

QUALITY-ASSURANCE PLAN FOR THE PILOT NATIONAL WATER-QUALITY ASSESSMENT PROGRAM



U.S. Geological Survey
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By H. C. Mattraw, Jr., W. G. Wilber, and W. M. Alley

U.S. GEOLOGICAL SURVEY

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1.0 INTRODUCTION

Beginning in 1986, Congress has annually appropriated funds for the U.S. Geological Survey (Geological Survey) to begin detailed planning and experimentation leading to the possible implementation of a National Water-Quality Assessment (NAWQA) Program. In response, the Geological Survey has established a pilot program to test and refine concepts and approaches for a fully implemented program. The goals of a full-scale NAWQA Program would be to:

1. Provide a nationally consistent description of current water-quality conditions for a large part of the Nation's water resources;
2. Define long-term trends (or lack of trends) in water quality; and
3. Identify, describe, and explain, as possible, the major factors that affect observed water-quality conditions and trends.

This information, obtained on a continuing basis, would be made available to water managers, policy makers, and the public to provide an improved scientific basis for assessing the effectiveness of water-quality management programs, and to predict the likely effects of contemplated changes in land- and water-management practices.

The NAWQA Program is organized into study units on the basis of known hydrologic systems. For surface water, the study units are large river basins; for ground water, the study units are large parts of aquifers or aquifer systems. The study units involve areas of a few thousand to several tens of thousands of square miles.

Seven pilot projects (four surface-water and three ground-water projects), representing a diversity of hydrologic environments and water-quality conditions, were selected to test and refine the assessment concepts and approaches. The surface-water pilot project areas are the Yakima River basin in Washington (McKenzie and Rinella, 1987); the lower Kansas River basin in Kansas and Nebraska (Stamer and others, 1987); the upper Illinois River basin in Illinois, Indiana, and Wisconsin (Mades, 1987); and the Kentucky River basin in Kentucky (White and others, 1987). The ground-water pilot project areas are the Carson basin in Nevada and California (Welch and Plume, 1987); the Central Oklahoma aquifer in Oklahoma (Christenson and Parkhurst, 1987); and the Delmarva Peninsula in Delaware, Maryland, and Virginia (Bachman and others, 1987).

1.1 Policy

The Geological Survey is committed to conducting high quality research and investigative studies. As part of the pilot National Water-Quality Assessment Program, a quality-assurance (QA) program has been established to ensure that technically sound procedures will be used to test the conceptual design of the NAWQA Program described in Hirsch and others (1988). The QA program requires that (1) data collection activities follow Geological Survey approved methods, (2) data analysis and interpretation procedures are documented and capable of being verified, and (3) reports are technically and editorially sound and consistent with Geological Survey policy. The quality-assurance plan will be updated as necessary to reflect revisions or additions to the program.

1.2 Purpose and Scope

The purposes of this document are to define the QA requirements and management's QA responsibilities for the pilot NAWQA Program. Actual data-collection handling and compilation procedures will be defined in manuals and methods descriptions developed for the Program. The QA requirements specified herein are applicable to Headquarters, Regional Offices, District Offices, project offices of the Geological Survey, and any contractors assigned to perform activities affecting data quality in the pilot NAWQA Program. This quality-assurance plan supplements other documents that include:

- (1) A report describing the overall concept for a NAWQA Program (Hirsch and others, 1988);
- (2) Descriptions and plans developed for the NAWQA Program including
 - (a) Surface-water field procedures manual,
 - (b) Ground-water field procedures manual,
 - (c) Evaluation of methods to determine contaminants in biological tissues,
 - (d) Evaluation of methods for conducting ecosystem surveys; and
- (3) Work plans for each pilot project.

2.0 PILOT PROGRAM ORGANIZATION AND RESPONSIBILITIES

2.1 Organization of the Water Resources Division

This section describes the organizational structure, functional responsibilities, levels of authority, and lines of communication of Geological Survey personnel performing work on the pilot NAWQA Program.

The Geological Survey, which is administered under the auspices of the Office of the Assistant Secretary for Water and Science in the U.S. Department of the Interior, consists of five Divisions--Geologic, National Mapping, Water Resources, Information Systems, and Administrative. The national organization of the Water Resources Division, which is responsible for implementing the NAWQA Program within the Geological Survey, is shown in figure 2.1-1. The functions of the Division are conducted at the Headquarters, Regional, and District levels (fig. 2.1-1). The organization of key Division offices involved in the pilot NAWQA Program are shown in figure 2.1-2.

