Introduction to the Quality-Assurance Plan for Water-Quality Activities Workbook

*The U.S. Geological Survey (USGS) collects and disseminates information about the quality and quantity of water in streams, lakes, and aquifers. As the Nation's principal earth-science agency, the USGS has a worldwide reputation for collecting accurate data and producing factual and impartial interpretive reports. The Office of Water-Quality (OWQ), in the Water Mission Area (WMA) of the USGS, is responsible for formulating policies, developing procedures, and providing training to personnel who man­age or conduct water-quality activities. Because many factors differ significantly from one USGS Water Science Center (WSC) to another, the OWQ recognizes the benefits to be gained when national policies are complemented by WSC policies and procedures that are suited to local environmental conditions and the knowledge and abilities of the WSC personnel. The OWQ also recognizes that various approaches to collecting and analyzing water-quality data may have equal technical validity; thus, personnel are able to adopt approaches that best fit the WSC and cooperator preferences and needs.*

The WMA requires that each WSC prepare a quality-assurance (QA) plan for water-quality activities and follow the policies and procedures described in the plan to ensure that water-quality data are collected, maintained, and made available for use by others in a manner consistent with established guidelines. As a means of ensuring consistency in water-quality pol­icies, procedures, and management among WSC, guidelines are presented in this report, structured as a workbook, to provide a specific framework for WSC to use in preparing QA plans.

The information and guidelines presented in this report are intended to serve as a frame­work for each WSC to prepare a QA plan that can be tailored to local conditions and require­ments. The focus and structure of the report are intended to assist the WSC by

* Providing a single source of WMA, OWQ, and WSC policies and procedures that guide the collection, processing, analysis, storage, and publication of water-quality data in each WSC;
* Delineating the topics, organization, language, and references needed for consistency among QA plans of the WSC, while providing latitude for knowledgeable WSC personnel to incorporateprocedures and policies that are more appropriate for some WSC; and
* Providing a structured and largely complete document that can proceed through the review and approval process in an effective and timely manner.
* Providing a framework for developing a QA plan for water-quality activities. The docu­ment is structured as a workbook with text and references provided, where possible, and fill-in-the-blank sections and instructions for adding information where it is needed to tailor the document to water-quality activities in each WSC.

The workbook is intended to provide a nearly complete QA plan based on WMA policies and memorandums. However, each WSC customizes this document by replacing text that appears **[red bracketed]**. Instructions are included *[pink bracketed in italics]* that suggest how WSC may add details that better describe their operations and procedures. Cited references (in green) are included and may be hyperlinked *(in green italics).*

The workbook contains current information on policies of the WMA for water-quality activities in a form that can be easily edited and supplemented to meet individual WSC requirements for a QA plan. The OWQ updates the workbook chapters annually, as needed, to keep the text and references current. A revision num­ber and date will identify sections that have changed in the workbook. A summary of the sec­tions changed will be provided as a separate Errata page.

The most viable implementation of this workbook will be as a living document that is updated and maintained online to reflect changes in the WSC. Updates to the WSC plan can be tracked by the modification date located in the lower right corner of the workbookThe WSC may choose to publish and reference the workbook as an Open-File Report document.

The authors of this report wish to thank the authors and editors of the National Field Manual for the Collection of Water-Quality Data (Book 9A of the U.S. Geological Survey report series, Techniques of Water-Resources Investigations) and the previous workbook for their hard work and attention to detail. These are invaluable resources for water-quality activities of the USGS Water Mission Area, and they served as critical reference materials for this QA plan. The authors also thank Mary L.Giorgino, Alissa L Coes and Jerri V. Davis for their suggestions and comments that substantially improved the final template.

 

Secondary Identification and /or Statement of Cooperation

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Quality-Assurance Plan for Water-Quality Activities in the [Name] Water Science Center

Compiled by Author, Author, and Author (Authors)

# Abstract

In accordance with guidelines set forth by the Office of Water Quality in the Water Mission Area of the U.S. Geological Survey, a quality-assurance plan has been cre­ated for use by the [Name] Water Science Center (WSC) in conducting water-quality activities. This quality-assurance plan documents the standards, policies, and procedures used by the [Name] WSC for activities related to the collection, processing, storage, analy­sis, and publication of water-quality data. The policies and procedures docu­mented in this quality-assurance plan for water-quality activities complement the quality-assurance plans for surface-water and groundwater activities and supplement the [Name] WSC’s quality-assurance plan.

# Introduction

The U.S. Geological Survey (USGS) was established by an act of Congress on March 3, 1879, to provide a permanent Federal agency to perform the systematic and sci­entific “classification of the public lands, and examination of the geologic structure, min­eral resources, and products of the national domain.” The Water Mission Area (WMA) of the USGS is the Nation’s principal water-resources information agency. The objectives of the WMA’s Basic Hydrologic Data Program are to collect and provide unbi­ased, scientifically based information that describes the quantity and quality of waters in the Nation’s streams, lakes, reservoirs, and aquifers. Water-quality activities in the [Name] WSC are part of the WMA’s overall objective of appraising the Nation’s water resources.

To assure water-quality data are reported, published and released by the WMA and to address quality-control issues related to water-quality activities, policies and procedures were designed to ensure that all scientific work conducted by or for the WMA is consistent and of documented quality. The Office of Water Quality (OWQ) is responsible for providing a quality-assurance (QA) plan that documents the policies and procedures that apply to the water-quality activities in each WSC in the WMA.

A QA plan is a document that describes the management policies, objec­tives, principles, organizational authority, responsibilities, accountability, and imple­mentation procedures for ensuring quality. Quality assurance, quality control, and quality assessment are all components of a QA plan. These terms are defined as follows:

Quality assurance (QA)—the systematic management of data-collection systems by using prescribed guidelines and criteria for implementing technically approved methods and policies. Quality assurance incorporates a comprehensive plan that outlines the over­all process for providing a product or service that will satisfy the given requirements for quality.

Quality control (QC)—The specific operational techniques and activities used to obtain the required quality of data. Quality control consists of the application of technical procedures to achieve prescribed standards of performance and to document the quality of collected data. Quality-control data that do not meet required standards are used to evaluate and implement corrective actions necessary to improve performance to accept­able levels.

Quality assessment—the overall process of assessing the quality of environmental data by reviewing (1) the appropriate implementation of QA policies and procedures and (2) analyzing the QC data. Quality assessment encompasses both the measurable and unmeasurable factors that affect the quality of environmental data. Assessment of these factors may indicate limitations that require modifications to protocols or standard oper­ating procedures for sample collection and analysis, or that affect the desired interpreta­tion and use of the environmental data. Quality-assurance, quality-control, and quality-assessment systems complement each other to provide a comprehensive QA program that ensures that quality objectives are identified and integrated into all levels of water-quality activities. Integrating these components into a discipline-wide QA guidance document will enhance water-quality data collected by the USGS by providing for the following:

* Consistency in data quality across all levels of the WMA;
* Accountability to clients, the scientific community, regulatory agencies, and the general public;
* Comparability of results among samples, sites, and laboratories;
* Traceability from the end product back to its origins, and to all supplementary information, through written records;
* Application of appropriate and documented techniques that lead to similar results time and again;
* Representativeness of the data in describing the actual chemical composition of the biological or physical conditions at a sampling site for a given point or period in time; and
* Adequacy of the amount of data obtained to meet data objectives.

## Purpose and Scope

The purpose of this QA plan for water-quality activities is to document the standards, policies, and procedures used by the [Name] WSC for activities related to the collection, processing, analysis, storage, and publication of water-quality data. This plan identifies responsibilities for ensuring that stated policies and procedures are executed. The plan also serves as a guide for all WSC personnel who are involved in water-quality activities and as a resource for identifying memoranda, publications, and other literature that describe associated techniques and requirements in more detail.

The scope of this QA plan includes discussions of the policies and procedures fol­lowed by the [Name] WSC for the collection, processing, analysis, storage, and publication of water-quality data. Although procedures and products of interpretive investigations are subject to the criteria discussed in this plan, some interpretive investi­gations may require separate and complete QA plans. The policies and pro­cedures documented in this QA plan for water-quality activities are intended to complement the QA plan for surface-water and groundwater activities and sup­plement the [Name] WSC QA plan.

# Organization and Responsibilities

Quality assurance is an active process of achieving and maintaining high-quality standards for water-quality data. Consistent quality requires that specific actions are car­ried out systematically in accordance with established policies and procedures. Errors and deficiencies can result when individuals fail to carry out their responsibilities. Clear and specific statements of responsibilities promote an understanding of each person's duties in the overall process of ensuring the quality of water-quality data.

## Organizational Chart

The [Name] WSC’s organizational structure is similar to those of other WSCs in the WMA, but different program requirements from one WSC to another contribute to the unique character of these organizational structures. The following chart illus­trates the organization of [Name]WSC personnel (fig. 2.1).

[Insert, attach or include link to WSC organizational chart.]

Figure 2.1 **[Name]** Water Science Center organizational chart, [date (month and year)].

## Responsibilities

The final responsibility for the preparation and implementation of and adherence to the QA policies that are described in this QA plan lies with the Director of the [Name]WSC ([Schroder and Shampine, 1992](http://pubs.usgs.gov/of/1992/0136/report.pdf), *p. 7*). [This section of the QA plan is designed to be a detailed and comprehensive summary of responsibilities related to the QA of water-quality data. Responsibilities are assigned to personnel by title, not by name. Any delegations of the WSC Director’s responsibility and authority should be stated clearly in the QA plan. In addition, the position title of the party responsible for future updates and revisions to the QA plan should be identified in this section.

WSCs may find that the most effective way of writing this section of the plan is to prepare a list of all position titles of WSC personnel associated with water-quality data collection, processing, storage, and publication; then list the water-quality-related responsibilities held by that position. As other sections of this workbook are completed and further responsibilities are discussed, the lists of responsibilities can be appended. Finally, when the remaining sections of the workbook have been completed, this “Responsibilities” section can be revisited and finalized. Include project chief and (or ) Field Office chiefs in the list of position titles and define their responsibilities in preparing QA plans as part of their proposals and workplans ([Shampine and others, 1992](http://pubs.usgs.gov/of/1992/0162/report.pdf), p. 2)].

Following is a list of responsibilities for selected WSC personnel who are involved in the collection, processing, storage, analysis, and publication of water-quality data:

**WSC Director** and designated management personnel: [The following are examples.]

* Managing and directing the WSC program, including designation of personnel responsible for managing all water-quality activities;
* Ensuring that water-quality activities in the WSC meet the needs of the Federal gov­ernment, the [Name] WSC, cooperating State and local agencies, and the general public;
* Ensuring that all aspects of this QA plan are understood and followed by WSC per­sonnel. This is accomplished by direct involvement of the WSC Director or through clearly stated delegation of this responsibility to other personnel in the WSC;
* Providing final resolution, in consultation with the Water-Quality Specialist, of any conflicts or disputes related to water-quality activities within the WSC;
* Briefing and updating subordinates on procedural and technical communications from the water science field teams (WSFT) and Headquarters technical offices;
* Participating in technical reviews of all water-quality programs on a [select quarterly, semiannual, or specify other] basis;
* Ensuring that all publications and other technical communications released by WSC personnel are accurate and comply with USGS policy;
* Approving the use of laboratories other than the National Water Quality Laboratory;

[Continue to list other responsibilities of the WSC Director and (or) designated man­agers.]

**WSC Water-Quality Specialist** or designated representative: [The following are examples.]

* Ensuring that water-quality activities in the WSC meet the needs of the Federal gov­ernment, the [Name] WSC, cooperating State and local agencies, and the general public;
* Preparing and implementing the WSC water-quality QA plan;
* Ensuring that the WSC QA plan is reviewed and revised at least once every 3 years to document current responsibilities, methodologies, and ongoing procedural improvements;
* Ensuring that all aspects of this QA plan are understood and followed by WSC per­sonnel. This is accomplished by the Water-Quality Specialist’s direct involvement;
* Keeping WSC personnel briefed on procedural and technical communications from the WSFT and Headquarters technical offices;
* Participating in technical reviews of all WSC water-quality programs on a [select quarterly, semiannual, or specify other]basis;
* Ensuring that all publications and other technical communications released by the WSC that relate to and include water-quality information are accurate and comply with USGS policy;
* Assisting project chiefs in preparing the Laboratory Evaluation Package (LEP) for laboratory approval;
* Providing technical assistance and review of the water-quality aspects of project proposals to ensure that proposed work is technically sound and meets WSC priorities

**Project chief and (or) Field Office chief:** [The following are examples.]

* Managing and directing the project’s field and laboratory water-quality activities;
* Ensuring that the project’s field and laboratory water-quality activities meet the needs of the Federal government, the [Name] WSC, cooperating State and local agencies, and the general public;
* Ensuring that all aspects of this QA plan that pertain to the project’s field and labora­tory water-quality activities are understood and followed by project personnel;
* Obtaining guidance, as appropriate, for project quality-assurance/quality-control (QA/ QC) activities from the WSC Water-Quality Specialist;
* Preparing the LEP for laboratory approval;
* Ensuring that QA/QC activities are properly carried out by the project staff;
* [Continue to list other position titles (such as Database administrators, Section Chiefs, Senior Technicians and Scientists and associated responsibilities as desired and similar to the example below for the QWDATA database administrator.]

 **Water-Quality Database Administrator (QWDBA)**

* User education--teaching users the correct methods for data entry, data retrieval, and data management procedures; serves as a reference for water-quality data checking and analysis programs;
* Filling requests for water-quality data;
* Participating in reviews of proposals of water-quality projects;
* Uploading water-quality data to the NWIS database as it arrives from laboratories;
* Notifying appropriate personnel that data have arrived from laboratories;
* Making sure all data entered into QWDATA are complete and that established data management procedures are followed;
* Suggesting procedures to improve the flow of water-quality data;
* Assisting project personnel in the resolution of specific database problems.

# Program and Project Planning

The WSC Director has primary responsibility for overall WSC program planning and is responsible for ensuring that WSC projects support local and national priorities. All water-quality projects require review and approval prior to the commencement of work. QA requirements and QC procedures should be integrated into the project proposal. The need for a project specific QA plan for a water-quality project will depend on the complexity of the work, the needs of the WSC or cooperator, or other criteria as described in [Shampine and others](http://pubs.usgs.gov/of/1992/0162/report.pdf) (1992).

[The two following sections are separated into requirements for project proposals and project workplans. If your WSC does not differentiate between the two, combine the applicable text from each section and tailor it to meet your WSC’s policies. If your WSC requires separate documents, tailor these sections accordingly.]

## Project Proposals (Revision 2, August 2012)

Project proposals are developed by the [Name] WSC in response to requests by coop­erating agencies, needs recognized by the USGS in working closely with other agencies, or national programs.Proposals conform to the format required by the Water Science Field Team at: https://collaboration.usgs.gov/wg/wsft/Proposal%20Development%20Tools/Forms/AllItems.aspx

Each proposal must:

* state the problem or need for the study,
* define objec­tives—what will be accomplished to help solve the problem,
* describe the relevance and bene­fits—why should USGS conduct the study and how will the work support the goals of the Water Mission Area; and
* define the approach—how work will accomplish the objec­tives and
* describe relevance and benefits to USGS goals as expressed in the [USGS Science Strategy](http://www.usgs.gov/start_with_science/science_strategy.asp), or the [USGS Federal-State Cooperative Program Pri­orities](http://water.usgs.gov/coop/usgs) (published annually by WMA memorandum.

The approach consists of a detailed outline of the data-collection activities to be carried out (if new data are needed), the QA plans, the QC information needed, and the analytical techniques to be used. Project report plans, cost estimates, time schedules, and personnel requirements also are addressed. Consultation with local and WSFT specialists is encouraged during the preparation of proposals and the execution of projects. To ensure that program activities do not infringe on work more appropriately done by the private sector, [USGS WMA Memorandum 12.01](http://water.usgs.gov/coop/about/avoiding_competition.pdf), (2012) guides activities that should be included and excluded from the Program, and works through the Federal Advisory Committee Act to obtain advice from both government and non-government entities.

Review of project proposals is given high priority. Project proposals are reviewed by the appropriate WSC personnel [list positions] and, at the discretion of the WSC Director, may be sent to other WSCs for review. The [Region] in consultation with the **WSFT** provides final review and approval of all project proposals.

## Project Workplan

Project workplans are developed from approved project proposals. The WSC requirements for the content, review, and revision of workplans are outlined below. *[Cite appropriate WSC and area memoranda that provide applicable guidelines.]*

The [name the responsible party] prepares a detailed workplan that identifies all project work elements and the related technical methods and approaches that are neces­sary to satisfy project objectives. The workplan links project personnel, tasks, and func­tions with associated funds and indicates the projected dates for on-time completion of project elements and, ultimately, the project. Workplans for water-quality programs and projects, including programs and projects with water-quality components, should clearly state how the WSC’s “Quality-Assurance Plan for Water-Quality Activities” will be implemented.

