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Quality-Assurance and Data-Management Plan for Water-Quality Activities in the Kansas Water Science Center, 2014

Open-File Report 2014–1233

U.S. Department of the Interior
U.S. Geological Survey

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Jennifer L. Graham, and James E. Putnam

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SALLY JEWELL, Secretary

U.S. Geological Survey
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Contents

Figures

Tables

Conversion Factors

SI to Inch/Pound

Multiply	By	To obtain
	Length	
centimeter (cm)	0.3937	inch (in.)
	Volume	
liter (L)	0.2642	gallon (gal)
	Flow rate	
liter per second (L/s)	15.85	gallon per minute (gal/min)
	Mass	
gram (g)	0.03527	ounce, avoirdupois (oz)

Specific conductance is given in microsiemens per centimeter at 25 degrees Celsius (µS/cm at 25°C).

Concentrations of chemical constituents in water are given either in milligrams per liter (mg/L) or micrograms per liter (µg/L).

Abbreviations and Acronyms

ADAPS	Automated Data Processing System
ANC	acid neutralizing capacity
ASTM	American Society for Testing and Materials
AWUDS	Aggregated Water Use Data System
BART	biological activity and reactivity test
BioData	Aquatic Bioassessment Database
BQS	Branch of Quality Systems
CHIMP	Continuous Hydrologic Instrumentation Monitoring Program
DCP	data collection platform
EDI	equal-discharge increment
EWI	equal-width increment
ELISA	enzyme-linked immunosorbent assay
EPA	Environmental Protection Agency
FNU	formazin nephelometric units
GPS	Global Positioning System
GWSI	Groundwater Site Inventory System
JHA	Job Hazard Analyses
KDHE	Kansas Department of Health and Environment

KSWSC	Kansas Water Science Center
NAWQA	National Water-Quality Assessment
NELAP	National Environmental Laboratory Accreditation Program
NFM	National Field Manual
NFQA	National Field Quality Assurance
NFSS	National Field Supply Service
NWIS	National Water Information System
NWQL	National Water Quality Laboratory
OSW	Office of Surface Water
OWQ	Office of Water Quality
PCFF	Personal Computing Field Form
PFD	personal flotation device
PTFE	polytetrafluoroethylene
QA	quality assurance
QC	quality control
QMS	Quality Management System
QWDATA	Water-Quality Data System
QWDX	Water-Quality Data Transfer System
RMS	Records Management System
SDS	site data sheets
SIMS	Site Information Management System
SOP	Standard operating procedure
SWUDS	Site-Specific Water Use Data System
TN	total nitrogen
USGS	U.S. Geological Survey
VOC	volatile organic compound
WMA	Water Mission Area
WUDS	Water-Use Data System

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Abstract

As the Nation's largest water, earth, and biological science and civilian mapping information agency, the U.S. Geological Survey is relied on to collect high-quality data, and produce factual and impartial interpretive reports. This quality-assurance and data-management plan provides guidance for water-quality activities conducted by the Kansas Water Science Center. Policies and procedures are documented for activities related to planning, collecting, storing, documenting, tracking, verifying, approving, archiving, and disseminating water-quality data. The policies and procedures described in this plan complement quality-assurance plans for continuous water-quality monitoring, surface-water, and groundwater activities in Kansas.

Introduction

The U.S. Geological Survey (USGS) was established in 1879 by an act of Congress to provide a permanent Federal agency to classify public lands, and examine the geologic and mineral resources of the national domain (Rabbitt, 1989). Today (2014), the USGS is the Nation's largest water, earth, and biological science and civilian mapping information agency (U.S. Geological Survey, 2014), and the USGS is relied on to collect high-quality data and produce factual and impartial interpretive reports. The Water Mission Area (WMA) is one of seven science mission areas of the USGS. The water mission is to collect and disseminate reliable, impartial, and timely scientific information that is needed to understand the Nation's streams, lakes, reservoirs, wetlands, and aquifers (Evenson and others, 2013). Water-quality activities in the Kansas Water Science Center (KSWSC), Lawrence, Kan., are part of this overall mission.

To help ensure the integrity of USGS science programs, a set of fundamental science practices and operational principles has been developed as the foundation for all USGS research and monitoring activities (Fundamental Science Practices Advisory Committee, 2011). Each USGS Water Science Center maintains a document that describes policies and procedures related to water-quality activities. Quality assurance (QA) is the term used to describe programs and procedures necessary to assure data reliability (Friedman and Erdmann, 1982). Quality control (QC) is the term that describes routine procedures used to produce data of satisfactory quality (Friedman and Erdmann, 1982). This document, the QA plan, describes objectives, principles, policies, organization, management, responsibilities, and implementation procedures for water-quality activities using prescribed guidelines and technically approved methods. QA plans enhance USGS science programs by providing consistency in data quality across all levels of the USGS, accountability to the scientific community and general public, comparability of results among sites and laboratories, traceability from the end product back to its origins, application of appropriate and documented techniques, representativeness of the data in describing the actual site conditions, and adequacy in the amount of data obtained to meet data objectives.

By following established QA policies and procedures, personnel ensure the technical quality and reliability of data and products of the KSWSC. This plan is intended to be a living document that is updated regularly as policy, procedures, and technology change. It is based on the following principles: (1) Water-quality programs and projects will be planned efficiently and effectively to provide information needed to evaluate local, state, and national water problems; (2) Technical and scientific activities will be performed in accordance with applicable USGS practices and policies; (3) Water-quality activities will be performed by technically qualified personnel performing at a level commensurate with their training and experience; (4) All such activities and projects will receive appropriate and timely review for completeness, reliability, and credibility; and (5) Remedial actions will be taken to correct any observed technical or project deficiency.

Purpose and Scope

The purpose of this plan is to describe and document the quality-assurance and data-management policies and procedures used by the USGS at the KSWSC for water-quality activities. Specific activities include planning, collecting, storing, documenting, tracking, verifying, approving, archiving, and disseminating data. This plan identifies responsibilities for ensuring that policies and procedures are carried out. The plan also serves as a guide for all personnel who are involved in water-quality activities, and as a resource for identifying memoranda, publications, and other resources that describe associated techniques and requirements in more detail. This plan applies to discrete water-quality activities conducted by KSWSC staff beginning in federal fiscal and water year 2015 (October 1, 2014 through September 30, 2015). For some studies, deviations from this plan may be necessary to meet project objectives. Those deviations must be documented in the project proposal or work plan, and described in related publications. The policies and procedures documented in this plan focus primarily on discrete water-quality data, and are intended to complement the QA plans for continuous water-quality monitoring, groundwater, and surface water, and to supplement existing project-specific plans. Public Web sites with additional pertinent information are included in this report. Additional Web sites are available to USGS employees on internal USGS Web sites. This plan does not apply to activities of the Organic Geochemistry Research Laboratory (OGRL).

Organizational Structure

The KSWSC maintains three offices including the primary office in Lawrence, Kansas that includes staff for hydrologic investigations, hydrologic data management, administrative services, and computer applications. Also located in the Lawrence office is field office staff and the OGRL staff. Additional field offices are located in Wichita, Kans., and Hays, Kans.

Records Management

The data-management policies described in this plan will help ensure proper management of water-quality records. Federal employees are required by law (44 USC 29) to manage all recorded information made or received in the course of transacting Federal business according to specific policies. This ensures proper accountability of government activities and ensures records are readily accessible to all authorized users. A record that must be maintained for a certain amount of time and archived is any “documentary material, regardless of physical form or characteristic, made or received” by the Federal Government that is evidence of the organization, functions, policies, decisions, procedures, operations, and activities; they are also maintained or archived because of the informational value of the data in them (U.S. Geological Survey, 2009). A record can be in paper, electronic, or physical form, and can include the following: data collected, laboratory results, meeting minutes, letters, electronic mail, telephone logs, completed forms, directives, memorandums, photographs, videos, maps, engineering drawings, report peer reviews, rock core, and physical samples. Nonrecords generally are materials unrelated to official duties that do not fit the definition of a record. They can include the following: incidental correspondence not related to business, conference notes, extra copies of materials, computer output easily reproducible, personal materials kept for convenience, and easily accessible general reference material. Non-records are destroyed when their purpose is served. The complete USGS policy for archiving all categories of hydrologic records can be accessed at *http://www.usgs.gov/usgs-manual/schedule/432-1-s2/index.html* (U.S. Geological Survey, 2006a).

Data collected to meet objectives of the KSWSC programs will be documented, organized, and archived in a manner that (1) facilitates retrieval, evaluation, and use by KSWSC personnel and others; and (2) enables an independent verification of data contained in reports and computer databases.

Data Storage

Hydrologic information collected by the KSWSC is stored in databases and in electronic files. Paper files existing before the transition to electronic files are stored in a central designated location of the KSWSC or in individual project files maintained by the Project Chief. Some original data from basic data-collection programs (before 2000) are archived at the National Archives and Records Administration. An overview of the electronic data storage structure (fig. 1) is described in this section. Additional details describing the process of collecting water-quality data, in particular discrete sample data, and storing them in appropriate locations are provided in subsequent sections of this plan. Some information related to continuous water-quality data is included in this document, but more details are provided in Bennett and others (2014). Details related to surface-water stage and streamflow data (Loving and others, unpub. data, 2011) and groundwater data (Putnam and Hansen, 2014) are provided in separate documents.

The National Water Information System (NWIS) is the primary database used by the USGS nationwide for storage of electronic hydrologic data (fig. 1). All USGS WMA data that functionally fit in NWIS must be stored there (Office of Water Quality [OWQ] Technical Memorandum 2008.05; U.S. Geological Survey, 2008). NWIS consists of the following four subsystems: the Automated Data Processing System (ADAPS), the Water-Quality Data System (QWDATA), the Groundwater Site Inventory System (GWSI), and the Water-Use Data System (WUDS).

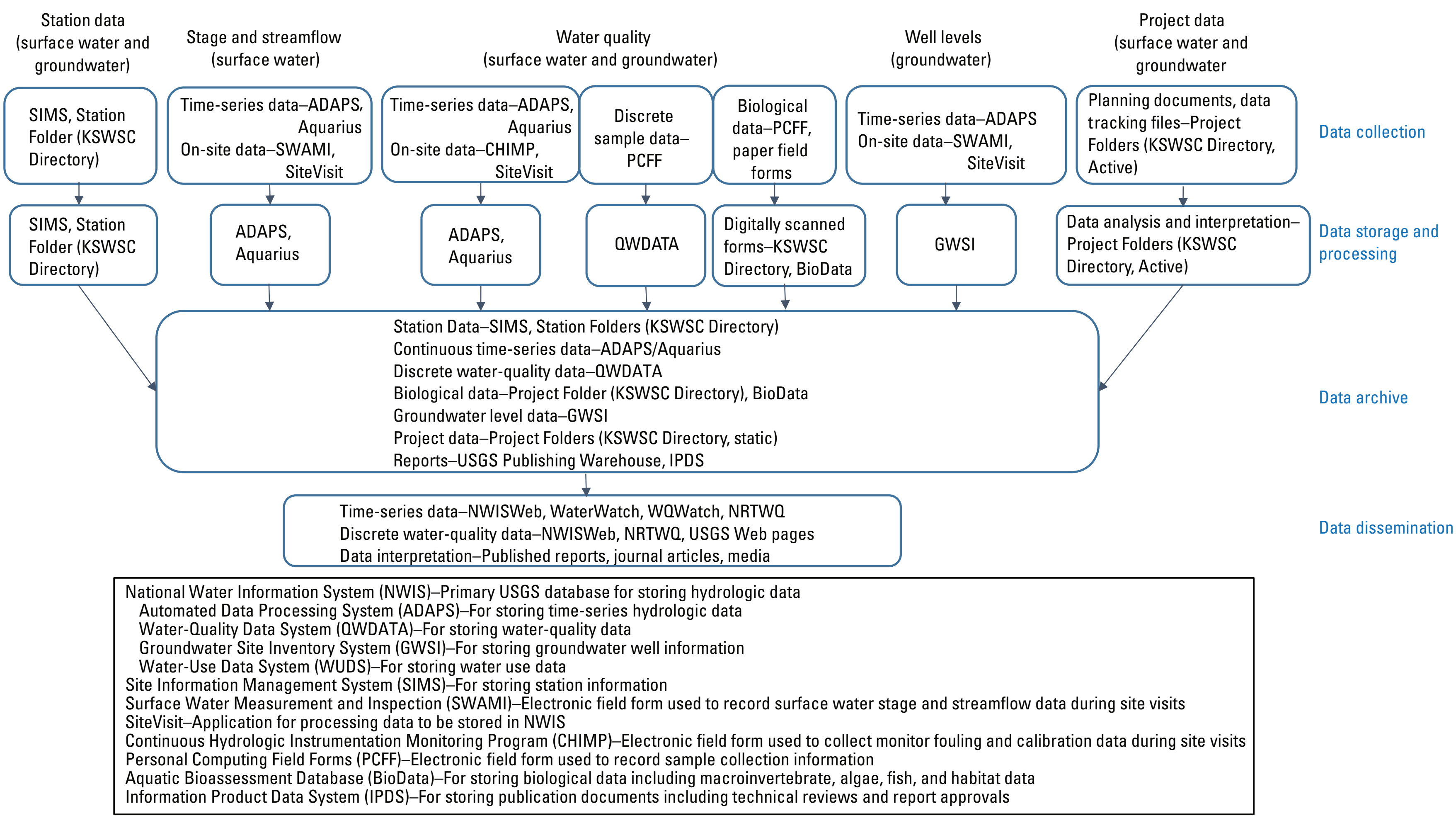


Figure 1. Process for data collection, storage, processing, archiving, and dissemination in the Kansas Water Science Center.

The ADAPS subsystem is used for storing time-series hydrologic data (fig. 1). Data stored in ADAPS are related to the quantity and quality of surface water and groundwater resources over time, and include gage heights or water levels, streamflow (or discharge), rainfall, water temperature, specific conductance, dissolved oxygen, pH, turbidity, and other water-quality constituents. SiteVisit is an application for processing data to be stored in NWIS. Time-series data are accessible to the public through the internet by automated uploads from ADAPS to the Web interface for NWIS, which is called NWISWeb (*http://waterdata.usgs.gov/ks/nwis*).

The QWDATA subsystem is used for storing discrete water-quality data. The database contains data related to the quality of surface water, groundwater, and precipitation samples including physical properties (such as streamflow and water levels); chemical data (such as major ions, nutrients, trace metals, and organic constituents); biological data (such as coliform bacteria); and sediment data. Water-quality properties or constituents measured in a sample, and their units of measure (such as filtered calcium in water, in milligrams per liter [mg/L]), are identified in QWDATA using a five-character parameter code (00915), which is typically documented with data on output. Water-quality data are accessible to the public through the internet by automated uploads from QWDATA to NWISWeb.

The GWSI subsystem primarily is used for storing hydrologic site information (Site File) and groundwater level information. Information about well construction and hydraulic properties are also contained in GWSI. Site information and water-level data are accessible to the public through the internet by automatic uploads from GWSI to NWISWeb.

The Water-Use Data System is used for storing information related to quantity and distribution of water use. It includes the Site-Specific Water Use Data System (SWUDS) and the Aggregated Water Use Data System (AWUDS).

Apart from NWIS, the Site Information Management System (SIMS) is used by the USGS nationwide for storing station-specific data including station descriptions, manuscripts, station analyses, maps, data collection platform (DCP) information, and other required data. Also within SIMS is the Records Management System (RMS), which is used to document and track processing of time-series data records. SIMS scripts are used to compile and publish annual water data (*http://wdr.water.usgs.gov/*) in site data sheets (SDS).

Some biological data and ecological data are electronically stored in the KSWSC Directory Project Folders and KSWSC Folders (table 1). A database is being developed by the USGS (Aquatic Bioassessment Database [BioData]) that stores macroinvertebrate, algae, fish, and habitat data. Limitations have existed for storing data collected following protocols that are different from the National Water-Quality Assessment (NAWQA) Program or other national protocols. Typically, the KSWSC uses protocols developed by the Kansas Department of Health and Environment (KDHE) for collecting macroinvertebrates so the data can be used to assess aquatic-life-use criteria. When BioData is fully capable of storing biological and ecological data collected with protocols used by the KSWSC, BioData will be used for data storage.

