GUIDELINES FOR PREPARING A QUALITY ASSURANCE PLAN FOR DISTRICT OFFICES OF THE U.S. GEOLOGICAL SURVEY

by LeRoy J. Schroder and William J. Shampine

U.S. GEOLOGICAL SURVEY

Open-File Report 92-136

Denver, Colorado
1992

U.S. DEPARTMENT OF THE INTERIOR

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ABSTRACT

The U.S. Geological Survey has a policy that requires each District office to prepare a Quality Assurance Plan. This plan is a combination of a District's management principles and quality assurance processes. The guidelines presented in this report provide a framework or expanded outline that a District can use to prepare a plan. Particular emphasis is given to a District's (1) quality assurance policies, (2) organization and staff responsibilities, and (3) program and project planning. The guidelines address the "how," "what," and "who" questions that need to be answered when a District Quality Assurance Plan is prepared.

INTRODUCTION

The U.S. Geological Survey collects and disseminates information about the quality and quantity of water in streams, lakes, and aquifers. Through cooperative and collaborative programs with local, State, and other Federal agencies, the Geological Survey monitors streamflow at sites through the Nation and investigates the occurrence, availability, and quality of water in numerous study areas. Information obtained from data-collection programs, investigative studies, and research efforts is made available to the public, water-resource managers, regulators, and developers through annual data reports, formal published reports, and open-file releases.

As the Nation's principal earth-science information agency, the Geological Survey has a worldwide reputation for collecting accurate data and producing factual and impartial interpretive reports. Methods for data collection and analysis developed by the Geological Survey have become standard techniques used by numerous Federal, State, and local agencies and private enterprises. The standards of professional conduct, attention to detail, and review that characterize the routine activities of the Geological Survey give users of our products a sense of confidence and trust in the accuracy and scientific validity of our work.

In response to those expectations and demands, the Water Resources Division of the U.S. Geological Survey has implemented a program designed to ensure that all scientific work done by or for the Division is conducted in accordance with a centrally managed quality assurance (QA) program. The responsibility for the program has been assigned to the Office of the Assistant Chief Hydrologist for Program Coordination and Technical Support (fig. 1). That office has established the Branch of Quality Assurance (BQA) to develop, coordinate, and implement the quality assurance program. As a part of that program, each District office in the U.S. Geological Survey is required to prepare a written District Quality Assurance Plan (DQAP) that covers all elements of scientific work conducted by or for the office.