Descriptions of the methods and approaches to be used to complete the technical elements of the project are required and include, for example, the design of environmen­tal sample collection to meet the study objectives. Any new or unapproved field and lab­oratory methods that will be used must be described in detail. The laboratory evaluation plan should monitored and cited in the plan. The plan also lists the environmental sampling locations and frequency, a description of the sample types and their expected uses, and descriptions of laboratory tests.

 Workplans also include a description of the design of QC sampling that is required to document bias and variability in the environmental data. The workplan lists QC sam­ple types, the frequency of collection, and their intended uses. The types of QC samples that typically are collected include blanks and spikes to estimate bias and replicates to estimate variability ([USGS, 2006](http://water.usgs.gov/owq/FieldManual/chapter4/html/Ch4_contents.html); [Mueller and others, 1997](http://pubs.er.usgs.gov/publication/ofr92162)).

Workplans state anticipated methods for data analysis and presentation, including report plans. Accurate cost estimates are needed for personnel, materials, and services related to planned completion dates for properly budgeting the project. Assuring the availability of project personnel is often difficult and can impose serious constraints on completing project tasks; therefore, WSC management should be consulted to ensure adequate staff resources are available to avoid the over-commitment of individuals to multiple projects. The project timeline lists major project elements and planned completion dates.

## Project Review

Project reviews are conducted periodically by WSC management, technical advi­sors, or discipline specialists to ensure compliance with the project workplan or proposal. Project reviews are used to ensure that data collection, analysis, and reporting are accomplished in accordance with the workplan and with broader WSC policies and require­ments. QA activities with respect to project reviews are outlined in the next section.

[Use this section to document the means in which project reviews are conducted in your WSC. Items under “Review Documentation” below are included for guidance purposes, but are generally part of a WSC review process. Customize this section as appropriate.]

### Review Schedules

The WSC has developed and implemented a review schedule for evaluating the technical development and progress of water-quality programs and projects, such as quarterly reviews or the 10-, 40-, 70-percent (10/40/70) project-completion milestones. Regularly planned reviews ensure that water-quality programs or projects are conducted efficiently to produce quality products on time. Informal reviews are part of ongoing quality assurance, whereby problems and related issues are addressed as they arise.

### Review Documentation

The WSC has developed a method for documenting program and project reviews. The following information should be included in program and project review documen­tation: [Edit this section as appropriate.]

* Date of review
* Type of review (quarterly, 10/40/70, discipline)
* Names of reviewers and(or) attendees
* Responses to recommended action items from the last review
* Status, plans, and problems with data collection, data analysis, and report writing
* Major findings
* Cooperator/customer contacts
* Project-related training needs
* Recommended follow-up or action items
* Date for next review

The WSC archives all review comments that address the presence or absence of project deficiencies, all actions or recommendations for resolving deficiencies, or documen­tation explaining why a deficiency has not been resolved. [Describe how project review comments are maintained and archived in the WSC.]

# Water-Quality Laboratories

Analytical laboratories provide data to the **[Name]** WSC water-quality studies for physical, chemical, radiochemical, and microbiological analyses. Each water-quality study has unique analytical needs defined by the specific goals of collecting the samples and the characteristics of the environment being sampled. The laboratories used for studies in the **[Name]** WSC must provide appropriate analytical methods to meet the study objectives and must perform the method as described. The guidelines and recommendations for evaluating laboratory analytical capability relative to the study objectives are provided in the at the [Branch of Quality Systems Laboratory Evaluation](http://internalbqs.cr.usgs.gov/labeval/) website, <http://internalbqs.cr.usgs.gov/labeval>.

## Evaluating Laboratory Performance

The **[**identify the responsible party such as **Project chief or QW specialist]** is responsible for obtaining, compiling and evaluating the data and information needed to ensure that the selected laboratory methods meet the study objectives. Initial laboratory selection is made by comparing mediums to be sampled, analytical results required, and expected environmental ranges of the project analyte list and associated detection levels. Data are needed to evaluate the capability of a laboratory to perform an analytical method as described. Analyses of reference material with known composition (typically referred to as standard reference material, certified standards, or performance test samples) are the most common source of the data needed. These samples, referred to as performance test (PT) samples in this document, are usually submitted as blind samples (composition unknown to the laboratory) from an external program, project or entity and result in:

* Level I analyses – Sufficient PT sample data is available from the laboratory or an external program to evaluate performance for the analytes, environmental concentration range and timeframe for sample analysis specific to the project; or
* Level II analyses - Insufficient PT sample data is available from the laboratory or an external program to evaluate performance for the analytes, environmental concentration range and timeframe for sample analysis specific to the project.

The **[**identify the responsible party such as **Project chief or QW specialist]** obtains and submits project relevant PT samples to produce the data needed to evaluate performance.

The **[**identify the responsible party such as **Project chief or QW specialist]** completes the initial evaluation before environmental samples are submitted to a laboratory. The purpose of the initial evaluation is twofold: (1) verify that the laboratory provides acceptable analytical methods to meet the project objectives and (2) examine PT data to evaluate the capability of the laboratory to perform the methods.

The **[**identify the responsible party such as **Project chief or QW specialist]** mitigates any substandard performance issues discovered. Most issues are resolved by communication with the analysts or managers at the laboratory. Either the laboratory corrects an error, makes adjustments to meet the needs of the project, or the project objectives are modified to be compatible with the data that will be delivered. If the issues are not resolved, the outcome may be a decision by the **[**identify the responsible party such as **Project chief or QW specialist]** to seek analyses from a different laboratory.

The **[**identify the responsible party such as **Project chief or QW specialist]** develops a plan for submitting the PT samples for Level 2 analyses during the initial evaluation phase for on-going evaluation. The plan includes sample sources and composition, frequency for submitting the samples, and a process for evaluating results. The **[**identify the responsible party such as **Project chief or QW specialist]** routinely evaluates existing PT sample data or project specific PT sample data throughout the analytical phase of the project.

## Laboratory Evaluation Packages (LEP)

The **[**identify the responsible party such as **Project chief or QW specialist]** documents the information and data gathered for the initial evaluation of analytical performance relative to the project objectives. The LEP contents include:

* A list of project analytes and expected environmental concentrations
* Laboratory Method reporting levels, calibration ranges, and measures of variability
* Description of the project objectives relative to the laboratory capabilities.
* A data portion of the package that shows the initial PT data for the analytes of interest in the concentration ranges of interest
* A plan for the on-going PT samples and data evaluation during the analytical phase of the project

If the PT sample data meet the Level 1 criteria, the LEP does not need to be reviewed or approved. The **[**identify the responsible party such as **Project chief or QW specialist]** and the WSFT Water Quality Specialist review the LEP for Level 2 analyses. The review establishes concurrence that the laboratory provides results appropriate for the objectives of the project. The **[**identify the responsible party such as **Project chief or QW specialist]** addresses reviewer comments before the package is submitted to the **[WSC Director, or other responsible party]** for approval to use the laboratory.

The **[**identify the responsible party such as **Project chief or QW specialist]** keeps the completed packages with signatures in the WSC files and provides copies to the appropriate WSFT Water Quality Specialist and the Branch of Quality Systems, Chief of Laboratory Evaluations, for archival.

## Laboratories/ Analytical Methods Used for Water-Quality Projects in the [Name]

[*Complete the following table with information about status of evaluation of analytical data for projects in the WSC or reference the documents containing this information (e.g. from your entry in LabTrackr, project plans, or QA plans) and the status of all evaluations associated with these laboratories.*]

Table 4.1 Status of Level 1 Analytical Data in the [Name] WSC.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Project | Project Chief | Start Date | Analytical laboratory | Analyses provided(by general category) | Frequency of Ongoing QC Sample Submission | Source of Ongoing QC samples (lab, vendor, made in WSC) | End Date |
|  |  |  |  |  |  |  |  |

Table 4.2 Status of Level 2 Analytical Data in the [Name] WSC.

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Project | Project Chief | Start Date | Analytical laboratory | Analyses provided(by general category) | LEP Status (R = Reviewed, Approved; P = Pending Approval; N = Not completed; X = Not Started) | Frequency of Ongoing QC Sample Submission | Source of Ongoing QC samples (lab, vendor, made in WSC) | End Date |
|  |  |  |  |  |  |  |  |  |

# Field Service Units and Laboratories, Mobile Laboratories and Field Vehicles

The WSC maintains laboratory facilities, such as Field Service Units, mobile laboratories, and field vehicles for use in preparing equipment for field activities, processing samples, performing sample analysis, and preparing samples for shipment to analytical laboratories. This section documents the criteria for maintaining and operating these facilities in the [Name] WSC.

## Field Service Units and Laboratories

[In some WSCs or field offices, the Field Service Unit may consist of an organi­zational unit responsible for maintaining a laboratory and field staging area, supplies, and equipment for general use. In other WSCs or field offices, the Field Ser­vice Unit may be simply a laboratory space or staging area, and responsibility for main­taining the space and providing equipment and supplies rests with project personnel who use the space. Laboratories may include a building or trailer where laboratory analyses are performed either routinely or temporarily to meet program needs. All Field Service Units and laboratories maintained by the WSC should be included here.]

 [Name] laboratories [or field service unit(s)]assist and support water-quality activities by providing field instrumen­tation maintenance and calibration, preparations for sample collection, and QA for these activities. The unit maintains a supply of instruments, equipment, and expendable sup­plies needed by field personnel for water-quality sample collection and analysis.

### [Facility Name] (Revision 2, August 2012) (Note: Sections 5.1.1, 5.1.1.1, and 5.1.1.2 can be copied and renamed for additional entries: for example, 5.1.2 [Facility Name], 5.1.2.1 Procedures, 5.1.2.2 Equipment and Supplies, 5.1.3 etc.)

[The following paragraphs and table should be repeated for each of the WSC facilities.]

The WSC maintains a [name of unit or laboratory] located in[location of facil­ity]. The [name of facility] contains laboratory benches, glassware, sinks, chemical stor­age cabinets, and other equipment and instruments listed in table 5.1. [Identify the responsible party] has responsibility for maintenance of the [name of facility] and QA of the equipment and instruments provided by the [name of unit or laboratory]. The facility is maintained in accordance with standards set forth in the [Name] WSC chemical-hygiene plan ([reference the WSC chemical-hygiene plan]; [Branch of Operations Technical Memorandum 91.01](http://water.usgs.gov/admin/memo/information/op91.01.html)).

Table 5.1 [Example table of equipment and instruments that are the responsibility of the Field Service Unit. Fill in the table as appropriate for your WSC.] Equipment and instruments provided by [name of unit or laboratory] and quality assurance [OWQ, Office of Water Quality; NA, not applicable]

|  |  |
| --- | --- |
| Laboratory equipment |  Quality assurance  |
| Laboratory balance | Calibration checked annually. |
| Refrigerator at 4 oC | Temperature monitored weekly. |
| Fume hood | Calibrated annually. |
| Supply of deionized water | Maintained per [OWQ Tech. Memo 92.01](http://water.usgs.gov/admin/memo/QW/qw92.01.html). |
| Ventilated acid cabinets | NA |
| Wash sink with drying rack | NA |
| Vacuum pump | NA |
| Drying oven | Calibration monitored weekly. |
| Autoclave | Maintained per manufacturer’s instructions. |
| Incubators | Calibration monitored biannu­ally. |
| Freezer | Temperature monitored weekly. |
| Lab pH and specific conduc­tance meter | Calibrated each use. |

### Procedures (Revision 2, August 2012)

The [Name of unit or laboratory]is managed by [title of unit or laboratory man­ager]*.* The [identify responsible party] is responsible for maintaining the laboratory space, supplies, and equipment listed above. The [identify responsible party] maintains QA records of laboratory equipment and supplies, such as calibration standards, chemical reagents, sample preservatives, and sample bottles that are provided to field personnel. The [identify responsible party] is responsible for repair and maintenance of project water-quality equipment and instru­ments. The [identify responsible party] oversees the WSC waste-disposal practices to ensure that procedures are in compliance with State and Federal regulations. The unit operations comply with the [Name] WSC chemical-hygiene plan. The operation of the unit is reviewed annually by [designate WSC staff]and every 3 years by the OWQ.

### Equipment and Supplies (Revision 2, August 2012)

It is the responsibility of [designate WSC staff] to order, store, and quality assure the following field equipment and supplies as needed by field personnel. [Com­plete the list of "field equipment and supplies" with supplies provided by the WSC Field Service Unit.]

Table 5.2. Summary of information on supplies, equipment, and instruments in the **[Name]** WSC [RP, responsible party; NIST, National Institute of Standards and Technology]

|  |  |  |
| --- | --- | --- |
| Supplies, equipment, and instruments | Source and guidelines for QA | Responsible party |
| Sample bottles | [List sources, such as purchase from National Field Supply Services at NWQL, or guidelines for preparation and QA by laboratory manager.] | [Identify RP, such as laboratory manager or project/field office chief.] |
| Coolers/shipping containers | [List source and guidelines for QA; refer to [OWQ Tech. Memo 92.06](http://water.usgs.gov/admin/memo/QW/qw92.06.html), [NWQL Tech Memo 2011.01](http://wwwnwql.cr.usgs.gov/tech_memos/nwql.2011-01.pdf)] | [Identify RP, such as laboratory manager or project/field office chief.] |
| Sample preservatives | [List source.] | [Identify RP, such as *laboratory manager or project/field office chief.]* |
| pH calibration standards | Commercially prepared buffers, traceable to NIST Standard Reference Material. | [Identify RP, such as laboratory manager or project/field office chief.] |
| Specific conductance calibra­tion standards | Commercially prepared buffers, traceable to NIST Standard Reference Material. | [Identify RP, such as *laboratory manager or project/field office chief.]* |
| Blank water for QA | [List source; refer to [NWQL Memo 92.01](http://wwwnwql.cr.usgs.gov/tech_memos/nwql.1992-01.pdf).] | [Identify RP, such as laboratory manager or project/field office chief.] |
| Deionized water | [Describe source and guidelines for QA; refer to [OWQ Tech. Memo 92.01](http://wwwnwql.cr.usgs.gov/tech_memos/nwql.1992-01.pdf).] | [Identify RP, such as *laboratory manager or project/field office chief.]* |
| [List other supplies if appropriate.] |  |  |
| Isokinetic water-quality sam­plers | [Specify guidelines for purchase and QA.] | [Identify RP, such as *laboratory manager or project/field office chief.]* |
| Splitting devices | [Specify guidelines for purchase and QA.] | [Identify RP, such as *laboratory manager or project/field office chief.]* |
| [List other equipment if appropriate.] |  |  |
| Specific conductance meters | [Specify guidelines for purchase and QA.] | [Identify RP, such as *laboratory manager or project/field office chief.]* |
| pH meters | [Specify guidelines for purchase and QA.] | [Identify RP, such as *laboratory manager or project/field office chief.]* |
| [List other instru­ments.] |  |  |

##

## Mobile Labs and Water-Quality Field Vehicles

[In some WSCs, mobile laboratories may be considered an extension of the Field Service Unit so that these two sections could more appropriately be combined. If vehicles are used for hazardous-waste site activities, include appropriate guidelines and safety information.]

Mobile laboratories are vehicles that are designed, designated, and outfitted for use during water-quality sample-collection and processing activities at or near sample-collection sites. The WSC maintains vehicles designated for water-quality sample collection and processing. If a non-designated vehicle must be used for water-quality work, portable processing and preservation chambers are used for sample processing, and extra QC samples are collected to document that the data have not been compromised. Refer to the [National Field Manual for the Collection of Water-Quality Data](http://water.usgs.gov/owq/FieldManual/) ([U.S. Geological Survey, variously dated](http://water.usgs.gov/owq/FieldManual/)) for guidelines on procedures for collecting and processing water-quality data.

A field vehicle is designated as a water-quality field vehicle when it meets criteria to maintain a non-contaminating environment for the constituents being sampled. The work area must be maintained to minimize sources of sample contamination. Specifica­tions for vehicles used when sampling for water-quality constituents are discussed by [Horowitz and others (1994)](http://pubs.usgs.gov/of/1994/0539/report.pdf) and in the NFM ([Lane and others, 2003, chap. A2.3](http://pubs.water.usgs.gov/twri9A2/)) and include the following: [Amend the list below according to your WSC’s criteria for water-quality field vehicles.]

