IMPLEMENTATION PLAN FOR THE NATIONAL WATER-QUALITY ASSESSMENT PROGRAM

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ABSTRACT

The National Water-Quality Assessment (NAWQA) Program is designed to describe the status and trends in the quality of the Nation's ground- and surface-water resources and to provide a sound understanding of the natural and human factors that affect the quality of these resources. To meet its goals, the program will integrate information about water quality at different spatial scales—local, study unit, and regional and national—and will focus on water-quality conditions that affect large areas or are recurrent on the local scale.

As part of the program, study-unit investigations will be conducted in 60 areas throughout the Nation to provide a framework for national and regional water-quality assessments. The study-unit investigations will consist of intensive assessment activity of 4 to 5 years duration followed by 5 years of less intensive activity. Twenty study units will be in an intensive data-collection and analysis phase during each fiscal year (FY), and the first cycle of intensive investigations covering the 60 study units will be completed in FY 2002.

National and regional assessments of ground- and surface-water quality will be provided from issue-oriented findings of nationally consistent information from the study units. By including study units (60) that cover both a large part of the United States and diverse hydrologic systems that differ in their response to natural and human factors, the NAWQA Program ensures that many critical water-resources and water-quality concerns or issues can be addressed by comparative studies that are national and regional in scale.

INTRODUCTION

The Nation's water resources are composed of many interrelated ground- and surface-water systems. The response of each of these systems to natural and human factors manifests itself in a corresponding set of hydrologic, chemical, and biological characteristics that reflect the water-quality effects of these factors. Many national water-quality concerns arise from the recognition of recurring local and regional problems related to managing and protecting water quality. In order to address these complex concerns and related issues, the U.S. Geological Survey (USGS) proposed a National Water-Quality Assessment (NAWQA) Program in 1985 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, to the extent possible, the major natural and human factors that affect observed water-quality conditions and trends.

In 1986, a pilot NAWQA program was begun, the purpose of which was to develop, test, and refine methods useful for a full-scale national water-quality assessment program (Hirsch and others, 1988). In 1987, the USGS requested the National Academy of Science's (NAS) Water Science and Technology Board to review the NAWQA pilot program. In September 1989, the NAS review committee submitted an interim report, which stated that (1) the implementation of a national water-quality assessment is in the best interest of the Nation, and (2) the USGS is well qualified to establish and implement a NAWQA Program. In late 1989, the Administration determined that the USGS should proceed with implementation of the NAWQA Program in FY 1991 and requested that Congress appropriate $18 million to begin the full program, which in 4 years is planned to increase to about $60 million annually. Background information on the objectives, design, and plan of implementation for the program is provided in this report.

PLAN FOR IMPLEMENTATION OF PROGRAM

The NAWQA Program consists of two major elements—study-unit investigations and regional and national syntheses of study-unit investigation results. Study-unit investigations, the basic building blocks of the NAWQA Program, are designed to address study unit and local water-quality issues and to provide the framework upon which regional and national water-quality assessments can be made. Findings from these comparative studies will provide an improved understanding of key national, regional, and local water-quality concerns.

Study-Unit Investigations

The major activities of the NAWQA Program are organized to take place within a set of hydrologic systems referred to as study units. Sixty study units (fig. 1, table 1), in which both ground- and surface-water quality will be studied, have been identified. Collectively, the study units encompass about 45 percent of the land area of the conterminous United States, an area in which withdrawals account for 60 to 70 percent of the Nation's water use as measured by total withdrawal and population served by public water supply. The water resource to be emphasized in each study-unit investigation will depend on water use in the study unit and the nature and importance of the ground- or surface-water-quality concerns. Coordinating activities among the USGS and representatives of Federal, State, and local interests will aid in identification of water-quality concerns. In FY 1991, planning and some limited water-quality sampling will begin in 20 study units. Selection of these 20 units will be based on the following criteria: (1) coverage of major hydrologic regions, (2) coverage of agricultural areas in keeping with the President's Water-Quality Initiative, (3) consideration of water-quality concerns and programs of other Federal and State agencies, and (4) water-quality concerns of the USGS.