Important information that cannot be stored in NWIS or SIMS is stored electronically in centrally located folders on the KSWSC network servers where files are backed up regularly and frequently. This includes Station Folders and Project Folders (table 1). Station Folders contain station inspection records, instrument setup information, levels, measurements, permits, photographs, and safety information (table 1). Project Folders contain planning documents, data QC information, and data analysis and interpretation files (table 1). Project Folders also contain biological information including macroinvertebrate, algae, fish, and habitat data, which cannot be stored in national USGS databases. Folders and files stored in the KSWSC Directory will follow an established structure and naming conventions, which are under development but similar to the structure shown in table 1.

Data and information stored in the electronic KSWSC Directory will be archived when data collection is completed and data are published. When a file is archived, access to the folder is locked and information is retained indefinitely. The archived files will be stored in the same electronic directory. Archiving of the station folders will be automated generally such that when a file has not been modified in 2 years, the file is locked and preserved. Project files will be archived at the request of the Project Chief after all documents and products have been stored in the directory, but generally within about a year after the project has ended. Most projects include a publication just before the end of the project.

Transition to Electronic Data Management

The KSWSC began a transition to storing hydrologic data and records in electronic format in October 2013, corresponding to the beginning of federal fiscal and water year 2014. Before that, data were stored in paper or electronic format. The goal for the KSWSC is to move to a paperless system in which all hydrologic data are collected electronically and stored in digital format. However, existing software programs for collection of water-quality data do not yet accommodate all types of data being collected. As the KSWSC transitions to electronic data storage, existing active project files will be migrated into the centrally-located electronic KSWSC Directory. For new projects, all data and files will be stored in the electronic directory from the onset of the project. For example, files related to data collection from Spring River and Johnson County projects are being stored electronically. Existing projects (in 2014) are being transitioned in an order generally corresponding to complexity of data collection and data management. For example, files related to the Neosho River and Kansas River projects are being transitioned first, and files related to the more complex *Equus* project may be transitioned last. Files are stored in pdf (Portable Document Format), xml (Extensible Markup Language), or Microsoft Office™ formats including Word, Excel, and PowerPoint. Decisions related to

Table 1. General file structure and naming conventions for centralized electronic data management directory used to store and archive data in the Kansas Water Science Center.

[Italics indicate file name; Y, year; M, month; D, date; T, time; KSWSC, Kansas Water Science Center; PCFF, Personal Computer Field Form; QC, quality control; ADCP, acoustic doppler current profiler; CHIMP, Continuous Hydrologic Instrumentation Monitoring Program; PFD, personal flotation device; JHA, Job Hazard Analysis]

Folder and contents	Description of contents	Required (if applicable)	Folder or file name	File names in folder
KANSAS WATER SCIENCE CENTER DATA MANAGEMENT DIRECTORY			KS_Data_Directory	
Station Folder	All station-specific information for surface and groundwater sites	X	Station_Specific	
Station	Folder containing all information related to specified site	X	*station#_shortname*	
Map	Map of site	X	Maps	*map_description*
Permits	Permits for access and construction	X	Permits	*permit_description*
JHA	Job Hazard Analysis	X	--	*jsite#*
Traffic control plan	Traffic control plan	X	--	*traffic*
Inspections	Streamgage inspections	X	Inspections	*S_station#_YYYYMMDD_TTTTTT*
Instrument setup	Descriptions of instrument installations and setup	X	Setup	*Setup_description*
Levels	Levels information	X	Levels	*L_station#_YYYYMMDD_TTTTTT*
Measurements	Streamflow measurements	X	Measurements	*####_YYYYMMDD*
Photos	Photographs of site	X	Photos	*station#_YYYYMMDD_shortdescription*
Well construction	Well construction information	X	Well_construction	To be determined
Geophysical logs	Geophysical log information	X	Logs	To be determined
Well integrity	Well integrity records	X	Wells	To be determined
Samples	Folder containing all water quality sample information	X	Samples	
Date	Information is stored by sample date/time	X	*YYYYMMDD.TTTT*	
Field sheet	PCFF or digitally scanned field sheet	X	--	*station#.YYYYMMDD.TTTT*
ASRs	Analytical Services Request forms	X	--	*station#.YYYYMMDD.TTTT.ASR1*
Attachments	Additional info related to sample such as field data that won't fit in PCFF	X	--	*station#.YYYYMMDD.TTTT.description*
CHIMP files	Water-quality monitor calibration forms and information	X	CHIMP_files	
Project Folder	All project-specific information that is not station-specific	X	Project_Specific	
Project	Folder containing all information specific to this project	X	*project#_shortname*	
General info	File with project description -overview, start date, stations included in study, etc	X	--	*General_Info_YYYYMMDD*
Proposal	Project proposal	X	--	*Proposal_YYYYMMDD*
JFA	Project Joint Funding Agreement	X	--	*JFA_YYYYMMDD*
Work plan	Project work plan	X	--	*Work_Plan_YYYYMMDD*
Project reviews	Folder containing files related to quarterly/annual project review	--	Reviews	*YYYYMMDD_review*
Data	Folder containing project data files including QC files and data not stored in databases	X	Data	To be determined
Reports in progress	Files related to reports in progress including drafts, preliminary data analysis	--	Reports	To be determined
Models in progress	Files related to models in progress	--	Models	To be determined
Photos	Folder containing project-specific photos	--	Photos	*station#_YYYYMMDD_shortdescription*
Final products	Folder containing all final products including reports and powerpoints	--	Products	*SIRXX-XXXX_final*

Table 1. General file structure and naming conventions for centralized electronic data management directory used to store and archive data in the Kansas Water Science Center.—Continued

[Italics indicate file name; Y, year; M, month; D, date; T, time; KSWSC, Kansas Water Science Center; PCFF, Personal Computer Field Form; QC, quality control; ADCP, acoustic doppler current profiler; CHIMP, Continuous Hydrologic Instrumentation Monitoring Program; PFD, personal flotation device; JHA, Job Hazard Analysis]

Folder and contents	Description of contents	Required (if applicable)	Folder or file name	File names in folder
KSWSC Folder	Information pertaining to multiple stations and projects	--	KSWSC_general	
Water quality	Folder containing water-quality information pertaining to multiple stations and projects	--	WaterQuality	
Batch files	Folder containing recent batch files for upload into NWIS	--	Qwbatchfiles	*YYYYMMDD.initials*
Watlists	Folder containing watlists	--	Watlists	*YYYYMMDD.1*
Data	Folder containing data files including QC files and data not stored in databases	--	Data	To be determined
Models	Folder containing all models developed in the KSWSC	--	Models	
Water quality	Folder containing all water-quality model information	--	WQ	To be determined
Groundwater	Folder containing all groundwater model information	--	GW	To be determined
Surface water	Folder containing all surface-water model information	--	SW	To be determined
Instrument checks	Information related to instrument calibrations	--	*Instrument_checks*	
ADCPs	Folder containing information on ADCPs	--	*manuf_model_serial*	*serialnumber_YYYYMMDD*
Flowtrackers	Folder containing information on Flowtrackers	--	*manuf_model_serial*	*serialnumber_YYYYMMDD*
Inflatable PFDs	Folder containing information on inflatable PFDs	--	*manuf_model_serial*	*serialnumber_YYYYMMDD*
Levels instruments	Folder containing information on levels instruments	--	*manuf_model_serial*	*serialnumber_YYYYMMDD*
Price meters	Folder containing information on Price meters	--	*manuf_model_serial*	*serialnumber_YYYYMMDD*
YSI field monitor calibrations	Folder containing information on YSI field monitor calibrations	--	*manuf_model_serial*	*serialnumber_YYYYMMDD*
Equipment repairs	Folder containing information on records of equipment repairs	--	*manuf_model_serial*	*equipment_YYYYMMDD*
Manuals	Folder containing information on operating manuals for field equipment	--	*manuf_model*	*title_YYYYMMDD*
Software	Folder containing information on software and updates used with field equipment	--	*manuf_model*	*title_YYYYMMDD*
Lab instrument records	Folder containing records of laboratory equipment checks and maintenance	--	*manuf_model_serial*	*equipment_YYYYMMDD*
Proposed gages	Folder containing information related to proposed stations	--	--	*description_YYYYMMDD*

handling files for active projects that existed prior to transition to electronic data will be made on a case-by-case basis. To facilitate the goal of complete electronic data storage, paper records for appropriate active projects may be digitally scanned and stored in the KSWSC Directory as the original form. When additional practical data storage capabilities are available in national databases and applications, the KSWSC will use those resources for appropriate data storage and archiving. Organization and structure of digital folders and files in the centralized location are presented in this report, but may change as the process is more fully developed.

Roles and Responsibilities

Quality assurance is an active process of achieving and maintaining high standards for water-quality data. Consistent quality assurance and data management requires specific actions that 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 integrity of water-quality data.

Quality Assurance and Data Management

The final responsibility for the preparation, and implementation of and adherence to the policies described in this plan lies with the KSWSC Director. Although the KSWSC Director has primary responsibility for overall program and project planning, the Director is aided and advised by the Chiefs of the Hydrologic Investigations and Data Sections, the Water-Quality Specialist, Project Chiefs, the Supervisory or Lead Hydrologic Technicians, Project and Field Staff, and the Database Administrator. Final review and approval of data archives is the responsibility of the Database Administrator, Project Chiefs, and Water-Quality Specialist. The Database Administrator is primarily responsible for the data archives, Project Chiefs are primarily responsible for project archives, and the Water-Quality Specialist assists with and provides oversight for all water-quality archives.

The KSWSC Director and other staff members are responsible for the following:

- Managing and directing the KSWSC program, including designation of personnel responsible for managing all water-quality and data-management activities.
- Ensuring that the water-quality and data-management activities of the KSWSC meet the needs of cooperating agencies, other Federal agencies, the USGS, and the KSWSC.
- Ensuring that all publications released by USGS personnel are technically correct, scientifically defensible, and comply with USGS publication standards and policies.
- Providing final resolution, in consultation with appropriate staff, of any conflicts or disputes related to water-quality and data-management activities within the KSWSC.
- Ensuring that all aspects of the quality-assurance and data-management plan are understood and adhered to by USGS personnel. This is accomplished by direct involvement of the KSWSC Director or through clearly stated delegation of this responsibility to other personnel in the KSWSC.
- Ensuring that data-management training is incorporated into each employee's training plan when appropriate.

The Chiefs of Hydrologic Investigations and Data Sections are responsible for the following:

- Ensuring that the water-quality and data-management activities of the KSWSC meet the needs of cooperating agencies, other Federal agencies, the USGS, and the KSWSC.
- Ensuring that all aspects of the quality-assurance and data-management plan are understood and adhered to by KSWSC personnel.
- Participating in management reviews of water-quality projects and programs in their sections.
- Planning, scheduling, and participating in technical reviews of water-quality projects and programs in their sections.
- Ensuring that personnel are following safety policies regarding traffic control, personal flotation devices (PFDs), Job Hazard Analyses (JHAs), laboratory use, boat operation, Safe-Return policy, and other related procedures.
- Ensuring that proper archiving of data is done according to USGS and KSWSC policies.

The Water-Quality Specialist or designated representative is responsible for the following:

- Ensuring that the water-quality activities of the USGS in Kansas meet the needs of cooperating agencies, other Federal agencies, the USGS, and the KSWSC.
- Ensuring that all aspects of the quality-assurance and data-management plan are understood and adhered to by KSWSC personnel.

- Ensuring that the plan is reviewed and revised triennially to document current responsibilities, methodologies, and on-going procedural improvements.
- Participating in management and technical reviews of all water-quality projects and programs.
- Participating in annual reviews of water-quality records before publication of the records in reports.
- Reviewing all water-quality-related project proposals.
- Reviewing draft water-quality reports by personnel as requested by KSWSC management or the KSWSC Reports Specialist.
- Keeping personnel in the KSWSC briefed on procedural and technical communications from region and headquarters offices.
- Planning and participating in training courses for water-quality personnel as needed.
- Ensuring that personnel are following safety policies regarding traffic control, PFDs, JHAs, laboratory use, boat operation, Safe-Return policy, and other related procedures.
- Ensuring that proper archiving of data is done according to USGS and KSWSC policies.

Project Chiefs or appropriately designated personnel are responsible for the following:

- Ensuring that the water-quality and data-management activities of the project or program meet the needs of cooperating agencies, other Federal agencies, the USGS, and the KSWSC.
- Ensuring that all aspects of the plan are understood and adhered to by project or program personnel.
- Participating in management and technical reviews of water-quality projects or programs for which they are responsible.
- Annually reviewing and approving data collected for their projects.
- Following USGS safety policies regarding traffic control, PFDs, JHAs, laboratory use, boat operations, Safe-Return policy, and other related procedures; and ensuring that personnel are doing the same.
- Ensuring that proper archiving of data is done according to USGS and KSWSC policies.

The Supervisory or Lead Hydrologic Technicians, or designated persons are responsible for the following:

- Ensuring that the water-quality activities of the project or program meet the needs of cooperating agencies, other Federal agencies, the USGS, and the KSWSC.
- Ensuring that all aspects of the plan are understood and adhered to by water-quality personnel in the Hydrologic Data Program.
- Providing leadership and guidance in the areas of water-quality field methods, data management, and data review.
- Communicating directly with the Water-Quality Specialist, Project Chiefs, and other personnel on technical and policy issues related to water quality.
- Working with the Water-Quality Specialist, Project Chiefs, and other personnel on issues that contribute to continuous improvement in all aspects of the KSWSC water-quality program.
- Following USGS safety policies regarding traffic control, PFDs, JHAs, laboratory use, boat operations, Safe-Return policy, and other related procedures; and ensuring that personnel are doing the same.
- Ensuring that equipment is maintained and functioning properly.
- Ensuring that proper archiving of data is done according to USGS and KSWSC policies.

All water-quality program or project staff are responsible for the following:

- Being familiar with and adhering to the contents of the quality-assurance and data-management plan in all water-quality activities.
- Seeking guidance from their supervisor, lead water-quality technician, or KSWSC Water-Quality Specialist on any aspect of their water-quality activities when questions or concerns arise.
- Following USGS safety policies regarding traffic control, PFDs, JHAs, laboratory use, boat operations, Safe-Return policy, and other related procedures.

The Database Administrator is responsible for the following:

- Operating and maintaining NWIS.
- Ensuring that automatic retrieval of the analytical data from the National Water-Quality Laboratory (NWQL) is completed at least twice weekly.

- Providing technical support, including training, on the use of NWIS.
- Ensuring that proper archiving of data is done according to USGS and KSWSC policies.

Safety

It is the responsibility of all KSWSC employees to follow established policy and commonsense guidelines regarding safety. Because the collection of water-quality data in the field can be hazardous at times, the safety of field personnel is a primary concern. Many field teams 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 equipment. 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 KSWSC communicates information and directives related to safety to all personnel. Training is provided by a combination of certified contract trainers and qualified in-house trainers. JHAs are provided to identify potential hazards and actions for avoiding them. Specific policies and procedures related to safety for employees are located on the KSWSC's internal Web site. Safety Web sites include the Traffic Control Plan, Hazard Communication Plan, Central Region Safety Newsletter, USGS Safety Home Page, and others. A Web site also is provided for the KSWSC Safe-Return Plan, which was implemented in 2013, and describes required procedures for tracking field personnel using Global Positioning System (GPS) devices and cell phone communications to ensure employees return safely from field work.

An individual has been designated as the Safety Officer for the KSWSC by the Director. In addition, Safety Officers are established in each field office. The Safety Officer serves as the focal point for all safety issues in Kansas, coordinates training and inspections, identifies and abates hazardous conditions, and promotes safety throughout the KSWSC. 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 suggestions to their immediate supervisor or the KSWSC Safety Officer. Additional guidelines pertaining to safety can be found in the USGS National Field Manual (NFM) for the Collection of Water-Quality Data, (U.S. Geological Survey, variously dated[b]). Employees can find additional safety information on the internal USGS Web site.

Training

Employees and supervisors are responsible for ensuring that all personnel involved with water-quality activities are properly trained to effectively and safely perform duties described in this plan. 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.