* Materials used for cabinets, storage, and work surfaces must be easy to maintain, made of or covered with non-contaminating materials, and such that they can be cleaned with water or solvents as appropriate. Cargo must be restricted to equipment and supplies related to water-quality sample collection unless stored in a separate compartment. No potentially contaminating equipment or sup­plies, such as sounding weights, solvents, fuel, etc., may be transported in the interior compartment of the vehicle.
* A dust barrier exists between the cab and work area of the vehicle, as well between the cargo area and work areas of the vehicle.

[Identify responsible party] is responsible for vehicle maintenance, for maintain­ing the suitability of the vehicle for water-quality sample collection, and for keeping the vehicle supplied.

# Water-Quality Instruments

The [Name] WSC complies with the WMA policy of providing personnel with high-quality field instruments and equipment that are safe, precise, accurate, dura­ble, reliable, and capable of performing required tasks ([WRD Memorandum 95.35](http://water.usgs.gov/admin/memo/policy/wrdpolicy95.035.html)). Accordingly, appropriate instruments for use in water-quality projects in the WSC should be selected based upon the specifications described in the USGS NFM,Chapter A6 ([Wilde, variously dated](http://pubs.water.usgs.gov/twri9A6/)) and the requirements of the project. The Hydrologic Instrumentation Facility (HIF), which pro­vides analyses of precision and bias for water-quality instruments, also should be con­sulted for recommendations when appropriate. Consultation with [identify responsible party] should be done if project personnel need assistance with the selection or use of equipment.

All instruments used by WSC personnel for water-quality measurements are to be properly operated, maintained, and calibrated. For correct operation of any field or laboratory equipment, the manufacturer’s operating guidelines should be carefully fol­lowed. Most instruments will be calibrated in the field prior to making the sample mea­surements, as described below. Information regarding the preparation and storage of calibration standards is provided in Section 5.0 of this QA plan.

Thorough documentation of all calibration activities associated with water-quality data collection is a critical element of the WSC QA program. Calibration and mainte­nance records of field equipment need to meet the following criteria:

* bound notebook with sequentially numbered pages (no looseleaf);
* includes the manufacturer, make, model, and serial or property number;
* all notes and recorded information in the log book are in waterproof ink;
* include maintenance record;
* include all calibration information, which includes initials of operation, date of calibrationoperator, calibration data, and lot numbers and expiration dates of buffers and standards;
* any other relevant information pertaining to the operation and maintenance of the equipment.

 Similar records for WSC laboratory equipment (see table 5.1.1.) are to be kept by [identify position of responsible party, such as laboratory manager]. Calibration and maintenance records for field and laboratory equipment are reviewed and checked periodically throughout the year by [identify responsible party] for completeness and accuracy.

[The WSC also should include additional information, as appropriate, concern­ing recommended procedures for the use of single or multiparameter water-quality mon­itors for continuous monitoring. For example, provide statements describing standard procedures for the installation of continuous monitors, guidelines on the frequency of inspection and servicing (or the use of local observers to provide systematic cleaning and report malfunctions), and the documentation requirements for each servicing trip (Wagner and others, 2006).]

## Calibration of Water-Quality Instruments (Revision 2, August 2012)

Table 6.1. provides summary information regarding the calibration methods, accep­tance criteria, calibration frequency and location, responsible persons, and references for specific instructions for the calibration and use of water-quality instruments to measure selected parameters in the [Name] WSC.

[The WSC may include asimilar table for calibrating continuous water-quality instruments (Wagner and others, 2006).]

Table 6.1. Summary of calibration information for water-quality instruments used to discretely measure selected parameters in the [Name] WSC.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Parameter | Calibration method used | Acceptance criteria and response if not acceptable | Calibration frequency and location | Responsible per­son | Reference for calibration and use |
| Temperature | NIST-certified thermometer | [Specify acceptable range, such as within 3 or 5 percent; and response, such as replacement.] | [Specify fre­quency, such as semi-annu­ally] in laboratory. | [Identify RP, such as labora­tory man­ager.] | [Wilde, 2006](http://water.usgs.gov/owq/FieldManual/Chapter6/6.1_contents.html); see manufac­turer’s instruc­tions. |
| Specific conductance  | At least two standards, bracketing expected values | [Specify acceptable range, such as within 3 or 5 percent; and response, such as clean­ing or replacement of probe.] | Daily in field, if appropriate, prior to taking measure­ments. | Field personnel or [identify RP, such as labora­tory man­ager], as appropriate. | [Radtke and others, 2005](http://water.usgs.gov/owq/FieldManual/Chapter6/6.3_contents.html) ; see manufac­turer’s instruc­tions. |
| pH | Two-point calibration, bracketing expected values | [Specify acceptable range, such as calculated slope must be within 5 per­cent of theo­retical slope; and response, such as clean­ing or replacement of probe.] | Daily in field, if appropriate, prior to taking measure­ments. | Field personnel or [identify RP, such as labora­tory man­ager], as appropriate. | [Ritz and Collins, 2008](http://water.usgs.gov/owq/FieldManual/Chapter6/6.4_contents.html); see manufac­turer’s instruc­tions. |
| Dissolved oxygen  | One or two point calibration [Specify standard procedure, such as air calibration in water.] | [Specify acceptable range, such as within 3 or 5 percent; and response, such as changing membrane or replacement of probe.] | [Specify fre­quency, such as daily or at each sam­pling site] in field or laboratory, asappropriate, prior to taking measure­ments. | Field personnel or [identify RP, such as labora­tory man­ager], as appropriate. | [Lewis, 2006](http://water.usgs.gov/owq/FieldManual/Chapter6/6.2_contents.html); see manufac­turer’s instruc­tions. |
| Barometric pressure | Mercury barometer | [Specify acceptable range, such as within 5 millimeters Hg; and response, such as replacement.] | [Specify fre­quency, such as before each field trip.] | [Identify RP, such as labora­tory man­ager.] | See manufac­turer’s instruc­tions. |
| Other parameters, such as turbidity or redox, as appropriate |  |  |  |  |  |

# Site Selection and Documentation

Deciding where to sample is an important initial step toward achieving project objectives and meeting WSC QA/QC requirements. Once a site is selected, thorough documentation, usually in the form of a station description, is required.

## Site Selection

Site selection for sampling is important to the validity of water-quality data. Selec­tion of a suitable site can be made only after considering a number of factors, including the need for information in a particular location, the suitability of a site for sampling, and its accessibility and safety. Specific guidelines for site selection are contained in Wilde ([2005](http://water.usgs.gov/owq/FieldManual/chapter1/Ch1_contents.html)). The project chief and (or) Field Office chief is responsible for the selection of sampling sites, after consultation with the Water-Quality Specialist and the Surface-Water or Groundwater Specialist, as appropriate.

### Flowing Surface Waters (Revision 2, August 2012)

If possible, water-quality stations are located at or near streamflow-gaging stations. Typically, the objective is to collect samples that represent the stream cross-section; therefore, well-mixed reaches are ideal location for sample collection. If this is not possible, the water-quality station should be located where the stream dis­charge can be measured, and water samples can be collected at all stages of flow to be monitored. If the water-quality station is located too close downstream from either the confluence of two or more streams or a point source of pollution, the collection of a rep­resentative sample may be difficult because of incomplete mixing. Under such condi­tions, the criteria for the minimum number of vertical transects sampled may need to be increased, and lateral mixing should be documented with cross-sectional surveys at var­ious stages of flow.

### Still- or Open-water sites (Lakes, reservoirs, wetlands, estuaries, and coastal waters)

Site selection for still-or open-water locations such as lakes, reservoirs, wetlands, estuaries, and coastal waters, additional factors must be considered. Study objectives will dictate site placement and sampling strategy. For example, objectives may require sampling at fixed points rather than cross sections and(or) sampling at multiple depths. To obtain a representative sample, natural lakes typically are sampled near the center or at the deepest location in the water body. Other lake studies may focus on water quality of near-shore areas, such as swimming beaches. Reservoirs typically exhibit a olongitudinal gradient of water-quality from the shallow headwaters to the deepest water near the dam, ant this gradient shoube be considered when developoing a sampling strategy. Sites near structures such as marinas, boat ramps, docks, and piers are avoided, unless these areas are specifically targeted for study.

### Wells (Revision 2, August 2012)

The selection of wells for groundwater sampling is dependent on many variables, including location, depth and accessibility of the well, type of well completion, availabil­ity of geologic and water-use information, and sampling purpose(s). If suitable existing wells cannot be found, new wells will need to be installed.

### Other Sites (meteorological sites and facilities)

[The WSC should include additional information, as appropriate, concerning selection of other types of sites, such as springs, wet and dry deposition; drinking-water plants, wastewater plants and other facilities; storm water conveyance systems, etc.]

## Site Documentation

The project chief and (or) Field Office chief constructs a physical or electronic site records folder containing descriptive information on loca­tion, conditions, purpose, and ancillary information for all new water-quality data-col­lection sites. Consultation with the appropriate discipline specialist during site establishment is advised to ensure that WSC minimum requirements are met. Much of this information also is stored electronically in computerized site files maintained by the [identify responsible party such as DBA, Data Management Section, etc]. [Identify responsible party]is responsible for assuring that the site file is maintained for each data-collection site. Data that document the site are entered and maintained in the WSC Management Groundwater Site-Inventory System (GWSI) [identity any other physical site records location or electronic records management system such as SIMS]. Archiving is discussed in Section 10.4.

To standardize and facilitate the processing of water-quality data in the WSC, and to assure that water-quality data are entered in the proper database in a timely manner, the following procedures are followed:

* Site records are established in the Groundwater Site-Inventory System (GWSI) of the NWIS database for each new site at which water-quality samples are or have been collected. A site-file record must exist in the NWIS site file before analytical data arrive from the NWQL. New site-file data must be checked by Project or Field Office personnel. These verified site records are stored in GWSI, and the resulting water-quality data are stored in the Water-Quality subsystem (QWDATA) of the NWIS database. The [Identify responsible party]is responsible for entry of the site-file records and maintenance of the site-file records. The pertinent information that comprises the site file must be entered in GWSI prior to data collection activities but no later than [number] days after sample collection.
* For each sample sent to the NWQL for analysis, an Analytical Ser­vices Request (ASR) form is completed by the Project or Field Office Chief with a copy (or facsimile) retained in a project file as part of the sample tracking system. The ASR forms can be downloaded from the NWQL ([OWQ Tech Memo 2011.04](http://water.usgs.gov/admin/memo/QW/qw11.04.html)) or produced from Personal Computer Field Forms (PCFF).

[All information about the site that is mandated by WSC policy should be clearly stated in this section. WSCs should reference their surface- and groundwater-GWSI forms and water-quality field forms to draw attention to the data needed during the site-selection phase of the project.]

### Surface Waters

A station description is prepared for each water-quality station that is sampled on a regular or periodic basis. River and stream sites established at existing surface-water gaging stations com­monly will need only supplemental information to complete the description. Other sur­face-water sites, such as lakes, estuaries, and coastal waters, may require varying amounts of supplemental information to complete the station descriptions. Consultation. Normally, the minimum electronically stored information required for a surface-water site-file record is dictated by the NWIS software used by the WSC. The minimum information required for establishing electronic files in NWIS for surface water is listed in table 1-1 in ([Wilde, 2005](http://pubs.water.usgs.gov/twri9A1/)). For continuous water-quality monitoring sites, station-description requirements are presented by [Wag­ner and others (2006)](http://pubs.usgs.gov/tm/2006/tm1D3/).

[Most WSCs expand upon these requirements, and these additional data criteria should be listed in this section of the report. The location of landowner agreements and permits for Federal land to access the site or install structures for sampling and monitoring are described here. All information about the station or sampling site that is mandated by WSC policy should be clearly stated in this section of the report.]

### Groundwater Wells

A well file (analogous to a station description above) is prepared for each well that is sampled on a regular or periodic basis. Although a well may be scheduled to be sampled once during the study period, it is not exempt from a well file for regularly sampled sites and should contain most if not all the same information. Normally, the minimum electronically stored information required for a groundwater-quality site is dictated by the NWIS soft­ware used by the WSC. The minimum information required for establishing electronic files in NWIS is listed in table 1-4 in [Wilde (2005)](http://pubs.water.usgs.gov/twri9A1/). Paper docu­ments, such as agreements for use of the well between the well owner and the USGS, also should be stored in the appropriate file.

### Other Sites

[Documentation for other less common site types, such as“Facilities”, and wet and dry deposition, should be stated in this section of the report.]

# Sample Collection and Processing

Water-quality data collected by the USGS are used by agencies throughout the Fed­eral, State, and local levels to guide their decisions concerning the appropriate and effi­cient management of water resources for the Nation. Water-quality data are collected as part of such Federal programs as the National Stream-Quality Accounting Network (NASQAN) and the National Water-Quality Assessment (NAWQA) Program, as well as cooperative projects jointly funded by local or State agencies, and are a vital component of water-resources activities performed by the USGS and the [Name] WSC.

The primary objective in collecting a water-quality sample is to obtain environmen­tal data that are representative of the system that is being studied. Sampling and process­ing techniques for specific constituents may vary according to the general class of compound, such as inorganic or organic chemicals. If incorrect sampling procedures pro­duce a non-representative sample, or if the sample is contaminated or degraded before analysis can be completed, the value of the sample is limited and the data are question­able. Therefore, compliance with documented and technically approved sample-collec­tion and processing protocols is critical to ensuring the quality of water-quality data.

It is the policy of this WSC that all personnel involved in collecting and process­ing water-quality data will be adequately informed and trained regarding water-quality data-collection and processing procedures established by the WMA. [If appropriate, pro­vide additional information about WSC policy pertaining to conformance to WMA guidelines for collecting and processing water-quality samples. Include appropriate sections for special sampling methods or devices such as passive diffusion and automatic samplers as needed] Because of rapid changes in technology, however, new and improved methods for sample collection and processing are continually being developed. All WSC personnel who are involved in water-quality sampling must be aware of changing requirements and recommendations. The [identify the responsible party] is responsible for providing current information to field personnel on the correct protocols to follow in collecting and processing water-quality samples.

The WSC Data Chief, project chief, Field Office Chief and Field personnel follow the sample collection and processing procedures described in the National Field Manual ([USGS, 2006, chap. A4](http://pubs.water.usgs.gov/twri9A4/)), to ensure the quality of the data collected. The USGS National Training Center’s two week field methods course (QW1028) is highly recommended for all staff collecting water-quality data. After the completion of the two week field methods course, staff who remain active or resume water-quality data collection activities should attend the USGS National Training Center’s one week field methods refresher course (QW3190) about every 5 years.

The Project or Office Data Chief also is responsible for seeing that field personnel take the following steps to ensure the quality and integrity of the WSC’s water-quality data:

**Discrete/Periodic Water-Quality Data**

* Samples must be collected and processed according to prescribed USGS proto­cols, as described and referenced below.
* All samples are collected and processed at the field site. If hazardous conditions preclude on-site processing or render the site unsafe the sample is processed nearby or as soon as safe conditions exist. [Special routine circumstances that require sample processing away from the field site or other delayed sample processing should be described here. Such circumstances may include sampling from deep canyons, transportation by helicopter, etc]
* All samples are shipped to the laboratory from the field, when applicable, in an expedient manner to be received by the laboratory within the required holding times for each analysis.
* All samples are logged into NWIS (usually within 7 days of sample col­lection) prior to the completion of analysis and transmittal of the results back to the WSC.
* All analytical data are to be reviewed in a timely manner and within the required holding times for each analysis (to allow time for re-analysis), and fully documented in the station analysis file as to meet the policy of the WMA ([OWQ Tech memo 2012.03](http://water.usgs.gov/admin/memo/QW/qw12.03.pdf)) or WSC policy.
* Data Quality Indicators (DQI) for reviewed data are set to the appropriate code in accordance with [OWQ Tech memo 2012.03](http://water.usgs.gov/admin/memo/QW/qw12.03.pdf).

**Continuous Water-Quality Data**

* For flowing surface water, the site should be located in a section of the stream that is vertically and horizontally well-mixed and representative of the cross section being measured.
* Location of the sensors must be fully documented, in paper files and SIMS or a similar data management system.
* All pertinent information regarding the site, cross-sectional variability, equipment maintenance, and data shifts are fully documented and included in the station analysis file.
* Monitors are inspected and calibrated as frequently as required to obtain as complete a record as possible
* Sites are operated as described by [Wagner and others (2006)](http://pubs.usgs.gov/tm/2006/tm1D3/).
* Continuous records are processed in accordance with [WRD Policy Memo 2010.02](http://water.usgs.gov/admin/memo/policy/wrdpolicy10.02.html).

