.2 Add 5N H_2SO_4 drop wise until neutralized to a faint pink/clear color.

11.3.3 Add 8 mL combined reagent to each sample, standard, and QC.

11.3.4 Cap and invert several times to mix.

11.3.5 Dilute samples and QC to 50 mL mark on digestion tubes. (For potable samples, this is done in Class A volumetric flasks. Pour samples to be analyzed back into graduated digestion tubes.)

11.3.6 Turn on spectrophotometer, and allow 20 minutes to warm up.

11.3.7 Allow samples to stand at least 10 minutes, but no more than 30 minutes.

11.3.8 Pour each sample into a cuvette and measure absorbance at 880 nm following the

17. ATTACHMENTS/TABLES

17.1 Standard/QC Preparation

Standard	Volume	Of Solution	Diluted with DI to	Conc. in mg/L
Calibration Blank	0 mL	2.5 mg/L STD Stock	25 mL	0.00 mg/L
Standard 1	1 mL	2.5 mg/L STD Stock	25 mL	0.10 mg/L
Standard 2	3 mL	2.5 mg/L STD Stock	25 mL	0.30 mg/L
Standard 3	5 mL	2.5 mg/L STD Stock	25 mL	0.50 mg/L
Standard 4	10 mL	2.5 mg/L STD Stock	25 mL	1.00 mg/L
LFB /QCS	5 mL	2.5 mg/L ALT stock	25 mL	0.50 mg/L

Final volume for all samples, standards, and QC is taken to 50mL after addition of the combined color reagent.

17.3 Example Batch Sheet

Total Phosphorus
SM_{20} 4500P B, E

ENVIRONMENTAL LAB
Batch Sheet

MONTGOMERY COUNTY

Analyst:_____
Date:_____

Calibration Curve Ref. Date _____

QCS Stock Ref #_____
LFM Stock Ref #_____

Phenolphthalein Ref # _____
5N H_2SO_4 Ref # _____
11N H_2SO_4 Ref # _____
10N NaOH _____
Ammonium persulfate Ref # _____
Combined Reagent Ref #_____

SAMPLE NAME/DATE	INITIAL VOLUME (mL)	FINAL VOLUME (mL)	Abs	Inst. RESULT (mg/L)	Final RESULT (mg/L)	COMMENTS
LRB	25	25				LRB < 0.050 mg/L
QCS (0.50 mg/L)	25	25			mg/L % Rec.	LFB 90-110%
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LFM/LFMD Recovery must be 80-110 % for Potables and 80-120 % for Wastewater;Duplicate RPD must be <10 %.

Appendix C
Field Standard Operating Procedures

Table of Contents

1. Surface Water Sampling SOP
2. Sample Packaging and Shipping SOP
3. Dissolved Oxygen Measurement SOP
4. pH and Conductivity Measurement SOP
5. Temperature Measurement SOP
6. Turbidity Measurement SOP
7. Wet Weather Event Sampling SOP

Title: Surface Water Sampling

INTRODUCTION

This Standard Operating Procedure (SOP) is applicable to the collection of representative liquid samples, both aqueous and nonaqueous from streams, rivers, lakes, ponds, lagoons, embayments, and surface impoundments. It includes samples collected from depth, as well as samples collected at the surface.

METHOD SUMMARY

Sampling situations vary widely, and, therefore, no universal sampling procedure can be recommended. However, sampling of both aqueous and non-aqueous liquids from the above mentioned sources is generally accomplished through the use of one of the following samplers or techniques:

- Dip sampler
- Direct method
- Discrete Depth samplers; e.g., Kemmerer or Van Dorn bottles
- Peristaltic pumps
- Stormwater collection devices

These sampling techniques will allow for the collection of representative samples from the majority of surface waters and impoundments encountered.

SAMPLE PRESERVATION, CONTAINERS, HANDLING, AND STORAGE

Once samples have been collected, follow these procedures:

1. Transfer the sample(s) into suitable labeled sample containers.
2. Preserve the sample if appropriate, or use pre-preserved sample bottles.
3. Cap the container, put it in a Ziploc plastic bag and place it on ice in a cooler.
4. Record all pertinent data in the site logbook and on a field data sheet.
5. Complete the chain of custody form.
6. Attach custody seals to the cooler prior to shipment.
7. Decontaminate all sampling equipment prior to the collection of additional samples.