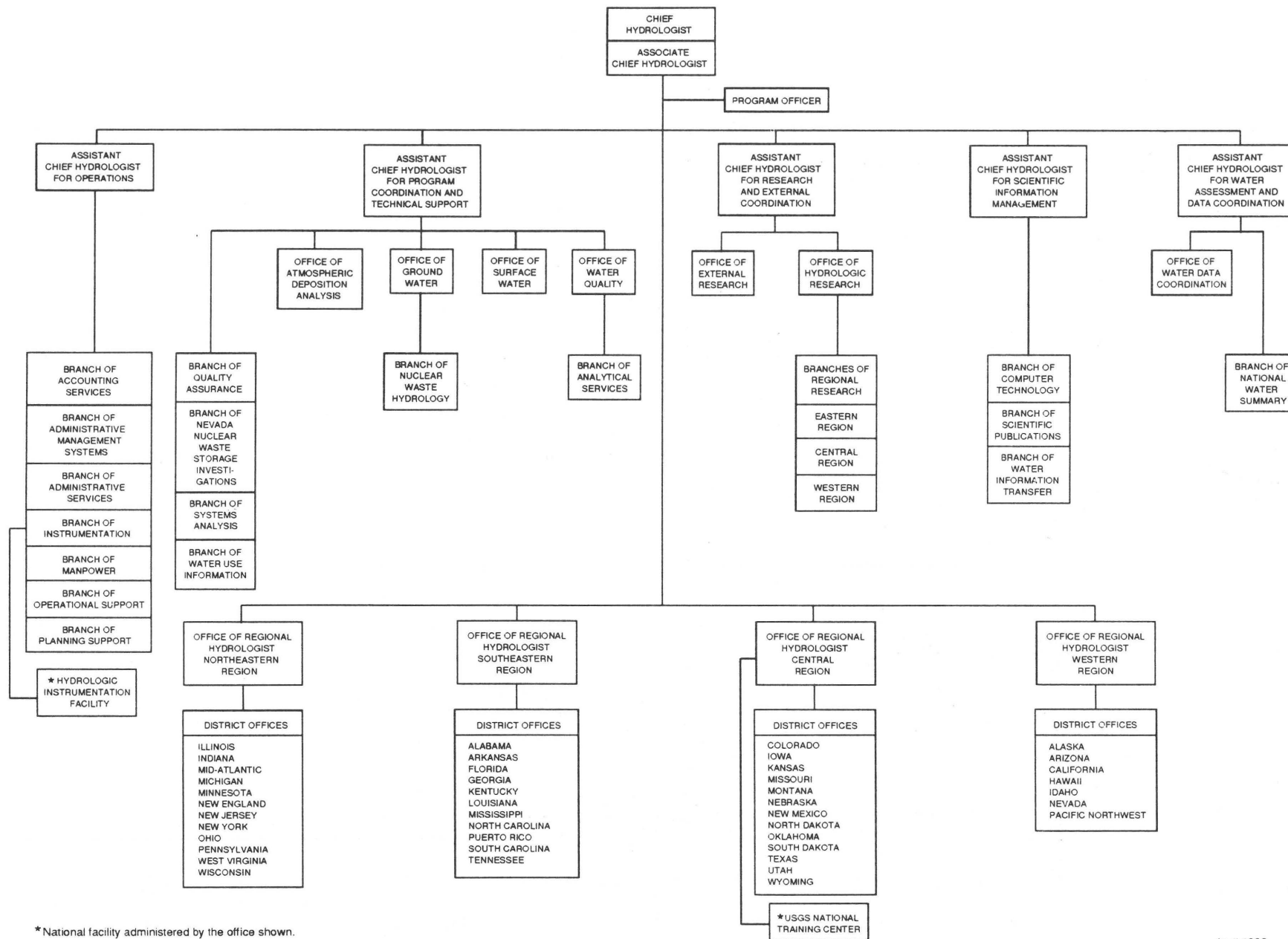


Figure 2.1-1.--Organization of the Water Resources Division of the U.S. Geological Survey.

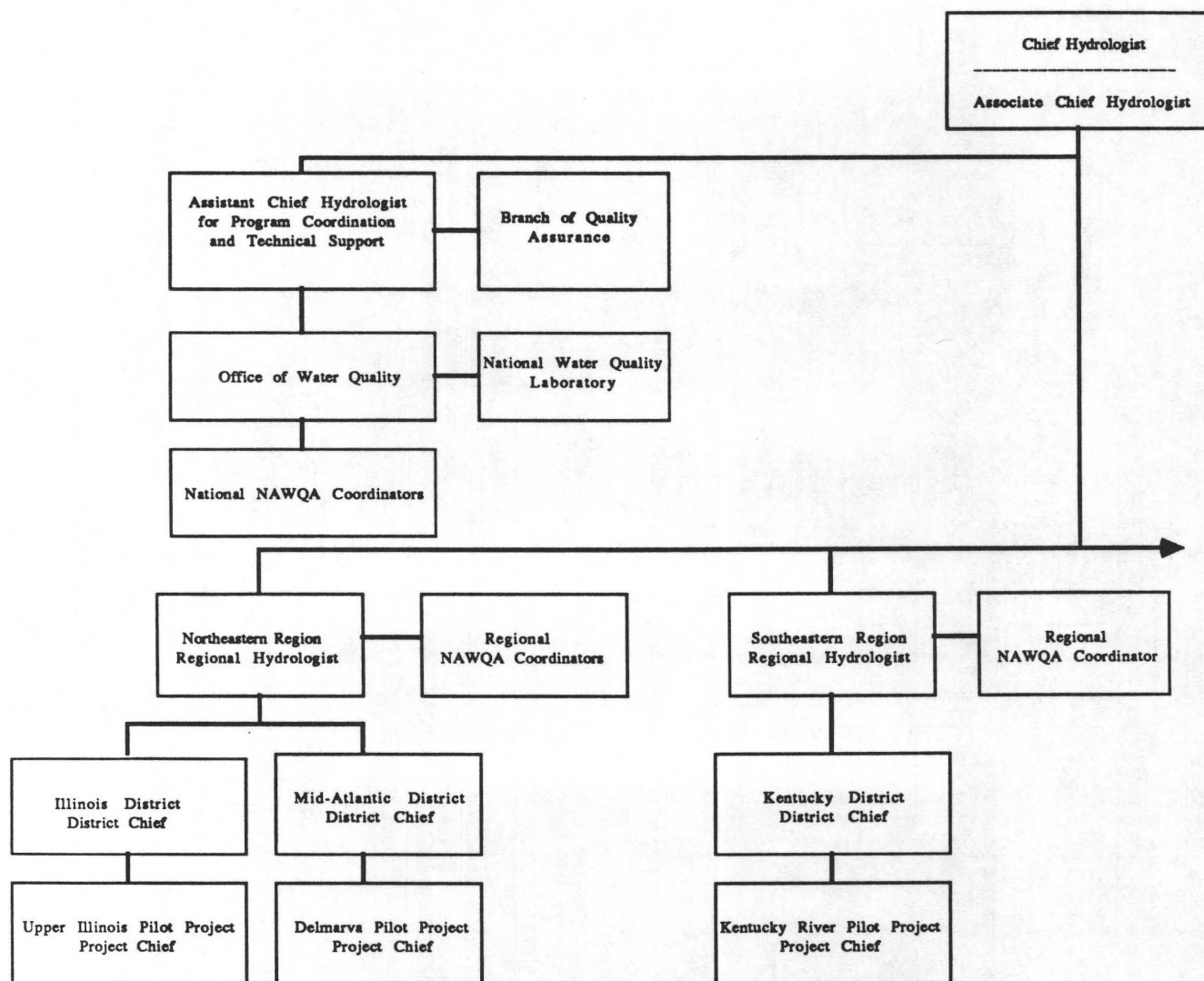


Figure 2.1-2.--Key Water Resources Division offices involved in the pilot National Water-Quality Assessment (NAWQA) Program.