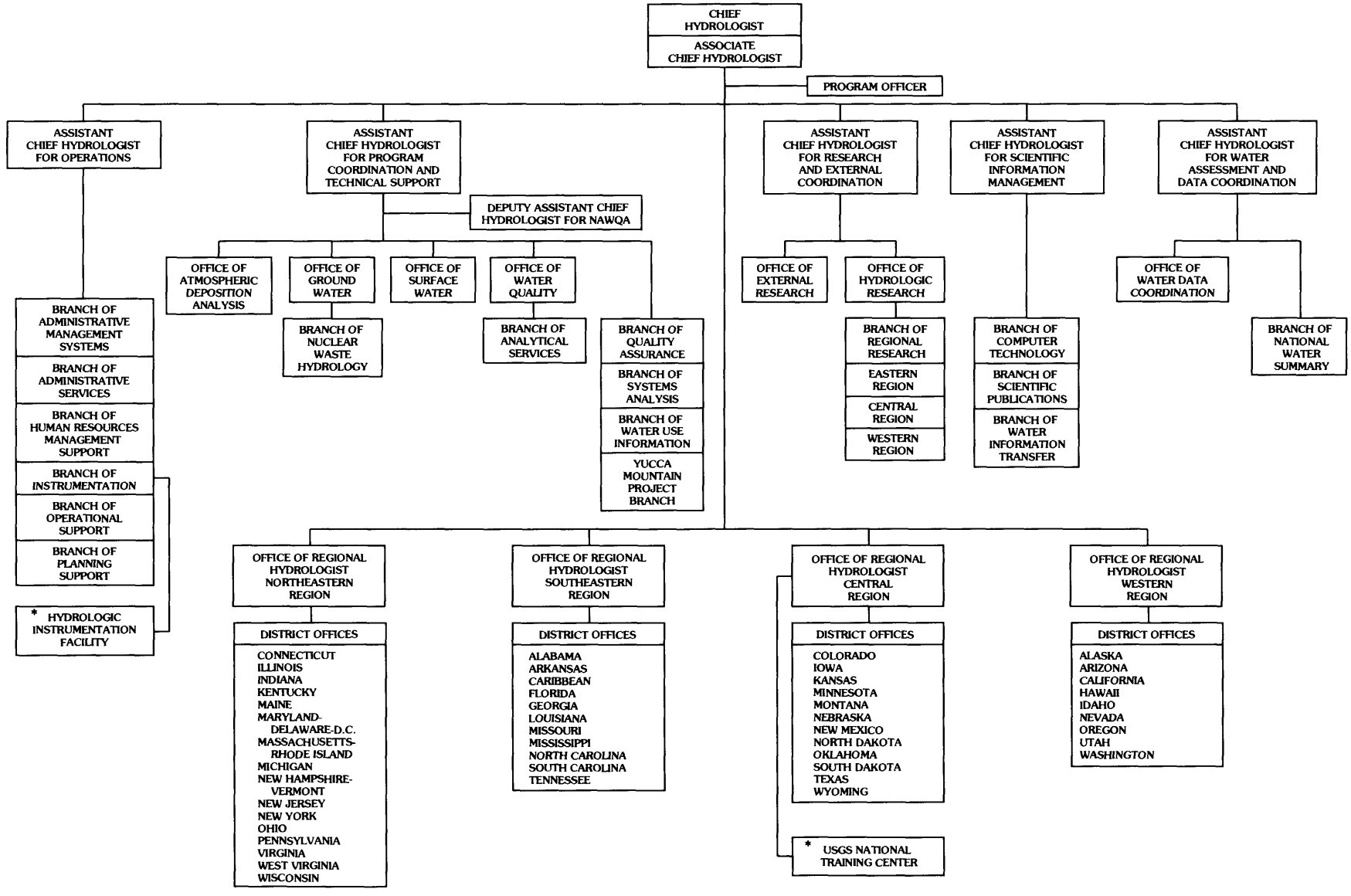

Figure 1.--Organization of the Water Resources Division of the U.S. Geological Survey.

Purpose and Scope

Quality management is a systematic way of ensuring that organized and planned activities are implemented. A QA program implements the processes of a quality-management system, and a QA plan identifies those processes. The plan needs to include only the processes that ensure reliability of work and not include the procedures required to do the work. A detailed DQAP will provide definable benefits such as:

- Clarity of expectations, to ensure that each employee fully understands what the U.S. Geological Survey expects from the employee's efforts.
- Consistently valid scientific data.
- A decrease in duplication of work.
- Products that are produced on time and that meet U.S. Geological Survey quality standards.

This report presents guidelines that can be used to help District offices prepare a DQAP.

Quality Assurance

The QA processes described in a DQAP should not be confused with quality control, which is a separate but related function. QA focuses on systems, policies, and broad-level processes and is implemented at the management level. Quality control focuses on the detailed measures needed to achieve a previously specified level of quality and is implemented at the field level.

A District needs to have a hierarchical system of documentation that includes: (1) A series of policy statements of the standards and limitations of work to be done by the District; (2) a series of documented technical procedures that describe how to accomplish the work, including planning, data collection/processing, and reporting; each document should describe appropriate quality control activities; and (3) a QA plan that describes the processes needed to ensure that work proceeds as planned.

Review Process

One requirement of the DQAP is that it is a document that can be referenced and freely distributed. To meet this requirement, the DQAPs are published as open-file reports and require adherence to the Geological Survey technical review process. One of the technical reviews of the plan can be provided by the BQA.

Distribution

In addition to the normal distribution for open-file reports, one copy will be sent to:

Assistant Chief Hydrologist for Program Coordination & Technical Support
The District's Regional Hydrologist
Chief, Branch of Quality Assurance
Office of Ground Water
Office of Quality of Water
Office of Surface Water

QUALITY ASSURANCE PLAN CONTENTS

Each plan component identified in the following topical outline needs to be addressed when preparing the DQAP. The material presented under the outline headings that relate to the mechanics of an open-file report, such as Title page and Contents, is required for Regional or Director approval.