Investigation Phases

The assessment activities in each of the study units will include 4 to 5 years of continuous and intensive data collection and analysis, immediately followed by 5 years of less intensive assessment activities (chiefly intermittent monitoring of water quality). The study-unit investigations will be conducted so that one-third will be in intensive assessment activities at a given time. In 12 years (FY 1991-2002), an intensive activity period will have been completed for all 60 study units. The schedule of investigations by principal activity for the NAWQA Program for FY 1991-2000 is shown in figure 2. During the less-intensive low-level activity period of each study-unit investigation, a project chief and one or two support project members will be needed to continue assessment activities. During the intensive period, as many as 10 project members having expertise in a wide range of scientific disciplines, including ground- and surface-water hydrology, water quality, geochemistry, ecology, geomorphology, and statistics will be involved in a study-unit investigation.

Scope of Activities

Major activities to be performed as part of the study-unit investigations include the compilation of available water-quality information, sampling and analysis of water quality for a wide array of physical, chemical, and biological properties, and the interpretation and reporting of results. Although the NAWQA Program is designed as an operational program, the approaches to be used will be "state-of-the-science" techniques and methodologies. Throughout the program, improved methods will be developed and adapted to meet the objectives of the program. Priority will be given to the development of (1) improved analytical methods for quantifying the concentrations of trace elements and trace-organic compounds in water, sediment, and tissue; (2) biological assessment techniques; (3) methods for evaluating ground- and surface-water quality; and (4) statistical and deterministic techniques of data analyses and interpretation on a regional and national scale.

Water-quality data available from water-resource agencies at all governmental levels will be assembled, screened, and evaluated to the extent possible. These data will be stored in the computerized USGS data base for the study-unit investigations. Additional water-quality data collected specifically for the study units including quality-assurance and ancillary information, such as local land use, will be stored in the computerized data bases and made readily accessible. The intent of this effort is to ensure that the data can be used effectively and efficiently for the study-unit investigations and for regional and national synthesis of study-unit investigations results by USGS and other Federal, State and local agencies, academia, and the private sector.

Study-Unit Reports

Results of each study-unit investigation will be presented in several reports during each period of intensive activity. Early in each investigation, the project team will prepare a work plan. This plan will present refined boundaries of the study unit, describe the hydrogeologic setting of the study unit, identify major water-quality concerns, define specific objectives of the assessment, and describe approaches that will be used. Briefing materials on planned water-quality assessments will be prepared and released to the public to aid in coordinating and ensuring that local interests are addressed by the program, and to keep the public informed about activities in each study-unit investigation. Informal reporting on activities through participation in public meetings addressing local water-quality concerns will be an important component of the study-unit investigations.