All personnel in the KSWSC involved in collecting and processing water-quality data will be adequately trained and informed regarding water-quality data-collection and data-management procedures. Individual training plans are developed by the supervisor and employee at least annually as part of the performance review process. Each training activity is documented in the KSWSC training files that are maintained by the KSWSC Training Officer. Each supervisor is responsible for informing their staff about the availability of training from in-house, the USGS, the U.S. Government, and other sources of training. The Water-Quality Specialist provides recommendations and advice to supervisors and their staff as needed. The KSWSC Training Officer 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 National Training Center at the Denver Federal Center; Central Region training; and KSWSC seminars or in-house training courses. The Water-Quality Specialist plays an important role in providing in-house water-quality-related training. Training documents are maintained by the Administrative Officer or designated persons in KSWSC personnel files and by the Personnel Office in the Central Region.

Because of rapid changes in technology, new and improved methods for data collection are continually being developed. All USGS personnel who are involved in water-quality sampling must be aware of changing requirements and recommendations. The Water-Quality Specialist, Project Chief, and Supervisory or Lead Hydrologic Technician in the KSWSC are responsible for providing current information to personnel on the correct protocols to follow in collecting and processing water-quality samples. Any substantial deviation from the specified standard procedures must be documented by the Project Chief, or Supervisory or Lead Hydrologic Technician, and reviewed and approved by the Water-Quality Specialist before using the alternative methods in the field. Additionally, the Project Chief, or Supervisory or Lead Hydrologic Technician are responsible for ensuring that personnel collecting and managing data are trained and qualified, and that personnel take appropriate steps to ensure the data integrity.

Project Planning and Review

The KSWSC Director has the primary responsibility for overall KSWSC program planning, and is responsible for ensuring that KSWSC projects are supportive of KSWSC and national priorities. All water-quality projects require review and approval before commencement of work. Quality-assurance and data-management requirements are integrated into the project proposal.

Project Proposals

Project proposals are mandatory for interpretive projects and may be required for data projects (WMA Memorandum No. 13.01; U.S. Geological Survey, 2013a). Project proposals serve to focus, coordinate, communicate, and document USGS science activities. Because the proposal specifies the scope and objectives, approach, timeline and expected products, it provides a basis for evaluating project progress and success, and aids in ensuring cooperator satisfaction. Project proposals must be submitted to the Water Sciences Field Team for review of technical and policy considerations to ensure that projects are technically sound and meet national quality standards; projects have an approved outlet for data, scientific information and interpretation, and the work does not violate USGS policy.

Elements of a full proposal include a Project Proposal Cover Sheet and the Project Proposal that includes (1) Title, (2) Background and Introduction, (3) Problem, (4) Objectives and Scope, (5) Relevance and Benefits, (6) Approach, (7) Quality Assurance and Quality Control, (8) Products, (9) References, (10) Timeline, (11) Personnel, and (12) Budget Summary. In addition, a Job Hazard Analysis is required. Proposals conform to the format required by WMA Memorandum 13.01 (U.S. Geological Survey, 2013a).

Project Work Plans

Soon after the proposal is approved and funding agreement is in place, and usually before beginning data collection, the Project Chief develops a project work plan containing details related to objectives, data collection activities, technical approaches to data analysis and interpretation, staffing, budget, planned information products, and task deadlines. The work plan may contain some or all of the elements listed in figure 2 and additional pertinent information specific to the project. The work plan includes a report plan that schedules report tasks so that Director's approval and Bureau approval can be obtained, and all reports published before the conclusion of project funding. Work plans also include plans for quality assurance for the project. The project budget is entered into the USGS budget tracking software (Basis+), which is used to help plan project staffing and general funding. The work plan is developed to provide details not provided in the proposal. If during development of the work plan, and (or) during the project, it becomes clear that the technology, funding, personnel, or time indicated in the original project description is inadequate to meet project objectives; additional discussion on modifications to the scope of work or prioritization of existing tasks within the scope of work may be necessary with the cooperating agency, the KSWSC, and Region staff; and a modified work plan may be developed.

Project Reviews

Project reviews that include discussion of management and technical aspects of each water-quality project or program are completed quarterly. Reviews are led by the KSWSC Director, Chief of Hydrologic Data Management Section, Chief of Hydrologic Investigations Section, Administrative Officer, Discipline Specialists, and other designated personnel. Region staff are kept informed of the review schedule and extended an open invitation to participate in any project review. It is the responsibility of the Chief of Hydrologic Investigations Section to plan and schedule project reviews of all water-quality studies.

The discussion of management during project review usually includes a brief discussion of the problem, objectives, approach, and status of work plan elements. Discussion of budget may be included in the project review, but often is scheduled separately at about the same time that project reviews take place. The bulk of the time reviewing management is devoted to dialogue between project staff and the review team, and typically includes discussions of the linkage between the project plan, and data collection, analysis and reporting activities, important findings, substantial problems, and related program development opportunities. The technical component of project review may include additional personnel with technical expertise in the subject area. Technical discussions are used to assess and provide guidance on the data-collection, data-analysis, and data-interpretation methodologies used in the project.

Water-Quality Data Collection

Water-quality data collected by the USGS are used by Federal, State, and local agencies to guide their decisions concerning the appropriate and efficient management of water resources for the Nation. Water-quality data are collected as part of Federal programs such as the NAWQA Program, and for cooperative projects jointly funded by local or State agencies, or other federal agencies. Data are a vital component of water-resources activities performed by the USGS and the KSWSC.

Data collection in support of water-quality programs in the KSWSC may include collection of water samples, streambed sediment samples, periphyton, macroinvertebrates, fish, and stream habitat information. Water samples commonly are

General contents of a project work plan include the following:

Specific objectives

Staffing

- Plans for staffing project tasks.
- Training needs for staff to accomplish objectives.

Study design

- Related literature citations.
- Quality assurance in study design.
- Explanation of unapproved methods and new approaches being used.

General timeline

Data collection

- Number and location of data collection sites.
- Reasoning for selecting specific sites.
- Plans for on-site installations including streamgages, monitors, telemetry, and so on.
- Descriptions of site access and needed permissions.
- Data collection methods and contingency plans for non-ideal sampling conditions.
- Frequency and targeted conditions for sample collection.
- Number, types, and timing of quality control samples.
- Processing requirements for samples.
- Laboratories to be used for analyses and plans for approval if needed.
- Specific laboratory analysis to be requested.
- Equipment and supplies to be used and plans for needed purchases.
- Plans for working data records and reviewing data.
- Deviations from quality-assurance plans.

Technical approaches to data analysis and interpretation

- Planned statistical analysis.
- Software to be used for analysis.
- Modeling approaches planned.

Data and information products

- Description of data available in real-time and plans for data verification.
- Description of reports and planned timelines.
- Plans for project website and outreach activities.

Figure 2. General contents of a project work plan, Kansas Water Science Center.

analyzed for major ions, nutrients, trace elements, suspended sediment, indicator fecal bacteria, pesticides and other organic compounds. Streambed sediment samples commonly are analyzed for trace elements, nutrients, carbon, and organic compounds. Discrete water-quality samples are collected in accordance with standard USGS sampling protocols described in the NFM (U.S. Geological Survey, variously dated[b]; fig. 3) and protocols described in this plan. Sample collection and processing methods that differ significantly from those deemed to be the official and citable USGS protocol must be documented by the Project Chief in the work plan, and reviewed and approved by the Water-Quality Specialist before using those methods in the field. Sample collection and processing methods that differ significantly from those deemed to be the official and citable USGS protocol are also documented in project publications.

The primary objective in collecting a water-quality sample is to obtain environmental data that are representative of the physical and chemical characteristics of the system that is being studied. This requires the appropriate use of sampling equipment and methods to describe environmental variability, and to prevent contamination or bias in the sampling process. Sampling and processing techniques for specific constituents may differ according to the general class of compound, such as inorganic or organic chemicals. If incorrect sampling procedures produce a nonrepresentative sample, or if the sample is contaminated or degraded before analysis can be completed, the value of the sample is limited. Therefore, compliance with documented and technically approved sample-collection and processing protocols is critical to ensuring the integrity of water-quality data.

Preparation for Sampling

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 analysis. To effectively execute field procedures it is necessary to properly plan and prepare for these activities.

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. Before commencing field activities, the data collectors, Project Chief, or designated persons are responsible for ensuring that the following preparations have been completed:

- Ensuring that safety considerations have been addressed.
- Ensuring that the NWIS Site File is current.
- Using a checklist in preparing for a trip to ensure field preparedness (fig. 4). Back-up instrumentation and sensors should be included on the checklist.
- Reviewing the sampling instructions for each site and the list of sample types required.
- Obtaining information needed to complete electronic field sheets, analytical services request forms (ASRs), or other forms as required by specific laboratories.
- Ensuring that necessary supplies are available, such as bottles, standards, filters, preservatives, meter batteries, waterproof markers, shipping containers, and so on.
- Ensuring that all sampling equipment is thoroughly cleaned and prepared.
- Checking meters and sensors for proper performance.

The NFM (U.S. Geological Survey, variously dated[b], chapter A1) provides additional details on preparations for water sampling.

Selecting Field Sites

Sites are selected by field and project staff following established study design. Sites usually are selected before the first sampling trip and are documented in the work plan. Additional factors to consider include the suitability of a site for sampling, and its accessibility and safety. Existing sites should be considered before establishing new sites. If possible, surface water-quality sites are located at or near streamgages. If this is not possible, the surface water-quality site should be located where streamflow can be measured and water samples can be collected at all stages of flow to be monitored. Specific guidelines for site selection are provided in the NFM (U.S. Geological Survey, variously dated[b], chapter A1). The Chief of Hydrologic Investigations Section or Project Chiefs are responsible for the selection of sampling sites.

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 purposes. Detailed guidance for ground-water site selection is provided in Putnam and Hansen (2014), Lapham and others (1997), and in the NFM (U.S. Geological Survey, variously dated[b]). If suitable existing wells cannot be found, new wells will need to be installed.

Field Instruments

The KSWSC complies with the USGS policy of providing personnel with high-quality field instruments and equipment that are safe, precise, accurate, durable, reliable, and capable of performing required tasks. Accordingly, appropriate instruments for use in water-quality projects in the KSWSC are selected based on the specifications described in the NFM (U.S. Geological Survey, variously dated[b]) and the requirements of the project. The USGS Hydrologic Instrumentation

A1. Preparations for Water Sampling (Wilde, 2005)
- 1.1 Field-trip preparations
- 1.2 Surface water
- 1.3 Ground water

A2. Selection of Equipment for Water Sampling (Wilde and others, 2014)
- 2.1. Sample collection
- 2.2. Sample processing
- 2.3. Field vehicles
- 2.4. Lists of equipment and supplies

A3. Cleaning of Equipment for Water Sampling (Wilde, 2004)
- 3.1 Supplies for equipment cleaning
- 3.2 General cleaning procedures
- 3.3 Specific procedures for cleaning selected types of equipment
- 3.4 Quality control for equipment-cleaning procedures

A4. Collection of Water Samples (U.S. Geological Survey, 2006)
- 4.1. Surface-water sampling
- 4.2. Ground-water sampling
- 4.3. Quality control

A5. Processing of Water Samples (Wilde and others, variously paged). Includes sections below:
- 5.1 Raw samples
- 5.2 Filtered samples
- 5.3 Solid-phase extraction of pesticides
- 5.4 Sample preservation
- 5.5 Handling and shipping of samples
- 5.6 Summary of sample-collection and sample-processing procedures for specific analytes

A6. Field Measurements (Wilde, variously dated)
- 6.0 General Information and Guidelines (Wilde, 2008)
- 6.1 Temperature (Wilde, 2006)
- 6.2 Dissolved Oxygen (Rounds and others, 2013)
- 6.3 Specific Electrical Conductance (Radtke and others, 2005)
- 6.4 pH (Ritz and Collins, 2008)
- 6.5 Reduction-Oxidation Potential-Electrode Method (Nordstrom and Wilde, 2005)
- 6.6 Alkalinity and Acid Neutralizing Capacity (Rounds, 2012)
- 6.7 Turbidity (Anderson, 2005)
- 6.8 Use of Multiparameter Instruments for Routine Field Measurements (Gibs and others, 2012)

A7. Biological Indicators (U.S. Geological Survey, variously dated)
- 7.0. Five-day Biochemical Oxygen Demand (Delzer and McKenzie, 2003)
- 7.1. Fecal Indicator Bacteria (Myers and others, 2014)
- 7.2. Fecal Indicator Viruses (Bushon, 2003)
- 7.3. Protozoan Pathogens (Bushon and Francy, 2003)
- 7.4. Algal Biomass Indicators (Berkman and Canova, 2007)
- 7.5 Cyanobacteria in lakes and reservoirs: toxin and taste-and-odor sampling guidelines (Graham and others, 2008)

A8. Bottom-Material Samples (Radtke, 2005)

A9. Safety in Field Activities (Lane and Fay, 1997)

Figure 3. Table of Contents from the National Field Manual for the Collection of Water-Quality Data, Techniques of Water-Resources Investigations, Book 9, Handbooks for Water-Resources Investigations, May 2014.

Sampling Equipment (non-cleaned items)
4-wheel base with crane
Bridge board
B-Reel
Field Meter
Short Cord
Long Cord
Hand Units
D-81 sampler
DH-95 sampler
D-95 sampler
Counterweights
Variable speed drive
Tagline

Sample Equipment (cleaned items)
Teflon bottles (1L)
Teflon nozzles (1/4")
Teflon nozzles (3/16")
Teflon nozzles (5/16")
Teflon collar
Teflon churn
Churn carrier
Ziplock bags (Large)
Clear plastic trash bags

Field Meter Calibration
Deionized water
Specific conductance, 1000 uS/cm
pH 7.0
pH 10
Dissolved oxygen aeration pump, tubing, stone, bucket
Waste container
Calibration logbook

Cleaning
Deionized water
LiquiNox
Acid rinse water
Carboys
Waste container
Brushes
Plastic sheeting

Sample Processing
Coolers
Pumps with power supply
Acid
Vacuum pump
Pump tubing
Gloves, powderless, nitrile
Chamber assembly
Waste container
Aluminum foil
Graduated cylinder
Blank water
Dissolved organic carbon filters
Chlorophyll filters
Bottle sets, labels
Filter assemblies

Vehicle
Flashlight
Drinking water
Paper towels
Site maps
FedEx locations maps

Sample Shipping
Coolers
Shipping labels
Tape

Safety Gear
Personal flotation devices
Safety cones and signs
Throw rope
First aid kit
Fire extinguisher
Waders
High-visibility gear
Rain gear

Other
Tablet with electronic field forms
Coding guidelines
Processing summary
Cleaning summary
Field manual
Cell phone and charger

Figure 4. Example checklist of equipment and supplies needed for surface-water sampling.

Facility (HIF), which provides analyses of precision and bias for water-quality instruments, also are consulted for recommendations when appropriate. Consultation with the KSWSC Water-Quality Specialist is done if project personnel need assistance with the selection or use of equipment.

All instruments used by personnel for water-quality measurements are 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 are checked and calibrated in the laboratory or field before making the sample measurements, or checked the work day before sampling. Instruments may also be checked after extended sampling or in accordance with the project work plan.

Thorough documentation of all calibration activities associated with water-quality data collection is a critical element of the quality-assurance program. Calibration and maintenance records of field equipment—including the manufacturer, make, model, and serial or property number—are kept in permanent records, and stored in NWIS or in appropriate folders in the KSWSC Directory (table 1). Field monitor calibration and maintenance records are maintained using USGS standard electronic field forms including the Continuous Hydrologic Instrumentation Monitoring Program (CHIMP) and Personal Computing Field Form (PCFF). A separate electronic document, such as an Excel spreadsheet, may be used when available tools do not accommodate the necessary data. This may occur, for example, when new field instruments are used that have not yet been built into the standard field-form software. Specific monitors and sensors may be designated as field meters to facilitate efficient record-keeping. Similar records for laboratory equipment are kept in the KSWSC Directory. Information that is required to be included with the calibration and maintenance records includes the date, initials, and last name of the individual performing the activity; results of calibration or equipment check; lot numbers and expiration dates of calibration standards; and any corrective actions taken (such as monitor repairs, monitor changes, or sensor changes). Protocols for calibrating and maintaining water-quality monitors used to collect field data are described in detail by Bennett and others (2014). Calibration and maintenance records are checked by Project Chiefs, the Supervisory or Lead Hydrologic Technician, or their designated persons, for completeness and accuracy as soon as possible after field work is completed, and before the release of analytical data by the laboratory. Records are reviewed annually by the KSWSC Water-Quality Specialist and every 3 years by the OWQ.