Report Organization

The DQAPs will vary from District to District because of differing District size and management styles, but all must have a degree of commonality. All plans need to focus on quality-assurance-related processes and have a uniform outline. The organization of a DQAP is outlined as follows:

Title page
Contents
Introduction
District quality assurance policies
Organization and responsibilities
Processes and procedures
Summary
Selected references
Appendices

The contents of each heading noted above are as follows:

Title Page

The report title is "Quality Assurance Plan for Water Resources Activities of the U.S. Geological Survey in _____."

Introduction

General Background Information

This section is to contain a brief statement of the Division's overall mission. For example,

> The mission of the U.S. Geological Survey, which supports the overall mission of the U.S. Department of the Interior and the Geological Survey, is to provide the hydrologic information and understanding needed for the best use and management of the Nation's water resources for the benefit of the people of the United States (see WRD information guide, 1990).

The general background information needs to include reference to the legislation that created the Geological Survey, legislation that describes the responsibility for water-data coordination, and other legislation pertinent to District operations. The District's role in accomplishing the Division's mission may be included in this section of the plan.

Purpose

This section of the DQAP establishes the tone for the remainder of the document. The purpose is used to provide District personnel, cooperators, and other readers with knowledge of what is to follow and how the DQAP is applied to the operation of the District; therefore, a brief description of the purposes of the DQAP is desirable. A statement of the purposes of a DQAP probably would include: (1) Documentation of the QA policies and procedures that are used by the District to collect and report water-resources data; (2) a description of efforts directed toward data transfer and cooperation with State and local governments; and (3) a description of the District's QA philosophy. The DQAP is informational in character and should be considered a clarifying document for District management and personnel.

Scope

The scope section defines the extent of the processes included in the DQAP. The scope needs to clearly state that the DQAP will include the QA processes for all of the District's hydrologic work done by either Geological Survey or contract personnel.

District Quality Assurance Policies

The policies section includes the District's policies on planning, training, reviewing reports, collecting data, and so forth. All of the District's policies are to be clearly stated. The plan can be the outlet for those policies that currently are not in written form.

Overall Quality Assurance Policy

A District's QA policy is a concise statement that covers all of the District's hydrologic investigations and data-reporting programs.

This policy statement needs to be given considerable thought. Stating that the District will collect the most precise or accurate data is not realistic, because the highest quality data is not always needed for every project and probably is not even practical to obtain in some instances. The two most important considerations are: (1) That the data collected are of high quality sufficient to meet the District's or cooperator's needs and requirements, and (2) that the quality of the data is known. The meaning of "known" is that the accuracy (bias and precision) of the data can be quantified. The quality of the data usually is known when a Survey-approved and documented procedure is used. However, when the District is implementing a new or innovative technique or procedure for which Survey-approved documentation is not available, it is the responsibility of the District to provide the necessary QA documentation that describes the procedure used. An example of a District QA policy statement is:

> The _____ District will conduct all its investigations in adherence to the policies and technical directives of the U.S. Geological Survey and in a manner that will produce high quality data whose accuracy can be quantified.

Specific Quality Assurance Policies

If the District has work done by either contract or cooperator personnel, the District's policies need to include the statements that this work is covered by the QA program and is an integral part of the DQAP. The District Chief may delegate or assign QA responsibilities to contractor or cooperator personnel, but the responsibility for specifying and documenting the procedures remains with the District Chief, and this fact needs to be addressed in the DQAP.

The DQAP needs to include specific policy statements that cover QA activities of the District including: program planning, project planning, reports, data collection, training, data processing and storage, QA funding, and so forth. Some examples of the type and scope of specific policy statements that could be included are:

1. Project Work Plans--In the _____ District, all project chiefs will prepare and follow a project work plan.
2. Data Collection--The _____ District will follow the data-collection procedures approved and documented by the U.S. Geological Survey. Any exceptions or deviations in the use of these procedures will be documented in a report that describes the District's field processes.
3. Training--The _____ District will ensure that its employees are trained sufficiently to perform their duties.

There are two options for inclusion of the specific policy statements. They can be included in the District QA policies section, where they would be "stand-alone" statements, or in the process and procedure section, where the implementation processes associated with each statement also would be included. The DQAP is a combination of the District's management principles and quality assurance processes, and specific policy statements need to be placed in the part of the plan that describes how the District operates.

