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Standard Guide for Planning and Implementing a Water Monitoring Program¹

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INTRODUCTION

Water resource monitoring has taken place in many forms for scores of years. This monitoring has been sponsored and performed by a variety of federal, state, and local public agencies; and perhaps by an even wider variety of private, quasi-public and industrial entities. Historically, much of the early data dealt with quantities of flow, and drinking water quality was judged by the standards of the period.

During the past several years the problems related to point and nonpoint sources of pollution of water resources have become increasingly apparent. Technology has improved dramatically, as the need for monitoring data has improved. There is a necessity for information on marine beaches and estuarine areas, fresh water swamps, ground water, wetlands, streams, and sediment deposits, and to better understand the entire hydrologic cycle.

The need for more and varied water quality information has expanded as rapidly as our technological ability to generate the information. Further, it has become increasingly difficult and sometimes impossible to understand and resolve conflicts among the different data sets available. Much of the data have been collected at different times, in different geographic areas, and for different purposes. The data have been collected by persons with varied training, using different methods, and with vastly different analytical capabilities. As a consequence, we presently are at the stage where we may know more about a given situation than we understand and workers in the field who receive the data are unable to integrate the data available into a useful solution. The need for standardization of monitoring programs is evident. Standardization does not herein mean everyone doing everything exactly the same way. It does mean the use of methods and procedures, where applicable, that follow recognized and documented protocols as well as the accurate recording and storage of the data in accessible formats.

Realizing the difficulties in water monitoring, the Office of Management and Budget (OMB) of the federal government charged the Water Information Program (WICP), a program of the U.S. Geological Survey's Office of Water Data Coordination, with studying water quality monitoring in the United States and recommending improvements. The Intergovernmental Task Force on Monitoring Water Quality (ITFM), a federal, state, and tribal partnership, was established under the WICP's Interagency Advisory Committee on Water Data to carry out this study. The results of three years of work by about 200 contributors have been captured in a series of three annual reports (**1-3**).²

The following summarizes the conclusions from those reports:

- (1) Monitoring programs shall keep pace with changing water-management programs.
- (2) A collaborative strategy is needed to link the many separate monitoring programs.
- (3) A genuine appreciation of the need for cooperation currently exists among monitoring agencies.
- (4) Recent advances in technology provide opportunities for interaction and cooperation that previously were impossible.

Based upon those conclusions, the following recommendations were made:

- (1) Implement an integrated, voluntary, nationwide strategy to improve water quality monitoring.
- (2) Charter a permanent national body to guide the implementation of ITFM recommendations.
- (3) Develop a framework for monitoring water quality that defines the components of a monitoring program.
- (4) Develop criteria with which to select parameters that measure progress in achieving water quality goals.
- (5) Recommend indicators to measure whether water quality uses designated by the state are being met.
- (6) Charter a Methods and Data Comparability Council to foster the development and use of performance-based methods of collection and analysis.
- (7) Use the ecoregions concept, reference conditions, and index calibration.

¹ This guide is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.02 on Quality Systems, Specification, and Statistics.

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² The boldface numbers in parentheses refer to a list of references at the end of this standard.

1. Scope

1.1 *Purpose*—This guide is generic in its application to surface or ground water, rivers, lakes, or estuaries (quantity and quality). It proposes a series of options that offer direction without recommending a definite course of action and discusses the major elements that are common to all purposes of water monitoring.

1.2 The elements described are applicable whether the monitoring is only for one location or integrates multiple measurement sites for the purpose of assessing a whole watershed, estuary, or aquifer system.

1.3 This guide is intended to outline for planners and administrators the components, process, and procedures which should be considered when proposing, planning, or implementing a monitoring program. The guide is not a substitute for obtaining specific technical advice. The reader is not assumed to be a technical practitioner in the water field; however, practitioners will find it a good summary of practice and a handy checklist. Other standard guides have or will be prepared that address the necessary detail.

1.4 *Monitoring Components*—A water monitoring program is composed of a set of activities, practices, and procedures designed to collect reliable information of known accuracy and precision concerning a particular water resource in order to achieve a specific goal or purpose. The purposes may range in scope from tracking status and trends on a regional or national basis to gathering data to determine the effects of a specific management practice or pollution incident such as a spill. This guide suggests and discusses the following process and components:

1.4.1 Establishment of program goals and objectives and recording of decisions in a written plan (see 6.1),

1.4.2 Developing background data and a conceptual model (see 6.1.12),

1.4.3 Establishment of data (quality, quantity, type) objectives (see 6.2),

1.4.4 Design of field measurement and sampling strategies and specification of laboratory analyses and data acceptance criteria (see 6.3),

1.4.5 Data storage and transfer (see 6.6),

1.4.6 Implementation of sampling and analysis strategies (see 6.4),

1.4.7 Data quality assessment (see 6.5),

1.4.8 Assessment of data (see 6.7),

1.4.9 Program evaluation (see 6.8), and

1.4.10 Reporting (see 6.9).

See also Fig. X1.1 in Appendix X1 and the condensed list of headings in Appendix X2.

1.5 *Monitoring Purposes*—Establishing goals defines the purpose for monitoring. Each purpose has some monitoring design needs specific to itself. There are six major purposes for water monitoring. They are as follows:

1.5.1 *Determining the Status and Trends of Water Conditions*—This can require long term, regular monitoring to determine how parameters change over time.

1.5.2 *Detecting Existing and Emerging Problems*—Determining if, how, or where a substance may move through an aquatic system, or if water quantities are changing.

1.5.3 *Developing and Implementing Management and Regulatory Programs*—Includes baseline and reconnaissance monitoring to characterize existing conditions such as to identify critical areas or hot spots; implementation monitoring to assess whether activities were carried out as planned; and compliance monitoring to determine if specific water quality or water use criteria were met.

1.5.4 *Responding to an Emergency*—Performed to provide information in the near term.

1.5.5 *Evaluating the Effectiveness of Water Monitoring Programs*—Is the monitoring able to achieve the stated goals? Also, monitoring to check on monitoring.

1.5.6 Supporting research objectives or validating of simulation models.

1.6 This guide is applicable to these purposes and provides guidance on some of the specific needs of each. After goals and objectives have been established, a specialist can define the