## Constituents in Water

Most studies that are designed to evaluate the water quality of an aquatic system are based upon analyses of physical and chemical parameters associated with the water. Physical parameters generally are measured in the field, whereas most chemical param­eters require laboratory analysis. This section of the QA plan includes an overview of rel­evant WSC and WMA policies, as well as references for specific procedures pertaining to the measurement of field parameters and the collection and processing of samples for water-quality analysis. Information in this section is drawn primarily from the NFM—a TWRI that describes in greater detail the recommended and required policies and procedures for collecting and processing water-quality samples. The project proposal and workplan also should be consulted for specific guidelines for field personnel regarding details of sam­ple collection and processing.

### Field Measurements

Routine field measurements include water temperature, dissolved oxygen concen­tration, specific conductance (conductivity), pH, and alkalinity. Other types of measure­ments that also may be necessary for specific projects include acid neutralizing capacity, reduction-oxidation potential (Eh), and turbidity. Procedures for collecting field measurements in surface-water and groundwater systems are provided in chapter A6 of the NFM ([Wilde, variously dated](http://pubs.water.usgs.gov/twri9A6/)). Field measurements should rep­resent, as closely as possible, the natural conditions of the system at the time of sampling. To ensure quality of the measurements, calibration within the range of field conditions at each site is required for most instruments. Instrument calibrations are documented in dedicated instrument logbooks as described in the NFM.

Field-measurement data , including methods, equipment, and calibration information are recorded while in the field. Field-measurement data are stored either electronically (such as PCFF) or on paper field forms. A template for customizing paper field forms is available at [http://water.usgs.gov/usgs/owq/Forms.html](http://water.usgs.gov/usgs/owq/Forms.html%20). The customized field form is reviewed by [identify all responsible parties associated with field form processing] for a particular project. The [identify responsible party] is responsible for reviewing paper and electronic field records for completeness. To avoid the loss of data because of possible instrument malfunction, [identify responsible party] should ensure that backup sensors or instruments are readily available and in good working condition.

To document the quality of field measurements, all WSC personnel involved in the collection of water-quality data are required to participate in the National Field Qual­ity Assurance (NFQA) Program ([Stanley and others, 1992](http://pubs.usgs.gov/of/1992/0163/report.pdf)). Results of the NFQA Pro­gram are reviewed by the WSFT Water-Quality Specialist and the WSC Water-Quality Specialist [or identify other responsible party]. Staff receiving an unsatisfactory rating will be required to satisfactorily analyze a follow-up (Round 2) NFQA sample. Staff unable to receive a satisfactory rating on both the initial and follow-up NFQA samples must retrain in that field measurement and demonstrate the ability to produce an accurate measurement before they may continue collecting water-quality data. [or identify other corrective actions related to the NFQA Program]*.*[Here, the WSC should include descriptions of QC checks for field measurements that are rec­ommended or required, such as the use of reference samples as part of a QA pro­gram for field measurements, or checking the precision of field measurements on subsamples by repeating the measurement on some predetermined basis].

### Cleaning of Sampling and Processing Equipment

Procedures for cleaning equipment used for water-quality sampling and processing are described in chapter A3 of the NFM ([Wilde, 2004](http://pubs.water.usgs.gov/twri9A3/)). All new equipment acquired for water-quality sampling, as well as equipment that has been in long-term storage, must be cleaned in the office before being used in the field. Similarly, equipment must be cleaned as soon as possible after sample collection and before being used again to avoid cross-contamination between sampling sites. The field rinsing of equipment only with site water just prior to sample collection is not a sub­stitute for proper cleaning.

Equipment blanks are a particular type of blank sample that is used to verify that cleaning procedures used by the field personnel are adequate for removing contamina­tion and are not introducing contamination. These blanks ensure that individual pieces of sampling equipment, sample handling, cleaning, and processing procedures are sufficient to produce contaminant-free samples. Equipment blanks, collected in the office laboratory, are required 1) annually, 2) when a cleaning procedure is followed for the first time, and 3) when new equipment will be used for the first time. An equipment blank is blank water that is processed under controlled conditins in the laboratory by being passed through each component of the sample sample processing and collection equipment ([Horowitz and others, 1994](http://pubs.usgs.gov/of/1994/0539/report.pdf); [Wilde, 2004](http://pubs.water.usgs.gov/twri9A3/)). Equipment blanks for new projects or studies are collected well enough in advance of sampling to allow for review and assessment of the blank data prior to data collection activities and annually thereafter. Equipment blanks that indicate detectable levels of constituents require submission of blanks for individual components of the equipment to isolate the source of contamination. When the source of contamination has been deter­mined, the necessary maintenance must be performed to eliminate contamination, or the equipment must be replaced. The [identify the responsible party] monitors the results of annual equipment blanks and ensures compliance with WSC standards.

### Surface-Water Sampling

Collecting surface-water samples that accurately represent the physical and chem­ical characteristics of the aquatic system requires the appropriate use of sampling equip­ment and methods in order to describe environmental variability and to prevent contamination or bias in the sampling process. All WSC personnel who are involved in water-quality studies must be well informed of the various factors that must be con­sidered to ensure the collection of representative samples. The choice of sampling equip­ment and method of sample collection are based on established protocols and guidelines, depending upon the characteristics of the target constituents, study objectives, hydro­logic conditions, and sampling logistics.

#### Equipment Selection

Guidelines for selecting equipment for sampling surface water are provided in [Horowitz and others (1994)](http://pubs.usgs.gov/of/1994/0539/report.pdf) and in chapter A2 of the NFM ([Lane and others, 2003](http://pubs.water.usgs.gov/twri9A2/)). [The WSC may include additional guidelines regarding equip­ment selection for specific situations, such as sampling in estuaries, as appropriate.] Review of equipment selection by WSC technical specialists occurs during proposal and workplan review and during periodic project reviews.

#### Sample Collection

Guidelines for the collection of surface-water samples are provided in chapter A4 of the NFM ([U.S. Geological Survey, 2006](http://pubs.water.usgs.gov/twri9A4/)). Field personnel are respon­sible for examining the sampling site carefully and choosing the most appropriate sam­pling method to collect the best, most representative sample possible under the conditions at the time of sampling. The standard procedure for stream sampling is to collect the sample through the entire depth of the water column at multiple vertical transects by either the equal-dis­charge or equal-width increment method. These procedures are used to collect a representative cross-sectional sample that is both flow-weighted and depth- and width-integrated ([OWQ Technical Memorandum 99.02](http://water.usgs.gov/admin/memo/SW/sw99.01.pdf); [Edwards and Glysson, 1999](http://pubs.usgs.gov/twri/twri3-c2/pdf/TWRI_3-C2.pdf); [Ward and Harr, 1990](http://pubs.usgs.gov/of/1990/0140/report.pdf)). Occasionally, the use of non-inte­grated or non-flow-weighted methods may be appropriate because of hydrologic, cli­matic, or safety conditions, or specific project objectives. [The WSC may wish to include additional policy statements pertaining to the use of non-standard sampling methods, such as “...dip samples from the centroid are acceptable when extreme flood or other conditions preclude the collection of the standard sample.”] Thorough documen­tation of sampling equipment and methods that are used is required in field records asso­ciated with water-quality samples. The [identify the responsible party, such as project chief and (or) Field Office chief] is responsible for timely review of field records.

All Field personnel follow a prescribed order of sample col­lection, described in the National Field Manual ([USGS, 2006, chap. A4](http://pubs.water.usgs.gov/twri9A4/)), to help ensure the quality of the data collected. In addition, two-person sam­pling teams are required to implement coordinated clean-handling techniques when col­lecting samples for trace elements with ambient concentrations at or near 1 g/L or when aluminum, iron, or manganese ambient concentrations are up to about 200 g/L ([USGS, 2006](http://pubs.water.usgs.gov/twri9A4/)). [The WSC should provide specific state­ments of policy regarding the use of ppb techniques for other studies that include inor­ganic constituents, such as “...the two-person sampling protocol may be modified as appropriate for studies in which low-level trace elements are not measured.” Such modifications are reviewed and approved by the Water-Quality specialist and must be documented in project records]

[The WSC should include additional guidelines for sample collection under spe­cific local conditions, such as use of automatic samplers and sampling in estuaries, as appropriate.]

Review of surface-water sampling procedures for each WSC water-quality project is performed at least annually by [identify the responsible party] and is docu­mented with a memorandum to the appropriate project chief and (or) Field Office chief and the WSC Director. An independent review of field methods, for at least one WSC project, is conducted once every 3 years during the OWQ WSC technical review.

### Groundwater Sampling

Groundwater sampling procedures are designed to ensure that the samples represent the water in the aquifer and are not contaminated by well con­struction material or sampling equipment, and that the composition of the samples is not altered by physical or chemical processes during sampling. It is critical that field person­nel are aware of all the factors that can compromise the integrity of groundwater samples and implement consistent strategies to protect sample integrity.

#### Equipment Selection

Guidelines for selecting appropriate equipment for groundwater sampling are pro­vided in the NFM ([Lane and others, 2003, chap. A2](http://pubs.water.usgs.gov/twri9A2/)). All project personnel involved in groundwater sampling for water-quality studies must be familiar with the advantages and disadvantages of available equipment with respect to study objec­tives. Because of the wide range of factors involved, the ideal equipment for sample col­lection under some circumstances may not exist. When compromise decisions are required, the field team must thoroughly document with field notes the compromises that are made. Review of equipment selection occurs during proposal and workplan review and during periodic project reviews by WSC technical specialists.

#### Sample Collection

Guidelines, which prevent or minimize loss of sample integrity, for collecting rep­resentative water-quality samples from groundwater are provided in chapter A4 of the NFM ([USGS, 2006](http://pubs.water.usgs.gov/twri9A4/)). The standard procedure for groundwater sampling is to purge the well to remove at least three well volumes of standing water while monitoring field measurements for stabilization. However, excep­tions to the three-well-volume rule can be made under some circumstances, depending upon project objectives or site characteristics. The [identify the responsible party, such as project chief and (or) Field Office chief] is responsible for timely review of field records.

All field personnel follow a prescribed order of sample col­lection, described in the NFM ([USGS, 2006, chap. A4](http://pubs.water.usgs.gov/twri9A4/)), to help ensure the quality of the data collected. In addition, two-person sam­pling teams are required to implement coordinated clean-handling techniques when col­lecting samples for trace elements with ambient concentrations at or near 1 g/L or when aluminum, iron, or manganese ambient concentrations are up to about 200 g/L ([USGS, 2006](http://pubs.water.usgs.gov/twri9A4/)). [If appropriate, the WSC should provide additional statements of policy regarding the use of ppb techniques for groundwater sampling.]

Review of groundwater sampling procedures for each water-quality project is performed at least annually by[identify the responsible party] and docu­mented with a memorandum to the appropriate project chief and (or) Field Office chief and the WSC Director. An independent review of field methods, for at least one project, is conducted once every 3 years during the Office of Water Quality technical review.

### Precipitation Sampling

Specific procedures in the **[Name]** WSC for collecting precipitation sam­ples are based primarily on the study objectives. Major factors that must be considered in sampling for precipitation quality include the location of sampling stations relative to human influences as well as natural influences such as overhanging trees and vegetation, the choice of sampling equipment, and special sample-handling procedures that may be necessary. A major decision is whether to collect wet-only samples, requiring an automated wet-only precipitation sampler, or bulk deposition samples where the sampler is exposed to precipitation and dry deposition between precipitation events. Integrated snowpack sampling is another form of precipitation sampling possible where a seasonal snowpack develops. Precipitation-quality sampling equipment should be composed of inert, nonabsorbent material that will not affect the typically low concen­trations of ions in solution.

Guidelines regarding the collection of precipitation samples are provided in the fol­lowing references which set standards for sites in the National Atmospheric Deposition Program precipitation chemistry networks :

1. NADP Site Selection and Installation Manual, Version 1.5, May 2011
<http://nadp.sws.uiuc.edu/lib/manuals/NADP_Site_Selection_and_Installation_Manual.pdf>
2. NADP Site Operation Manuals
 National Trends Network (majors ions, nutrients, acid anions in precipitation [[Dossett and Bowersox, 1999](http://nadp.sws.uiuc.edu/lib/manuals/opman.pdf)])
 <http://nadp.sws.uiuc.edu/lib/manuals/opman.pdf>
 Mercury Deposition Network (2003; total and methyl mercury in precipitation)
 <http://nadp.sws.uiuc.edu/lib/manuals/mdnopman.pdf>

The USGS BQS operates a Precipitation Quality Assurance Project. Project personnel and project publications should be consulted for guidance on general QA techniques and approaches when sampling precipitation chemistry. Project and contact information can be found at <http://bqs.usgs.gov/Precip/>.

Precipitation sampling can involve as many variables and constituents as any other water-quality project, along with unique factors associated with precipitation collection. The project proposal and workplan should be consulted for specific guidelines regarding the factors that must be considered in choosing the sample location, the sam­pling equipment and frequency, and the special sample handling procedures that may be necessary based upon the study objectives.

*[The WSC may wish to add specific policies that pertain to precipitation sam­pling for special projects, such as regional or background precipitation-quality studies, as appropriate.]*

### Sample Processing

All water-quality samples are processed at the field site according to procedures described in the NFM ([Wilde and others, 2004, chap. A5](http://pubs.water.usgs.gov/twri9A5/)) and as soon as possible following collection. Processing procedures may require deviations from those described in the NFM in order to properly prepare samples for the constituents of interest or to meet the study objectives. Any deviation from the procedures in the NFM are described in the project workplan.

All WSC water-quality studies that include the analysis of trace elements in con­centrations less than 10 ppb must use the protocols for sample processing as described in [Wilde and others (2004)](http://pubs.water.usgs.gov/twri9A5/). These techniques require the use of processing and preservation chambers to reduce the potential for contamination from the surrounding environment during sample splitting, filtration, and preservation. [The WSC may choose to add specific policy statements concerning modifications to ppb techniques for sample processing that are acceptable for other WSC water-quality studies.]

Review of sample processing procedures for all water-quality projects occurs during proposal and workplan review and during periodic project reviews by the WSC Water-Quality Specialist [or identify other responsible party].

#### Sample Compositing and Splitting

Guidelines for using sample compositors and splitters are in the NFM ([Wilde and others, 2004, chap. A5](http://pubs.water.usgs.gov/twri9A5/)). Two types of sample splitters pres­ently in use in the WMA are the churn splitter, which also serves as a compositing device, and the cone splitter, which requires a separate compositing vessel. Each splitter has spe­cific advantages and disadvantages, as described in [OWQ Technical Memorandum 97.06](http://water.usgs.gov/admin/memo/QW/qw97.06.html). Either splitting method can be applied to inorganic and organic constituents within the technical design limits of the device and provided the equipment is con­structed of appropriate materials and properly cleaned.

#### Sample Filtration

Filtration is required for many water-quality samples in order to separate particu­lates from the water and constituents in solution. Selection of the appropriate filter unit and filter characteristics to be used depends on the constituent class of interest and is based on guidance provided in the NFM ([Lane and others, 2003, chap. A2](http://pubs.water.usgs.gov/twri9A9/)). Guidelines for filtration procedures for specific constituent groups are provided in the NFM ([Wilde and others, 2004, chap. A5](http://pubs.water.usgs.gov/twri9A5/)). For surface water, the most common filtration system consists of a variable-speed battery-operated peristaltic pump and 0.45-micron pore size disposable capsule filter. For groundwater, the sample is generally pumped directly from the well through a 0.45-micron pore size disposable capsule filter. Filtration of samples for analysis of trace ele­ments in concentrations less than 10 ppb must be done in a processing chamber that encloses the filtering unit and sample bottles in a protected environment ([Wilde and oth­ers, 2004](http://pubs.water.usgs.gov/twri9A5/)).

 Surface-water and groundwater samples collected for organic analysis may require the use of an aluminum plate filter with a 0.7 micron glass fiber filter. Surface-water samples are pumped through Teflon tubing using either a ceramic-piston valveless metering pump or Teflon diaphragm pump head on a peristaltic pump. Groundwater samples collected for filtered organic analysis are pumped directly from the well through Teflon tubing using either an aluminum plate filter with a 0.7 micron glass fiber filter or a 47mm diameter Teflon filter unit with a 0.7 micron glass fiber filter ([Wilde and others, 2004](http://pubs.water.usgs.gov/twri9A5/)). The NFM ([Wilde and others, 2004, chap. A5](http://pubs.water.usgs.gov/twri9A5/)) recommends that filtration of samples for organic analysis take place in a processing chamber that encloses the filtering unit and sample bottles in a protected environment.