INTERFERENCES AND POTENTIAL PROBLEMS

There are two primary interferences or potential problems with surface water sampling. These include cross-contamination of samples and improper sample collection.

- Cross-contamination problems can be eliminated or minimized through the use of dedicated sampling equipment. Another suitable method can be to work collecting samples from low to high concentration, should this information be available. If

PROCEDURES

1.1 Preparation

1. Determine the extent of the sampling effort, the sampling methods to be employed, and which equipment and supplies are needed.
2. Obtain necessary sampling and monitoring equipment.
3. Decontaminate or preclean equipment, and ensure that it is in working order.
4. Prepare scheduling and coordinate with staff, clients, and regulatory agency, if appropriate.
5. Perform a general site survey prior to site entry in accordance with the site-specific health and safety plan.
6. Use stakes, flags, or buoys to identify and mark all sampling locations. If required, the proposed locations may be adjusted based onsite access, property boundaries, and surface obstructions.

1.2 Sampling Considerations

The physical location of the investigator when collecting a sample may dictate the equipment to be used. If surface water samples are required, direct dipping of the sample container into the stream is desirable. This is possible, however, only from a small boat, a pier, etc., or by wading in the stream. Wading, however, may cause the re-suspension of bottom deposits and bias the sample. Wading is acceptable if the stream has a noticeable current (is not impounded), and the samples are collected while facing upstream. If the stream is too deep to wade, or if the sample must be collected from more than one water depth, or the sample must be collected from a bridge, etc., supplemental sampling equipment must be used.

Representative Samples: In order to collect a representative sample, the hydrology and morphometrics (e.g., measurements of volume, depth, etc.) of a stream or impoundment should be determined prior to sampling. This will aid in determining the presence of phases or layers in lagoons or impoundments, flow patterns in streams, and appropriate sample locations and depths. Water quality data should be collected in impoundments to determine if stratification is present. Measurements of dissolved oxygen, pH, and temperature can indicate if strata exist which would affect analytical results. Conductivity and oxidation-reduction potential can also assist in the interpretation of analytical data and the selection of sampling sites and depths anytime surface water samples are collected. Measurements should be collected at 1-meter (maximum) intervals from the substrate to the surface using an appropriate instrument, such as a Hydrolab (or equivalent).

When using the direct method, do not use pre-preserved sample bottles as the collection method may dilute the concentration of preservative necessary for proper sample preservation.

Discrete Depth Samplers: When discrete samples are desired from a specific depth, and the parameters to be measured do not require a Teflon® coated sampler, a standard Kemmerer or Van Dorn sampler may be used. The Kemmerer sampler is a brass cylinder with rubber stoppers that leave the ends of the sampler open while being lowered in a vertical position, thus allowing free passage of water through the cylinder. The Van Dorn sampler is plastic and is lowered in a horizontal position. In each case, a messenger is sent down a rope when the sampler is at the designated depth, to cause the stoppers to close the cylinder, which is then raised. Water is removed through a valve to fill respective sample containers. With a rubber tube attached to the valve, dissolved oxygen sample bottles can be properly filled by allowing an overflow of the water being collected. With multiple depth samples, care should be taken not to stir up the bottom sediment and thus bias the sample.

1. Using a properly decontaminated Kemmerer or Van Dorn bottle, set the sampling device so that the sampling end pieces are pulled away from the sampling tube, allowing the water to be sampled to pass through this tube.
2. Lower the pre-set sampling device to the predetermined depth. Avoid bottom disturbance.
3. When the discrete sampler bottle is at the required depth, send down the messenger, closing the sampling device.
4. Retrieve the sampler and discharge the first 10 to 20 mL to clear any potential contamination on the valve. Transfer the sample to the appropriate sample container.
5. Be sure to use special attachments available on some discrete samplers to distribute small volumes at low flow rates; e.g., VOCs at 100 to 200 mL/ min.

Peristaltic Pump Samplers: Another device that can be effectively used to sample a water column is the peristaltic pump/vacuum jug system. The use of a metal conduit to which the tubing is attached, allows for the collection of a vertical sample (down to about a 25 foot depth) which is representative of the water column. Commercially available pumps vary in size and capability, with some being designed specifically for the simultaneous collection of multiple water samples. The battery-powered "ISCO" sampler is one such peristaltic pump. It is designed to collect discreet samples into 24 polyethylene or glass bottles at preset intervals. Some ISCO models can be configured to collect samples into a single container. To operate the compositor:

1. Place collection jars in appropriate positions in compositor. Add ice.
2. Connect sample hose and strainer and position in waste stream.