District Organization and Responsibilities

Organization

A table or chart showing the District organization and line authority needs to be shown. The key positions responsible for ensuring the collection of data need to be identified. The routine assessment of measurement systems for determining bias, precision, and accuracy also needs to be described, and the QA functional responsibilities of key personnel need to be stated.

A number of people, such as lead technicians, can have QA functions that are ancillary to their normal duties. These functions are to be documented in the plan. Many of these positions provide QA support by calibrating instruments, verifying records, and reviewing field notes. QA functions and interactions can be included in the plan by providing concise descriptions of the QA elements of these employees' ancillary duties. The chart need not contain the individual names but should contain the individual position titles.

Delegation of Responsibilities

The responsibility for the preparation of, implementation of, and adherence to the QA policies described in the DQAP is with the District Chief. Any delegations of that responsibility and authority need to be stated clearly. A statement about the responsibility of the District personnel to adhere to the District's QA policies is to be included. The employee (position title only) responsible for writing or updating sections of the DQAP needs to be identified.

District Quality Assurance Processes and Procedures

This section of the DQAP is to describe and document how all the District's QA processes function. This section needs to be structured in parallel with the specific policy section of the DQAP, so each policy statement will have a QA process associated with the statement. This section needs to include descriptions of QA procedures but not technical procedures, such as those described in the USGS Techniques of Water-Resources Investigations report series. Any detailed procedures used by the District that need to be included in the DQAP can be incorporated in an appendix.

The subheadings presented in this part of the DQAP guidelines are topics and examples that BQA believes are fundamental to most District programs. These topic and example subheadings are discussed in some detail to provide guidance about the scope of documentation that is needed. Additional topics or subheadings that are unique to a District or that the District deems important and useful to describe can and should be added to the DQAP. The DQAP needs to be considered interdisciplinary in nature and include the District's management functions.

Program Planning

District staffs commonly are charged with developing short- and long-term programs and with formulating the scope and dimension of future programs or projects. This section of the plan documents how the District functions when planning programs. The topics that need to be described are:

1. The membership of the District senior staff;
2. The program-planning duties of each staff member;
3. The documentation of discussions among project chiefs, field-office supervisors, and district staff with cooperating agencies; and
4. The relation of National needs and regional and local priorities.

An example of a QA policy for program planning is:

> The _____ District develops program plans that include the annual program priorities issued by Headquarters. All District program plans will complement the National interests of the Geological Survey. Regional and local interests are addressed to the extent that National priorities and responsibilities are served.

Project Planning

Districts conduct technical projects based on procedures that progress from preparing project proposals to completing the final report. The QA guidelines are designed to ensure that these procedures are documented in the DQAP. The process used by the District to plan projects needs to be documented in this part of the DQAP. The level of detail needed to document each procedure is indicated by the questions listed below:

1. Project proposals
   - What components are required in a proposal (objective, scope, cost estimate, report plans, and so forth)?
   - What is the review process to obtain approval of a project?
   - Who is responsible for reviews (identify the personnel by position title)?
   - How are revisions to the proposal documented and approved?
   - Who is responsible to prepare proposals?
2. Project staffing
   - How are new project members selected and informed and prepared to accomplish their responsibilities?
   - Is there a list of topics to be discussed at an introductory briefing meeting?
   - Who attends the introductory briefing meeting?
   - Is there a written record that summarizes the briefing meeting?
3. Project description preparation
   - Who prepares the description for Regional approval?
   - How many days after tentative approval by the Region is the description submitted to the Region?
   - What is the District process for review of the project-description form?

Project Implementation

After formal approval of a project, a project is implemented by preparation of a work plan. The work plan serves as the infrastructure to complete the project. The work plans need to be written in sufficient detail that colleagues and discipline specialists can determine if the deadlines can be met. Work plans should include report plans and can contain draft parts of the final report. The work-plan preparation and review process used by the District needs to be documented in this part of the DQAP. Examples of the level of detail that should be included to document each procedure are indicated by the questions listed below:

1. Work plans
   - Who prepares the work plan?
   - What topics should be included in the work plan?
   - Who approves the work plan?
   - How and when is the work plan revised?
   - What QA activities are scheduled in the work plan?
   - What parts of the final report are included in the work plan?
2. Project reviews
   - What is the review process?
   - When and why are projects reviewed?
   - Is there a difference between data-collection projects and interpretive project reviews?
   - How are reviews documented?
   - Who initiates corrective actions?
   - How are new QA processes added, if needed?
   - How are project files stored upon completion of the study (raw data, note books, correspondence, reviews, and similar documents)?
3. Project QA plan

   Some large projects might require a project QA plan. A project QA plan documents the QA processes used to ensure successful planning, programming, data collection, and reporting. This section describes the criteria that will be used by the District to determine if a project requires an individual QA plan.