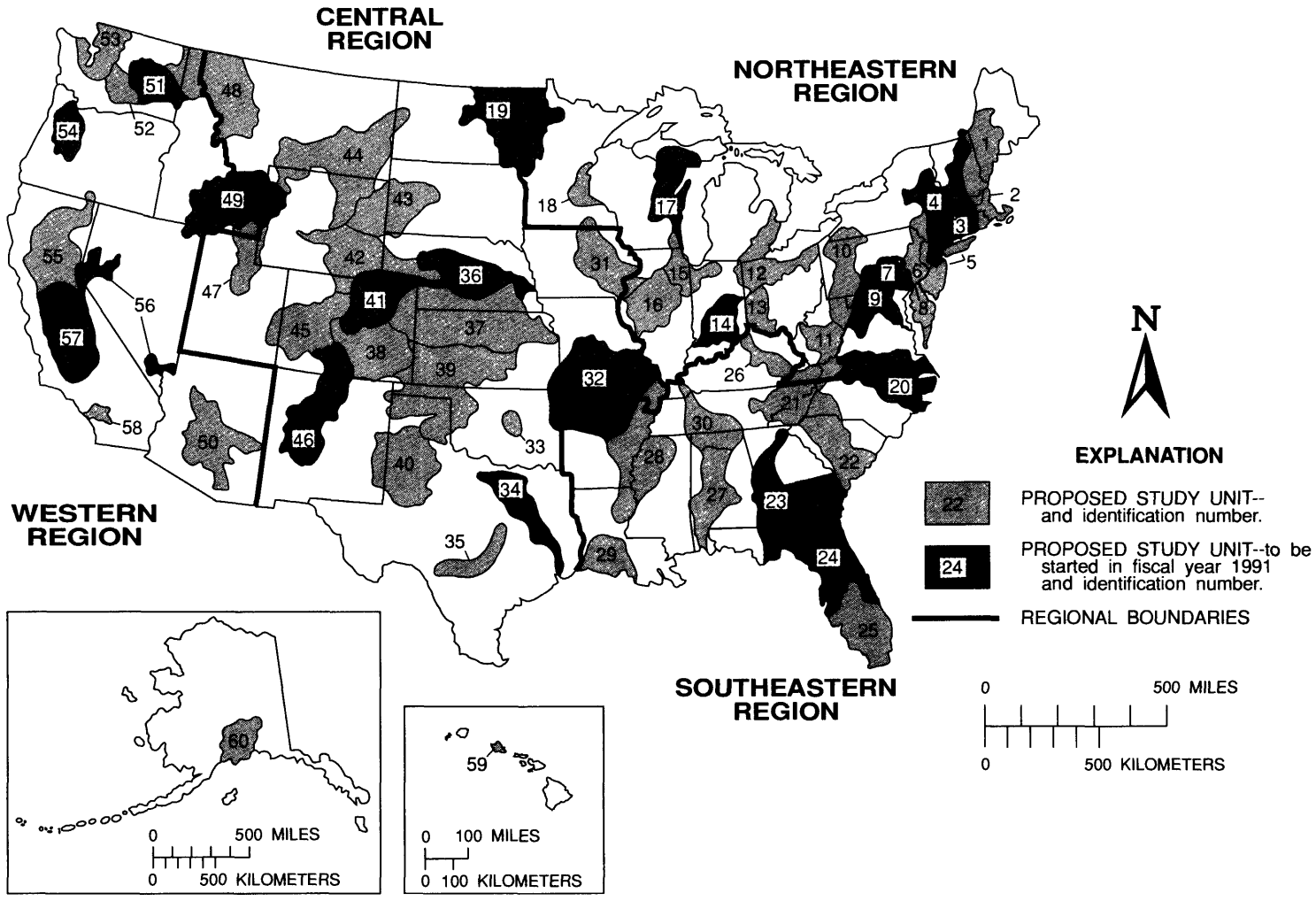

Figure 1. – Location of proposed study units for the National Water-Quality Assessment Program.

Table 1.—*Proposed study units for the National Water-Quality Assessment Program*

Map identification (Fig. 1)	Study-unit name	State(s)
	NORTHEASTERN REGION	
1.	New Hampshire-Southern Maine Basins	ME, NH, MA
2.	Southeastern New England	MA, RI
3.	Connecticut Valley Drainage	NH, VT, MA, CT
4.	Hudson Basin	NY, VT, MA, CT, NJ
5.	Long Island and New Jersey Coastal Plain	NY, NJ
6.	Delaware Basin	NY, NJ, PA, DE
7.	Lower Susquehanna Basin	PA, MD
8.	Delmarva Peninsula	DE, MD, VA
9.	Potomac Basin	WV, MD, VA
10.	Allegheny and Monongahela Basins	NY, PA, WV
11.	Kanawha Basin	WV, VA, NC
12.	Lake Erie-Lake Saint Claire Drainage	MI, OH, IN
13.	Great and Little Miami River Basins	OH
14.	White River Basin	IN
15.	Upper Illinois River Basin	IL, IN, WI
16.	Lower Illinois River Basin	IL
17.	Western Lake Michigan Drainage	WI, MI
18.	Minneapolis-St. Paul Basin	MN
19.	Red River of the North	MN, ND
	SOUTHEASTERN REGION	
20.	Albemarle-Pamlico Drainage	NC, VA
21.	Upper Tennessee River Basin	TN, NC, VA
22.	Santee Basin and Coastal Drainage	SC, NC, GA
23.	Apalachicola-Chattahoochee Basin	GA, FL, AL
24.	Georgia-Florida Coastal Plain	FL, GA
25.	Southern Florida	FL
26.	Kentucky River Basin	KY
27.	Mobile River and Tributaries	AL, MS
28.	Mississippi Embayment	MS, LA, AR, TN, KY, MO
29.	Chicot-Evangeline	LA
30.	Lower Tennessee River Basin	TN, AL, KY