Equipment checkout and calibration activities must occur prior to sampling/operation and they must be documented.

HEALTH AND SAFETY

When working with potentially hazardous materials, follow U.S. EPA, OSHA and specific health and safety procedures. More specifically, when sampling lagoons or surface impoundments containing know or suspected hazardous substances, take adequate precautions. The sampling team member collecting the sample should not get too close to the edge of the impoundment, where bank failure may cause him or her to lose their balance. The person performing the sampling should be on a lifeline and be wearing adequate protective equipment. When conducting sampling from a boat in an impoundment or flowing waters, follow appropriate boating safety procedures.

Title: Sample Packaging and Shipping

PURPOSE

The sample packaging and shipment procedures summarized below will ensure that the samples will arrive at the laboratory with the chain-of-custody intact. The field sampler is personally responsible for the care and custody of the samples until they are transferred or properly dispatched. As few people as possible should handle the samples.

RECOMMENDED EQUIPMENT

Sample Coolers
Sample Labels
Ice
Waterproof ink pen
Chain-of-custody Forms

PROCEDURES

1) All bottles will be identified by use of sample labels with sample numbers, sampling locations, date/time of collection, and type of analysis.

2) Sample labels are to be completed for each sample using waterproof ink unless prohibited by weather conditions. For example, a logbook notation would explain that a pencil was used to fill out the sample label because the ballpoint pen would not function in freezing weather.

3) Samples are 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 a mobile laboratory, to the permanent laboratory, or to/from a secure storage area.

4) Samples will be properly packaged on ice at 4°C for shipment and dispatched to the appropriate laboratory for analysis, with a separate signed custody record enclosed in and secured to the inside top of each sample box or cooler. Shipping containers will be locked and secured with strapping tape and custody seals for

Title: Dissolved Oxygen Measurement

PURPOSE

This guidance details the steps required to measure the dissolved oxygen concentration of an aqueous sample while in the field. Dissolved oxygen levels in natural water and wastewater depend on the physical, chemical, and biochemical activities in the water body. Conversely, the growth of many aquatic organisms as well as the rate of corrosivity and photosynthetic activity are dependent on the dissolved concentration. Thus, analysis for dissolved oxygen is a key test in water pollution and waste treatment process control, and environmental quality assessments of surface water bodies. In addition, dissolved oxygen analysis is a key field parameter for proper well development.

The guidance document is applicable to all aqueous samples such as potable well water, monitoring well water, surface, leachate, and other water samples. Monitoring well water can be analyzed in situ for wells up to 100 ft. deep.

Dissolved oxygen probes are normally electrochemical cells that have metals of different nobility immersed in an electrolyte. The electrolyte is retained by an oxygen-permeable membrane. The metal of highest nobility (the cathode) is positioned at the membrane. When a suitable potential exists between the two metals, reduction of oxygen to hydroxide ion occurs at the cathode surface. An electrical current is developed that is directly proportional to the rate of arrival of oxygen molecules at the cathode. A galvanic or an electrolytic cell can be used as the probe.

Since the current produced in the probe is directly proportional to the rate of arrival of oxygen at the cathode, it is important that a fresh supply of sample by in contact with the membrane; otherwise, the oxygen in the aqueous layer along the membrane is quickly depleted and false low readings are obtained. It is necessary to stir the sample or the probe constantly.

Dissolved oxygen probes are relatively free of interferences. Interferences that can occur are reactions with gases such as chlorine or hydrogen sulfide. Probes exhibit temperature sensitivity. Automatic temperature compensation is normally provided by the manufacturer. If gaseous interference is suspected, it should be noted in the field logbook and checked if possible.

DEFINITIONS

Galvanic Cell – An electrochemical cell in which chemical energy is spontaneously converted to electrical energy. The electrical energy produced is supplied to an external circuit.

Title: pH and Conductivity Measurement

INTRODUCTION

This guideline is to provide reference information on the measurements of pH and conductivity in aqueous solutions.