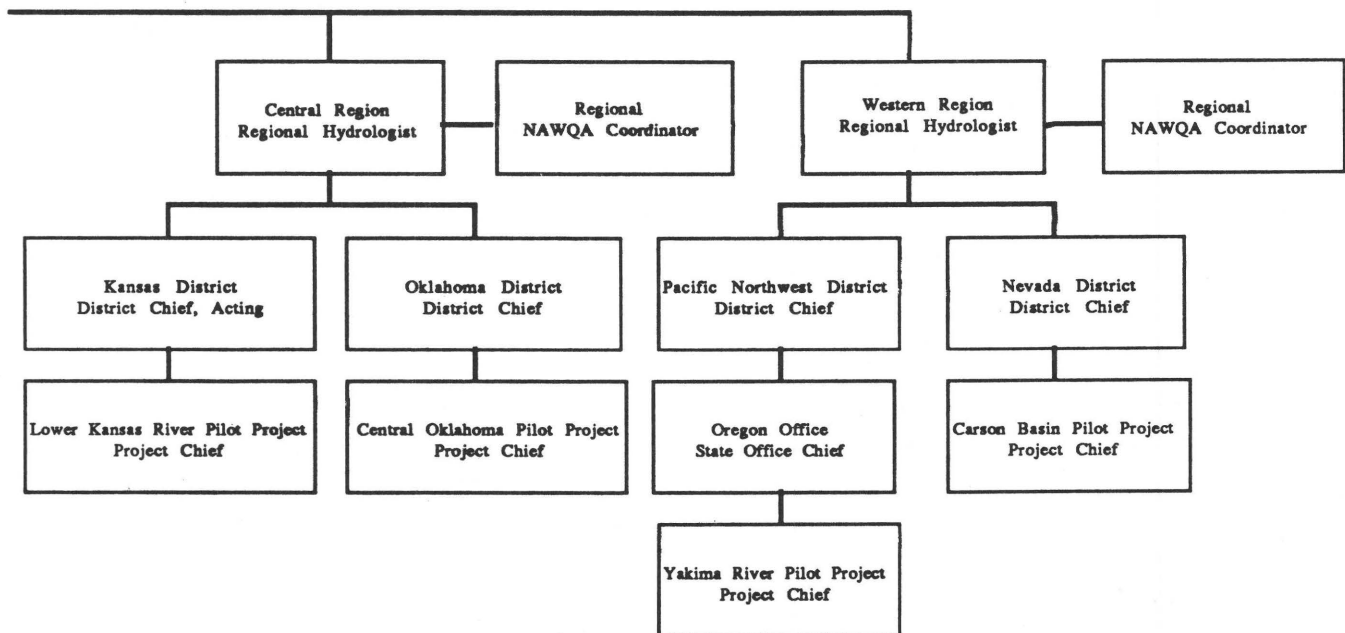


Figure 2.1-2.--Key Water Resources Division offices--Continued.

2.1.1 Headquarters

Headquarters is responsible for the overall direction of the Division and consists of the Offices of the Chief Hydrologist, the Associate Chief Hydrologist, and five Assistant Chief Hydrologists: for Operations, Scientific Information Management, Program Coordination and Technical Support, Research and External Coordination, and Water Assessment and Data Coordination.

The Chief Hydrologist has delegated the overall responsibility for program coordination for the pilot NAWQA Program to the Chief, Office of Water Quality, under the Assistant Chief Hydrologist for Program Coordination and Technical Support (ACH/PC&TS). Within the Office of Water Quality are two National Coordinators of the pilot NAWQA Program, one for surface water and one for ground water. These coordinators are responsible for the day-to-day coordination and technical liaison with the Regional Coordinators, District Chiefs, pilot Project Chiefs, the National Water-Quality Laboratory (NWQL) in Arvada, Colo., other offices and programs of the Geological Survey, and with other Federal agencies and organizations.

The Chief Hydrologist has delegated responsibility for quality assuring the pilot NAWQA Program to the ACH/PC&TS. Activities associated with assessing the technical quality of the pilot projects will be coordinated by the Office of Water Quality. The Chief, Office of Water Quality, will advise the ACH/PC&TS of the quality-assurance status of the pilot projects and of identified needs for corrective actions. The ACH/PC&TS will notify the Regional Hydrologists of needed corrective actions and ensure that the pilot NAWQA projects follow technically sound procedures.

2.1.2 Regions and Districts

Most of the activities necessary to accomplish the goals of the assessment program will be conducted at the Regional and District levels.

2.1.2.1 Regional Hydrologists

The general direction of the Division's field program is through four Regional Hydrologists, each of whom is located at regional centers (fig. 2.1.2.1-1) in Reston, Va. (Northeastern Region), Atlanta, Ga. (Southeastern Region), Denver, Colo. (Central Region), and Menlo Park, Calif. (Western Region).

The Regional Hydrologists have line authority from the Chief Hydrologist. They are responsible for the direction, planning, personnel, and financial management of regional programs and operations, and serve as the Division representative within the Region. Regional Hydrologists direct the operations of all District offices in their respective regions. The Regional Hydrologists are responsible for taking any corrective actions necessary to ensure the technical adequacy of the pilot NAWQA projects. Each of the four Regional Hydrologists has assigned a staff member as the Regional NAWQA Coordinator (fig. 2.1-2) to coordinate the respective pilot projects. The Regional NAWQA Coordinators represent the Regional Hydrologist at NAWQA meetings and participate in project QA reviews and report reviews. The Northeastern Region has two coordinators: one for surface water and one for ground water.