Table 1.—*Proposed study units for the National Water-Quality Assessment Program*—Continued

Map identification (Fig. 1)	Study-unit name	State(s)
	CENTRAL REGION	
31.	Eastern Iowa Basins	IA, MN, IL
32.	Ozark Plateau	MO, AR, OK, KS
33.	Central Oklahoma	OK
34.	Trinity River Basin	TX
35.	Balcones Fault Zone	TX
36.	Central Nebraska Basin	NE
37.	Kansas River Basin	KS, NE, CO
38.	Upper Arkansas River Basin	CO
39.	Central High Plains	KS, TX, OK, CO
40.	Southern High Plains	TX, NM
41.	South Platte Basin	CO, WY, NE
42.	North Platte Basin	WY, CO, NE
43.	Cheyenne and Belle Fourche Basins	SD, WY
44.	Yellowstone Basin	MT, WY, ND
45.	Upper Colorado Basin	CO, UT
46.	Rio Grande Valley	NM, CO
47.	Great Salt Lake Basins	UT, ID, WY
48.	Northern Rockies Intermontane Basins	MT, ID, WA
	WESTERN REGION	
49.	Upper Snake River Basin	ID, WY, NV
50.	Southern Arizona	AZ
51.	Mid-Columbia Basin	WA
52.	Yakima River Basin	WA
53.	Puget Sound Drainages	WA
54.	Willamette Basin	OR
55.	Sacramento Basin	CA, OR
56.	Western Great Basin	NV, CA
57.	San Joaquin-Tulare	CA
58.	Santa Ana Basin	CA
59.	Oahu	HI
60.	Cook Inlet Basin	AK