[The WSC may choose to add specific policy statements regarding filtration procedures such as dissolved organic carbon and chlorophyll]

#### Sample Preservation

Sample preservation techniques are required for some constituent groups to prevent reduction or loss of target analytes and to stabilize analyte concentrations for a limited time. Guidelines for sample preservation are provided in the NFM ([Wilde and others, 2004, chap. A5](http://pubs.water.usgs.gov/twri9A5/)), and the [NWQL Services Catalog](http://wwwnwql.cr.usgs.gov/USGS/catalog/index.cfm). Since some samples have a very limited holding time even when pre­served, field personnel must ensure that all water-quality samples are shipped to the lab­oratory as quickly as possible and that time-sensitive samples are received in good condition within the appropriate holding time. For details on sample shipping require­ments, refer to the section 9.0 of this QA plan. [Describe the WSC’s procedure for ensuring that samples arrive at the laboratory in good condition. For example, some WSCs enclose a return postcard so that the lab can report the temperature of the cooler when received. Describe the procedure for ensuring that holding times are met.]

## Other Types of Water-Quality Samples

Many water-quality studies in the WMA employ a multidisci­plinary approach that relies on data from a range of sampling media. A variety of differ­ent types of biological, sediment, and radiochemical samples may be incorporated into a water-quality project in order to provide multiple lines of evidence with which to evalu­ate a particular aquatic system. This section of the QA plan includes an overview of stan­dard WSC QA procedures and references for detailed instructions that describe the collection of biological, sediment, and radiochemical samples. [The WSC should amend and include elements in this section that are relevant to current work con­ducted in the WSC such as passive diffusion and automatic samplers, etc...]

### Biological Sampling

Water-quality activities in the [Name] WSC [select include, do not include] the collection of biological samples. [If the WSC is involved in collecting biological samples, informa­tion regarding the collection of these samples should be included in this section, as appropriate, for specific projects, including NAWQA. Biological samples may include sampling for bacteria, viruses, or protozoa; biological oxygen demand; chloro­phyll and algae, including phytoplankton or periphyton; benthic invertebrates; fish; and contaminants in biological tissues. Measurements related to biological condition also may include evaluations of stream habitat. Guidelines for documentation and QA and specific references to personnel who can answer questions regarding various kinds of biological sampling should be included. See biological related references in additional references section 8.0 at end of the document for consideration in this section]

### Suspended-Sediment and Bottom-Material Samples (Revision 2, August 2012)

Water-quality activities in the [Name] WSC [select include, do not include] the collection of suspended-sediment and bottom-material samples. [If the WSC is involved in collect­ing sediment samples, include the following sections of this QA plan that pertain to sed­iment. See sediment related references in additional references section 8.0 at end of the document for consideration in this section]

Guidelines for the collection of sediment samples are described in selected WMA publications and in WMA Office of Surface Water (OSW) memoranda (section 14). Suspended-sediment samples are typically analyzed by the [Name] sediment laboratory for concentration and either sand and silt distribution or complete particle-size distribution. Samples for both suspended sediment and bottom sediment may be analyzed for chemical constituents, including trace elements or hydrophobic organic compounds.

Field personnel must be familiar with the factors involved in the selection of sedi­ment-sampling equipment that are based on the type of analyses to be performed and hydraulic conditions, as well as special cleaning procedures that may be required when sampling sediment. The project workplan should be consulted for specific guidelines for sediment sampling, depending on project objectives.

Individuals who have questions regarding the collection and handling of sediment samples should contact [identify the responsible party]. For particular questions con­cerning sediment chemistry samples, contact [identify the responsible party].

## Quality-Control Samples

Quality-control (QC) samples are collected as integral components of all water-quality studies to determine the acceptability of performance in the data-collection process and provide a basis for evaluating the adequacy of procedures used to obtain data. Guidelines for the collection of specific types of QC samples and the use of QC data are provided in the NFM ([USGS, 2006, chap. A4](http://pubs.water.usgs.gov/twri9A4/)). Issues of QC sample design are addressed in section 3.2 of this plan. Specific guide­lines for the collection and processing of QC samples must be included in the project workplan. The project chief and (or) Field Office chief **[or identify other responsible party]** is responsible for reviewing QC data in a timely manner and implementing necessary modifications, when appropriate, to sampling and processing techniques. The WSC Water-Quality Special­ist [or identify other responsible party] has the responsibility for advising WSC per­sonnel regarding the collection and interpretation of QC samples. WSC personnel (project chief, Field Office chief or Data Chief) overseeing the collection of water-quality data should attend the USGS NTC course QW2034, Quality-Control Sample Design and Interpretation.

## Safety Issues

Because the collection of water-quality data in the field can be hazardous at times, the safety of field personnel is a primary concern. Field teams often work in areas of high traffic, remote locations, and under extreme environmental conditions. Field work involves the transportation and use of equipment and chemicals and commonly requires working with heavy machinery. Additionally, field personnel may come in contact with waterborne and airborne chemicals and pathogens while sampling. Beyond the obvious concerns regarding unsafe conditions for field personnel, such as accidents and personal injuries, the quality of the data also may be compromised when sampling teams are exposed to dangerous conditions.

So that personnel are aware of and follow established procedures and protocols that promote all aspects of safety, the WSC communicates information and directives related to safety to all personnel. Specific guidance for safe field operations in the WSC safety plan. *[Describe what actions are taken to communicate this information, such as in-house training classes, memoranda, recorded media, or oth­ers as appropriate.]* Specific policies and procedures related to safety can be found [state where personnel can find this information, such as in the WSC safety plan or other material].

An individual has been designated as Safety Officer by [select the WSC, Region, or other]. The duties of the Safety Officer include [specify the responsibilities of the Safety Officer and the training (s)he provides relative to water-quality activ­ities]. Personnel who have questions or concerns pertaining to safety, or who have sug­gestions for improving some aspects of safety, should direct those questions, concerns, and(or) suggestions to [identify the appropriate individual, such as the supervisor, Safety Officer, or other].

[The WSC may choose to include other specific items related to safety issues, as appropriate.] Guidelines pertaining to safety in field activities are provided in the NFM ([Lane and Fay, 1997 chap. A9](http://pubs.water.usgs.gov/twri9A9/)), the webpage for [Water Resources Safety](http://1stop.usgs.gov/safety/) and [USGS Safety Homepage](http://internal.usgs.gov/ops/safetynet/index.html) .

# Water-Quality Sample Handling and Tracking

All water-quality samples must be uniquely identified, documented, handled, shipped, and tracked appropriately. Following proper protocols for sample handling, shipping, and tracking ensures that samples are processed correctly and expeditiously to preserve sample integrity between the time of collection and the time of analysis. This section describes the procedures used by the [Name] WSC for handling, ship­ping, and tracking samples from collection through transfer of the samples to an analyt­ical facility. Receipt of analytical data from laboratories is covered in Section 10.0 (Water-Quality Data Management).

## Preparation for Sampling

Ensuring that field personnel have the correct equipment and supplies on hand to perform the necessary sampling activities saves time and labor costs associated with repeated sampling trips that result from inadequate planning. Therefore, before com­mencing field activities, the [identify the responsible party] is responsible for ensuring that the following preparations have been completed:

[Fill in steps that are required to be completed before each sampling field trip. These steps may include the following:

* Review the sampling instructions for each site and the list of sample types required.
* Ensure that the station site file is current.
* Prepare bottle labels for samples.
* Ensure that current site information and analytical services request form (ASR) templates are established in PCFF or cbtain field sheets or notebooks and ASRs.
* Ensure that necessary supplies are available, such as bottles, standards, filters, preservatives, meter batteries, waterproof markers, shipping containers, etc. (see section 5.1.3 Equipment and Supplies).
* Ensure that all sampling equipment is thoroughly cleaned and prepared.
* Check meters and sensors for proper performance prior to sampling trip.]

Preparation details are provided in chapter A1 of the NFM ([Wilde, 2005](http://pubs.water.usgs.gov/twri9A1/)).

## Onsite Sample Handling and Documentation (Revision 2, August 2012)

The [identify the responsible party such as WSC Data Chief, Project Chief or Field Office Chief] is responsible for ensuring that all of the sampling require­ments are implemented by all personnel involved in sample collection. During a sampling trip, it is imperative that accurate notes be taken and that sample bottles be labeled and handled appropriately for the intended analysis. Poor sample handling and labeling may result in mislabeled bottles, erroneous data, or destroyed samples. The [identify the responsible party] is responsible for ensuring that all of the following require­ments are implemented:

* Samples are in the required container type and clearly labeled with the station identifier, sample date, sample time, bottle type designation, and laboratory schedule, using a permanent, waterproof marker or preprinted label
* Preservative, if required, is applied immediately
* Field notes are completed before leaving the site, including any instrument calibration information, and documentation of all sampling circumstances and any deviation from standard protocol

Further guidance on sample processing and container types can be found on the [NWQL Catalog](http://nwql.cr.usgs.gov/usgs/catalog/index.cfm) and in [Wilde and others (2004), chap. A5](http://pubs.water.usgs.gov/twri9A5/):

## Sample Shipment and Documentation (Revision 2, August 2012)

Samples are packaged and shipped to the laboratory for analysis as soon as practical. Generally, the shorter the time between sample collection and processing and sample analysis, the more reliable the analytical results will be. Before shipping samples to the laboratory, the [identify the responsible party] should complete the following:

* Ship samples after sample collection and the same day whenever possible.
* Check that sample sets are complete and that sample bottles are labeled correctly, with all required information (see Section 9.2).
* Complete the ASR’s for all samples being sent to the NWQL. If samples are being sent to a different, approved laboratory, information similar to that required on the ASR’s should be provided to the laboratory as well as any additional information required by that approved lab to conduct a timely analysis of the sample.
* Pack samples carefully in shipping containers to avoid bottle breakage, shipping con­tainer leakage, and sample degradation. Check that bottle caps are securely sealed. Follow the packing and shipping protocols established by the USGS and the receiv­ing laboratory (reference [NWQL Technical Memorandum 2011.01](http://wwwnwql.cr.usgs.gov/tech_memos/nwql.2011-01.pdf) and the NFM for additional information; USGS employees can also access NWQL [Rapi-Notes 01-013](http://wwwnwql.cr.usgs.gov/rn.shtml?01-013), [01-023](http://wwwnwql.cr.usgs.gov/rn.shtml?01-023), [01-033](http://wwwnwql.cr.usgs.gov/rn.shtml?01-033), and [01-034](http://wwwnwql.cr.usgs.gov/rn.shtml?01-034)).

[Expand this section as needed to tailor it to the WSC’s procedures *Such as: 1. Follow USDA regulations when shipping “regulated soils” to any lab across state lines (*[NWQL Rapi-Note 12-023](http://wwwnwql.cr.usgs.gov/USGS/rn.shtml?12-023)*) 2. The U.S. Department of Transportation (DOT) and the International Air Transport Association (IATA) regulate shipments containing dry ice. Overnight shipments via FedEx that contain dry ice (e.g. chlorophyll and some isotope samples require certification of the person preparing the shipment.* Chapter A5 of the NFM ([Wilde and others, 2004)](http://pubs.water.usgs.gov/twri9A5/) has tables that summarize sample processing requirements and list NWQL designation codes for commonly mea­sured organic and inorganic constituents. It may be useful to include these tables in this section as a reference guide for field personnel.]

## Sample Tracking Procedures

The [WSC or projects] maintain(s) a record of all samples collected and shipped to a laboratory for analysis to ensure the complete and timely receipt of analytical results. [Identify the responsible party] has responsible for recording the required informa­tion. [Identify the responsible party] is responsible for reviewing the tracking log to determine if analyses are missing and for taking corrective action(s) if necessary.

 *[Describe the system used by the WSC to track samples.]*

## Chain-of-Custody Procedures for Samples

When chain-of-custody procedures are appropriate or required (for example, when data may be used in legal proceedings), the [identify the responsible party] should establish, maintain, and document a chain-of-custody system for field samples that is commensurate with the intended use of the data. A sample is in custody if it is in actual physical possession or in a secured area that is restricted to authorized personnel. Every exchange of a sample between people or places that involves a transfer of custody should be recorded on appropriate forms that document the release and acceptance of the sam­ple. Each person involved in the release or acceptance of a sample should keep a copy of the transfer paperwork. The project chief and (or) Field Office chief, or designee, is responsible for ensuring that custody transfers of samples are performed and documented according to the require­ments listed below.

[This section should be used to clarify the WSC’s chain-of-custody procedures for samples. Following are some things to consider:

* The means for identifying custody should be clearly understood (use of forms, stickers, etc.);
* Instructions for documenting the transfer of samples and the person responsible for this documentation must be clearly defined; and
* A plan must be in place for maintaining records in a specific location for a spe­cific period of time (for example, in the site folder).
* Since laboratories should have their own internal chain-of-custody requirements, it is probably not necessary to include information on their procedures. However, indi­vidual projects may need laboratory chain-of-custody documentation, but this can be documented in a project workplan.]

# Water-Quality Data Management

Water-quality data are recorded electronically or on paper and include chemical, physical and bio­logical data, along with observations, and ancillary field information. Paper records are documented on stan­dard [USGS field forms](http://water.usgs.gov/usgs/owq/Forms.html) and stored in site records folder. The field form templates are modified according to project objectives and WSC policy with input from all personnel associated with processing, checking, reviewing, and approving water-quality data. [Describe the WSC procedure for modifying and approving the templates for water-quality field forms.] Electronic records include field notes and measurements, analytical results, continuous monitor inspections and continuous monitoring data transmitted over the computer network or stored by electronic data logger. Electronic field notes such as those produced from PCFF are printed in the field or the database is backed-up on independent media for subsequent printing Data that are recorded on paper and electronically typically are entered either in the NWIS QWDATA database ([USGS, 2012a](http://nwis.usgs.gov/currentdocs/qw/QW.user.book.html)) or in NWIS ADAPS database ([USGS, 2012b](http://nwis.usgs.gov/nwisdocs5_0/adaps/adaps.book.html)). The NWIS is the storage medium for all water-quality, streamflow, well, and water-use information collected by the USGS. Data that cannot be stored in these national databases may be stored in other databases, such as project databases.

## Processing Data

Sampling information, field determinations, and ancillary information are recorded on appropriate water-quality field forms and are considered original record. These data are combined with analytical data from the laboratory in computer data and paper files. Sample information and field data are logged into QWDATA upon return from the field by [list appropriate person] within [list appropriate time frame] after the conclusion of the field trip. Data analyzed by laboratories other than the NWQL or those in the Water -Quality Data Transfer System (QWDX) are entered into NWIS, if possible, and identified according to analyzing laboratory. Data entry is the responsibility of **[name responsible party]**. Figure 10.1 describes the flow of water-quality data and records in the **[Name]** WSC.

### Continuous Monitoring Data (Revision 2, August 2012)

Continuous monitoring data are water-quality records collected onsite by electronic sensors and data loggers. Two methods for electronically recording data are by (1) trans­mitting data from a remote location by land line or radio telemetry to a central location where they are recorded on [list appropriate medium, such as CD or flash drive], and (2) recording data at a remote location on [list appro­priate medium, such as magnetic tape, disk, or solid-state memory device]. Initial data processing in the office is for the purpose of obtaining a copy of the original data for archiving (see Section 10.4). Data are not manipulated by the field instrument or a com­puter except to convert recorded signals into data in commonly used units or to display data in a convenient format. The transfer of data from the electronic storage medium to NWIS requires thorough checking to ensure that the data have transferred successfully or that as much data as possible have been recovered and errors identified ([WRD Mem­orandum 87.85](http://water.usgs.gov/admin/memo/policy/wrdpolicy87.085.html)). [Describe the WSC procedure for transferring QW data from the stor­age medium to NWIS.] Continuous water-quality data are processed as described in [Wagner and others (2006)](http://pubs.usgs.gov/tm/2006/tm1D3/).

[Discuss the WSC policies for downloading QW data from the recording device, entering data to the permanent storage medium (NWIS, or other), and checking the record for completeness and accuracy. Guidelines and criteria for making adjustments to the record also should be described in this section. Tools used to capture and process data such as spreadsheets, GRSAT, CHIMP, and SHOVEL should be described in this section. WMA policy pertaining to electron­ically recorded data and continuous records processing are contained in WRD Memorandum 87.085 and 2010.02 and is implemented as described below.]

Figure 10.1. EXAMPLE Data processing flow-chart for **[Name]** Water Science Center, [**date (month and year)]**.

*[Modify the example below to describe the flow of data in the WSC. Separate flow-charts may be required for discrete and continuous data]*

**

#### Real-time continuous water quality and Regression analysis

In some instances, discrete water-quality data are collected at sites where continuous water-quality data are collected to develop regression models to estimate real-time constituent concentrations and/or loads. Sediment regression model development and use should adhere to the guidelines described in [Rasmussen and others (2009)](http://pubs.usgs.gov/tm/tm3c4/). Other constituent models should follow the general principles outlined in Rasmussen and others (2009) and [Helsel and Hirsch (2002)](http://pubs.usgs.gov/twri/twri4a3/). Both require documentation in a USGS scientific investigations report (SIR) prior to providing data to the public via the National Real-Time Water-Quality (NRTWQ) website. Sites operating and providing data to the public must remain active with ongoing discrete water-quality data collection to confirm the validity of the model(s). When sampling is discontinued, so must the site’s real-time data display on the NRTWQ site.