Equipment and Instrument Calibration and Maintenance

Hydrologic data obtained either onsite or in a laboratory require equipment and instruments that need to be calibrated and maintained. Although the maintenance usually follows the manufacturer's instructions and manuals, calibration of instruments needs to follow Survey and District procedural guides. The District employee's responsibilities need to be documented in the DQAP, and the District's quality assurance policy for equipment and instrument calibration needs to be stated. Examples of the level of detail that need to be included to document instrumentation calibration and use are indicated by the following questions:

- Who is responsible for maintaining equipment and instruments?
- Who is responsible for reviewing onsite and laboratory techniques?
- How are District guidelines for calibration prepared?
- Who is responsible for updating the equipment guidelines?
- Are instruments for the collection of water-quality data tested by the National Field Quality Assurance Project?

An example of a District quality assurance policy for equipment and instrument calibration is:

> Equipment and instruments used by the _____ District to obtain hydrologic data will be maintained in accordance with manufacturer's instructions and manuals. Instruments will be calibrated following Survey and District guides, and all instruments used to obtain water-quality data will be included in the National Field Quality Assurance Project.

Data Processing and Storage

The periodic changes in computer systems and the emphasis on the District data bases probably will cause changes in the processes and requirements for data handling. A series of questions again are asked to indicate the detail needed in this section of the DQAP.

- How and where does the District maintain the data files for the different disciplines?
- How are project data stored?
- Who maintains project-specific and Division-wide data bases?
- Are hard copies of the data stored?
- What is the minimum time data are stored?
- How are data processed that are transmitted by telephone or satellite?
- What data can be transmitted directly to cooperators?
- What QA activities are in place to monitor the data bases?
- Who is responsible for certification of data?
- How much time is allowed after data collection before data entry?
- Are data duplicated for backup on tapes or other storage devices?

An example of a District quality assurance policy for data processing and storage is:

> Hydrologic data collected by or for the _____ District will be reviewed and certified to meet Survey standards and entered into Division-wide data bases. Primary records are considered to be historical information and are stored for reference by the District.

Data Analysis

Analysis of hydrologic data includes all activities from direct reporting of data to the development and application of multidiscipline models. Districts encourage the development or adaptation of new

ideas and procedures to interpret hydrologic data. The process used by the District to determine if the analysis of data is correct needs to be documented in the DQAP. Examples of the level of detail that need to be included to document data analysis are indicated by the following questions:

- What criteria are used to accept new ideas or procedures?
- Who reviews an investigator's approach to data analysis?
- How is a method documented (final report, memorandum)?
- Are new ideas reviewed by Headquarters, Regional, or District discipline specialists?
- Who determines if appropriate methods are used to analyze data?

An example of a quality assurance policy for data analysis is:

> The _____ District will analyze hydrologic data using accepted U.S. Geological Survey procedures documented in technical reports and citable references. New procedures will be presented in the project work plan and described in interpretive reports.

Reports

The overall U.S. Geological Survey report process is documented in a variety of publications and memorandums; the inclusion of the District's QA processes for reports should complement these documents. Each District has policies for reports that are unique to the District, and the QA activities for the District need to be documented in the DQAP. Examples of the level of detail that need to be included for each report type are indicated by the following questions:

1. Noninterpretive open-file reports
   - What data are required in the report (QA, replicate samples, and so forth)?
   - Who initially compiles the data?
   - Who reviews the compiled data?
   - How are data certified before transfer to the District office from a field or Subdistrict office?
   - How is corrective action initiated, if needed?
   - Who prepares the hydrologic summary for the annual data report?
2. Interpretive reports
   - Who reviews the report within the District?
   - Who selects reviewers from other Districts, the National Research Program, or outside organizations?
   - Who determines that all report requirements are met before transmittal to the Region?
   - Do discipline specialists or section chiefs or office chief review the data for a report before colleague review?
   - What are the author's responsibilities for responding to review comments?
   - Are reports scheduled for non-Survey publication processed differently than reports to be published in a Survey report series?