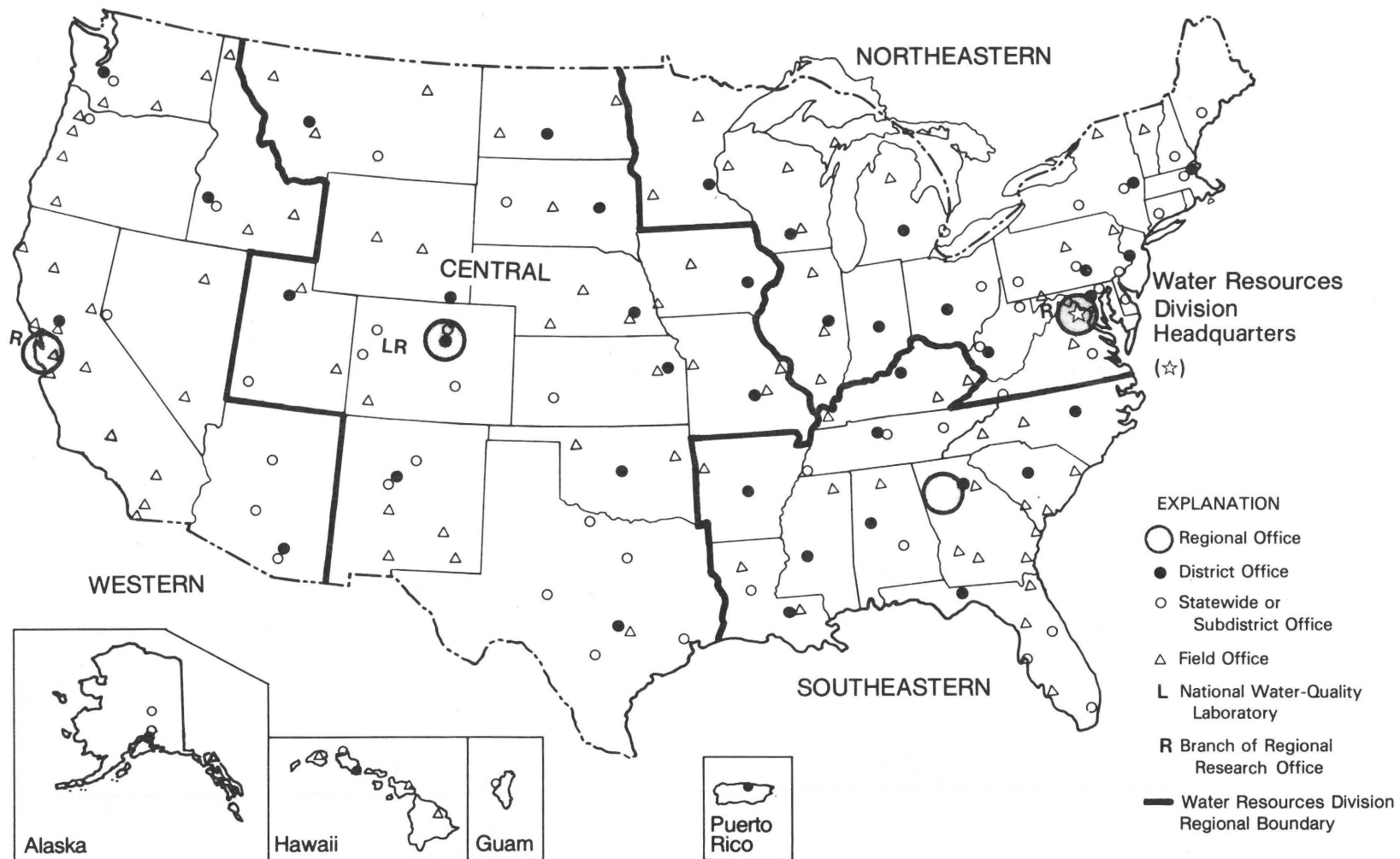


Figure 2.1.2.1-1.--Regions and offices of the Water Resources Division of the U.S. Geological Survey.

2.1.2.2 District Chiefs

Each Region in the Division consists of a number of Districts. Typically, the areal responsibility of a District is one State, although several are multi-State Districts.

District Chiefs are responsible to the Office of the Regional Hydrologists and are responsible for the direction, financial management, and execution of data collection and hydrologic studies within their respective Districts. Each District Chief maintains a staff of professional and technical personnel who conduct these activities. The pilot projects are under the direct supervision of the District Chief in the District for which the major part of the study area is located. The District Chief shares the QA responsibilities with the Regional Hydrologist for ensuring that adequate technical review of the work is performed, and that the personnel comply with the technical and QA policies applicable to the work performed. In addition, the District Chief is responsible for reporting to the Regional and National Coordinators in a timely fashion, any significant problems or issues affecting the technical activities of the pilot project, and for ensuring that the pilot project team has an appropriate level of training in both technical and QA issues.

2.1.2.3 Pilot Project Chief

The pilot Project Chief and team consist of District personnel. The Project Chief is responsible for:

1. Planning and executing the different components of the pilot projects;
2. Quality assurance of the results of field and laboratory measurements;
3. Coordinating assessment activities and communicating results to other Federal, State, and local agencies; and
4. Preparing reports summarizing the results of the projects.

2.2 National Water-Quality Laboratory

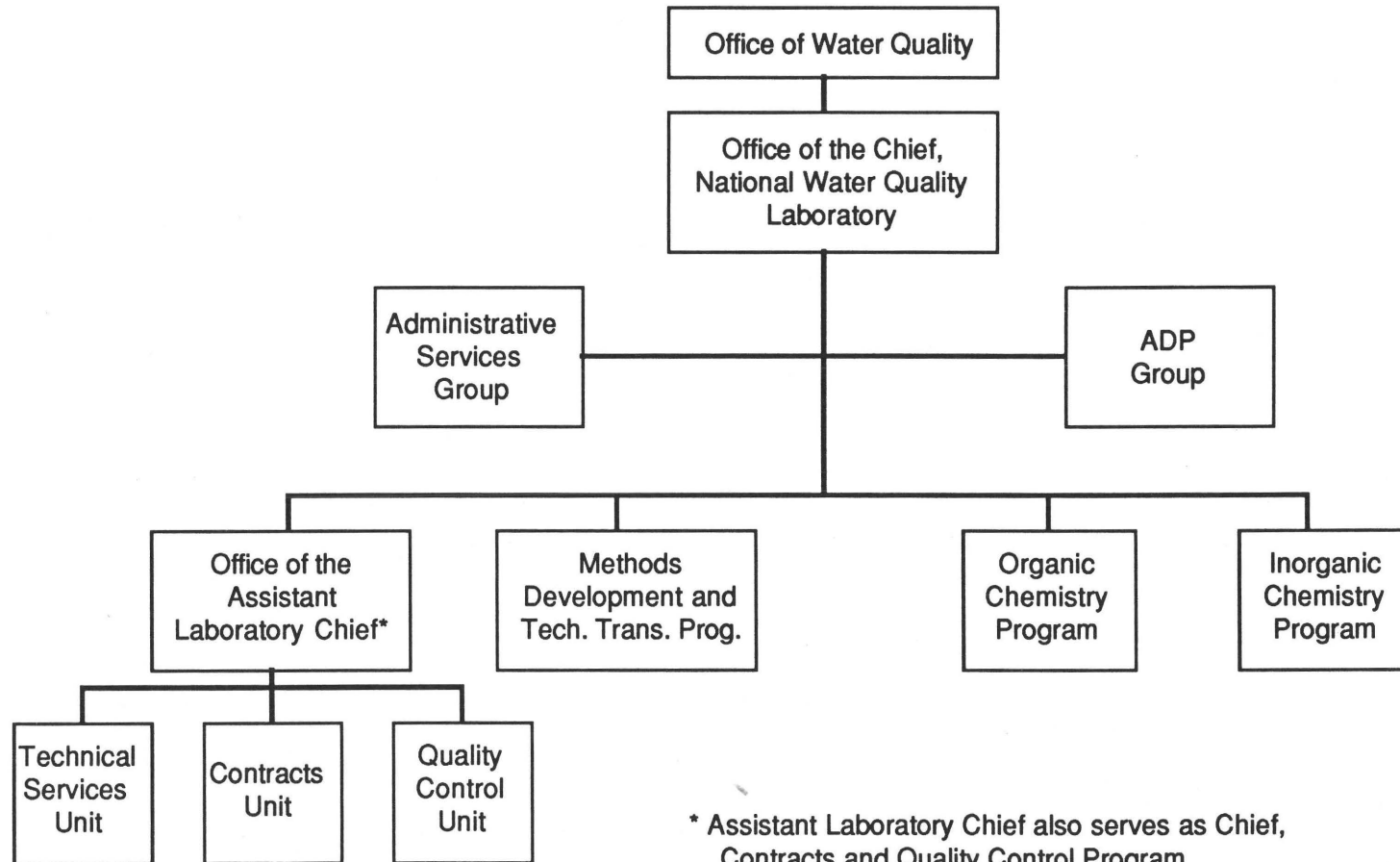
Most of the laboratory analyses for the pilot NAWQA Program will be provided by the National Water-Quality Laboratory (NWQL). The Chief of the NWQL is responsible to the Chief, Office of Water Quality. The organizational structure of the NWQL is shown in figure 2.2-1. The NWQL is responsible for providing quality control of the analyses performed within its facility and to those laboratories performing contract analyses for the NWQL. The NWQL will provide the pilot projects with sample containers and preservatives after appropriate quality-assurance and quality-control testing. The NWQL will provide the analytical results to the District for entry into the Geological Survey's data base systems.