Calibration checks, recalibrations, repair, and maintenance of all multiparameter water-quality monitors for continuous monitoring also are recorded in permanent records or appropriate field forms. Standard procedures for the installation and operation of continuous water-quality monitors are described by Wagner and others (2006), Pellerin and others (2013), and Bennett and others (2014).

Onsite Sample Handling and Documentation

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. Otherwise, bottle mix-ups or other errors may occur, and the samples may be wasted. Field personnel are responsible for ensuring that all of the following sampling requirements are implemented:

- Labeling each bottle with the site identification, date and time of sample collection, bottle type, and laboratory codes using a permanent, waterproof marker, or preprinted waterproof labels that will remain securely adhered to the bottle even when wet.
- Completing electronic field sheets before leaving each site that includes documentation of all sampling circumstances and any deviation from standard protocol.

Field Forms and National Water Information System Coding Guidance for Data Collection

The PCFFs are used to electronically complete field forms and enter sample collection information into NWIS. The PCFF cannot currently (2014) store or be used to record all of the field data that is entered onsite. In those cases, customized spreadsheets or paper field forms are used and the data are hand entered into NWIS. The original paper copy is scanned and archived electronically, and filed in paper copies depending on the specific project requirements. The intent is to transition to 100 percent electronic data entry, and recording of all field notes and data as soon as technically possible. If requested, ASRs accompany samples to NWQL and some other laboratories. Guidance for coding water-quality samples in QWDATA can be found in appendixes A and K of the User Manual for QWDATA (Dupré and others, 2013).

Collection of Discrete Water Samples

This section describes collection of discrete water samples from surface water and groundwater sites. An overview is provided of relevant USGS policies and references for procedures pertaining to the measurement of field parameters, and the collection and processing of samples for water-quality analysis. The choice of sampling equipment and method of sample collection are based on established protocols and guidelines that depend on the characteristics of the target constituents, study objectives, hydrologic conditions, and sampling logistics. Information in this section is drawn primarily from the NFM (U.S. Geological Survey, variously dated[b]). The project proposal and work plan also should be consulted for specific guidelines for field personnel regarding details of sample collection and processing.

Specific clean hands and dirty hands procedures using two-person sampling teams with specific, designated roles in sample collection, and handling are required when sampling for trace inorganic constituents with ambient concentrations at or near 1 part per billion [ppb (mg/L)], or when aluminum, iron, and manganese concentrations are less than 200 ppb, as described in the NFM (U.S. Geological Survey, variously dated[b], chapter A4).

Field review of water sampling procedures for water-quality projects is done at least annually by the Water-Quality Specialist, Project Chief, or Supervisor or Lead Technician. An independent review of field methods of several water-quality projects of the KSWSC is completed once every 3 years during the OWQ technical review.

Equipment and Supplies

Field equipment and supplies must be selected and maintained to avoid imparting bias to the water-quality data. Supplies and equipment sold through the USGS One-Stop shopping may be tested or certified. However, users should do their own testing if needed to ensure data are not adversely affected by factors related to specific equipment or supplies. Guidelines for selecting equipment for sampling surface water and groundwater are provided in Horowitz and others (1994) and in the NFM (U.S. Geological Survey, variously dated[b], chapter A2). All field collectors involved in sampling for water-quality studies must understand 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. Equipment selection decisions are reviewed during proposal review and during periodic project reviews by KSWSC discipline specialists.

Equipment is maintained as recommended by manufacturers and established protocols, and is repaired as needed to ensure proper performance during field activities. The Supervisory or Lead Hydrologic Technician, or designated person is responsible for keeping track of equipment and ensuring timely repairs.

Cleaning Equipment and Supplies

Procedures for cleaning equipment used for water-quality sampling and processing depend on types of samples to be collected (fig. 5), and are described in the NFM (U.S. Geological Survey, variously dated[b], chapter A3) and in table 2. All new equipment acquired for water-quality sampling, as well as equipment that has been in storage, must be cleaned in the laboratory 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. Water in cleaning tubs is changed frequently to avoid contamination of equipment. Good field practices are implemented, and clean hands and dirty hands sampling techniques are used to prevent or minimize sample contamination.

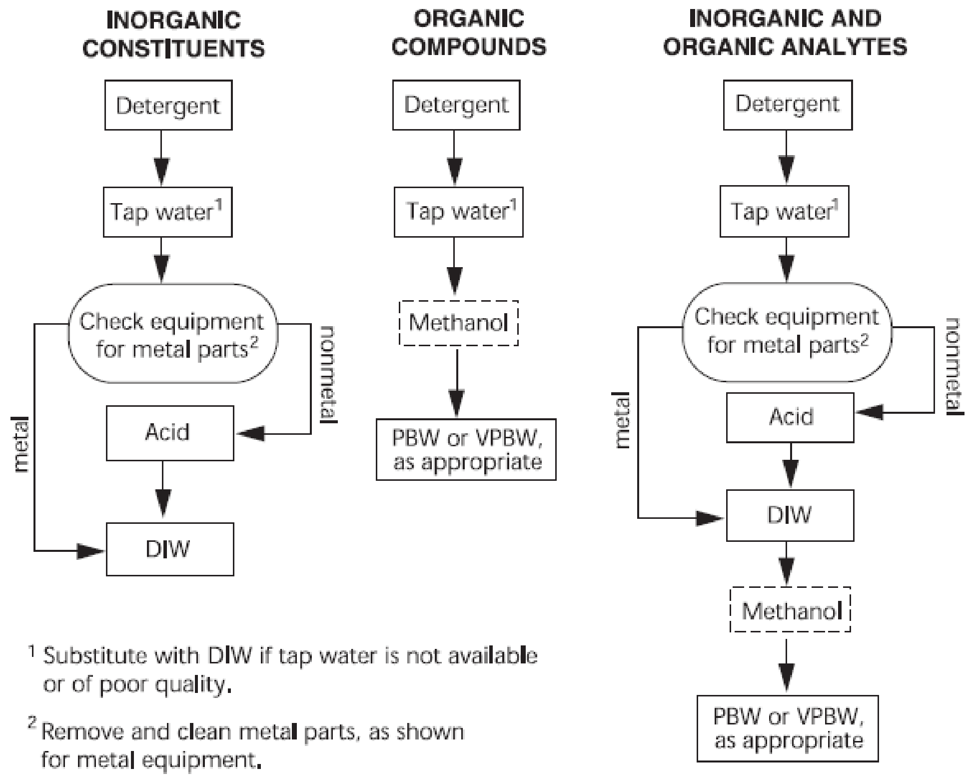
Surface Water Sampling

Guidelines for the collection of surface-water samples are provided in the NFM (U.S. Geological Survey, variously dated[b], chapter A4). Project-specific sampling guidelines are provided in work plans. Field collectors are responsible for examining the sampling site carefully and choosing the most appropriate sampling method to generate the best 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 the equal-discharge increment (EDI) or equal-width increment (EWI) method. These procedures generate a representative cross-sectional sample that is flow-weighted, and depth- and width-integrated (Edwards and Glysson, 1999). 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 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 (U.S. Geological Survey, variously dated[b], chapter A4). Usually, fecal bacteria samples are collected by dipping a sterile bottle in the centroid of flow. Thorough documentation of sampling equipment and methods that are used is required in field records associated with water-quality samples. It is important that field personnel be aware of factors that can compromise the integrity of surface-water samples and implement consistent strategies to protect sample integrity. The Project Chief, or Supervisory or Lead Hydrologic Technician is responsible for ensuring that field records are reviewed in a timely manner.

When samples are collected using EWI or EDI methods, cross-section measurements are made with a water-quality monitor simultaneously with collection of water. Preferred sample time recorded on field forms for surface water samples is the first 10-minute increment after the last section in the transect is collected. This ensures that cross section measurements are representative of conditions during sample collection and that sample time does not conflict with times recorded during cross-section measurements. Sample field measurements are recorded as the average of cross section measurements except for pH, which is the median of cross-section measurements. Cross-section measurements are stored in QWDATA.

Groundwater Sampling

Groundwater sampling procedures used by the KSWSC are designed to ensure that the samples collected are representative of water in the aquifer and are not contaminated by



[1] Substitute with DIW if tap water is not available or of poor quality.

[2] Remove and clean metal parts, as shown for metal equipment.

EXPLANATION

DIW	Distilled/deionized water
methanol (dashed box)	Current protocol includes methanol rinse except for equipment used to sample for organic-carbon analyses. SAFETY ALERT: Methanol is highly flammable; fumes can be hazardous to human health.
PBW	Pesticide-grade blank water
VPBW	Volatiles- and pesticide-grade blank water

Figure 5. General sequence for cleaning equipment before sampling for inorganic and (or) organic analytes water-quality sampling (U.S. Geological Survey, variously dated).

Table 2. Steps for cleaning equipment used when sampling inorganic and organic water-quality constituents.

[NAWQA, National Water Quality Assessment]

Step	Description
Step 1:	Preparation
	A. Prepare a clean area to work. 1. Gather cleaning supplies that have already been cleaned. 2. Clean work surface or place clean plastic sheeting over work surface. 3. Put on lab coat or apron, safety glasses, disposable powderless gloves.
	B. Prepare cleaning solutions 1. 0.1 to 0.2 percent non-phosphate detergent solution (Liquinox™). 2. Warm tap water; in container or from tap. 3. 5 percent, by volume, hydrochloric acid (HCl). 4. Deionized water (DIW); in container or from DIW tap.
Step 2:	Detergent wash and tap water rinse.
	A. Disassemble all equipment. (In field, rinse with DIW.) B. Soak equipment in Liquinox solution for 30 minutes. (In field, soaking not necessary.) C. Change gloves. Scrub equipment with soft brush. D. Rinse thoroughly with tap water. E. Change gloves.
Step 3:	Acid soak
	A. Place non-metal equipment in basin filled with 5 percent HCl. B. Soak for 30 minutes if in laboratory. (In field, rinse using wash bottle.)
Step 4:	DIW rinse
	A. Change gloves. B. Transfer equipment from acid to a clean basin. C. In a basin or under a tap, rinse all equipment thoroughly with DIW. D. Allow equipment to dry in an area free of airborne contaminants or bag wet if being used within 1–3 days. If needed to protect from airborne contaminants, cover equipment with clean plastic bags while drying.
For NAWQA organics samples only (except carbon)—Rinse equipment with methanol after rinsing with tap water:	
	A. Put on gloves that are resistant to solvents. B. Place cleaned equipment in organic-resistant basin (for example, stainless steel). C. Using a Teflon® squirt bottle, rinse all equipment with a minimum amount of pesticide-grade methanol. D. Rinse with pesticide-grade blank water. E. Allow equipment to air dry in an area that is free from airborne contaminants. F. Wrap equipment in aluminum foil or place in Teflon® bags.
Step 5:	Reassemble and bag equipment
	A. Reassemble all equipment (bottle, cap, and nozzle, and so on). B. Place equipment in doubled plastic bags and seal. C. Place double-bagged churn splitter inside churn carrier.

well construction material or sampling equipment, and that the composition of the samples is not altered by physical or chemical processes during sample collection and processing. It is critical that field personnel be aware of all factors that can compromise the integrity of groundwater samples and implement consistent strategies to protect sample integrity.

Groundwater samples are collected by two USGS personnel using methods described by Ziegler and Combs (1997) and the NFM (U.S. Geological Survey, variously dated[b]). The standard USGS purge procedure removes three or more well volumes of standing water while monitoring water level and field parameters before removing sample water (U.S. Geological Survey, variously dated[a]). The well is purged a minimum of 30 minutes regardless of the number of well volumes removed. Exceptions to the three-well-volume rule can be made when the well has been continuously pumped or recently pumped (within 24 hours), or the well does not produce enough water to continuously withdraw. Samples are collected by using a noncontaminating submersible pump constructed of polytetrafluoroethylene (PTFE) and stainless steel. During purging, specific conductance, pH, water temperature, turbidity, and dissolved oxygen are measured and recorded every 5 minutes. Stabilization criteria from the NFM (U.S. Geological Survey, variously dated[b], chapter A6, section 6.0) are used as a general guideline for stabilization (table 3). Samples are collected only if the values of these properties and constituents are within 10 percent for 3 consecutive readings made at least 5 minutes apart and if the turbidity was less than 10 nephelometric turbidity units (NTU). In places, purging of five well volumes is needed to meet the turbidity requirement before samples are collected. The average of last 3 readings is recorded for field measurements. The flow rate during sampling is 0.5 to 1.0 liter per minute (L/min; 0.13 to 0.26 gallon per minute [gal/min]), similar to the method described by Puls and Barcelona (1996). Purged water is conveyed far enough away from the wells so as not to affect the recharge area. Groundwater samples generally are collected from upgradient to downgradient sites or from sites with the lowest concentrations of water-quality constituents to those with the highest concentration. Between sites, the sampling equipment is cleaned as described in the NFM (U.S. Geological Survey, variously dated[b], chapter A3) and summarized in figure 5 and table 2. Samples are collected in-line, and processed and preserved inside isolation chambers to prevent ambient air contamination.

Measurement of Field Parameters

Field measurements are made in the field when water samples are collected and should represent, as closely as possible, the natural conditions of the system at the time of sampling. USGS procedures for collecting field measurements in surface water and groundwater systems are provided in the NFM (U.S. Geological Survey, variously dated[b], chapter A6). The project work plan describes which field parameters and onsite determinations are required during sample collection. Calibration and maintenance protocols for water-quality monitors used in the KSWSC to measure field parameters are described in detail by Bennett and others (2014). Stabilization criteria from the NFM (U.S. Geological Survey, variously dated[b], chapter A6, section 6.0) are used as a general guideline for stabilization (table 3).

Routine field measurements include water level (for groundwater), gage height and streamflow (for surface water), and measurements made with multiparameter water-quality monitors that include water temperature, dissolved oxygen, concentration, specific conductance, pH, and turbidity. Additional measurements using a water-quality monitor may include nitrate, oxidation-reduction potential, chlorophyll fluorescence, phycocyanin fluorescence, and colored dissolved organic matter. To ensure quality of the measurements, calibration within the range of field conditions at each site is required for most instruments. Operation and maintenance of the water-quality monitors is described in the NFM (U.S. Geological Survey, variously dated[b], chapter A6), by Wagner and others (2006), and by Bennett and others (2014). The Nitratax monitor is being used for measuring in-stream nitrate, and monitors are operated as described in Pellerin and others (2013). When Nitratax concentrations exceed 10 mg/L (the maximum contaminant level for drinking water), field personnel will try to collect a sample for laboratory verification. Additional field measurements might include alkalinity or acid neutralizing capacity depending on project objectives. If alkalinity samples are collected and processed, the alkalinity calculator in PCFF or on-line alkalinity calculator is to be used to report and store advanced speciation of alkalinity (U.S. Geological Survey, 2012b).

Field parameter measurements must be recorded in the field, including methods, equipment, and calibration information, using the PCFF. The Project Chief, or Supervisory or Lead Technician (or designated person) is responsible for ensuring that field records are reviewed for completeness. To avoid the loss of data because of possible instrument malfunction, field personnel should ensure that backup sensors or instruments are readily available and in good working condition.

To document the quality of field measurements, all USGS personnel involved in the collection of water-quality data are required to participate in the National Field Quality Assurance (NFQA) Program to test the proficiency of the equipment and analyst to measure prepared samples for pH, specific conductance, and alkalinity. Results of the NFQA Program are reviewed by the USGS Water Sciences Field Team Water-Quality Specialist and the KSWSC Water-Quality Specialist. Unsatisfactory results require followup to determine the source of the problem. Usually followup includes obtaining second-round samples for reanalysis.

Other types of data also may be collected and analyzed by project staff for specific projects. Biological samples may include fecal indicator bacteria, fecal indicator viruses or protozoa, biological oxygen demand, and cyanobacteria. Procedures are described in the NFM (U.S. Geological Survey, variously dated[b] chapter A7). Onsite determinations

Table 3. Stabilization criteria for recording field measurements (U.S. Geological Survey, variously dated [b]).