Training

Training is an important QA activity. The DQAP is to present the systematic training program used to prepare people for work being done by or for the District. The following questions indicate what type of details need to be included in the training section of the DQAP:

- What does the District consider as training?
- Who prepares individual training plans?
- What are the minimum training standards or requirements for data collectors?
- How are data collectors trained?
- When is formal training required?
- How are training records kept?
- Is actual training compared to training plans (by whom and when)?
- Who does the on-the-job training (data collection and investigative projects)?
- Does one person attend formal training and then instruct others at the District?
- Who trains observers and contractors?

Quality Assurance Funding

Some QA processes have an associated inherent cost; for example, chemical analysis of duplicate, blank, and spiked samples, duplicate data-measurement efforts, and data review have costs associated with them. The mechanism that the Districts use to finance these processes varies among Districts. The fiscal planning to finance all QA processes is not limited to data collection but also includes all activities that are related to hydrologic investigations, data processing, and reporting by the Districts. The following questions indicate what is to be included in the QA funding section of the DQAP.

1. Data-collection activities
   - What percentage of budget is allocated to data QA activities?
   - How is QA training financed?
   - Is equipment maintenance considered part of QA activities?
   - How is equipment calibration and servicing funded?
   - Who pays for data review and certification?
   - Are training costs charged to the District overhead or to project accounts?
2. Hydrologic investigations
   - Is QA a line item in project proposals and budgets?
   - Are replicate sampling or measurements included?
   - How are the QA requirements for a new technique funded?
   - Are data reviews charged to project accounts?

3. DQAP preparation
   - Will DQAP preparation and maintenance be part of the District overhead?
   - Can preparation costs be offset by not having to continually restate QA processes in project proposals and plans?

District Quality Assurance Plan Revisions

The DQAP documentation is a dynamic process and needs to be reviewed regularly and revised as appropriate. A series of questions are asked to indicate the detail that is to be in this section of the DQAP.

1. DQAP responsibilities
   - Who is responsible for DQAP reviews?
   - How is review done?
   - Who will decide if revision is needed?
   - Who assigns authorship?
   - Who is assigned authorship (by job title)?
   - How does the District Chief affirm revisions?
2. Preparation frequency
   - How often will the plan be reviewed (semiannually, annually, biennially)?
   - Will selected sections of the plan be reviewed more frequently than others?
3. Publication frequency and mechanism
   - How often will the DQAP be revised (state the maximum length of time between revisions)?
   - Who decides if changes in District operations require that the DQAP needs to be revised?
   - Who decides if the revised DQAP needs to be published as a new report?

Summary

The following questions indicate the type of information from the main body of the DQAP that is expected to be presented in the summary.

- Why was the plan written?
- What is the principal function of the plan?
- Who is responsible for the District's QA activities and plans?
- How are QA activities used to meet the District and District Chief's goals?
- How long will this plan be in effect?

References

The bibliographic listing in the DQAP should include references, such as:

- U.S. Geological Survey's Techniques of Water-Resources Investigations series
- Suggestions to Authors of the Reports of the United States Geological Survey, (Hansen, 1991)
- Publications Guide, volume 1, Publications Policy and Text Preparation, Water Resources Division, (Alt and Iseri, 1986)
- U.S. Geological Survey Water-Supply Papers
- WRD Project and Report Management Guide, (Green, 1991)

All references need to be reasonably available to the public. Moreland (1991) presents a reference list for a DQAP.

Appendix

An appendix is optional; however, the District might want to include material in this section that enhances the plan but is not appropriate for inclusion in the DQAP. Difficult-to-locate references or descriptions of technical procedures used by an individual District need to be included in this section.

SUMMARY

The District Quality Assurance Plan is a report that provides guidelines for documentation of the quality assurance processes of a District and, as such, should be limited to quality assurance activities and should not become a manual of technical or quality-control procedures. The District Quality Assurance Plan is to be a management tool for the District Chief and staff to use to achieve the Quality Assurance goals of the U.S. Geological Survey and the District. The plan reaffirms that the District Chief, often through a designated delegate, has the responsibility for the Quality Assurance of the District's data collection, interpretive investigations, and reporting. The plan describes the processes for accomplishing these responsibilities.

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*U.S. GOVERNMENT PRINTING OFFICE:1992-774-207/60012