2.3 Branch of Quality Assurance

The Branch of Quality Assurance (BQA) reports to the ACH/PC&TS. The BQA is responsible for (1) developing, implementing, monitoring, and updating a Divisionwide QA program that addresses sample collection, field measurements, laboratory analysis, and data management; and (2) providing technical administrative guidance to field, laboratory, and data-base QA programs. The BQA has the responsibility for providing an unbiased, external review of the QA program associated with the pilot NAWQA Program.

NATIONAL WATER QUALITY LABORATORY

ARVADA, COLORADO



* Assistant Laboratory Chief also serves as Chief, Contracts and Quality Control Program

Figure 2.2-1.--Organization of the National Water-Quality Laboratory of the U.S. Geological Survey.

2.4 National Research Program

The National Research Program (NRP) will participate in pilot NAWQA projects to address questions about the feasibility of particular approaches in specific types of physical or hydrologic settings and to help provide examples of approaches that could become standardized if the NAWQA Program is fully implemented. A technical advisor from the NRP has been identified for each of the pilot projects and personnel from the National Research Program serve on internal advisory committees to the pilot NAWQA Program.

2.5 National Coordinating Work Group

A National Coordinating Work Group has been established by the Director of the Geological Survey under the general auspices of the Inter-agency Advisory Committee on Water Data and the Advisory Committee on Water Data for Public Use. The work group meets twice per year. The general purposes of the work group are to advise the Geological Survey about water-quality information needs of non-Federal and Federal communities of water-information users, and about procedures for making the data and information stemming from the pilot NAWQA Program both appropriate to planning needs and available in a timely manner. The work group currently consists of the Chief Hydrologist, nine Federal members, seven non-Federal members, and a member from each of the pilot project liaison committees.

2.6 Pilot Project Liaison Committees

Each pilot NAWQA project has a liaison committee to help ensure that the scientific information produced by the program is relevant to local and regional interests. Each liaison committee is chaired by the District Chief, with meetings generally being held every 6 to 9 months. Specific activities include:

1. Exchanging information about water-quality issues and activities that affect water-quality conditions,
2. Discussing potential adjustments to the project design to meet project objectives, and
3. Reviewing and commenting on planning documents, work plans, and project reports.

2.7 Other Offices and Agencies

All other offices and agencies that support the pilot NAWQA Program shall comply with the policies of the NAWQA quality-assurance program as specified by specific agreements, or they shall perform under equivalent programs approved by the Geological Survey.

3.0 PILOT PROJECT ACTIVITIES

The National Coordinators, in consultation with the Regional Coordinators, technical advisors, and pilot Project Chiefs have the responsibility to develop guidelines on how to accomplish the objectives of the projects within the bounds of technical and fiscal restraints. The pilot

Project Chief, in consultation with the supervising District Chief and Regional Hydrologist, has the responsibility to conduct the work necessary to meet project objectives.

3.1 Use of Existing Data

One of the first activities to be undertaken by each pilot project is to compile, screen, and interpret available data for the project area. The NAWQA protocol allows for the use of data collected by other agencies. However, each pilot Project Chief is responsible for ensuring that all data used in any particular analysis meet appropriate screening criteria, and that the screening procedures are documented in the interpretive reports. The Regional and National Coordinators will review and approve the screening process used by the Project Chiefs.

3.2 Field Activities

The concepts for pilot NAWQA Program field activities are described in Hirsch and others (1988). Actual field procedures to be used will be identified in manuals and methods descriptions that are being developed (see Purpose and Scope).

The implementation of field activities is described in work plans prepared by the Project Chief for each pilot project. Each work plan includes, but is not limited to, the objectives of the investigation, a description of the work to be performed, and the procedures and schedules to be followed in completing the work. The work plan contains a level of detail that will enable an independent reviewer to evaluate the technical adequacy and completeness of the sampling program. Each work plan has been reviewed and approved by the project District Chief, the Regional Hydrologist, and the National Coordinator. Proposed modifications to the work plan by a pilot Project Chief must be submitted to the District Chief, the Regional Hydrologist, and the National Coordinator for approval before implementation. Pilot Project Chiefs are responsible for field activity quality assurance.

3.3 Physical and Chemical Measurements

A set of national target variables has been established for the seven pilot projects to enable interpretations of water quality at the national scale. The national target variables consist of a common set of physical measurements, inorganic constituents, organic compounds, and radiochemical determinations that will be included in sample analyses for all pilot project areas. Specified laboratory analytical methods will be used for each national target variable. The national target variables differ between surface water and ground water.

Guidance in selecting the national target variables and associated analytical methods was provided by a group of scientists from within and outside of the Geological Survey. Many of the constituents are presently targeted on lists developed for regulatory purposes, such as those lists developed under the 1986 Amendments to the Safe Drinking Water Act.

Additional study-unit target variables have been selected by each project team to supplement the national list. These constituents have been identified in the individual pilot project work plans.

3.4 Biological Measurements

The role of biology in a full-scale NAWQA Program, as presently structured, is described in Hirsch and others (1988). Procedures to be used in each of the surface-water pilot projects to determine the sanitary quality of streams will be described in the surface-water field-procedures manual.