### Analytical Data (Revision 2, August 2012)

Analytical data are results of field and laboratory chemical, physical, or biological determinations. Most water-quality samples are analyzed either in the field or a laboratory. In some cases, samples may be analyzed by research laboratories or by laboratories outside of the USGS (see Section 4.1).

In order to enter analytical data into the NWIS database, a site identification num­ber must first be assigned and entered into the WSC site file (see Section 7.2). Field measurements are entered into the NWIS QWDATA database by [identify the responsible party] as soon as possible after returning from the sampling field trip. A record number is assigned by QWDATA and is recorded in the provided space on the field form and other places as described by the WSC (fig. 10.1). *[Describe WSC policy or how and where record numbers are tracked/recorded*; for example, they may be entered on field forms or recorded in a log book or a tracking system.] (see Section 9.4 for sample tracking.) Sam­ple log-in is required for data from the laboratory to successfully transfer the data into the database. Environmental sample data are entered into the WSC NWIS QWDATA [enter database number]; QA data are entered into the WSC NWIS QWDATA [enter database number]. [Briefly describe the structure and purpose of the NWIS and other database;, for example, what data are maintained outside of NWIS and are special databases within NWIS established for special projects.]

Figure 10.2. Example page from a WSC sample-collection log book or spreadsheet..

All laboratory results are electronically transferred to the appropriate WSC database by [identify the responsible party; for example, the WSC Database Administrator]at least once per week. Hard copies of the analytical reports (WATLIST’s) are forwarded to [identify the responsible party]for storage in project files[or name appropriate location]. The NWIS QWDATA database receives daily incremental backup and weekly full backup.

Data analyzed by all laboratories are entered in NWIS, if possible ([Hubbard, 1992](http://pubs.usgs.gov/of/1992/ofr92-56/)), and identified according to the analyzing labo­ratory. Data entry is the responsibility of [identify the responsible party]. Data are entered and stored according to procedures already described for processing NWIS ana­lytical data. Appropriate codes are used to identify the data as originating from USGS and non-USGS sources.

### Non-National Water Information System Databases

Sometimes data collected by project personnel cannot be entered into the WSC NWIS QWDATA because NWIS cannot accept the type of data that are gener­ated by the project (for example, spectra and taxonomic data), or appropriate parameter/method codes do not exist. In these cases, project databases may be established to accommodate the data storage requirements and formats for data that cannot be entered in NWIS (all data that can be entered into NWIS should be entered into NWIS). Project databases that are the sole repository for project data should have a written procedure for data entry, storage, and long-term backup and archival. [Identify the responsible party] has the responsibility for developing and implementing management of project databases.

## Validation (Records Review)

Data validation is the process whereby water-quality and associated data are checked for completeness and accuracy. [Continue to describe the records/data check, review and approval official]After validation, data records are finalized by [identify the responsible party sucha as DBA or Data Manager] in the WSC database by setting the DQI code to the appropriate value in a timely manner as described in [Office of Water Quality Technical Memorandum 2012.03](http://water.usgs.gov/admin/memo/QW/qw12.03.pdf) **[or enter WSC policy information if more stringent than 2012.03].**

### Continuous Monitoring Data

Following the entry of continuous monitoring data into NWIS, raw data and(or) graphs of raw data are reviewed by [identify the responsible party]for anomalous val­ues, dates, and times, and preliminary updates are completed as needed. Data reviewed and edited according to procedure described by Wagner and others (2006). [Continue to describe any fur­ther validation steps that are a part of the WSC’s standard procedures including implementation of timelines for continuous records processing. If the WSC estimates constituents from *surrogate time-series data, describe the process by which those ratings are checked and maintained.*]**.** Once the data are edited, the record is submitted to [identify the responsible party] for final review and approval. Continuous monitor data are finalized within the timelines established in [WRD Policy Memo 2010.02](http://water.usgs.gov/admin/memo/policy/wrdpolicy10.02.html).

### Analytical Data (Revision 2, August 2012)

All field notes and field measurements are reviewed for completeness and accuracy [enter the time limit; for example, within 7 days or as soon as possible]after returning from the field trip by [identify the responsible party]. All chemical analyses are reviewed for completeness, and questionable values are noted. Prompt review is neces­sary to allow analytical re-analysis to be performed before sample holding times have been exceeded for accuracy and precision. *[Describe the WSC review procedure; for example, within 7 days, or when all analytical results have been returned.]* All chemical analyses entered into NWIS QWDATA using one of the batch processing modes results in output (WATLIST) that includes a copy of the analysis and a report of general validation checks **[**[**USGS, 2012a**](http://nwis.usgs.gov/currentdocs/qw/QW.user.book.html)**, to current version of NWIS User’s Manual for Water-Quality System, http://nwis.usgs.gov/currentdocs/qw/QW.user.book.html]**, including but not limited to the following:

* Comparison of determined and calculated values for dissolved solids,
* Comparison of dissolved constituents and total constituents,
* Comparison of specific conductance with dissolved solids, cations, and anions
* Comparison of constituents with relevant Federal drinking-water standards, and
* Comparison of sum of cations with sum of anions (ion balance).

Field and laboratory analyses, such as pH, specific conductance, and alkalinity, are compared to confirm agreement of independent measurements. If data from more than one sample are available for a site, the analysis also is compared with previous analyses within a hydrologic context to identify obvious errors, such as decimal errors, and pos­sible sample mix-ups or anomalies warranting analytical re-analysis. These reports and comparisons are reviewed and noted on the analytical report (WATLIST). If necessary, corrections or re-analysis may be requested by [identify the responsible party].

Requests to the NWQL for re-analysis are made by USGS employees through the NWQL in-house [NWQL Sample Status](http://nwql.cr.usgs.gov/usgs/sampstatus/index.cfm) Web page [enter procedures for other laboratories used by the WSC] and in writing to other laboratories as stipulated in the laboratory contract. Re-analysis requests are logged and tracked by [describe the WSC procedure(s) for logging and tracking re-analysis requests] (fig. 10.2). Corrections to NWIS resulting from reruns by the NWQL must be made to the laboratory database as well as to the WSC database and are made by [identify the responsible party]by email requestto LABHELP.

Figure 10.3. Example of re-analysis request form.

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Date requested | Lab ID number | Station number | Date | Time | Parameter number | Parameter name | Old value | Reason for reerun | New value | UpdateNo update/ Delete |
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Project QC data, such as blanks, replicates, blind standards, and matrix spikes, peri­odically are tabulated or graphed by [identify the responsible party] to facilitate iden­tification of inaccuracies or systematic bias that may not be discernible when reviewing an individual analysis. [Describe corrective actions; for example, rejecting questionable values or values in error from the database upon approval by the responsible party.] All personnel responsible for sample collection and field analysis participate in the NFQA Program and process an equipment blank once per year.QA data, including NFQA sample results and annual equipment blanks, are reviewed by [identify the responsible party]. [Describe corrective actions.]

## Data Storage (Revision 2, August 2012)

In accordance with WMA policy, all water-quality data collected as part of routine data col­lection by the WMA are stored in the NWIS database. Data collected by others, such as cooperators, universities, or consultants, which are used to support published USGS documents and are not published or archived elsewhere, also should be entered into NWIS . However, these data are entered into their own record and flagged with the appropriate data elements to assign the data as collected by non-USGS personnel. This requires that at the time of record creation during sample log-in, the appropriate collecting agency is database entered at the sample level. It is the responsibility of **[enter WSC person responsible for requesting new collecting and analyzing agencies through OWQ]** to ensure the collecting agency codes for the WSC are available ([OWQ Tech Memo 2006.03](http://water.usgs.gov/admin/memo/QW/qw06.03.html)). In addition to the collecting agency, if the data were not analyzed by USGS laboratories, the analytical results will have the appropriate analyzing agency entered at the result level. It is the responsibility of **[enter WSC person responsible for requesting new collecting and analyzing agencies through OWQ]** to ensure the analyzing agencies for the WSC are available ([OWQ Tech Memo 2006.03](http://water.usgs.gov/admin/memo/QW/qw06.03.html)). The collecting and analyzing agency reference lists are updated quarterly. Requests for new codes are made by filling out and submitting the [Parameter and Method Code Request Form](http://water.usgs.gov/usgs/owq/parm_request.html). Other outside data may be entered into the database at the discretion of the [identify the responsible party] if data-collection methods and quality have been reviewed and found acceptable. Electronically stored data that cannot be entered into NWIS are stored in project databases online or offline. The [identify the responsible party] has responsibility for maintaining backups of data stored electronically in NWIS or online. Data stored electronically offline are maintained by [identify the responsible party].

In addition to electronically stored data, other project data and information, includ­ing field notes, ASR’s, WATLIST’s, and [list other items] are retained in station folders and maintained by [identify the responsible party] in [name the location; for exam­ple, project office] while the project is active.

[Describe the WSC procedure for storing records that cannot be stored in NWIS such as PCFF, CHIMP, biological, and habitat data.

Enter the WSC standard procedures for short-term storage of data, updating data quality indicators after approval, and other project information. Relatively new data, which are compiled, modified, reviewed, and frequently used, require high levels of accessibility. As these data become older, lower levels of accessibility are typically needed. Data in the database generally should move from areas of higher accessibility and lower security to areas of lower accessibility and higher security as the need for access diminishes and the data become finalized. As this occurs, data may be moved from online to near online or offline, as appropriate.]

## Records Archival

According to WMA policy, all original data that are published or support published scientific analyses shall be placed in archives (*WRD Memorandums* [92.59](http://water.usgs.gov/admin/memo/policy/wrdpolicy92.059.html) *and* [99.33](http://water.usgs.gov/admin/memo/policy/wrdpolicy99.33.html)*;* [Hubbard, 1992](http://pubs.usgs.gov/of/1992/ofr92-56/)). Original data—from automated data-collection sites, laboratories, outside sources, and non-automated field observations—are unmodified data as collected or received and in conventional units (engineering units, generally with a decimal). Original data should be preserved in this form, no matter how they may be modified later ([Hub­bard, 1992](http://pubs.usgs.gov/of/1992/ofr92-56/)). Original data include paper and electronic field notes, field measurements, images, ASR’s, WATLIST’s, continuous water-quality monitoring records, and calibration notes. Original electronic records are to be preserved in a format that allows them to be retrieved at a later date. These data are archived when *[insert the criteria for archiving data; for example, the project is completed or terminated, or if data are more than 7 years old].* It is the responsibility of [identify the responsible party]to ensure that project files entered into the WSC archive are organized and complete. The WSC archive is located [state the location] and is maintained by [identify the responsible party]. Data from the WSC archives may be transferred to [name the national archive] as needed [or insert the cri­teria for transfer to permanent archives]. The disposition schedule (<http://www.usgs.gov/usgs-manual/schedule/432-1-s2/index.html#equip>) for WMA records includes a description of record types and disposal instructions.

# Publication of Water-Quality Data

Water-quality data are published in hydrologic data reports, interpretive reports, or on-line via NWISWeb ([OWQ 2012.03](http://water.usgs.gov/admin/memo/QW/qw12.03.pdf)). The selection of the appropriate publication outlet for water-quality data will be the responsibility of [identify the responsible party and describe the approval process for the report outlet choice]. A summary of USGS [Fundamental Science Practices](http://www.usgs.gov/fsp/policies.asp) and WMA policies pertaining to the publication of data and interpretive reports is contained in the WRD Publications Guides ([Alt and Iseri, 1986, p. 382-385](http://pubs.usgs.gov/of/1987/0205/report.pdf); [U.S. Geological Survey, 1995](http://pubs.usgs.gov/fs/1995/0217/report.pdf); [OWQ Technical Memoranda 2012.03](http://water.usgs.gov/admin/memo/QW/qw12.03.pdf), [2007.04](http://water.usgs.gov/admin/memo/QW/qw07.04.html), *and* [2007.03](http://water.usgs.gov/admin/memo/QW/qw07.03.html)). Other references that should be consulted when writing reports include "Suggestions to Authors ..." ([Hansen, 1991](http://www.nwrc.usgs.gov/lib/lib_sta.htm)) and the U.S. Government Printing Office Style Manual ([U.S. Government Printing Office, 2008](http://www.gpo.gov/fdsys/pkg/GPO-STYLEMANUAL-2008/pdf/GPO-STYLEMANUAL-2008.pdf)).

[The US Geological Survey Manual Chapters 502.1 -502.4 describe the Fundamental Science Practices for policy, research, review and approval of information products. The authority to approve information products is described in the Survey Manual Chapter 205.18. . Add a paragraph to Sections 11.1 and 11.2 to describe the report review and data release processes in your WSC.]

## Hydrologic Data Reports

All non-proprietary water-quality data collected during the water year at the discretion of the WSC may be pub­lished or released online in [Annual Water Data Reports](http://wdr.water.usgs.gov/), in individual project data series (DS) reports, or via NWISWeb ([OWQ 2012.03](http://water.usgs.gov/admin/memo/QW/qw12.03.pdf)). Hydrologic data reports make water-quality data available to users, but without interpretations or conclusions. Approval of hydro­logic data reports is in accordance with applicable WMA, Region, and WSC policy ([Alt and Iseri, 1986](http://pubs.usgs.gov/of/1987/0205/report.pdf); [cite relevant Region and WSC memos]).

## Interpretive Reports

Interpretive reports include such USGS outlets as Circulars, Professional Papers, Fact Sheets, Scientific Investigations Reports, and Open-File Reports, as well as non-USGS outlets, such as scientific journals, books, and proceedings of technical con­ferences. The WSC Water-Quality Specialist, project supervisor, and outside technical specialists will provide guidance in ensuring that each water-quality report meets the highest technical standards. Approval of interpretive reports is in accordance with appli­cable WMA Region, and WSC policy (*USGS Manual* [205.18](http://www.usgs.gov/usgs-manual/200/205-18.html/), [502.3](http://www.usgs.gov/usgs-manual/500/502-3.html), [502.4](http://www.usgs.gov/usgs-manual/500/502-4.html)) and is more tech­nically rigorous than the required approval for non-interpretive data reports.

## Other Data Outlets (Revision 2, August 2012)

Article 502.5 of the Department of the Interior USGS Manual ([U.S. Department of the Interior, 2012](http://www.usgs.gov/usgs-manual/500/502-5.html)) states that data and information are released through publications; however, publication is not limited to paper media. Electronic outlets include the internet (NWISWeb at http://waterdata.usgs.gov/nwis/) ([OWQ 2012.03](http://water.usgs.gov/admin/memo/QW/qw12.03.pdf)) and computer storage media, such as CDROM.

The term “data” refers to documented observations or measurements or other quantitative measurements that have not been interpreted and usually result from field observations or laboratory analyses of water, sediment, or biota. Data can be released to the public after preliminary review for accuracy by appropriate WMA personnel ([WRD Memorandum 90.38](http://water.usgs.gov/admin/memo/policy/wrdpolicy90.038.html)). Constituents in water samples collected by or for the USGS that exceed USEPA drinking water maxi­mum contaminant levels (MCL’s), as specified in the National Primary Drinking Water Regulations, are promptly reported by [identify the responsible party] to appropriate agencies that have a need to know ([WRD Memorandum 90.38](http://water.usgs.gov/admin/memo/policy/wrdpolicy90.038.html)).

The term “information” refers to interpretations of data or conclusions of investi­gations. Interpretive results or conclusions require colleague review and Director’s approval for publication. Release of preliminary interpretations prior to final approval is prohibited to avoid disseminating incomplete and(or) incorrect conclusions, which are subject to change as a result of subsequent technical and policy reviews.

# Water-Quality Training and Reviews

Periodic reviews of data-collection procedures are used to evaluate the effective­ness of training programs and to determine if technical work is being conducted correctly and efficiently. Such reviews also are used to identify and resolve problems before they become widespread and potentially compromise the quality of the data.

## Training (Revision 2, August 2012)

Employee training is an integral part of water-quality activities allowing current employees to maintain and enhance their technical knowledge and new employees to gain the specific skills needed to adequately perform their job. A well-documented train­ing program not only ensures that samples are collected correctly by technically compe­tent personnel, but also lends legal credibility to data and interpretations. Training is accomplished according to the following policies and protocols.