Table 6.0–1. Stabilization criteria for recording direct field measurements

[±, plus or minus value shown; °C, degrees Celsius; ≤, less than or equal to value shown; µS/cm, microsiemens per centimeter at 25°C; >, greater than value shown; unit, standard pH unit; ~, about; DO, dissolved-oxygen concentration; mg/L, milligram per liter; FNU, formazin nephelometric unit]

Standard direct field measurement[1]	Stablization criteria[2] (variability should be within the value shown for about five or more measurements)
Temperature:	
Thermistor thermometer	± 0.2°C
Liquid-in-glass thermometer	± 0.5°C
Conductivity (SC):	
≤100 µS/cm	± 5 percent
> 100 µS/cm	± 3 percent
pH: (meter displays to 0.01)	± 0.1 to 0.2 pH unit[3] Allow ± 0.3 pH units if drifting persists, or measurement is in low-conductivity (~75 µS/cm) water, or for continous monitor.
DO[4]	
Amperometric sensors	± 0.2 mg/L (± 0.3 mg/L for continous monitor)
Optical/luminescent-method sensors	± 0.2 mg/L (± 0.3 mg/L for continous monitor)
Turbidity[5, 6]	
≤ 100 FNU (or other turbidity unit)	± 0.5 turbidity unit or ± 5% of the measured value, whichever is greater.
> 100 FNU (or other turbidity unit)	± 10 percent[6]

[1] Eh is not considered to be a routine or direct field measurement (see NFM 6.5). Alkalinity and acid neutralizing capacity determinations require a titration procedure and are not considered direct measurements.
[2] Refer to NFM 6.8 for similar criteria when using multiparameter instruments. For continuous monitors, consult Wagner and others, 2006.
[3] Select pH sensor criteria based on precision and accuracy listed for the sensor being used.
[4] **Amperometric sensors**: Note that the calibration criterion when DO is measured by a continuous monitor can be extended to ± 0.3 mg/L. **Optical/Luminescent sensors**: The criterion for luminescent-method sensors is biased conservatively, owing to the differing technologies that are employed among the various manufacturers of these sensors and current paucity of field data. **Spectrophotometric method**: Stabilization is not applicable to the spectrophotometric method.
[5] Multiparameter instruments used for most USGS turbidity applications contain single-beam infrared wavelength turbidity sensors and are reported in FNU. Check the Excel spreadsheet at http://water.usgs.gov/owq/turbidity_codes.xls to determine the appropriate turbidity unit of measure; consult NFM 6.7 for detailed guidance on turbidity measurement and instrumentation.
[6] In high-turbidity conditions, especially when collecting data during storms, lengthening the averaging period to help smooth out the signal (assuming this is an option for the instrument in use) or increasing the time period between measurements, is recommended.

for chlorine and hydrogen sulfide, and lab determination of biological activity and reactivity tests (BART) are done by field personnel following procedures described by each of these kit manufacturers with quality-assurance procedures in the field. Photometer testing kits manufactured by Chemetrics, Inc. or another acceptable vendor may be used for nitrate and phosphate determinations. Chlorine and hydrogen sulfide kits are manufactured by Hach. BART kits are manufactured by Droycon Bioconcepts, Inc. Generally quality assurance is done using spilt replicate analysis as a check on procedures and reports, and data are recorded on the paper field form or on a separate field sheet to record the data. These data are then entered into NWIS. Forms are retained in the KSWSC electronic file directory with field sheets.

Sample Processing

All samples collected for water-quality analysis must be processed according to procedures described in the NFM (U.S. Geological Survey, variously dated[b], chapter A5) as soon as possible following collection. The constituents of interest and study objectives determine the specific processing procedures that are necessary, which must be described in the project proposal or work plan. The work plan also describes whether samples must be processed on site, or may be transported to the laboratory or other site for processing. Groundwater samples are always processed onsite except for bacteria samples and field alkalinities. The samples are kept on ice, and transported to the field office laboratory for processing by USGS field personnel. It may be acceptable to process surface-water samples in the laboratory if the site is less than about an hour drive away. This is sometimes beneficial during storm sampling, for example, when a field team, and separate processing team in the laboratory or mobile laboratory can process samples most efficiently.

All water-quality studies that include the analysis of trace-inorganic concentrations at or near 1 ppb, or when aluminum, iron, and manganese concentrations are less than 200 ppb, must use the two-person sample processing protocol (clean hands and dirty hands, or ppb protocol) as described in the NFM (U.S. Geological Survey, variously dated[b], chapter A4). 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. Arsenic speciation methods are included for groundwater samples following protocols described in the NFM (U.S. Geological Survey, variously dated[b], chapter A5). Sample processing procedures for all water-quality projects are reviewed during proposal and work plan review, and during periodic project reviews by the KSWSC Water-Quality Specialist.

Detailed sample processing order is described in the NFM (U.S. Geological Survey, variously dated[b], chapter A5) and may differ slightly for groundwater and surface water samples. The general order for filling surface-water sample bottles is unfiltered organics (such as total organic carbon), unfiltered inorganics (such as total suspended solids and turbidity), filtered inorganics (such as trace elements, nutrients, major ions, and alkalinity), and filtered organics such as dissolved organic carbon and pesticides). The general order for filling of groundwater sample bottles is volatile organic compounds (VOCs), fecal indicator bacteria (such as fecal coliform, *Escherichia coli*, and total coliform) and viruses (such as coliphage), unfiltered organics (such as total organic carbon), unfiltered inorganics (such as total suspended solids and turbidity), filtered inorganics (such as metals, nutrients, anions, and radiochemicals), and filtered organics such as dissolved organic carbon and pesticides).

Sample Compositing and Splitting

Guidelines for using sample compositors and splitters are described in the NFM (U.S. Geological Survey, variously dated[b], chapter A5). Two types of sample splitters presently in use in the USGS 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 (U.S. Geological Survey, 1997) and by Horowitz and others (2001). The churn splitter is constructed from polyurethane and Teflon. Either splitting method can be applied to inorganic and organic constituents within the technical design limits of the device, and as long as the equipment is constructed of appropriate materials. The KSWSC uses 14-L or 8-L Teflon churn splitters for most water-quality sampling.

Sample Filtration

Filtration is required for many water-quality samples 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. For surface water, the most common filtration system consists of a reversible, variable-speed battery-operated peristaltic pump and a 0.45-mm pore size disposable capsule filter. Filtration of samples for pesticides, whether for surface water or groundwater samples, is done through a 0.7-mm pore size glass fiber filter. Capsule filters and glass fiber filters are purchased through the USGS National Field Supply Service (NFSS), and are quality-assured by the NWQL to meet USGS specifications. Filtration of samples for analysis of trace elements in concentrations less than 1 ppb, or when aluminum, iron, or manganese ambient concentrations are less than 200 ppb, must be done in a processing chamber that encloses the filtering unit and sample bottles in a protected environment as described in the NFM (U.S. Geological Survey, variously dated[b], chapter A5).

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 (U.S. Geological Survey, variously dated[b], chapter A5) and the NWQL Catalog which is available on an internal Web site. Samples for arsenic speciation in groundwater are preserved following protocols described in the NFM (U.S. Geological Survey, variously dated[b], chapter A5). Nevertheless, individual laboratories may have different policies for sample preservation. For example, the NWQL in Denver, Colo., does not require total organic carbon (TOC) samples to be preserved, whereas the contract laboratory City of Wichita Laboratory in Wichita, Kans., requires that total organic carbon samples be preserved with sulfuric acid. Contact must be made with every laboratory that is being used by the KSWSC to ensure proper sample preservation. Care is taken to ensure that proper preservatives are used and that expiration dates have not been exceeded. Litmus paper pH strips are available to ensure proper acidification of samples before shipping. Because some samples have a 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.

Collection of Quality Control Samples

The sources of variability and bias introduced by sample collection and processing affect the interpretation of water-quality data. Collection of QC samples ensures that the data collected are compatible and of sufficient quality to meet program objectives. The quality of data collected must be documented by collecting QC samples that may include replicates, blanks (equipment and field), and field-matrix-spike samples. The number and types of quality control samples are described in the project work plan. Generally, quality-control samples represent at least 10 percent of the total samples collected for a project. Remaining datasets are expected to be at least 90 percent complete. The Project Chief and Water-Quality Specialist determine appropriate data quality objectives for projects.

Replicate samples are samples collected in the same manner as environmental samples so that a replicate sample should have the same concentrations as the corresponding environmental sample. Split and concurrent replicate samples are the most common types of replicate samples collected in the KSWSC. Split samples are collected from the same compositing container as the environmental sample. Concurrent samples are collected at the same time and placed in separate compositing containers. Replicate and concurrent samples are used to estimate the variability associated with the sample collection and analysis process. Generally, relative percent differences among replicate samples for inorganic and organic analytes, and metals should be within about 20 percent, and for biological samples should be within 50 percent. When concentrations are at or near the laboratory reporting level, higher percent differences are acceptable. In addition, some organic analytes, such as atrazine enzyme-linked immunosorbent assays (ELISAs), may have higher variability.

Equipment blanks are a type of blank sample that are used to verify that sample equipment, cleaning, collection, and processing procedures used by the field personnel are adequate to produce contaminant-free results. These equipment blanks ensure that individual pieces of sampling equipment are not sources of detectable concentrations of constituents to be analyzed in environmental samples. An annual equipment blank is required for all sampling equipment used for inorganic ppb level sampling. Exemptions from this requirement are given to equipment used continuously throughout the year, which are part of an adequate and continuous quality control program (for example, some hydrologic data programs), or when a significant piece of the sampling equipment is repaired or replaced. Annual equipment blanks that indicate detectable levels of constituents require submission of equipment blanks for individual components of the equipment to isolate the source of contamination as described in Horowitz and others (1994). Sources of contamination are to be determined before use of the equipment to collect environmental data. When the source of contamination has been determined, the necessary maintenance must be completed to eliminate contamination or the equipment must be replaced. The Water-Quality Specialist, Project Chief, Supervisory or Lead Hydrologic Technician, or designated person monitors the results of annual equipment blanks, and ensures compliance with USGS standards. Concentrations in blank samples generally should not exceed twice the analyte detection limit.

Sample Handling, Storage, and Shipping

Water-quality samples are refrigerated at a temperature that is less than 4 °C, but above freezing. Proper packing and shipment of samples is necessary to comply with Department of Transportation and other regulations, to protect workers who handle the samples, and to ensure samples arrive at the laboratory in good condition. All samples must be shipped in an expedient manner and well within the required holding times for each analysis. Samples that are chilled or otherwise time dependent, such as nutrients and VOCs, should be shipped overnight, and samples should not be collected if they would arrive at the NWQL later in the week than Friday. Upon completion of a sampling trip, nontime sensitive samples (such as major ions and trace elements) should be packaged and shipped to the laboratory for analysis as soon as possible. Generally, the shorter the time between sample collection, and processing and sample analysis, the more reliable the analytical results will be.

Specific guidance on sample packaging, shipment, and documentation is provided on the NWQL internal Web site, and in the NFM (U.S. Geological Survey, variously dated[b], chapter A5). Some of the more important points of the aforementioned memorandum include the following steps, which should be followed before shipping any samples to the laboratory:

- Check that sample sets are complete and that sample bottles are labeled correctly with all required information.
- Complete the ASRs 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 ASRs should be provided to the laboratory.
- Line all shipping containers, including those without ice, with two heavy-duty clear plastic bags.
- Check that bottle caps are securely sealed. Pack sample bottles from a site in a Ziploc bag, and pack samples carefully in the shipping container to avoid bottle breakage, shipping container leakage, and sample degradation.

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 Project Chief 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, Supervisory or Lead Hydrologic Technician, or designated persons are responsible for ensuring that custody transfers of samples are completed and documented according to the requirements listed below:

- The means for identifying custody should be clearly understood (use of forms, stickers, and so on).
- Instructions for documenting the transfer of samples and the person responsible for this documentation must be clearly defined.
- A plan must be in place for maintaining records in a specific location for a specific period of time (for example, in the station folder).

Detailed guidance on chain-of-custody procedures is provided by the NWQL. Specific procedures for other laboratories may differ. The process for chain-of-custody samples including electronic record-keeping is described in the project work plan.

Collection of Suspended-Sediment Data

Most water-quality studies in the KSWSC include collection of suspended-sediment data. Currently (2014), no network sediment data collection is done in the KSWSC Data Section. Sediment samples usually are analyzed at the USGS Sediment Laboratory in Iowa City, Iowa, or Rolla, Mo. USGS personnel in Kansas collect suspended-sediment data by using sampling methods that include the single vertical method, and the EWI or EDI method. Automatic pumping-type samples are seldom used. Methods are specified in the project work plan.

The policies and procedures related to sediment followed by the KSWSC are described in selected publications, and in memorandums issued by the Office of Surface Water (OSW) and OWQ. Techniques are presented in Knott and others (1993), and Gray and others (2008). The USGS also follows procedures presented in the following publications in the series “Techniques of Water-Resources Investigations of the U.S. Geological Survey”:

- Book 3, chapter C1, “Fluvial Sediment Concepts” by H.P. Guy (1969).
- Book 3, chapter C2, “Field Methods for Measurement of Fluvial Sediment” by Edwards and Glysson (1999).
- Book 3, chapter C3, “Computation of Fluvial-Sediment Discharge” by George Porterfield (1972).
- Book 3, chapter C4, “Guidelines and Procedures for Computing Time-Series Suspended-Sediment Concentrations and Loads from In-Stream Turbidity Sensor and Streamflow Data” by Patrick Rasmussen and others (2009).

Another resource for sediment sampling procedures is Davis (2005).

Continuous Water-Quality, Streamflow, and Precipitation Data

Many protocols for collecting additional data collected with water-quality samples are described in separate documents. Protocols for collection of continuous, time-series water-quality data are described in the KSWSC Quality-Assurance Plan for Continuous Water-Quality Monitoring in Kansas (Bennett and others, 2014) by Wagner and others (2006; *http://pubs.usgs.gov/tm/2006/tm1D3/*). Protocols for measuring streamflow and collecting precipitation data are described in the KSWSC Quality-Assurance Plan for Surface Water Activities in Kansas (Loving and others, unpub. data, 2011). The KSWSC does not currently (2014) collect precipitation samples for water-quality analysis. The pressure transducers used in groundwater wells in Kansas include a water temperature thermistor that provides temperature correction data to the pressure transducer. In Kansas, these data are used as ancillary information for internal use only. Additional discussion on this topic is provided by Putnam and Hansen (2014).

Collection of Streambed Sediment and Bottom-Material Samples

Water-quality activities by the KSWSC include the collection of streambed sediment and bottom-material samples. Guidelines for the collection of bottom-material samples are presented in the NFM (U.S. Geological Survey, variously dated[b], chapter A8). Reservoir sediment studies are also guided by project specific quality assurance plans. Samples for both streambed sediment and bottom material may be analyzed for chemical constituents including trace elements or hydrophobic organic compounds. Protocols for collecting streambed-sediment are adapted from the USGS NAWQA Protocol for collecting and processing streambed-sediment samples (Shelton and Capel, 1994) and the NFM (U.S. Geological Survey, variously dated[b]). The project work plan describes specific guidelines for sediment sampling depending on project objectives. Methods used for processing and shipping may be modified as directed by specific laboratories, and project chiefs and collectors need to be familiar with requirements, equipment, and supplies of other laboratories.

Field personnel must be familiar with the factors involved in the selection of sediment-sampling equipment that are based on the type of analyses needed and hydraulic conditions, as well as special cleaning procedures that may be required when sampling sediment chemistry.

Collection of Streambed Sediment Samples

Wadeable depositional zones containing fine-grained particulate material should be identified at 5 to 10 locations for each site. Depositional zones should be selected that represent upstream effects, and various flow regimes such as left bank, right bank, center channel, and different depths of water. This will ensure that the sediment sample represents depositional patterns from various flow regimes and sources within the reach. Each depositional zone at a sampling site will be subsampled several times, and the subsamples will be composited with samples from other depositional zones sampled at the same site. Samples are composited in clean glass containers. Compositing will smooth the local scale variability and represent the average contaminant levels present at the site. All sampled zones should be underwater from the time of deposition until collection. The selected depositional zone is approached by moving upstream to avoid disturbing the area to be sampled and the sampling point is approached from downstream. The top 2–3 centimeters (cm; 0.8–1.2 inch [in.]) of surficial fine material from the streambed is removed with a PTFE scoop.