LIMITATIONS

These limitations apply to all measurements of pH and conductivity excepting requirements of project-specific plans for measurements of pH and conductivity.

DEFINITIONS

pH. The negative logarithm (base 10) of the hydrogen ion activity. The hydrogen ion activity is related to the hydrogen ion concentration, and, in relatively weak solution, the two are nearly equal. Thus, for all practical purposes, pH is measure of the hydrogen ion concentration.

pH Meter. The pH meter consists of a potentiometer, a reference electrode, a glass electrode, and a temperature compensating device. A balanced circuit is completed through the potentiometer when the electrodes are immersed in the sample. The reference electrode consists of a half cell that provides a standard electrode potential. The liquid junction of the reference electrode forms a salt bridge with the sample and a liquid junction potential is generated that in turn affects the potential produced by hydrogen ions.

Resistance. The inability of a substance to conduct a current. For metals and solutions the resistance is defined by Ohm's law, $E = IR$, where E is the potential difference, I is current, and R is the resistance.

Conductance. The reciprocal of the resistance, 1/R.

Specific Conductance. The conductance of a 1-cm cube of electrolyte. Conductivity and specific conductance are used synonymously; this SOP will use the term "conductivity".

Conductivity Meter. The conductivity meter consists of a conductivity cell, a temperature compensating device, and a Wheatstone bridge to measure the electrical resistance of a sample by measuring the ratio of alternating current through the conductivity cell to the voltage across the cell.

EQUIPMENT

The following equipment is needed for taking field measurements:

1. Accumet 150 portable pH meter or equivalent

Initial Calibration

1. Inspect the Nester pH Pen for field readiness. The probe should be clean and the glass membrane should be intact, free of visible deposits of silver chloride.
2. Document the EPA serial number of the pH pen and the expiration date of the pH electrode.
3. Remove the Probe Boot by sliding the boot downward off the pH Pen. The switch is on when the Probe Boot is removed.
4. Slide the Battery Compartment Sleeve downward off the pH pen and insert the battery park.
5. Initial calibration of the Nester pH requires use of a certified buffer solution traceable to a National Bureau of Standards (NBS) standard solution. The initial calibration buffer should be within 3 pH units of the expected pH range of the environmental samples. A buffer solution of pH 4.0 is normally used as the initial calibration solution.
6. Record the supplier, the lot number, and the expiration date of the calibration buffer.
7. Rinse a 250 mL beaker with deionized water, then fill with the calibration buffer.
8. Rinse the glass membrane of the Nester pH Pen with deionized water, then immerse the probe in the calibration buffer. After 1 minute, record the initial pH reading, time and date.
9. If the initial pH reading is not with 0.1 pH unit of the known pH of the calibration buffer, calibrate the Nester pH Pen by turning the Calibration Adjustment Screw.
10. Record the pH value after calibration, document the date and time of calibration, record the name of the analyst.
11. Rinse the probe with deionized water.
12. Check the accuracy of the initial calibration against a second NBS Standard Buffer. Usually pH 7.0 buffer is used to confirm calibration. The pH reading for the second buffer should be within 0.1 pH unit. If not, recalibrate using the pH 4.0 calibration buffer.
    Note: If pH 10.0 buffer is used as the second confirmatory buffer, the pH reading should be pH 10.0 ± 0.5. pH 10.0 buffer freely dissociates; the hydroxide in the buffer reacts with atmospheric CO_2 to produce carbonate.
13. Record the pH reading of the confirmatory buffer solution.
14. Discard the buffer solutions; DO NOT REUSE.
15. Rinse the probe with deionized water.
16. Replace the Battery Compartment Sleeve.
17. Replace the Probe Boot to turn off the power switch.

pH Measurement

1. Remove the Probe Boot by sliding the boot downward off the Nester pH Pen. The power switch is no when the Probe Boot is removed.
2. Rinse a 250 mL beaker with deionized water, then collect an aliquot of the aqueous sample.
3. Immerse the probe in the aqueous sample.

7. Rinse a 250 mL beaker with deionized water, then fill with the calibration solution.
8. Rinse the Conductivity Cell with deionized water.

   CAUTION: The electrode surfaces of the Conductivity Pen have been platinized for optimum performance. Care must be taken to avoid touching the platinized electrodes, as platinization is easily removed by even mild abrasion, thus affecting calibration. To clean, simply soak or rinse the cell with deionized water.
9. Discard the conductivity standard; DO NOT RINSE.
10. Rinse the probe with deionized water.
11. Replace the Battery Compartment Sleeve.
12. Replace the Probe Boot to turn off the power switch.