Individual training plans are developed by the supervisor and employee at least annually as part of the performance review process. The WSC Water-Quality Specialist or Data Chief is responsible for informing WSC staff about the availability of training—in-house, USGS, U.S. Government, and other sources of training. The Water-Quality Specialist provides recommendations and advice to supervisors and their staff as needed for routine data and sample collection as well as special projects and data analysis. The [identify the responsible party] has authority and responsibility for approving training opportunities. In addition, staff are responsible for taking full advantage of the training provided.

Primary sources of water-quality training are USGS courses, usually taught at the USGS NTC at the Denver Federal Center; [identify the Region] regional training; cyberseminars, and WSC seminars or in-house training courses. A list of the currently scheduled water-quality training courses is available at the [Office of Water Quality Training Courses & Resources](http://water.usgs.gov/usgs/owq/training.html) web page or the [DOI Learn](https://gm2.geolearning.com/geonext/doi/login.geo) course catalog. The Water-Quality Specialist plays an important role in providing in-house training. Training documents are maintained by the [identify the responsible party, such as Training Officer or Administrative Officer] in WSC personnel files and by the Per­sonnel Office in [identify the Region] Region.

[Include a table from the WSC training plan or make a table that lists the minimum required training for each type of water-quality position.]

## Reviews (Revision 2, August 2012)

Reviews of water-quality data-collection activities are conducted annually [or other frequency, if different] for each individual in the WSC who is actively involved in water-quality data collection. Reviews are conducted in the field or laboratory by [iden­tify the responsible party].

Reviews are completed in a timely manner, and comments are documented by the reviewer in a memorandum or [name other document] to the immediate supervisor with a copy to [list recipients]. Reviews address sample collection and processing techniques, compliance with WMA, OWQ, and WSC policies, the condition of the work environ­ment (for example, the field vehicle), and any other activities pertaining to the collection of high-quality data. When deficiencies are noted, the reviewer, in consultation with the Water-Quality Specialist, is responsible for identifying corrective actions. The immedi­ate supervisor is responsible for ensuring that, once identified, corrective actions are implemented and completed in a timely manner.

# References and Memoranda (by section)

**[Accessed dates below to be updated by WSC personnel during the development of the QA Plan]**

**1.0 Introduction**

No references

**2.0 Organization and Responsibilities**

[Schroder, L.J., and Shampine, W.J., 1992, Guidelines for preparing a quality-assurance plan for the District offices of the U.S. Geological Survey: U.S. Geological Survey Open-File Report 92-136, 14 p.](http://pubs.usgs.gov/of/1992/0136/report.pdf) **[accessed May 14, 2013]** at <http://pubs.usgs.gov/of/1992/0136/report.pdf>

[Shampine, W.J., Pope, L.M., and Koterba, M.T., 1992, Integrating quality assurance in project work plans of the U.S. Geological Survey: U.S. Geological Survey Open-File Report 92-162, 12 p.](http://pubs.usgs.gov/of/1992/0162/report.pdf) **[accessed May 14, 2013]** at <http://pubs.usgs.gov/of/1992/0162/report.pdf>

**3.0 Program and Project Planning**

[Mueller, D.K., Martin, J.D., and Lopes, T.J., 1997, Quality-control design for surface- water sampling in the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 97-223, 17 p.](http://pubs.usgs.gov/of/1997/223/pdf/ofr97-223.pdf) **[accessed May 14, 2013]** at <http://pubs.usgs.gov/of/1997/223/pdf/ofr97-223.pdf>

[Shampine, W.J., Pope, L.M., and Koterba, M.T., 1992, Integrating quality assurance in project work plans of the U.S. Geological Survey: U.S. Geological Survey Open-File Report 92-162, 12 p.](http://pubs.usgs.gov/of/1992/0162/report.pdf) **[accessed May 14, 2013]** at <http://pubs.usgs.gov/of/1992/0162/report.pdf>

U.S. Geological Survey, 2006, Collection of water samples (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A4, September 2006, **[accessed September 12, 2012]**, at <http://pubs.water.usgs.gov/twri9A4/>.

Central Region Memorandum 2004.01, 2004, Policy: Updated procedures for project proposal preparation and submission process: Water Resources Discipline, Central Region, **[accessed September 12, 2012]** at <http://www.cr.usgs.gov/water/uo/proposals/CRproposalweb.html>

[Eastern Region Water Science Team Memorandum 09.01, 2009, Program & Plans - Fiscal Year 2009 Guidance for Submittal and Approval of Cooperative Water Program and Other Federal Agency Proposals](http://er.water.usgs.gov/sci/proposals/docs/TechMemo0901.docx), **[accessed September 12, 2012]** at <http://er.water.usgs.gov/sci/proposals/docs/TechMemo0901.docx>

Western Region Memorandum, 1999, Programs & Plans – Preparation and submission of project proposals, **[accessed September 12, 2012]** at <http://wwwrcamnl.wr.usgs.gov/uo/adm/Policies/Prog_Plans-Pol_on_Prep_Submssn_Proj_Proposal.html>

U.S. Geological Survey, Science Strategy, **[accessed September 12, 2012]** at <http://www.usgs.gov/start_with_science/>

U.S. Geological Survey, Water Mission Area Memorandum 12.01, 2012, Avoiding competition with the private sector, **[accessed September 12, 2012]** at <http://water.usgs.gov/coop/about/avoiding_competition.pdf>

**4.0 Water-Quality Laboratories**

Water Resources Division Memorandum 92.36, 1992, Policy of the Water Resources Division on the use of laboratories by National water-quality programs, **[accessed September 12, 2012]** at <http://water.usgs.gov/admin/memo/policy/wrdpolicy92.036.html>

**5.0 Field Service Units and Laboratories, Mobile Laboratories and Field Vehicles**

Horowitz, A.J., Demas, C.R., Fitzgerald, K.K., Miller, T.L., and Rickert, D.A., 1994, U.S. Geological Survey protocol for the collection and processing of surface-water samples for the subsequent determination of inorganic constituents in filtered water: U.S. Geological Survey Open-File Report 94-539, 57p. **[accessed May 15, 2013]** at <http://pubs.usgs.gov/of/1994/0539/report.pdf>

Lane, S.L., Flanagan, Sarah, and Wilde, F.D., 2003, Selection of equipment for water sampling (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A2, March 2003, **[accessed September 12, 2012]** at <http://pubs.water.usgs.gov/twri9A2/>

U.S. Geological Survey, variously dated, National field manual for the collection of water-quality data: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A1-A9, **[accessed September 12, 2012]** at http://pubs.water.usgs.gov/twri9A

Branch of Operation Technical Memorandum 91.01, 1991, Safety – Chemical Hygiene Plan, **[accessed September 12, 2012]** at <http://water.usgs.gov/admin/memo/information/op91.01.html>

National Water Quality Laboratory Technical Memorandum 92.01, 1992, Technology Transfer – Availability of equipment blank water for inorganic and organic analysis, **[accessed September 12, 2012]** at <http://wwwnwql.cr.usgs.gov/tech_memos/nwql.1992-01.pdf>

National Water Quality Laboratory Technical Memorandum 2011.01, 2011, Requirements for the proper shipping of samples to the National Water Quality Laboratory**, [accessed September 12, 2012]** at <http://wwwnwql.cr.usgs.gov/tech_memos/nwql.2011-01.pdf>

Office of Water Quality Technical Memorandum 92.01, 1991, Distilled/deionized water for district operation, **[accessed September 12, 2012]** at <http://water.usgs.gov/admin/memo/QW/qw92.01.html>

Office of Water Quality Technical Memorandum 92.06, 1992, Reports – Report of committee on sample shipping integrity and cost, **[accessed September 12, 2012]** at <http://water.usgs.gov/admin/memo/QW/qw92.06.html>

**6.0 Water-Quality Instruments**

Lewis, M.E., Dissolved Oxygen (ver. 2.1): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6, sec. 6.2, June 2006, **[accessed May 15, 2013]** at <http://water.usgs.gov/owq/FieldManual/Chapter6/6.2_contents.html>

Radtke, D.B., Davis, J.V., and Wilde, F.D., 2005, Specific electrical counductance (ver. 2.1): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6, sec. 6.3, August 2005, **[accessed May 15, 2013]** at <http://water.usgs.gov/owq/FieldManual/Chapter6/6.3_contents.html>

Ritz, G.F. and Collins, J.A., 2008, pH (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6, sec. 6.4, October 2010, **[accessed May 15, 2013]** at <http://water.usgs.gov/owq/FieldManual/Chapter6/6.4_contents.html>

Wagner, R.J., Boulger, R.W. Jr., Oblinger, C.J. and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality monitors: station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1-D3, **[accessed September 12, 2012]** at <http://pubs.usgs.gov/tm/2006/tm1D3/>

Wilde, F.D., 2006, Temperature (ver. 2): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6, sec. 6.1, March 2006, **[accessed May 15, 2013]** at <http://water.usgs.gov/owq/FieldManual/Chapter6/6.1_contents.html>

Wilde, F.D., ed., variously dated, Field Measurements: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6. With sec. 6.0-6.8, **[accessed September 12, 2012]** at <http://pubs.water.usgs.gov/twri9A6/>

Water Resources Divison Memorandum 95.35, 1995, Programs and Plans – Transmittal of an instrumentation plan for the Water Resources Division and the Water Resources Division Hydrologic Field Instrumentation and equipment policy and guidelines, **[accessed September 18, 2012]** at <http://water.usgs.gov/admin/memo/policy/wrdpolicy95.035.html>

**7.0 Site Selection and Documentation**

Wagner, R.J., Boulger, R.W. Jr., Oblinger, C.J. and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality monitors: station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1-D3, **[accessed September 12, 2012]** at <http://pubs.usgs.gov/tm/2006/tm1D3/>

Wilde, F.D., 2005, Preparations for water sampling: : U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A1, January 2005, **[accessed September 12, 2012]** at <http://pubs.water.usgs.gov/twri9A1/>

Office of Water Quality Technical Memorandum 2011.04, 2011, Effective September 16, 2011 – the new analytical service request (ASR) form for samples received at the National Water Quality Laboratory (NWQL) is available for use, **[accessed September 19, 2012]**, at <http://water.usgs.gov/admin/memo/QW/qw11.04.html>

**8.0 Sample Collection and Processing**

Dossett, S.R., and Bowersox, V.C., 1999, National trends network site operation manual: Champaign, Ill., National Atmospheric Deposition Program Office at the Illinois State Water Survey, NADP Manual 1999-01 (revised), **[accessed September 19, 2012]** at [*http://nadp.sws.uiuc.edu/lib/manuals/opman.pdf*](http://nadp.sws.uiuc.edu/lib/manuals/opman.pdf)

[Edwards, T.K., and Glysson, G.D., 1999, Field methods for measurement of fluvial sed­iment: U.S. Geological Survey Techniques of Water-Resources Investigations, book 3, chap. C2, 89 p.](http://pubs.usgs.gov/twri/twri3-c2/pdf/TWRI_3-C2.pdf) **[accessed May 15, 2013]** at <http://pubs.usgs.gov/twri/twri3-c2/pdf/TWRI_3-C2.pdf>

Horowitz, A.J., Demas, C.R., Fitzgerald, K.K., Miller, T.L., and Rickert, D.A., 1994, U.S. Geological Survey protocol for the collection and processing of surface-water samples for the subsequent determination of inorganic constituents in filtered water: U.S. Geological Survey Open-File Report 94-539, 57p. **[accessed May 15, 2013]** at <http://pubs.usgs.gov/of/1994/0539/report.pdf>

Lane, S.L., and Fay, R.G., 1997, Safety in field activities: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A9, October 1997, **[accessed September 17, 2012]**, at <http://pubs.water.usgs.gov/twri9A9/>.

Lane, S.L., Flanagan, Sarah, and Wilde, F.D., 2003, Selection of equipment for water sampling (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chaps. A2, March 2003, **[accessed September 12, 2012]** at <http://pubs.water.usgs.gov/twri9A2/>

Mercury Deposition Network, 2003, MDN glass sample train collection and deployment – trace metal clean sampling handling (revised), **[accessed September 19, 2012]** at <http://nadp.sws.uiuc.edu/lib/manuals/mdnopman.pdf>

National Atmospheric Deposition Program, 2011, NADP site selection and installation manual (ver. 1.5), May 2011, **[accessed September 19, 2012]** at <http://nadp.sws.uiuc.edu/lib/manuals/NADP_Site_Selection_and_Installation_Manual.pdf>

[Stanley, D.L., Shampine, W.J., and Schroder, L.J., 1992, Summary of the U.S. Geologi­cal Survey National Field Quality-Assurance Program from 1979 through 1989: U.S. Geological Survey Open-File Report 92-163, 14 p.](http://pubs.usgs.gov/of/1992/0163/report.pdf) **accessed [May 15, 2013]** at <http://pubs.usgs.gov/of/1992/0163/report.pdf>

U.S. Geological Survey, 2006, Collection of water samples (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A4, September 2006, **[accessed September 17, 2012]**, at <http://pubs.water.usgs.gov/twri9A4/>.

Wagner, R.J., Boulger, R.W. Jr., Oblinger, C.J. and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality monitors: station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1-D3, **[accessed September 12, 2012]** at <http://pubs.usgs.gov/tm/2006/tm1D3/>

Ward, J.R., and Harr, C.A., 1990, Methods for collection and processing of surface-water and bed-material samples for physical and chemical analyses: U.S. Geological Survey Open-File Report 90-140, 71 p. **accessed [May 15, 2013]** at <http://pubs.usgs.gov/of/1990/0140/report.pdf>

Wilde, F.D., ed., 2004, Cleaning of Equipment for water sampling (ver. 2.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A3, April 2004, **[accessed September 17, 2012]**, at <http://pubs.water.usgs.gov/twri9A3/>.

Wilde, F.D., ed., variously dated, Field Measurements: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6. With sec. 6.0-6.8, **[accessed September 12, 2012]** at <http://pubs.water.usgs.gov/twri9A6/>

Wilde, F.D., Radtke, D.B., Gibs, Jacob, and Iwatsubo, R.T., eds., 2004 with updates through 2009, Processing of water samples (ver. 2.2): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A5, April 2004, **[accessed September 17, 2012]**, at <http://pubs.water.usgs.gov/twri9A5/>.

Office of Water Quality Technical Memorandum 97.06, 1997, Comparison of the suspended-sediment splitting capabilities of the churn and cone splitters, **[accessed September 17, 2012]** at <http://water.usgs.gov/admin/memo/QW/qw97.06.html>

Office of Water Quality Technical Memorandum 99.02, 1998, Guidance for collecting discharge-weighted samples in surface water using an isokinetic sampler, **[accessed September 17, 2012]** at <http://water.usgs.gov/admin/memo/SW/sw99.01.pdf>

Office of Water Quality Technical Memorandum 2012.03, 2012, Update of policy on review and publication of discrete water data, **[accessed September 17, 2012]** at <http://water.usgs.gov/admin/memo/QW/qw12.03.pdf>

Water Resources Discipline Policy Numbered Memorandum No. 2010.02, 2010, Continuous records processing of all water time series data, **[accessed September 17, 2012]** at <http://water.usgs.gov/admin/memo/policy/wrdpolicy10.02.html>

**9.0 Water-Quality Sample Handling and Tracking**

Wilde, F.D., 2005, Preparations for water sampling: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A1, January 2005, **[accessed September 17, 2012]**, at <http://pubs.water.usgs.gov/twri9A1/>.

Wilde, F.D., Radtke, D.B., Gibs, Jacob, and Iwatsubo, R.T., eds., 2004 with updates through 2009, Processing of water samples (ver. 2.2): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A5, April 2004, **[accessed September 17, 2012]**, at <http://pubs.water.usgs.gov/twri9A5/>.