Processing

Laboratory analysis usually is done on the fine materials (less than 63 micrometer [µm]), and the bulk samples can be sieved in the field before shipping or by the laboratory. Project objectives determine if field or laboratory sieving is appropriate. The 500-milliliter (mL) glass jars are filled to be shipped to appropriate laboratories for sieving and analysis from the composited bulk sample. Bulk material that is field-sieved before shipping is removed from the composited glass container, and small amounts are placed onto a 63-µm mesh sieve with the PTFE scoop. A stainless steel or PTFE sieve is used for material analyzed for organic compounds. A plastic or PTFE sieve is used for material analyzed for trace elements. Native water that has been collected directly from the stream into a 500-mL PTFE wash bottle is used to elutriate the sediment sample. The fine sediments pass through the sieve with a stream of water delivered by the wash bottle. Small amounts of sediment material are worked through the sieve, and the material remaining on the sieve is discarded. It is not necessary to sieve all of the material that is less than 63 µm in each aliquot. Sieved sediments are then transferred into 500-mL glass jars.

Sample Handling, Storage, and Shipping

Streambed-sediment samples are refrigerated at a temperature that is less than 4 °C, but above freezing. Samples for nutrient and trace-element analyses should be packed for shipping as directed by the laboratory. Samples for organic-contaminant analyses are placed into a protective sleeve, packed in ice (but not frozen), and shipped to the USGS NWQL. Samples should be packaged and shipped to the laboratory for analysis as soon as possible. Before shipping, check that sample bottles are labeled correctly with all required information, required paperwork is included, bottle caps are securely sealed, and the shipping container is properly packed and labeled.

Collection of Ecological Data

Some KSWSC water-quality activities include the collection of ecological samples including periphyton, benthic macroinvertebrates, fish, and contaminants in biological tissues. Ecological data also may include evaluations of stream habitat. Guidelines for ecological sampling are described by Stone and others (2012), and in project work plans.

Collection of Periphyton

Periphyton consists of the attached algae that grow on submerged surfaces in water bodies, such as rocks, woody debris, and sand (Allan, 1995). These periphyton protocols are adapted from those used by the Kansas Biological Survey (Bouchard and Anderson, 2001); the U.S. Environmental Protection Agency's (EPA) rapid bioassessment protocols (RBP; Stevenson and Bahls, 1999); and the USGS revised protocols for sampling algal, invertebrate, and fish communities as part of the NAWQA Program (Moulton and others, 2002).

Periphyton is collected from unattached hard substrates (cobble or woody debris) in riffles and runs when present. A bar clamp sampler is clamped onto a smooth part of each substrate, and a new test tube brush is used to scrub periphyton from the known area of the surface of the substrate. The periphytic material is wetted with 0.7-µm filtered streamwater by a squirt bottle and transferred to a 250-mL beaker using a fresh plastic pipette. This process is repeated several times until all of the visible periphyton is removed from the sampling area.

Collection of Macroinvertebrates

The collection of macroinvertebrate data usually is done following KDHE's qualitative macroinvertebrate protocols (Kansas Department of Health and Environment, 2000) for assessing biological quality of streams and rivers, which have been used for stream evaluations in water-quality monitoring studies within the state (Poulton and others, 2007; Teresa Rasmussen and others, 2009; Graham and others, 2010). Before invertebrate sampling begins, the sampling reach and types of in-stream habitats present in the reach must be identified and documented. The KDHE macroinvertebrate protocol calls for 2, 100-organism field-sorted samples to be collected with a standard rectangular frame kicknet (9 in. by 18 in. with 500-µm mesh) simultaneously by each of 2 individual biologists working independently of one another. For each of the 2 biologists, sampling ends after 1 hour, even if the 100-organism count has not been reached. Both 100-organism samples are later pooled into 1, 200-organism sample. For each sample collected at a site, the 2 independent samples are combined into 1, 200–organism sample, and the sample bottle preservative is decanted and refilled with 80-percent ethanol to reduce the chance of spoilage. Sample bottles are sealed with electrical tape. Samples are shipped to the USGS NWQL for identification and enumeration.

Collection of Fish Samples

Fish protocols are adapted from the EPA Rapid Bioassessment Protocols (Barbour and others, 1999), and the USGS revised protocols for sampling algal, invertebrate, and fish communities as part of the NAWQA Program (Moulton and others, 2002). Fish collection procedures focus on a multihabitat approach where habitats are sampled in relative proportion to their local representation. Electrofishing is done in two separate passes of the reach, and the fish collected from the first pass are processed before the second pass. Seining is done after electrofishing. Three seine collections are taken and combined before fish processing. Identifications are made by a crew member who is familiar with the fish species commonly found in the study area. An attempt is made in the field to identify all fish to the species level.

Water-Quality Laboratories and Analyses

Two of the most critical issues for a water-quality program are data comparability and data consistency. Because of the inherent variability among laboratories, one of the best ways to provide comparability and consistency is to use a single laboratory as much as is practical. However, using just one laboratory does not ensure consistency. Laboratory performance must be continually evaluated.

Selection and Use of an Analytical Laboratory

Contract or cooperator laboratories can be used when the cooperative agreement designates a laboratory other than the NWQL or when analytical services are required that cannot be provided by the NWQL. Laboratory performance must be evaluated to ensure that it meets program requirements (U.S. Geological Survey, 2014). Generally, the approval process ensures that the analytical techniques and methods used at the laboratory will provide sufficient and reliable data at the concentrations ranges of concern to meet the project objectives. The evaluation and approval process includes laboratories that provide chemical, biological, radiochemical, stable isotope, or sediment analytical services.

Data are used 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 usually are submitted as blind samples (composition unknown to the laboratory) from an external program and are used to determine whether sufficient performance data and information are available to evaluate performance before and during the project's data-collection phase (Level I), or insufficient or no performance data or information are available to evaluate performance before and during the project's data-collection phase (Level II). Use of laboratory data classified as Level 2 requires the production of a separate laboratory evaluation package to assess and document specific laboratory performance. Knowledge about the data quality from analytical laboratories is used in the assessment of the environmental data.

The USGS policy on approval of analytical laboratories (U.S. Geological Survey, 2014): (1) is project based and assesses a laboratory's capability to meet specific project needs (as defined by project specific data quality objectives), (2) includes a performance-based laboratory evaluation process using samples specific to the project design, (3) makes it the responsibility of project management to prepare and implement a laboratory evaluation plan that includes submitting QC samples to the laboratory during the life of the project and re-evaluating performance regularly, and (4) makes it the responsibility of the Water Science Center Director to approve the laboratory evaluation plan for each project and ensure that it is implemented throughout the life of the project. Emphasis is on maintaining data quality required to achieve project objectives. This policy pertains to all laboratories used by the KSWSC, even when the analytical method being used by a project does not yet have an approved analytical method report.

To assist in this process, the Branch of Quality Systems (BQS) developed a database of laboratory information and performance data. The information contained in the BQS database is evaluated as part of the KSWSC process for approving analytical laboratories. Additional considerations include the following:

- Participate in the National Environmental Laboratory Accreditation Program (NELAP or NELAC). Information from this program may be useful in evaluating laboratory performance.

- Use approved and published analytical methods. Analytical methods must be approved and published by one of the following sources: USGS; EPA; American Public Health Association, American Water Works Association, and Water Environment Federation (Standard Methods); or American Society for Testing and Materials (ASTM). The publication of the method must include documentation for the analytical techniques and chemical processes, and the expected data quality. If a specific analytical method not published by the sources listed above is requested for a specific project, it is the responsibility of the KSWSC to clearly explain methods used and qualify data entered in QWDATA (OWQ Technical Memorandum 2004.01, U.S. Geological Survey, 2004).

- Have standard operating procedures (SOPs) for analytical methods. All analytical methods must have documented SOPs that are approved in accordance with procedures contained in the laboratory QA plan.

- Have an approved laboratory QA plan. The laboratory must have an approved QA plan that is supplied to USGS customers upon request. The laboratory QA plan should provide internal guidance and documentation that will ensure the laboratory is operating under a standardized, rigorous QA program, and is producing analytical results of a known and documented quality. The laboratory QA plan should describe QA activities, QC procedures and requirements, performance acceptance criteria, and required corrective actions that will be taken if the criteria are not met.

- Have a documented QC program that provides the data necessary to continuously track the bias and variability of analytical data. All QC information, such as QC charts, analysis of laboratory QC samples, calibration records, and analyst bench logs, should be maintained for at least 3 years, and be available to USGS customers.

- Demonstrate the ability to provide the analytical services required. Laboratories can demonstrate the ability to provide the required analytical services by participation in existing USGS; non-USGS certification, evaluation, blind-sample programs; or by documentation of similar projects.

Analytical Laboratories Used by the Kansas Water Science Center

The KSWSC uses several different laboratories for sample analyses. Laboratory name, location, medium, and Web site are included in table 4. Web sites provide information about available analyses, methods, certifications, and quality control.

The primary laboratory used by the KSWSC for analytical services is the USGS NWQL in Lakewood, Colo. (table 4). An electronic copy of the Quality Management System (QMS) can be accessed through the NWQL's homepage (table 4). The QMS is a document that discusses management and technical requirements as well as QA and QC requirements for NWQL, and is updated as changes are made. Laboratory QC at the NWQL is monitored by (1) method performance; (2) data review, and the blind sample program administered and monitored by the BQS; and (3) performance evaluation studies. The NWQL participates in performance evaluation studies and laboratory certification programs. External agencies and customer organizations audit the NWQL to assess analytical methods and QA and QC programs. Additional information about all of these programs is available on the Web site.

Kansas Water Science Center Laboratories

The KSWSC maintains the Organic Geochemistry Research Laboratory (a project laboratory at the KSWSC location in Lawrence, Kans.), a field office laboratory in Wichita, Kans., mobile laboratories, and field vehicles in the Wichita Field Office and the KSWSC in Lawrence, Kans. (table 4). These facilities are used for preparing equipment for field activities, processing samples, completing field analytical measurements, completing sample and microbial analysis, and preparing samples for shipment to analytical laboratories. This section documents the criteria for maintaining and operating these facilities. Laboratories are maintained in accordance with the KSWSC chemical hygiene plan, and recommendations provided by the Chemical Hygiene Officer and the KSWSC Safety Officer.

Table 4. Analytical laboratories used by the Kansas Water Science Center.

[USGS, U.S. Geological Survey]

Laboratory	Medium	Analytes	Web site
USGS National Water-Quality Laboratory, Lakewood, Colo.	Water, sediment, macroinvertebrates	Nutrients, trace elements, major ions, carbon, organic compounds	*http://nwql.usgs.gov*
USGS Crustal Geophysics and Geochemistry Science Center, Denver, Colo.	Sediment	Trace elements, nutrients, carbon	*http://crustal.usgs.gov*
USGS Geosciences and Environmental Change Science Center, Denver, Colo.	Sediment	Trace elements, nutrients, carbon	*http://esp.cr.usgs.gov*
USGS Ohio Water Microbiology Laboratory, Columbus, Ohio	Water, sediment	Microbial analytes	*http://oh.water.usgs.gov/micro_index.htm*
USGS Organic Geochemistry Research Laboratory, Lawrence, Kans.	Water	Organic compounds, algal toxins	*http://ks.water.usgs.gov/9-Research-Lab*
USGS Sediment Laboratory, Iowa City, Iowa	Water	Suspended-sediment concentration	*http://ia.water.usgs.gov/usgs/data/lab.html*
USGS Sediment Laboratory, Rolla, Mo.	Water	Suspended-sediment concentration	*http://mo.water.usgs.gov/*
USGS Stable Isotope and Tritium Laboratory, Menlo Park, Calif.	Water, seston	Isotopes	*wwwrcamnl.wr.usgs.gov/isoig/bios/team.html*
USGS St. Petersburg Coastal and Marine Science Center, St. Petersburg, Flor.	Water	Suspended-sediment concentration	*http://coastal.er.usgs.gov/*
BSA Environmental Services, Beachwood, Ohio	Phytoplankton, periphyton, zooplankton	Identification, enumeration, and biovolume	*http://www.bsaenv.com*
Bio-Limno Research & Consulting, Halifax, Nova Scotia	Sediment	Algal identification and enumeration	*http://www.bio-limno.com/*
Engineering Performance Solutions, Gainesville, Flor.	Water	Geosmin, 2-methylisoborneol (MIB)	*http://www.epslabs.com/*
Johnson County Environmental Laboratory, Olathe, Kans.	Water	Nutrients, trace elements, major ions, indicator bacteria	*http://www.jcw.org/env_wql_WaterQualityLab.htm*
PhycoTech, Inc., St. Joseph, Mich.	Water, sediment, periphyton, phytoplankton, zooplankton	Akinete, identification, enumeration, biovolume	*http://www.phycotech.com/*
TestAmerica Laboratories, Arvada, Colo.	Sediment	Nitrogen	*http://www.testamericainc.com/*
Wichita Municipal Water and Wastewater Laboratory, Wichita, Kans.	Water	Nutrients, trace elements, major ions, indicator bacteria	*http://www.wichita.gov/*

U.S. Geological Survey Organic Geochemistry Research Laboratory, Lawrence, Kansas

The KSWSC maintains the Organic Geochemistry Research Laboratory located at the KSWSC in Lawrence, Kans. (table 4). General oversight of the Organic Geochemistry Research Laboratory is provided by the Research Project Director.

Water Science Center Project Laboratory, Lawrence, Kansas

The KSWSC also maintains the project laboratory located in Lawrence, Kans.. Responsibility for general oversight of the laboratory is delegated by the WQ Specialist. The project laboratory contains laboratory benches, glassware, sinks, chemical, acid storage cabinets, and other equipment and instruments listed in table 5. All laboratory users have responsibility for maintenance and repair of the instruments, and QA of the equipment and instruments. All personnel are responsible for proper waste-disposal practices to ensure that procedures are in compliance with State and Federal regulations. A refrigerator is used to store samples and supplies that require refrigeration such as indicator bacteria agar plates. The temperature inside the refrigerator is maintained at 4 °C.

Deionized water is produced in the project laboratory for use by KSWSC personnel to rinse laboratory glassware and other supplies, pre-rinse filters and sample bottles, and for other purposes as described in the NFM (U.S. Geological Survey, variously dated[b]). The ion-exchange system is serviced routinely by the manufacturer, and cartridges are changed as needed to meet USGS requirements (U.S. Geological Survey, 2011). Conductivity of the deionized water is tested regularly to ensure that maximum specific conductance is less than 1.0 microsiemens per centimeter (μS/cm). A deionized water sample is submitted to the NWQL for analysis approximately annually.

Wichita Field Office Laboratory, Wichita, Kansas

A laboratory also is maintained in the field office in Wichita, Kans.. The field laboratory contains laboratory benches, glassware, sink, chemical and acid storage cabinets, and other equipment and instruments. All laboratory users have responsibility for maintenance and repair of the instruments, and QA of the equipment and instruments. Responsibility for general oversight of the field office laboratory is delegated by the WQ Specialist. All personnel are responsible for proper waste-disposal practices to ensure that procedures are in compliance with State and Federal regulations.

Deionized water is produced in the field office laboratory for use by KSWSC personnel to rinse laboratory glassware and other supplies, pre-rinse filters and sample bottles, and for other purposes as described in the NFM (U.S. Geological Survey, variously dated[b]). The reverse-osmosis system is serviced routinely by Quality Water Services, and the mixed-bed tanks, charcoal tank, and 0.2 micron and 5 micron filters are changed as needed to meet USGS requirements (U.S. Geological Survey, 2011). Conductivity of the deionized water is tested regularly to ensure that maximum specific conductance is less than 1.0 μS/cm. A deionized water sample is submitted to the NWQL for analysis approximately annually.

Mobile Laboratories and Water-Quality Field Vehicles

Water-quality field vehicles refer to all vehicles that are designed, designated, and outfitted for use during water-quality sample collection, and processing activities at or near sample-collection sites. The KSWSC maintains field vehicles designated for water-quality sample collection and processing. If a nondesignated 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.

Table 5. Equipment in the Kansas Water Science Center project and field laboratories, and required quality assurance.

Laboratory equipment	Quality assurance
Refrigerator	Temperature monitored monthly.
Freezer	Temperature monitored monthly.
Fume hood	Routine checks and filters replaced.
Supply of deionized water, Siemens	Maintained as recommended.
Autoclave	Maintained per manufacturer's instructions.
Incubators	Temperature checked when used.
Tabletop turbidimeter	Routine calibration and maintained per manufacturer's instructions.
Multiparameter water-quality monitors	Maintained per Bennett and others (2013).
pH meters	Calibrated when used and maintained per manufacturer's instructions.