Conductivity Measurements

1. Remove the Probe Boot by sliding the boot downward off the Nester Micro Mho Pen. The power switch is on when the Probe Boot is remove.
2. Rinse a 250 mL beaker with deionized water, then collect an aliquot of the aqueous sample.

   Note: Conductivity measurements are only taken in aqueous solutions. Do not immerse the Conductivity Pen in solvents or oils.
3. Immerse the Conductivity Pen in the sample aliquot. After 1 minute, record the conductivity of the sample.
4. Immerse the Conductivity Pen in the standard calibration solution. After 1 minute, record the initial conductivity reading, time and date.

   Note: Readouts in the normal mode must be multiplied by a factor of ten; e.g. a readout of 54% is equivalent to 540 umhos/cm.

   Note: Depressing the Range Switch puts the readout in the high range mode. These readings must be multiplied by a factor of 100; e.g. a readout of 54% is equivalent to 5400 umhos/cm.
5. The initial conductivity readings must be within 3% ± 1 digit of the known conductivity standard. If not, calibrate the Nester Micro Mho Pen by turning the Calibration Adjusting Screw.
6. Record the conductivity value after calibration, document the date and time of calibration, record the name of the analyst.

   Note: Readouts in the normal mode must be multiplied by a factor of ten; e.g. a readout of 54% is equivalent to 540 umhos/cm.

   Note: Depressing the Range Switch puts the readout in the high range mode. These readings must be multiplied by a factor of 100; e.g. a readout of 54% is equivalent to 5400 umhos/cm.
7. Rinse the probe with deionized water.
8. Replace the Probe Boot to turn off the power switch. NOTE* Remove the battery pack for long-term storage.

Title: Temperature Measurement

PURPOSE

The purpose of this procedure is to outline a procedure for personnel on how to perform a temperature measurement. Temperature measurements are carried out with a temperature probe. In addition the procedure will talk about the calibration procedure for the temperature probe.

EQUIPMENT

The following equipment is needed to measure the turbidity of a water sample:

1. Temperature probe

PROCEDURES

Temperature Testing Procedure:

Temperature is usually measured during a combined test with pH and conductivity.

Calibration Procedure:

The test probe will be checked biannually for calibration, by immersing it with a reference thermometer in a bath of known temperature until equilibrium is reached. The thermometer will not be used if it is found to have more than 10% error. The reference thermometer used will be a NIST-approved thermometer.

REFERENCES

None.

Title: Turbidity Measurement

PURPOSE

This guideline details the steps required to measure the turbidity of groundwater while in the field. Measuring turbidity during the development of a monitoring well ensures that the well has been properly developed. This guidance is applicable to all aqueous samples such as potable well water, monitoring well water, surface water, and other water samples. Turbidimeters are highly sensitive meters which measure small amounts of turbidity and have a linear and direct response to increases in turbidity. In this instrument, the light beam enters the sample through the bottom of the sample cell and passes up through the sample into the light shield. As light passes through the sample, some light is scattered by turbidity in the sample. A portion of the light scatters at 90 degrees is sensed by the photocell and the resulting photocell output is conditioned to drive the instrument meter. The meter scale is calibrated in nephelometric turbidity units to provide direct turbidity readouts. The response of any turbidimeter to a test sample is directly dependent on the physical design features of the instrument. It should be noted that whenever the physical design of any two turbidimeters differ, a sample may not read the same turbidity value on the two instruments even when both were calibrated with the same calibration standard.

Definitions

Turbidity – Turbidity refers to solids and organic matter that do not settle out of water. Turbidity is measured by how much light is transmitted or scattered when a beam of light is passed through a water sample.

Sample Cells – The sample cells are 18x15 mm, Pyrex glass, and are filled with the water sample to be analyzed.

Turbidity Standards – Secondary standards used to standardize/calibrate the turbidity meter.

Nephelometric Turbidity Units (NTU) – The measurement of light scatters at a 90-degree or 270-degree angles to the incident light beam.