Two documents that describe the objectives and approaches for determining the occurrence of selected contaminants in tissues and for conducting ecological surveys are being developed. Decisions on the implementation of the approaches described in the two procedure manuals will be made by the National Coordinator, in consultation with technical advisors, after they have been tested in one or two of the pilot projects.

4.0 LABORATORY PROCEDURES

The laboratory analyses for the pilot NAWQA Program primarily will be done at the NWQL. The protocols used by the NWQL for sample handling and quality assurance are described by Friedman and Erdmann (1983) and Jones (1987). Analytical techniques for inorganic constituents are described by Fishman and Friedman (1985). Methods for determining organic compounds are described by Wershaw and others (1987). In addition, selected analytical schedules, requirements for sample treatments, and availability of required sample bottles are described in the NWQL analytical services catalog (Feltz and others, 1985).

4.1 Inorganic Constituents and Radiochemical Determinations

Inorganic constituent and radiochemical determinations for surface-water samples are described by W. G. Wilber (U.S. Geological Survey, written commun., 1988); those for ground-water samples are described by M. A. Hardy (U.S. Geological Survey, written commun., 1988). Concentrations to be reported typically are three or more times larger than the detection limits of the particular constituents and are given in Feltz and others (1985). The selection of the analytical methods for the target inorganic and radiochemical constituents was made by the National Coordinators after consultation with the technical advisors, Regional NAWQA Coordinators, and the pilot Project Chiefs.

4.2 Organic Compounds

Eight major classes of organic compounds will be determined from samples collected in the pilot NAWQA study areas. The analytical methods for some of the pesticides recently have been modified to incorporate additional compounds included in the U.S. Environmental Protection Agency's National Pesticide Survey (Mason and others, 1988).

4.3 External Laboratories

The pilot NAWQA Program will adhere to the policies and procedures of the Division for the use of external laboratories. These procedures include having the laboratory respond to a questionnaire, submission and review of the laboratory's QA plan, participation in the Geological Survey Standard Reference Water Sample Program, and an on-site laboratory review by BQA. The National Coordinators are responsible for approving the use of external laboratories.

4.4 Laboratory Quality Assurance

Quality assurance of all laboratories being used by the pilot NAWQA Program is the responsibility of the National Coordinators, with assistance from the BQA. For the NWQL, the QA efforts include weekly test samples sent to the facility as "blind" samples, site visits, review of the facility's quality-control data, and frequent discussions of the NWQL operation between the facility's senior staff and the NWQL review team. Quality-assurance efforts on external laboratories will include a laboratory review and test samples (blanks, duplicates, and spikes) at a level commensurate with the analytical service being provided.

The pilot projects will submit about 15 percent of their laboratory analytical requests in the form of blank, spike, standard reference, or replicate samples. The BQA will work closely with the pilot Project Chiefs to coordinate the QA-plan activities with laboratories.

4.5 Corrective Action

The results of the QA samples will be reviewed on a current basis by a pilot project team member. The pilot Project Chief (or the BQA, depending on the source of the QA data) is responsible for notifying the BQA (or the pilot Project Chief) and the Regional and National Coordinators of problems identified by the QA samples. The Regional Coordinators, with assistance from BQA, are responsible for ensuring that corrective measures are taken to re-establish satisfactory laboratory performance. The corrective measures may include additional test samples, technical correspondence, and any follow-up, on-site laboratory review, as needed.

5.0 DATA STORAGE AND DOCUMENTATION

All pilot NAWQA studies will make use of appropriate files of the Geological Survey's National WATER Data STORAGE and RETRIEVAL System (WATSTORE) (U.S. Geological Survey, 1975a) and the National Water Information System--85.1 (NWIS) (Edwards and others, 1986) data bases. The primary files to be used are the Water-Quality File for the storage of all water-quality analyses, the Basin-Characteristics File for storage of all data on drainage basin characteristics, and the Ground-Water Site-Inventory File for the storage of all data on the construction characteristics of wells and hydrogeology of well and spring sites. Use of these files will allow thorough documentation of the NAWQA data in a consistent manner, and will make all data readily available for retrieval. The Regional and National Coordinators are responsible for working with the Office of Water Quality and the Office of the Assistant Chief Hydrologist for Scientific Information Management to ensure that appropriate modifications are made to the files when needed. It is the responsibility of the District Chief to ensure that (1) the data are reviewed prior to being entered into the data bases and appropriate action is taken when an error is identified, (2) the data are entered into the data bases, and (3) information about new sites is entered and information for existing sites is updated in the data bases.

Ancillary data not compatible with the above files may be stored within other files. For example, spatial data digitized by the NAWQA studies will be stored primarily in a geographic information system (GIS). A data dictionary will be developed to ensure that the characteristics

of GIS data are documented properly. As a minimum, for each variable collected, the data dictionary will include: variable description (long and short name), data type (alpha, numeric, and so forth), field size, precision, reporting units, descriptions of remarks codes and numeric rounding rules (for tabling), and any needed conversion factors. Alternate forms of data storage that are used must be accompanied by a well-marked paper copy of all records in the project files. The pilot Project Chief is responsible for ensuring adequate documentation and storage.

5.1 Water-Quality File

The Water-Quality File contains information pertaining to the physical, chemical, biological, and isotopic composition of surface and ground water. The data stored in this file are obtained primarily through the analyses performed by the NWQL and, to a lesser extent, through external laboratories. In addition, any instantaneous discharge data collected in connection with the sampling of streams will be stored in the Water-Quality File. Documentation of the Geological Survey's Water-Quality File is contained in Volume 3 of the WATSTORE User's Guide (U.S. Geological Survey, 1983).

Water-quality data stored in this file are subjected to various quality-assurance procedures. Within the laboratory system, quality-control measures regarding sample handling, analytical equipment, and measurement accuracy are applied. The NWQL procedures also call for chemical-logic checks for each analysis. As the data are entered into the data base, an alert-limit system compares the values of selected constituents to national water-quality standards. Data that exceed national water-quality standards are flagged for verification. Data-consistency verifications are also performed as the data are entered. The analyses are examined for accurate coding of station identification, dates, times, and parameter codes. Further data verifications will be invoked at the field office, including a review of the chemical-logic check for ionic balance, proper determination of calculated values, valid relations between water-quality variables, and an edit verification that compares the data entered in the current file to original data. The pilot Project Chief is responsible for requesting laboratory reruns, as needed.