A field vehicle is designated as a water-quality field vehicle when it meets criteria to maintain a noncontaminating environment for the constituents being sampled. The work area must be maintained to eliminate sources of sample contamination. Specifications for vehicles used when sampling for water-quality constituents are discussed in the NFM (U.S. Geological Survey, variously dated[b]), by Horowitz and others (1994), and Lane and others (2003); and include the following:

- Materials used for cabinets, storage, and work surfaces must be easy to maintain, made of, or covered with noncontaminating materials and such that they can be cleaned with water or solvents as appropriate.
- Cargo should 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, and so on, may be transported in the interior compartment of the vehicle. Such equipment and materials must be physically isolated from the sample-processing area of the water-quality field vehicle.
- A dust barrier should exist between the cab and work area of the vehicle.
- The Project or Office Chief, or designated persons are responsible for vehicle maintenance, maintaining the suitability of the vehicle for water-quality sample collection, and keeping the vehicle supplied.

Data Management

Data management is an important component of the USGS mission of providing accurate and impartial scientific data. Data management applies to every step of a process beginning with planning and collecting data. Because those steps were discussed in previous sections, this section describes the subsequent steps of storing, documenting, tracking, verifying, approving, and archiving data for long-term availability to the public. Dissemination of data in various formats, such as publications, database access, and internet Web sites, is the final step. Data-management objectives are similar for continuous and discrete water-quality data, and for surface water and groundwater sites. The emphasis in this plan is on discrete water-quality data from surface water and groundwater sites. Data management of continuous water-quality data and groundwater data is described in separate documents (Bennett and others, 2014; Putnam and Hansen, 2014). Some furnished groundwater records are provided to the KSWSC, and guidelines are described by Putnam and Hansen (2014).

Storing, Documenting, and Tracking Discrete Water-Quality Data

On October 1, 2013, the KSWSC began transitioning to systematically store all data in electronic form to be readily accessible, and to facilitate efficient data management, review, and archiving. When the transition is fully implemented, any original records that are not generated electronically (such as water-quality field forms) are digitally scanned and stored in electronic form, with the other required documents. All electronic information is stored in a central location accessible from the KSWSC internal Web site. Locations for storage of all data are described in this section.

National Water Information System Databases

NWIS is the official database maintained by the USGS to store information about the occurrence, quantity, quality, distribution, and movement of surface water and groundwater. USGS WMA policy states that all data collected or used, and reported by a WSC must be stored in NWIS. The KSWSC follows this policy; therefore, all water-quality data collected by the KSWSC are stored in QWDATA. The WMA policy includes data from outside sources that are used in support of USGS published conclusions, and are not archived or published elsewhere. NWIS documentation and USGS policy memorandums can be found in Dupré and others (2013) and in USGS Water-Quality Memorandums (*http://water.usgs.gov/admin/memo/QW/*).

National Water Information System Site File

Before storing any data in NWIS, a data record for a hydrologic site (or station) must be created in the Site File for new sites, or the Site File must be updated for existing sites (such as discontinuing or reactivating a site; or correcting datums, latitude and longitude, or size of drainage area size). The establishment of sites and site folders for new data-collection sites in the KSWSC NWIS database is accomplished by a six-step process, which includes the following: (1) searching for duplicate data-collection sites, (2) locating site, (3) establishing a site identification number (ID) and site name (an 8-digit site ID is used when a surface-water site includes streamflow and is expected to be long-term; groundwater sites are always 15-digits), (4) coding the site information, (5) establishing the required content of site (or station) folders in electronic form, (6) creating and reviewing batch input files for Site File processing and site folders, and (7) uploading of batch files to the NWIS Site File. The Project Chief and Database Administrator are responsible for adherence to these Site File guidelines.

Electronic Station Folders

Each data collection site has an electronic station folder designed for the permanent storage and central access of all original data documenting the physical establishment of a data-collection site. The station folder contains the necessary information to verify data in a report or database. The station folder is located in the KSWSC Directory (table 1) on the KSWSC computer network. The station folders, in addition to other key files, are backed up (input the frequency of the back-ups and why backups are important). Some information historically required as part of the station folder may be stored in USGS databases such as SIMS and NWIS. In these instances, information included in the station folder describes locations of those documents that are stored elsewhere. Project staff are responsible for creating an electronic station folder for any new sites established in NWIS or updating existing station folders if existing NWIS sites are revised.

Any changes in data (for example, incorrectly located sites) are explained, dated, and initialed in the electronic station folders, and appropriate updates are made to the databases in conjunction with the water-quality or other discipline specialists. All changes to a site will be noted in the electronic station folder. Water-quality analytical result reruns, field sheet calculations, and other data corrections that are associated with collection or analysis of a sample are noted on the electronic form, or tracked electronically with updated data entered into QWDATA. After a project report has been approved and as part of the annual data review, if the station is discontinued when the project ends, the station folders will be archived in the KSWSC archive files.

Contents of a station folder include the following (table 1):

- Site description, how to access the site, and a copy of a map showing site location.
- Permission and permits to sample and install equipment (property owner permissions).
- Original field notes including onsite chemical determinations.
- Photographs of relevant features of the site, which may include surrounding land use, equipment, and bench marks.
- Level notes and computations including information on the altitude of the land surface, and a description of the measuring point, reference points, and benchmarks.
- Copies of analytical services request forms (laboratory login sheets).
- Water-quality analytical laboratory related forms (field alkalinity, bacteria, biological oxygen demand, and so on).
- Water-quality sample analytical result rerun and verification (requests, results, and interpretations).

Sample Tracking

Sample information is entered into QWDATA as soon after collection as possible, which is usually within a few days. Sampling information, field measurements, and ancillary information are recorded in electronic water-quality field forms using PCFFs if possible, or on paper forms that are subsequently scanned. Samples are logged into QWDATA directly from the PCFF files. When PCFF files are not available, samples are logged in manually by entering information from paper field forms and ASRs. These data are combined with analytical data from the laboratory and create a sample record. Analytical data are results of field and laboratory chemical, physical, or biological determinations. A record number is assigned by QWDATA to a sample when it is first entered into the system. All data from the NWQL, USGS sediment and research laboratories, and some contract laboratories through the NWQL are electronically transferred to the Water-Quality Data Transfer System (QWDX). These data are entered into the KSWSC QWDATA through QWDX and downloaded by the Water-Quality Database Administrator at least twice per week. Environmental sample and quality-assurance samples that are replicate environmental sample data are entered into QWDATA database 01 (DB1); QC data for artificial water samples or spiked environmental samples are entered into the QWDATA quality-assurance database 20 (DB20). Data analyzed by laboratories other than the NWQL must also be entered into QWDATA using appropriate analyzing entity code to identify the analyzing laboratory performing the measurement for that result. Other USGS laboratories may use the QWDX system to transfer data. Manual data entry is usually required for analytical results from non-USGS laboratories. Data entry is the responsibility of the Project Chief and Database Administrator. QWDATA receives daily incremental backup and weekly full backup.

When water-quality data is batch-loaded into QWDATA, a listing of water data (WATLIST) is created that details which constituents have been added, updated, or deleted in QWDATA. It is the responsibility of the Project Chief to ensure that the WATLIST files are retrieved and reviewed in a timely manner. WATLISTs contain sample information related to analytical method, precision, analytical date, and important remarks from the lab. Sample level and result-level quality-assurance checks are completed in QWDATA, and are detailed in WATLISTs.

Sample collection, data verification, and data approval are accomplished using a project-level tracking spreadsheet. Each Project Chief or designated persons maintain a record of all samples collected and shipped to a laboratory for analysis to ensure the complete and timely receipt of analytical results. The following is a summary of the tracking procedures:

- Sample information is loaded into the QWDATA subsystem as soon after collection as possible, which is usually within a few days. The data collector indicates field forms and ASRs are electronically available for the Project Chief for review. The Project Chief or designated persons are responsible for ensuring that samples are logged into QWDATA in a timely and efficient manner to facilitate the timely and error-free entry of analytical data received from the NWQL into the water-quality database. Samples submitted to the NWQL must be logged into QWDATA before data are released from the NWQL, which is usually within 7 days of collection.

- The Project Chief or designated persons are responsible for ensuring that sample status is tracked so that sample holding times are not exceeded. Sample tracking should also facilitate timely data review such that reruns of any questionable analytical data can be requested and completed before sample holding time elapses. The NWQL provides an online sample status reporting service that can be accessed on the internal Web site.

- The Project Chief or Water-Quality Specialist is responsible for ensuring that all analytical data are reviewed as soon as possible after release from the laboratory to allow for any reruns before sample holding times elapsing. Data that are rejected from QWDATA will be corrected immediately and reloaded into QWDATA.

The Water-Quality Database Administrator will regularly perform the following:

- Ensure that the biweekly automatic retrieval of the analytical data from QWDX has run successfully, retrieves analytical data, and loads results into QWDATA.

- Separate data into WATLIST files for the primary and QC database, as well as corresponding rejected sample and result files for data that could not be entered into QWDATA.

- Sort the WATLIST, and rejected sample and result files by project account numbers, and notify Project or Data Chiefs, or designated persons of data availability.

- Assist personnel with problems related to sample tracking, data delivery, and QWDATA.

- Work with all project chiefs to complete annual review of all water-quality data by April 1 and flag data appropriately (approved or rejected) for the previous water year of data.

Sample Coding Conventions

Standardized coding of samples is required for all samples entered in QWDATA. Most data are entered under 5-digit parameter codes. All coding can be found in appendix 4 of the QWDATA User's Manual (Dupré and others, 2013). Information required with every sample entered into the database includes station number, station name, sample date, sample time, medium code, and sample type. Additional details related to sample coding may be provided in the project-specific work plan.

National Water Information System, Water-Quality Data System Database 01

Sample-level information and parameter codes are used to properly describe environmental sample data in QWDATA DB1. Sample time conventions also are described.

Environmental Water-Quality Samples

Preferred sample time is to the nearest 10-minute increment following cross-section measurements. The following codes are used for environmental water-quality samples:

- Sample-medium code—
  - WS (surface water).
  - WG (groundwater).
  - SB (bottom material).
  - BI (benthic invertebrates).
- Sample-type code—9 (regular).
- Gage height (00065)—for surface water samples.
- Discharge (00061)—for surface water samples.
- Static water level (72019)—for groundwater samples.
- Sampling method (82398).
- Sampler type (84164).
- QC data associated with sample (99111)—
  - 1 (no associated QC data).
  - 10 (blank).
  - 20 (blind sample).
  - 30 (replicate sample).
  - 40 (spiked sample).
  - 100 (more than one type of QA sample).
  - 200 (other).

Replicate Samples

Sample time is 5 minutes past environmental sample time. The following codes are used for replicate samples:

- Sample-medium code—
  - WSQ (surface water quality).
  - WGQ (groundwater quality).
  - SBQ (bottom material quality).
  - BIQ (benthic invertebrates quality).
- Sample-type code—7 (replicate).
- Sampling method (82398)
- Sampler Type (84164)
- Replicate type (99105)
  - 10 (concurrent)
  - 20 (sequential)
  - 30 (split)

National Water Information System, Water-Quality Data System Database 20

Sample-level information and parameter codes are used to properly describe QC sample data in QWDATA DB20. Sample time conventions also are described.

Blank Samples

The actual sample time is to the nearest 5-minute increment. Blank samples usually are done before an environmental sample, but are not offset from the environmental sample time. The following codes are used for blank samples:

- Sample-medium code—OAQ (artificial substance, surface water or groundwater).
- Sample-type code—2 (blank).
- Blank-solution type (99100)—
  - 10 (inorganic grade).
  - 40 (pesticide grade [OK for DOC]).
  - 50 (volatile-organic grade [OK for pesticides and DOC]).
- Blank, source of solution (99101).
- Blank-sample type (99102)—
  - 1 (solution).
  - 30 (trip).
  - 80 (equipment [non-field environment]).
  - 100 (field).
  - 200 (canister [comments are canister blank]).
- For trip blanks, the start date and end date are stored using the following parameter codes:
  - Start date is the date received from the NWQL (99109) formatted as YYMMDD (Y, year; M, month; D, day).
  - End date is the date shipped to the NWQL (99110) formatted as YYMMDD.

Blank water lot numbers from certificate of analysis or from NWQL quality assurance information should be stored using the following parameter codes:

- IBW (inorganic grade blank water [99200]).
- PBW (pesticide grade blank water [99202]).
- VBW (VOC grade blank water [99204]).

Spiked Samples

Sample time is 5 minutes past environmental sample time; some spike solutions may require different sample times. The following codes are used for spiked samples:

- Sample-medium code
  - WSQ (surface water [associated environmental sample is WS]).
  - WGQ (groundwater [associated environmental sample is WG]).
- Sample-type code—1 (spike).
- Reference material or spike kit lot number (99104)—see list from NWQL Web site.
- Replicate-sample type (for replicate spikes; 99105)—
  - 10 (concurrent).
  - 20 (sequential).
  - 30 (split).
- Spike-sample type (99106)—
  - 10 (field).
  - 20 (laboratory).
- Spike-solution source (99107)—
  - 10 (NWQL).
- Spike-solution volume, in mL (99108).

Reference Samples

The following codes are used for reference samples:

- Sample-medium code—OAQ.
- Sample-type code—3 (reference).
- Reference-material source (99103)—
  - 30 (standard reference water sample [USGS]).
- Reference material or spike lot number (99104).

Verifying and Approving Discrete Data

All analytical data must be reviewed in a timely manner and within the required holding times for each analysis (to allow time for re-analysis), It is the responsibility of the Project Chief to develop, adopt, and use objective data-review criteria for every water-quality program or project. Discrete water-quality data are reviewed and approved on or before April 1st of the year that follows the water year of sample collection (U.S. Geological Survey, 2012c). The Project Chief's review of data, sometimes referred to as the annual data review, often takes place on a quarterly or bi-annual basis, and is completed well ahead of the April 1 deadline.

Data review generally takes place in several steps. Initial review of discrete water-quality data for verification includes checking that data are complete, environmentally plausible, and reported with the appropriate parameter code and correct units. Thorough review of discrete data includes evaluating the environmental and QC analytical data, measurements of field parameters, field notes, and other pertinent information. Data are evaluated for accuracy and precision to ensure the integrity of the data stored in databases and used in published reports. Data also are evaluated statistically. During data reviews, data outliers or anomalies are identified. When possible errors are found, sources of the error are investigated by checking field notes, and requesting that the laboratory verify the results or rerun the analysis. The Water-Quality Specialist is consulted regarding questionable data that remain unresolved.

Data reviews usually are completed at the project level using different complementary approaches such as spreadsheets with automated data downloads and flagging codes. Physical and chemical properties of water that may be used to help identify data errors include the following:

- Results not within expected ranges.
- Not the expected number of detections.
- Cation and anion balance.
- Filtered as compared to whole water samples.
- Replicate and environmental sample pair comparisons.
- Blank and environmental sample pair comparisons.
- Plotting related measurements against each other.
- Comparing field and lab measurements.
- Data does not fit site conceptual model.

Results are coded in QWDATA as described in the user manual using value qualifier codes, remark codes, and data-quality indicator (DQI) codes (Dupré and others, 2013). As of March 15, 2008, water-quality data stored in NWIS is made publicly available on NWISWeb from nightly updates of data unless data or samples are coded to prevent data from being displayed on the Web. New results usually are entered into QWDATA coded with a data-quality indicator code of "S" (presumed satisfactory), which allows the results to be displayed publically on NWISWeb. When data have been reviewed, this code is changed to "R" for reviewed and accepted. Values that have been rejected usually are not deleted from the database, but instead coded with a "Q" for reviewed and rejected. This code will prevent values from being displayed on the Web. Coding values as reviewed is the final step of data validation and indicates that data are approved. Data are reviewed and coded as such approximately quarterly, and by the end of the water year or end of the project before publication. Data that are to be provided to cooperators in a data summary or reported monthly are required to be reviewed and flagged as approved in NWIS before the data summary is provided to the cooperator. It is the responsibility of the Project Chief to review data and inform the database administrator and Water-Quality Specialist of coding updates.