EQUIPMENT

The following equipment is needed to measure the turbidity of a water sample:

1. Hach Portolab Turbidimeter or equivalent

Title: Wet Weather Event Sampling

PURPOSE

This Standard Operating Procedure (SOP) provides guidelines for initiating a wet weather sampling event. This SOP is applicable to the collection of water quality samples from non-point source (NPS) receiving streams during wet weather events.

GENERAL CONSIDERATIONS

The objective of the wet weather event sampling is to isolate the effect of a discrete rainfall event to permit the characterization of runoff and the determination of the impact on receiving water quality. Typically, NPS monitoring programs are intended to characterize water quality conditions for a certain time period (an instant, a season, a year before or after a project is completed, etc.) or for certain conditions (dry-weather baseflow, rain fall events, etc.). Generating a data set suitable to characterize, or represent, a time period or a particular condition depends on matching the sample collection frequency with the variability of the parameter(s) during that time period or condition. Certain water quality parameters can vary with time of day, time of year, sampling depth, location in the stream, etc., but the most important factor affecting the variability of many parameters is weather condition; most parameters are much more variable during rain events than during dry-weather, baseflow conditions. This is especially true for bacteria, nutrients, and suspended sediments. For example, phosphorus concentrations may be low before a rain event, peak shortly after the rain starts (the "first-flush" phenomenon), fall back to pre-rainfall concentrations, and rise again more than a day after the rain began (often due to phosphorus runoff upstream of the sampling location that was transported to this location even after the water level had returned to normal).

METHOD SUMMARY

Standardized methods for collecting surface water samples in wadeable stream are described in the Surface Water Sampling SOP.

DEFINITIONS

Wet weather event: a rain event of greater than 0.5 inches of rainfall in a 6-hour period, but following at least a 48-hour antecedent dry period (i.e., two days of dry weather).

Dry weather: a period when no rainfall (defined as less than 0.1 inches) has occurred within the previous 48 hours

Appendix D
Examples of Field Forms

Table of Contents

1. Greene County Regional Laboratory Sample Chain-of-Custody
2. Montgomery County Environmental Laboratory Sample Chain-of-Custody
3. Water Quality Sampling Field Data Sheet

CHAIN OF CUSTODY FORM

GREENE COUNTY SANITARY ENGINEERING DEPARTMENT
REGIONAL LABORATORY
422 FACTORY ROAD
BEAVERCREEK, OHIO 45434-6214

PHONE: (937) 562-7150
FAX: (937) 426-6198

Company Name		
Report Address		
City	State	Zip
Phone	Fax	
Report Attention		
Project Name		

SAMPLE IDENTIFICATION	MATRIX	COLLECTION TIME	COLLECTION DATE	ANALYSIS REQUESTED	REMARKS
Special Instructions:				Laboratory Comments:	

Relinquished by (sign)	Date	Time	Received by (sign)	Date	Time
Relinquished by (sign)	Date	Time	Received by (sign)	Date	Time
Relinquished by (sign)	Date	Time	Received by (sign)	Date	Time
Relinquished by (sign)	Date	Time	Received by (sign)	Date	Time
Relinquished by (sign)	Date	Time	Received by (sign)	Date	Time
Relinquished by (sign)	Date	Time	Received by (sign)	Date	Time
Relinquished by (sign)	Date	Time	Received by (sign)	Date	Time
Relinquished by (sign)	Date	Time	Received by (sign)	Date	Time

Sample Submission Request

Montgomery County Environmental Laboratory
Sanitary Engineering Department
4257 Dryden Road, Dayton, Ohio 45439
Lab Manager – (937) 496-7051
Laboratory – (937) 496-7053

MONTGOMERY COUNTY

Report To:

Name: _____

Organization: _____

Sample Log Number: _____ (Lab Use Only)

Sample Identification:

Sample Name/#/ID: _____

Sample Location: _____

Address: _____

City: _____ Zip: _____

Collected By: _____

☐ Grab Collected On: _____ Time: _____

☐ Composite Collected On: _____ Time: _____

☐ Drinking Water ☐ Wastewater ☐ Sludge ☐ Other _____

Field Treatment:

☐ Filtered ☐ Iced ☐ H_2SO_4

☐ NaOH ☐ HNO_3 ☐ Unpreserved

☐ $Na_2S_2O_3$ ☐ Other _____

Field Analysis:

pH (SU) _____ DO (mg/L) _____ Cond (umhos) _____

Temp (°C) _____ Cl, Free (mg/L) _____ Cl, Total (mg/L) _____

Flow (gal) _____ Other _____ _____

Lab Analysis

Wet Chemistry

- ☐ Alkalinity
- ☐ Alkalinity Stability
- ☐ Ammonia as N
- ☐ BOD, 5-Day
- ☐ cBOD, 5-Day
- ☐ Chlorine, Free (Lab)
- ☐ Chlorine, Total (Lab)
- ☐ Conductivity
- ☐ Cyanide, Total
- ☐ Cyanide, Free
- ☐ Dissolved Oxygen (Lab)
- ☐ Fluoride
- ☐ Hardness
- ☐ Hexavalent Chromium
- ☐ Nitrate as N
- ☐ Nitrite as N
- ☐ Nitrate-Nitrite as N
- ☐ Oil and Grease
- ☐ Phosphorus, Ortho as PO_4
- ☐ Phosphorus, Total as P
- ☐ pH (Lab)
- ☐ Residue, Total (TS)
- ☐ Residue, Total Volatile (TVS)
- ☐ Residue, Total Nonfilterable (TSS)
- ☐ Residue, Total Volatile Nonfilterable (TVSS)
- ☐ Residue, Settleable (SS)
- ☐ Specific Gravity
- ☐ Total Kjeldahl Nitrogen
- ☐ Turbidity

Bacteriology

- ☐ Total Coliform/E. Coli (Drinking Water)
- ☐ Fecal Coliform (#/100 mL)
- ☐ Fecal Coliform (#/gram dwt.)

Metals

- ☐ Aluminum
- ☐ Antimony
- ☐ Arsenic
- ☐ Barium
- ☐ Beryllium
- ☐ Cadmium
- ☐ Calcium
- ☐ Chromium
- ☐ Cobalt
- ☐ Copper
- ☐ Iron
- ☐ Lead
- ☐ Magnesium
- ☐ Manganese
- ☐ Mercury
- ☐ Molybdenum
- ☐ Nickel
- ☐ Potassium
- ☐ Selenium
- ☐ Silver
- ☐ Sodium
- ☐ Thallium
- ☐ Titanium
- ☐ Vanadium
- ☐ Zinc

Other

- ☐ Fluoride Screen _____ mg/L
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____
- ☐ _____

Comments:

_____

_____

_____

_____

_____

_____

_____

_____

Relinquished By: _____ Date: _____ Time: _____

Received By: _____ Date: _____ Time: _____

Water Quality Sampling Field Data Sheet

General Information:

Stream Name: North Fork Massie Creek

Site #:_____ Date:_____ Time:_____

Investigators:_____

Comments:_____

_____

Stream Flow Rate: ❑ High ❑ Normal ❑ Low ❑Negligible

Weather in past 24 hours:

- ❑ Storm (heavy rain)
- ❑ Rain (steady rain)
- ❑ Showers (intermittent rain)
- ❑ Overcast
- ❑ Clear/Sunny

Weather now:

- ❑ Storm (heavy rain)
- ❑ Rain (steady rain)
- ❑ Showers (intermittent rain)
- ❑ Overcast
- ❑ Clear/Sunny

Field Parameter Data:

1. Dissolved Oxygen

Instrument (indicate meter type/model):_____

Test 1 _____ . _____ mg/L Test 2 _____ . _____ mg/L

2. pH

Instrument (indicate meter type/model):_____

pH value _____ . _____ (Std. Units)

3. Temperature

Instrument (indicate meter type/model):_____

Water temperature _____ . _____ (°C)

3. Turbidity

Instrument (indicate meter type/model):_____

Turbidity _____ . _____ (NTU)

4. Conductivity

Instrument (indicate meter type/model):_____

Conductivity _____ . _____ (mS)

Successful daily calibration completed on all meters? ❑ Yes ❑ No

Calibration completed by:_____ (initials)

Sampling Information:

Samples collected for laboratory analysis:

Parameter	Sample No.	QC Sample ID*	Time Collected
Total Phos.			
Total Phos.			

**Indicate field blank (FB), equipment blank (EB), matrix spike (MS), or matrix spike dublicate (MSD) after sample number.*

Comments/Observations:

Provide any other comments regarding field/sampling conditions:

_____

_____

_____

_____

Photos (indicate no.):_____

_____