National Water Quality Laboratory Technical Memorandum 2011.01, 2011, Requirements for the proper shipping of samples to the National Water Quality Laboratory, **[accessed September 17, 2012]** at <http://wwwnwql.cr.usgs.gov/tech_memos/nwql.2011-01.pdf>

National Water Quality Laboratory Rapi-Note 01-013, 2001, Sample Shipping reminder, **[accessed September 17, 2012]** at <http://wwwnwql.cr.usgs.gov/rn.shtml?01-013>

National Water Quality Laboratory Rapi-Note 01-023, 2001, Shipping time-sensitive samples to the National Water Quality Laboratory for radiochemical analysis, **[accessed September 17, 2012]** at <http://wwwnwql.cr.usgs.gov/rn.shtml?01-023>

National Water Quality Laboratory Rapi-Note 01-033, 2001, Shipping reminder from the Central Region Safety Officer, **[accessed September 17, 2012]** at <http://wwwnwql.cr.usgs.gov/rn.shtml?01-033>

National Water Quality Laboratory Rapi-Note 01-034, 2001, Update to 01-033, Safe shipping reminder, **[accessed September 17, 2012]** at <http://wwwnwql.cr.usgs.gov/rn.shtml?01-034>

**10.0 Water-Quality Data Management**

Helsel, D.R. and R. M. Hirsch, 2002. Statistical Methods in Water Resources: U.S. Geological Survey Techniques of Water-Resources Investigations, book 4, chap. A3, **[accessed September 18, 2012]**, at <http://pubs.usgs.gov/twri/twri4a3/>

[Hubbard, E.F., 1992, Policy recommendations for management and retention of hydro­logic data of the U.S. Geological Survey: U.S. Geological Survey Open-File Report 92-56, 32 p.](http://pubs.usgs.gov/of/1992/ofr92-56/pdf/ofr92-56.pdf) **[accessed May 15, 2013]** at <http://pubs.usgs.gov/of/1992/ofr92-56/>

Rasmussen, P.P., Gray, J.R., Glysson, G.D., and Ziegler, A.C., 2009, Guidelines and procedures for computing time-series suspended-sediment concentrations and loads from in-stream turbidity-sensor and streamflow data: U.S. Geological Survey Techniques and Methods book 3, chap. C4, **[accessed September 18, 2012]**, at <http://pubs.usgs.gov/tm/tm3c4/>

U.S. Geological Survey, 2012a, User’s manual for the National Water Information System of the U.S. Geological Survey: Water-Quality System, (version 5.0), **[accessed September 17, 2012]** at <http://nwis.usgs.gov/currentdocs/qw/QW.user.book.html>

U.S. Geological Survey, 2012b, User’s manual for the National Water Information System of the U.S. Geological Survey: Automated Data Processing System (ADAPS), (version 5.0), **[May 15, 2013]** at <http://nwis.usgs.gov/nwisdocs5_0/adaps/adaps.book.html>

Office of Water Quality Technical Memorandum 2006.03, 2006, National Water Information System – Notice of enhancements planned for the QWDATA software that will affect NWIS QWDATA batch file formats, **[accessed September 19, 2012]**, at <http://water.usgs.gov/admin/memo/QW/qw06.03.html>

Office of Water Quality Technical Memorandum 2012.03, 2012, Update of policy on review and publication of discrete water data, **[accessed September 17, 2012]** at <http://water.usgs.gov/admin/memo/QW/qw12.03.pdf>

Water Resources Division Memorandum 87.85, 1987, Programs and Plans – Policy for the collection and archiving of electronically recorded data, **[accessed September 18, 2012]**, at <http://water.usgs.gov/admin/memo/policy/wrdpolicy87.085.html>

Water Resources Division Memorandum 92.59, Policy for the management and retention of hydrologic data of the U.S. Geological Survey, **[accessed September 17, 2012]** at <http://water.usgs.gov/admin/memo/policy/wrdpolicy92.059.html>

Water Resources Division Memorandum 99.33, 1999, Preservation of original digital field-recorder time-series data, **[accessed September 17, 2012]** at <http://water.usgs.gov/admin/memo/policy/wrdpolicy99.33.html>

Wagner, R.J., Boulger, R.W. Jr., Oblinger, C.J. and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality monitors: station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1-D3, **[accessed September 12, 2012]** at <http://pubs.usgs.gov/tm/2006/tm1D3/>

WRD Policy Numbered Memorandum No. 2010.02, 2010, Continuous records processing of all water time series data, **[accessed September 17, 2012]** at <http://water.usgs.gov/admin/memo/policy/wrdpolicy10.02.html>

**11.0 Publication of Water-Quality Data**

[Alt, D.F., and Iseri, K.T., eds., 1986, WRD publications guide, v. 1. Publications policy and text preparation: U.S. Geological Survey, 429 p.](http://pubs.usgs.gov/of/1987/0205/report.pdf) **[accessed May 15, 2013]** at <http://pubs.usgs.gov/of/1987/0205/report.pdf>

[Hansen W.R., ed., 1991, Suggestions to authors of the reports of the United States Geo­logical Survey (7th ed.): Washington, D.C., U.S. Government Printing Office, 289 p.](http://www.nwrc.usgs.gov/lib/lib_sta.htm) **[accessed May 15, 2013]** at <http://www.nwrc.usgs.gov/lib/lib_sta.htm>

[U.S. Department of the Interior, 1992, Safeguard and release of U.S. Geological Survey data and information, *in* U.S. Geological Survey manual 500.14.1: U.S. Department of the Interior, Geological Survey, May 15, 1992, 3 p.](http://www.usgs.gov/usgs-manual/500/500-14.html)

U.S. Department of the Interior, 2011, Authority to Approve Information Products, in U.S. Geological Survey manual 205.18: U.S. Department of the Interior, Geological Survey, December 13, 2011 **[accessed March 11, 2013]** at <http://www.usgs.gov/usgs-manual/200/205-18.html>

U.S. Department of the Interior, 1993, Policy for release of computer databases and computer programs, in U.S. Geological Survey manual 500.24: U.S. Department of the Interior, Geological Survey, April 9, 1993, 4 p. **[accessed May 15, 2013]** http://www.usgs.gov/usgs-manual/500/500-24.html

U.S. Department of the Interior, 2011, Authority to Approve Information Products, in U.S. Geological Survey manual 502.1: U.S. Department of the Interior, Geological Survey, December 16, 2011 **[accessed March 11, 2013]** at <http://www.usgs.gov/usgs-manual/500/502-1.html>

U.S. Department of the Interior, 2011, Fundamental Science Practices: Peer Review, in U.S. Geological Survey manual 502.3: U.S. Department of the Interior, Geological Survey, December 16, 2011 **[accessed May 15, 2013]** at <http://www.usgs.gov/usgs-manual/500/502-3.html>

U.S. Department of the Interior, 2012, Fundamental Science Practices: Review, Approval and Release of Information Products in U.S. Geological Survey manual 502.4: U.S. Department of the Interior, Geological Survey, December 19, 2012 **[accessed May 15, 2013]** at <http://www.usgs.gov/usgs-manual/500/502-5.html>

U.S. Department of the Interior, 2012, Safeguard and release of U.S. Geological Survey Data and information in U.S. Geological Survey manual 502.5: U.S. Department of the Interior, Geological Survey, December 16, 2011 **[accessed May 15, 2013]** at http://www.usgs.gov/usgs-manual/500/502-4.html

[U.S. Geological Survey, 1995, Guidelines for writing hydrologic reports: U.S. Geologi­cal Survey Fact Sheet FS-217-95, 4 p.](http://pubs.usgs.gov/fs/1995/0217/report.pdf) **[accessed May 15, 2013]** at <http://pubs.usgs.gov/fs/1995/0217/report.pdf>

[U.S. Government Printing Office, 2008, Style manual: Washington, D.C., U.S. Govern­ment Printing Office, 453 p.](http://www.gpoaccess.gov/stylemanual/browse.html) **[accessed May 15, 2013]** at <http://www.gpo.gov/fdsys/pkg/GPO-STYLEMANUAL-2008/pdf/GPO-STYLEMANUAL-2008.pdf>

Office of Water Quality Technical Memorandum 2007.03, 2007, Changes to the NWISWeb aggregation and display of water-quality data, **[accessed September 17, 2012]** at <http://water.usgs.gov/admin/memo/QW/qw07.03.html>

Office of Water Quality Technical Memorandum 2007.04, 2007, Controlling flow of water-quality data to NWISWeb, **[accessed September 17, 2012]** at <http://water.usgs.gov/admin/memo/QW/qw07.04.html>

Office of Water Quality Technical Memorandum 2012.03, 2012, Update of policy on review and publication of discrete water data, [**[accessed September 17, 2012]** at <http://water.usgs.gov/admin/memo/QW/qw12.03.pdf>

Water Resources Division Memorandum 90.38, 1990, Programs and Plans-Policy for reporting maximum contaminant level exceedances, **[accessed September 17, 2012]** at <http://water.usgs.gov/admin/memo/policy/wrdpolicy90.038.html>

**12.0 Water-Quality Training and Reviews**

No references

# Additional References for sections not included in the text

**1.0 Introduction**

No references

**2.0 Organization and Responsibilities**

No references

**3.0 Program and Project Planning**

No references

**4.0 Water-Quality Laboratories**

Stevenson, D.L.., ed., 2012, Quality management system, U.S. Geological Survey National Water Quality Laboratory: unpublished U.S. Geological Survey Report, version 2.0, 3 January 2012, **[accessed September 19, 2012]**, at <http://wwwnwql.cr.usgs.gov/qas.shtml?qms>

**5.0 Field Service Units and Laboratories, Mobile Laboratories and Field Vehicles**

No references

**6.0 Water-Quality Instruments**

Anderson, C.W, 2005, Turbidity (ver. 2.1): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6, sec. 6.2, September 2005, **[accessed September 12, 2012]** at <http://pubs.water.usgs.gov/twri9A6/>

Gibs, Jacob, Wilde, F.D., and Heckathorn, H.A., 2012, Use of multiparameter instruments for routine field measurements: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A6, sec. 6.8, September 2005, **[accessed September 12, 2012]** at <http://pubs.water.usgs.gov/twri9A6/>

Wagner, R.J., Boulger, R.W. Jr., Oblinger, C.J. and Smith, B.A., 2006, Guidelines and standard procedures for continuous water-quality monitors: station operation, record computation, and data reporting: U.S. Geological Survey Techniques and Methods 1-D3, **[accessed September 12, 2012]** at <http://pubs.usgs.gov/tm/2006/tm1D3/>

Alvarez, D.A., 2010, Guidelines for the use of the semipermeable membrane device (SPMD) and the polar organic chemical integrative sampler (POCIS) in environmental monitoring studies: U.S. Geological Survey, Techniques and Methods 1-D4, 28 p. at http://pubs.usgs.gov/tm/tm1d4/

**7.0 Site Selection and Documentation**

No references

**8.0 Sample Collection and Processing**

Bushon, R.N., 2003, Fecal indicator viruses: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A7, section 7.2, November 2003, **[accessed September 19, 2012]**,at <http://pubs.water.usgs.gov/twri9A7/>.

Bushon, R.N., and Francy, D.S., 2003, Protozoan pathogens: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A7, section 7.3, November 2003, **[accessed September 19, 2012]**,at <http://pubs.water.usgs.gov/twri9A7/>.

[Crawford, J.K., and Luoma, S.N., 1993, Guidelines for studies of contaminants in bio­logical tissues for the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 92-494, 69 p.](http://pubs.usgs.gov/of/1992/0494/report.pdf)

Delzer, G.C., and McKenzie, S.W., 2003, Five-day biochemical oxygen demand: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A7, sec. 7.0, November 2003, **[accessed September 19, 2012]**, at 7<http://pubs.water.usgs.gov/twri9A7/>.

Graham, J.L., Loftin, K.A., Ziegler, A.C., and Meyer, M.T., 2008, Cyanobacteria in lakes and reserviors—Toxin and taste-and-odor sampling guidelines (ver. 1.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A7, section 7.5, September 2008, **[accessed September 19, 2012]**, at 7<http://pubs.water.usgs.gov/twri9A7/>.

Guy, H.P., 1969, Laboratory theory and methods for sediment analysis: U.S. Geological Survey Techniques of Water-Resources Investigations, book 3, chap. C1, 58 p.

Hambrook Berkman, J.A., and Canova, M.G., 2007, Algal biomass indicators (ver. 1.0): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A7, section 7.4, August 2007, **September 19, 2012**,at <http://pubs.water.usgs.gov/twri9A7/>.

[Knott, J.M., Glysson, G.D., Malo, B.A., and Schroder, L.J., 1993, Quality-assurance plan for the collection and processing of sediment data by the U.S. Geological Sur­vey, Water Resources Division: U.S. Geological Survey Open-File Report 92-499, 18 p.](http://pubs.usgs.gov/of/1992/0499/report.pdf)

Matthes, W.J., Scholar, C.J., and George, J.R., 1992, Quality-assurance plan for the analysis of fluvial sediment by laboratories of the U.S. Geological Survey: U.S. Geological Survey Open-File Report 91-467, 31 p.

[Moulton II, Stephen R., Kennen, Johathan G., Goldstein, Robert M., and Hambrook, Julie A., 2002, Revised protocols for sampling algal, invertebrate, and fish communities as part of the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 02-150, 75 p.](http://pubs.usgs.gov/of/2002/ofr-02-150/pdf/ofr02-150.pdf)

Myers, D.N., Stoeckel, D.M., Bushon, R.N., Francy, D.S., and Brady, A.M.G., 2007, Fecal indicator bacteria (ver. 2.0): U.S. Geological Survey Techniques of Water-Resourcs Invvestigations, book9, chap. A7, section 7.1, February 2007, **[accessed September 19, 2012],** at 7<http://pubs.water.usgs.gov/twri9A7/>.

[Peden, M.E., and others, 1986, Development of standard methods for the collection and analysis of precipitation: Cincinnati, Ohio, U.S. Environmental Protection Agency [variously paged].](http://www.isws.illinois.edu/pubdoc/CR/ISWSCR-381.pdf)

Radtke, D.B., 2005, Bottom-material samples (ver. 1.1): U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A8, June 2005, **[accessed September 19, 2012]**, at <http://pubs.water.usgs.gov/twri9A8/>.

Shelton, L.R., and Capel, P.D., 1994, Guidelines for collecting and processing samples of streambed sediment for analysis of trace elements and organic contaminants for the National Water-Quality Assessment Program: U.S. Geological Survey Open-File Report 94-458, 20 p.

U.S. Geological Survey, variously dated, Biological indicators: U.S. Geological Survey Techniques of Water-Resources Investigations, book 9, chap. A7, with sec. 7.0–7.5 **[accessed September 19, 2012]**, at <http://pubs.water.usgs.gov/twri9A7/>.

[Willoughby, T.C., 1995, Quality of wet deposition in the Grand Calumet River water­shed, northwestern Indiana, June 30, 1992–August 31, 1993: U.S. Geological Survey Water-Resources Investigations Report 95-4172, 55 p.](http://pubs.usgs.gov/wri/1995/4172/report.pdf)

Office of Surface Water Technical Memorandum 93.01, 1992, Summary of documentation that describes instrumentation and field methods for collecting sediment data, **[accessed September 19, 2012]**, at <http://water.usgs.gov/admin/memo/SW/sw93.01.html>

Office of Water Quality Technical Memorandum 2008.04, 2008, Nitrogen isotope analysis – information and revised field procedures, **[accessed September 19, 2012]**, at <http://water.usgs.gov/admin/memo/QW/qw08.04.pdf>

Office of Water Quality Technical Memorandum 2009.04, 2009, Reminder of how to minimize contamination of volatile organic compound samples, **[accessed September 19, 2012]**, at <http://water.usgs.gov/admin/memo/QW/qw09.04.pdf>

**9.0 Water-Quality Sample Handling and Tracking**

Office of Water Quality Technical Memorandum 2010.05, 2010, Policy for the mandatory storage of discrete sediment data and selected metadata in the National Water Information System, and availability of SedLOGIN software to assist in data entry, **[accessed September 19, 2012]**, at <http://water.usgs.gov/admin/memo/QW/qw10.05.pdf>

Office of Water Quality Technical Memorandum 2011.01, 2011, Effective September 16, 2011 – the new analytical service request (ASR) form for samples received at the National Water Quality Laboratory (NWQL) is available for use, **[accessed September 19, 2012]**, at <http://water.usgs.gov/admin/memo/QW/qw11.04.html>

**10.0 Water-Quality Data Management**

Office of Water Quality Technical Memorandum 2002.15, 2002, Use of the new data-quality-indicator (DQI) field in NWIS 4\_1, **[accessed September 19, 2012]**, at <http://phoenix.cr.usgs.gov/policy/OWQ_02.15_dqi.html>

Office of Water Quality Technical Memorandum 2007.03, 2007, Changes to the NWISWeb aggregation and display of water-quality data, **[accessed September 19, 2012]**, at <http://water.usgs.gov/admin/memo/QW/qw07.03.html>

Office of Water Quality Technical Memorandum 2010.05, 2010, Policy for the mandatory storage of discrete sediment data and selected metadata in the National Water Information System, and availability of SedLOGIN software to assist in data entry, **[accessed September 19, 2012]**, at <http://water.usgs.gov/admin/memo/QW/qw10.05.pdf>

**11.0 Publication of Water-Quality Data**

Office of Water Quality Technical Memorandum 2008.06, 2008, Policy for interpreting and reporting of radiological data, **[accessed September 19, 2012]**, at <http://water.usgs.gov/admin/memo/QW/qw08.06.html>

**12.0 Water-Quality Training and Reviews**

No references