Archiving Data

Archiving is a systematic process to ensure that data (electronic and paper form) and information will be permanently stored and maintained without change in a secure and accessible environment. In general, all data published in USGS reports, or used to support scientific analyses leading to conclusions in the reports, are entered in NWIS (including furnished data) and archived. Electronic archiving is the storing of electronic project files with the capability to recover the data. All data are stored and archived electronically in consultation with the database administrator.

While a project is active, a Project Folder is maintained in the KSWSC Directory (table 1). The folder contains planning files, data spreadsheets, data QC assessments, data analysis and interpretation files, and other important documents. At the conclusion of a project, the electronic files are moved to the KSWSC electronic archives. During the duration of the project the project folder is a living document. When the project ends, the project folder becomes static and is moved to an archive area within the KSWSC Directory. Proper data-organization and verification efforts during the project will ensure more rapid, efficient, and quality-assured responses to information requests from the archives. Records and files contained in archives are listed in table 6.

Table 6. Hydrologic data records and project files stored and archived electronically by the Kansas Water Science Center.

[SIMS, Site Information Management System; NWIS, National Water Information System; IPDS, Information Product Data System; BioData, Aquatic Bioassessment Database; USGS, U.S. Geological Survey; KSWSC, Kansas Water Science Center]

Record	Location
Project proposal and workplan	Project Folder (KSWSC Directory).
List of data collection sites	Project Folder (KSWSC Directory).
Station description	SIMS.
Station manuscript	SIMS.
Station analysis	SIMS.
Station map	SIMS.
Station photographs	Station Folder (KSWSC Directory).
Job Hazard Analysis	Station Folder (KSWSC Directory).
Traffic Control Plan	Station Folder (KSWSC Directory).
Permits, permissions	Station Folder (KSWSC Directory).
Field notes	NWIS, Station Folder (KSWSC Directory).
Analytical Services Request forms (ASRs)	NWIS, Station Folder (KSWSC Directory).
Water-quality monitor calibration forms	NWIS, Station Folder (KSWSC Directory).
Sample data	NWIS.
Biological data	BioData, Project Folder, KSWSC Folder (KSWSC Directory).
Watlists	KSWSC Folder (KSWSC Directory).
Sample tracking information	NWIS, Project Folder (KSWSC Directory).
Quality assurance/quality control records	Project Folder (KSWSC Directory).
Laboratory instrument records	Project Folder (KSWSC Directory).
Data spreadsheets and analyses records	Project Folder (KSWSC Directory).
Important emails and meeting notes	Project Folder (KSWSC Directory).
Model documentation	KSWSC Folder (KSWSC Directory).
Geospatial data	Project Folder (KSWSC Directory).
Report drafts, technical reviews	IPDS, Project Folder (KSWSC Directory).
Final reports	USGS Publications Warehouse, Project Folder (KSWSC Directory).

Data Publication and Dissemination

Data and interpretation of data are disseminated in USGS reports, journal articles, Web sites, videos, and other information products. Activities governed by Fundamental Science Practices are intended to ensure that our work uses sound methods, and undergoes review and approval before being shared with cooperators or the public.

The term "data" refers to uninterpreted observations, or measurements that are usually quantitative measurements resulting from field observations and laboratory analyses of water, sediment, or biota. The term "information" refers to interpretations of data or conclusions of investigations. Interpretive results or conclusions require peer review and Director approval for publication (table 7). Release of preliminary interpretations before 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.

Although the format varies, all water-quality data collected by the KSWSC are published. Formats include hydrologic data reports, interpretive reports, the KSWSC public Web site, or NWISWeb (*http://waterdata.usgs.gov/ks/nwis*). KSWSC management discourages the publication of lengthy data reports for individual projects. The selection of the appropriate publication outlet for water-quality data will be the responsibility of the Data Chief or Project Chief and the appropriate supervisors.

Hydrologic data are made available to the public on several USGS Web sites including NWISWeb (*http://waterdata.usgs.gov/nwis*), WaterWatch (*http://waterwatch.usgs.gov/*), WaterQualityWatch (*http://waterwatch.usgs.gov/wqwatch/*), GroundwaterWatch (*http://groundwaterwatch.usgs.gov/*), National Real-Time Water Quality (*http://nrtwq.usgs.gov/*), and various project web pages on the KSWSC home page (*http://ks.water.usgs.gov/*). Data are provided in multiple locations and formats to accommodate different user needs.

Table 7. Report review process for quality assurance in the U.S. Geological Survey Kansas Water Science Center (from Putnam and Hansen, 2014).

[OMB, Office of Management and Budget; USGS, U.S. Geological Survey; WSC, Water Science Center; SPN, Science publishing network]

Step	Description	Action
1	Staff overview	Checks organization, completeness of content, verification spot checks, ensures that project objectives are met, and arranges for complete verification review. Report entered into Information Product Data System.
	Author(s) revisions	Revise and submit to next step. Suggests peer reviewers.
2	Supervisor review	Determines if report is ready for peer review; accepts author's suggested reviewers or identifies other reviewers; monitors whether report could be considered *as influential or highly influential scientific information* for the OMB Peer Review Agenda process.
	Peer review (one internal and one external to the USGS Kansas WSC)	Checks technical validity of analyses and supporting data, organization, and readability.
3	Author revisions and response to reviewers	Revise, write response, and submit to next step. See USGS Fundamental Science Practices and Survey Manual sections 502.1 through 502.5 (*http://www.usgs.gov/fsp/*).
4	Supervisor check	Determines if response to peer review comments is adequate and if editorial review is required.
	Review by technical editor at the Science Publishing Network (SPN)	Checks format, for policy, technical and grammatical content, logic, organization, and verification; ensures readability for intended audience.
	Author(s) revisions	Revise and submit to next step.
	Review by Section Chief	Check adequacy of response to reviewer comments, data analysis, and correctness of interpretation.
	SPN preparation	Prepares report for approval by WSC Director.
5	Review by WSC Director	Approval for publication (noninterpretive reports) or recommended approval for publication (interpretive reports).
6	Review by Bureau Approving Official	Ensures all required reviews are performed, validates peer review reconciliation, identifies any revisions needed, and returns (for additional review or revision approved or unapproved package) to WSC Director (interpretive reports).
7	WSC Director	Sends to author for appropriate action.
8	Author(s) revisions	Respond to Bureau Approving Official recommendations and required revisions. Submit for preparation and printing.
9	SPN prepares final layout	Manuscript and illustrations prepared in format appropriate for publication.
	Review by author(s)	Read through to catch format problems.
	Proofs prepared and sent to printer and for web posting	SPN handles printing, distribution, and web posting.

Interpretive reports include such USGS publications as Circulars, Professional Papers, Scientific Investigations Reports, and Open-File Reports; as well as non-USGS outlets, such as scientific journals, books, and proceedings from technical conferences. The project supervisor or other designated persons (that is, Water-Quality Specialist or other technical specialists) provide guidance in ensuring that each water-quality report meets the highest technical standards. The report review process is described in table 7. Approval of interpretive reports is in accordance with applicable USGS, Office of Science Quality and Integrity, and KSWSC policy; and is more technically rigorous than the required approval for noninterpretive data reports. The Information Product Data System (IPDS) is used to store and track report documents including technical reviews and report approvals. USGS publications are electronically available to the public from the USGS Publications Warehouse (*http://pubs.er.usgs.gov/*).

Special Topics

Miscellaneous special topics related to water-quality and data-management activities are discussed in this section.

Methanol

Methanol rinses are required by standard USGS protocols for removing organic contaminants when cleaning equipment for some water-quality procedures (U.S. Geological Survey, variously dated[b], chapter A3). Methanol is flammable and toxic. Inhalation or absorption through skin can cause confusion, visual impairment, nausea, headaches, and sleepiness. For this reason, methanol rinses rarely are included in cleaning procedures for KSWSC projects. Instead, blank samples are evaluated to ensure equipment is free of contaminants.

Exceptions include field work for the NAWQA Program or other national programs that require consistent protocols for multiple field teams. When methanol is used, areas are well-ventilated, and free from sparks and sources of ignition. The minimum amount of methanol needed to wet equipment surfaces is used, and then surfaces are rinsed thoroughly with blank water to prevent methanol from contaminating samples. When not being used, methanol is stored in its original container and in a clearly marked flammable cabinet.

Documenting and Addressing Bias in Analysis Methods

Occasionally, bias in analysis methods is discovered and actions are taken to minimize and quantify effects on data. Analysis of samples using different methods for a period of time helps quantify differences for sites where the KSWSC collects data, and for the range in hydrologic and water-quality conditions. For example, as a result of observed bias in total nitrogen (TN) concentrations described in OWQ Technical Memorandum 2013.01 (U.S. Geological Survey, 2013), the KSWSC has made adjustments to requested nitrogen analyses. The bias was reported in whole water samples analyzed using alkaline persulfate and Kjeldahl digestion methods (Rus and others, 2013). Rus and others (2013) identified a connection between suspended sediment and negative bias in alkaline persulfate methods, and positive bias in Kjeldahl methods in the presence of elevated nitrate. The preferred method, as recommended by the OWQ, is TN (computed as the sum of dissolved and particulate nitrogen) because it was found to have less bias. The KSWSC routinely adds analysis of particulate nitrogen to facilitate the recommended TN calculation and to establish a basis for method comparison during the transitional period.

Alkalinity

Alkalinity and acid neutralizing capacity (ANC) are measures of the ability of a sample to neutralize a strong acid. The USGS distinguishes between alkalinity, which is the acid neutralizing capacity of solutes in a filtered water sample, and ANC, which is the acid-neutralizing capacity of solutes plus particulates in an unfiltered water sample (U.S. Geological Survey, variously dated[b], chapter A6). Which of these measurements is measured as part of a study is determined during the planning stages, and is dependent on study objectives and stream conditions. Advanced speciation methods and the USGS alkalinity calculator are used as recommended by OWQ Technical Memorandum 2012.05 (U.S. Geological Survey, 2012b).

Generally, field alkalinity and ANC are more accurate than laboratory alkalinity and ANC as determined by NWQL evaluations that found differences of about 10 percent between field and laboratory values. However, alkalinity and ANC in Kansas surface water have been found to be more stable with smaller differences when compared to the laboratory evaluation. Most KSWSC projects use laboratory alkalinity and ANC as the primary measurement. At least 25 percent of samples collected include both field and laboratory determinations for comparison and demonstration that the laboratory results are of acceptable quality for project purposes.

The NFM (U.S. Geological Survey, variously dated[b], chapter 6) recommends checking calibration on digital titrators once annually, or more frequently if wear or damage is noted. Calibration can be checked by (1) using the titrator to measure a standard reference sample of known alkalinity; (2) checking volume delivered by the digital titrator against volume delivered from a buret; and (3) checking the volume delivered by the titrator using a spent acid cartridge filled with deionized water, and weighing the cartridge before and after delivery of a few hundred counts (water weighs 1 gram per milliliter [g/mL]).

Field Determinations of Nutrient Concentrations

Photometer testing kits are being used as part of some projects to make field determinations of nitrate and phosphate concentrations. Field determinations for nitrate are used to check performance of the continuous nitrate monitor. Field determinations also are useful for choosing the appropriate method and reporting level when samples are submitted for laboratory analysis to avoid qualified data results such as non-detections. The photometer data currently (2014) is not being entered into the database because problems have been detected with high variability in results. The KSWSC is working on identifying the source of the variability by examining field techniques and test kit components. When the problems are corrected and data meet quality-control objectives, data will be entered into the database under appropriate parameter codes and associated method codes.

Sample Collection During Drought Conditions

Generally it is undesirable to collect water-quality samples from streams when there is no streamflow. During drought conditions, when there is no visible or measurable streamflow, the Project Chief in consultation with others must determine whether samples will meet project objectives and should be collected. If samples are collected, they should be taken from pool locations that represent the typical condition observed at the site. Conditions must be clearly noted on field forms. Data collected during these conditions may need to be segregated from other samples in interpretive reports. When logging this kind of data into NWIS, the hydrologic event code is set to 1 (Drought), and hydrologic condition is 4 (Stable low) or X (not applicable). A note is made in the remarks section during login that the sample was collected from pooled water. In this way it is clear to the public when viewing the data on NWISWeb.

Sample Collection During Flood Conditions

Sample collection during flood conditions requires special attention to safety concerns, particularly those related to road conditions, bridge traffic, and flowing debris. In addition, adjustments to field procedures may be necessary. Examples may be related to difficulties accessing sampling location, or collecting EWI and EDI samples. The KSWSC maintains a communication plan for flood events on the KSWSC internal Web site to provide additional guidance during flood conditions. Thorough and accurate field notes documenting sampling conditions and changes in standard procedures are required. When logging this kind of data into NWIS, the hydrologic event code is set to 7 (Flood); and hydrologic condition is 5 (Falling stage), 7 (Peak stage), or 8 (Rising stage).

USGS Policies and Memorandums

Public Web sites where USGS manuals, policies, memorandums, and other information are listed in table 8. Additional Web sites are available to USGS employees on internal USGS Web sites.

Table 8. Summary of Web sites for manuals, policies, memorandums, and other information related to water-quality and data-management activities in the Kansas Water Science Center.

[USGS, U.S. Geological Survey; NWQL, National Water Quality Laboratory; WRD, Water Resources Division; BQS, Branch of Quality Systems]

Information	Web site
Organization and general information	
USGS Manual	*http://www.usgs.gov/usgs-manual/*
USGS Water Mission Area information	*http://www.usgs.gov/water/*
USGS Office of Water Quality	*http://water.usgs.gov/owq/*
USGS Water Quality Technical Memorandums	*http://water.usgs.gov/admin/memo/QW/*
USGS Branch of Quality Systems Memorandums	*http://bqs.usgs.gov/memos/*
USGS Science strategy	*http://www.usgs.gov/start_with_science/*
Data management	
User's Manual for the USGS National Water Information System	*http://pubs.usgs.gov/of/2013/1054/*
Fundamental Science Practices	*http://www.usgs.gov/usgs-manual/500/502-2.html*
USGS Policy for Archiving Records	*http://www.usgs.gov/usgs-manual/schedule/432-1-s2/index.html*
Policy on Review and Publication of Discrete Water Data	*http://water.usgs.gov/admin/memo/QW/qw12.03.pdf*
WRD Scientific Records Disposition Schedule	*http://www.usgs.gov/usgs-manual/schedule/432-1-s2/index.html*
USGS Records Disposition Schedules	*http://www.usgs.gov/usgs-manual/schedule/index.html*
USGS General Records Disposition Schedule	*http://www.usgs.gov/usgs-manual/schedule/432-1-s1/infotouse1.html*
Project planning	
Guidelines for Preparation, Submission, and Approval of Water Science Center Project Proposals	*http://water.usgs.gov/admin/memo/policy/wmapolicy13.01.pdf*
Water Resources Techniques, Methods, and Modeling	*http://water.usgs.gov/techniques.html*
Laboratories	
BQS National Field Quality Assurance Program	*http://bqs.usgs.gov/nfqa/*
NWQL Technical Memorandums	*http://nwql.usgs.gov/Public/techmemo.shtml*
Policy for evaluation of analytical laboratories	*http://water.usgs.gov/admin/memo/QW/qw2014.01.pdf*
Sample collection	
National Field Manual	*http://water.usgs.gov/owq/FieldManual/*
Water Quality Methods and Techniques	*http://water.usgs.gov/owq/methods.html*
Safety	
Occupational Safety and Health Program Requirements Handbook	*http://www.usgs.gov/usgs-manual/handbook/hb/445-2-h.html*

Summary

As the Nation’s largest water, earth, and biological science and civilian mapping information agency, the U.S. Geological Survey is relied on to collect high-quality data, and produce factual and impartial interpretive reports. The water mission is to collect and disseminate reliable, impartial, and timely scientific information that is needed to understand the Nation’s streams, lakes, reservoirs, wetlands, and aquifers. Water-quality activities in the Kansas Water Science Center, Lawrence, Kans., are part of this overall mission.

This quality-assurance and data-management plan provides guidance for water-quality activities conducted by the Kansas Water Science Center. Policies and procedures are documented for activities related to planning, collecting, storing, documenting, tracking, verifying, approving, archiving, and disseminating water-quality data. The plan also serves as a guide for all personnel who are involved in water-quality activities, and as a resource for identifying memoranda, publications, and other resources that describe associated techniques and requirements in more detail. The policies and procedures described in this plan complement quality-assurance plans for continuous water-quality monitoring, surface-water, and groundwater activities in Kansas.

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