5.2 Basin-Characteristics File

Volume 4 of the WATSTORE User's Guide (Dempster, 1983) documents how to input and update streamflow, basin, and climate characteristics for gaging stations in the Basin-Characteristics File. The pilot Project Chief is responsible for ensuring that information for all sampled surface-water sites is entered into the file and kept current.

5.3 Ground-Water Site-Inventory File

The Ground-Water Site-Inventory (GWSI) File (Baker and Foulk, 1975) contains descriptive elements about sites where ground water is sampled. The pilot Project Chief is responsible for ensuring that information for all sampled wells and springs is entered into the file and kept current.

5.4 Other Files

Field notebooks, source materials, inventory forms, instrument calibrations, worksheets, and other pertinent pilot project materials will be

catalogued and stored. The acceptance criteria for storage is to make organization of the records useful to a succeeding project team 6 or more years after completion of the initial intensive investigation phase. The pilot Project Chief is responsible for ensuring adequate documentation. The District Chief is responsible for maintaining the records in accessible and usable condition. The Regional Coordinators will verify that the records were assembled, clearly documented, and stored.

6.0 PROJECT REVIEW AND CORRECTIVE ACTION

Pilot project activities will undergo periodic review to ensure that the quality of the data, interpretations, and reports meet the standards of the Geological Survey. Periodic reviews will provide an objective assessment of the effectiveness of project work activities, procedures, and documentation. Each project review will be conducted by a team consisting of members selected from the Regions, Headquarters, Branch of Quality Assurance, National Research Program, and (or) other Districts. Each team will prepare a report summarizing the results of the review.

6.1 Review Schedule and Plans

Project reviews will be scheduled by the National Coordinators in conjunction with Regional and District offices. Scheduling will be based on the planned project activities. The scope of the review shall be established by considering the activities of the specific NAWQA project, the results of any previous reviews, the nature and frequency of identified deficiencies, and changes in project personnel.

For each project review, the Regional and National Coordinators will select the review team, ensure necessary qualifications and training of review team members, and designate a Review Team Leader (fig. 6.1-1). The Review Team Leader shall prepare the review plan and provide copies to Regional and District managers of the project being reviewed. A notification letter confirming the review dates shall be sent to the District Chief at least 30 days in advance of the scheduled review and shall include a copy of the review plan. Review plans shall include the purpose and scope of the review, the activities to be reviewed, names of the reviewers, organizations to be notified, the review schedule, identification of applicable documents, and written review procedures or checklists.

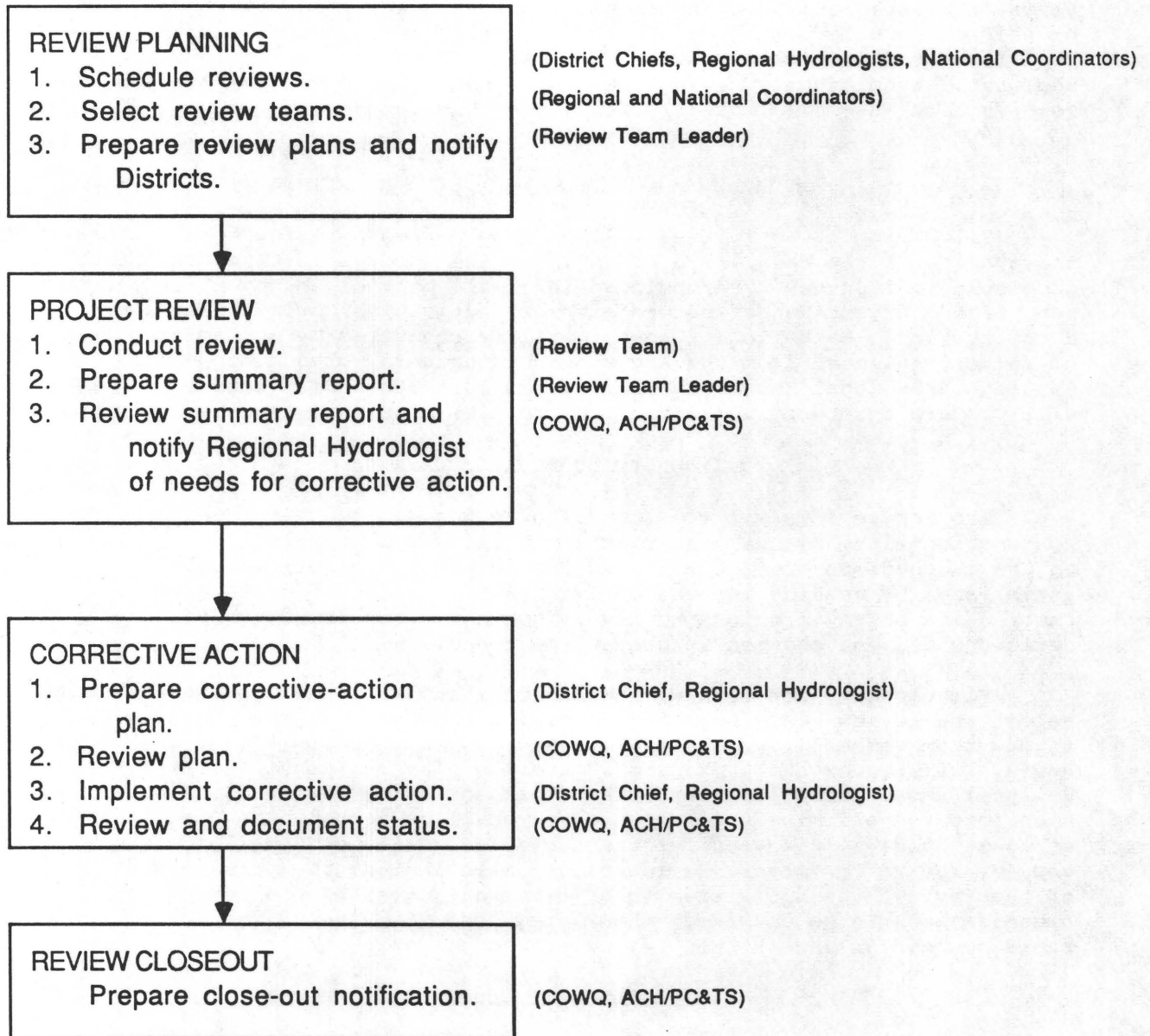
6.2 Review Procedures

At the outset of the review, the review team will meet with District management and project personnel to review the objectives and schedule for the review. The review team shall conduct reviews in accordance with the review plan. Project work activities, procedures, and documentation shall be examined for compliance with project quality-assurance requirements. The review team will meet with District management and project personnel at the conclusion of the review to discuss review findings and observations.

6.3 Summary Report

A summary report shall be prepared and signed by the Review Team Leader and sent within 3 weeks of the review to the Chief, Office of Water Quality. The summary report shall include the purpose and scope of the review, names of reviewers, personnel contacted, conclusions drawn from the

Responsible official(s)



EXPLANATION

COWQ = Chief, Office of Water Quality
ACH/PC&TS = Assistant Chief Hydrologist for Program
Coordination and Technical Support

Figure 6.1-1.--Tasks and responsible officials involved in conducting quality-assurance reviews of the National Water-Quality Assessment Pilot Projects.

review, including a statement of the effectiveness of the pilot project's QA program elements reviewed, and a detailed description of the activities needing corrective action.

Within 1 week of receipt, and after review, the Chief, Office of Water Quality, will transmit the report, along with any identified needs for corrective action, to the ACH/PC&TS. The ACH/PC&TS will discuss the report with the Chief, Office of Water Quality, and, upon their mutual concurrence, will forward a copy of the report to the appropriate Regional Hydrologist. The Office of Water Quality will file and maintain the signed original copy of all documents. The Regional Hydrologist will forward the report to the District Chief for appropriate action.

6.4 Corrective Action

Within 30 days from receipt of the summary report, the District Chief, working with the appropriate Regional office, shall provide the ACH/PC&TS with a corrective-action statement for each activity in need of corrective action. The corrective-action statement shall include a description of the condition that needs to be corrected, a statement of the proposed corrective action to be taken, a schedule for implementing the corrective action, and any additional actions that need to be taken to prevent recurrence of the condition. Within 2 weeks of receipt of the corrective-action statement, the ACH/PC&TS shall review the adequacy and effectiveness of the statement and provide any response comments or suggestions to the Regional Hydrologist.

All corrective action(s) shall be implemented by the District as scheduled in the reviewed statement. Status of the corrective action(s) shall be monitored by the ACH/PC&TS, through the Regional Hydrologist, to verify progress and (or) completion. Should verification prove that the corrective action was incomplete or otherwise unacceptable, the ACH/PC&TS shall note the unacceptable conditions on a continuation sheet to the summary report and document what further corrective action is needed.

All actions taken to correct, verify, and close out the review shall be documented. Upon satisfactory verification of all corrective actions, the ACH/PC&TS shall send a formal close-out notification to the Regional Hydrologist of the reviewed pilot project.

6.5 Review Tracking System

The Office of Water Quality shall establish and maintain a Review Tracking System. This system shall indicate the extent of completion of the review and the status of needed corrective actions.

7.0 REPORTS

All report products resulting from pilot project studies will undergo a technical, editorial, and Geological Survey policy review according to guidelines established in Alt and Iseri (1987). Two or more colleague reviewers (at least one from outside the originating office) shall be contacted by the District or pilot Project Chief. At least one colleague reviewer shall be expert or thoroughly knowledgeable on the subject of the report. All colleague reviewers shall provide to the author(s) a memorandum documenting comments and suggested revisions and a signed Manuscript Routing Sheet (fig. 7.0-1). All colleague review memorandums

and the Manuscript Routing Sheet shall accompany the report through the review process through Director's approval of the report for release to the public.

When appropriate, the report shall be revised by the author(s) in response to colleague review comments, and a response-to-colleague review memorandum shall explain why any colleague review comments or suggested revisions were rejected. The District Reports Specialist shall perform an editorial review, as well as verify the adequacy of the author's responses to colleague reviews. District managers shall review the report for Geological Survey policy and technical adequacy. Once approved by the District, the report will be forwarded to the appropriate Office of the Regional Hydrologist.

The Regional Reports Improvement Advisor shall review the report to ensure that it is technically and editorially sound and that the contents are consistent with Geological Survey policy. The Regional Reports Improvement Advisor will forward the signed manuscript routing sheet, copies of the report, marked-up colleague review copies of the manuscript, and any supporting documentation to the Office of Scientific Information Management for Headquarters evaluation, or will return the report to the District for revisions, if warranted.

The Staff Hydrologist for Reports, Office of Scientific Information Management, will perform final evaluation of the report's suitability for release to the public and recommend Director's approval for the Division. To ascertain the technical quality of the report, the Staff Hydrologist will forward the report to appropriate reviewers at Headquarters for additional review. Headquarters reviewers for pilot NAWQA project reports include the National Coordinators and other appropriate technical specialists. After the report has been determined to be editorially adequate, technically sound, and consistent with Geological Survey policy, the report shall be forwarded to the Director's approving official. Director's approval will be recorded on the Manuscript Routing Sheet by the Office of Scientific Publications in the Geologic Division. After approval of the report for release to the public, the publication process will follow appropriate procedures for the type of report series selected for release.

FORM 9-1531 (JULY 1984)		U.S. DEPARTMENT OF THE INTERIOR – GEOLOGICAL SURVEY WATER RESOURCES DIVISION MANUSCRIPT ROUTING SHEET										WRD NO. (ASSIGNED BY HDQRS.)				
AUTHOR(S) (LAST NAME FIRST)												PROJECT NO. (Example VA099)				
TITLE												NO. PAGES (INCL. TABLES)				
(CHECK ONE) <input type="checkbox"/> INTERPRETIVE REPORT <input type="checkbox"/> DATA REPORT <input type="checkbox"/> ABSTRACT <input type="checkbox"/> OTHER												NO. ILLUSTRATIONS				
TYPE OF PUBLICATION (WSP, HA, OPEN FILE, JOURNAL, STATE PUBLICATION, ETC.)												TABLES NO. _____ NO. PAGES _____				
COOPERATING AGENCY										DOES REPORT CONTAIN GEOLOGIC NAMES? <input type="checkbox"/> YES <input type="checkbox"/> NO						

1	NAME (Print or type)	DATE IN	DATE OUT	TOPICS REVIEWED	NO. HRS SPENT	CHECK STEP COMPLETED												ENTER NEXT ROUTING HERE (Print or type)
						AUTHOR	EDITORIAL REVIEWER	*TECHNICAL REVIEWER	DIST/PROJ CHIEF	REGIONAL	HYDROL	GEOLOGIC NAMES	ADDITIONAL EVALUATION	SCI PUB PROG	SP&DM	DIRECTOR		
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CONTINUE ON ADDITIONAL FORMS, IF NECESSARY.

* See instructions for technical reviewers on back of page.

Figure 7.0-1.--Manuscript routing sheet.

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