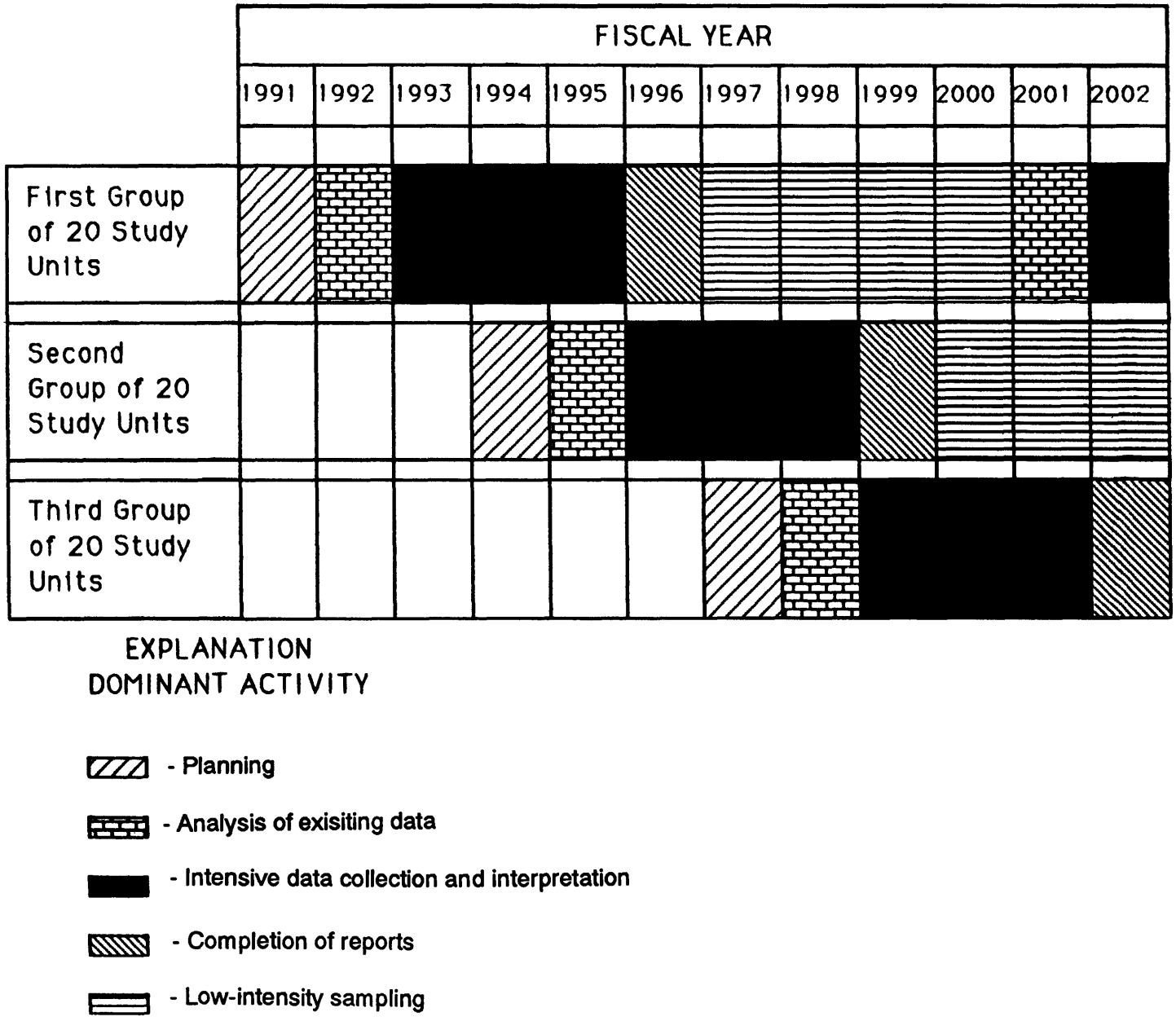

Figure 2. – Schedule of first cycle of study-unit investigations, by dominant activity, for the National Water-Quality Assessment Program, fiscal years 1991-2002.

The results of each of the study-unit investigations will be described as appropriate in technical journals, reports for the general public, and USGS formal and informal series reports. A series of interpretative reports presenting results of the investigation will be prepared at the completion of each period of intensive activity. The first chapter is reserved for a summary of key findings. Subsequent chapters may include an analysis of available water-quality information and more detailed discussion of pertinent findings from the intensive activity period and previous less intensive activity periods.

Regional and National Synthesis of Study-Unit Results

Regional and national synthesis of information from selected study units will be the foundation for comprehensive assessments of the Nation's water quality. The synthesis activities will consist of comparative studies of specific water-quality issues using nationally consistent information and will focus on differences and similarities in observed water-quality conditions, trends, and causes of these conditions and trends among the 60 study units. To permit meaningful comparisons a major part of the synthesis activities will be the characterization of each study unit in terms of nationally consistent information on water quality and factors such as land use, geology, climate, agricultural practices, and hydrology. Some of the synthesis activities will focus on water-quality issues that affect large contiguous hydrologic regions. Other synthesis activities will focus on large noncontiguous areas that are affected by similar specific water-quality issues or concerns.

An example of a specific water-quality issue is the presence of atrazine, one of the most heavily applied herbicides in the United States. Most of the usage of atrazine is concentrated in agricultural areas in the Midwest, along the Mid-Atlantic coast, and in specific regions of many other States. Thus, a "regional" analysis of the presence of atrazine to natural and human factors would focus on several large noncontiguous geographical areas of the Nation. Therefore, the NAWQA approach to synthesis of study-unit investigation results provides a unique opportunity to examine the presence of this herbicide in ground and surface water in different parts of the country that are characterized by distinct differences or similarities in climate, hydrology, and agricultural practices.

Regional and National Water-Quality Concerns

Some of the national water-quality concerns to be addressed in the first cycle of NAWQA studies along with regional and national water-quality policy questions are given in table 2. These water-quality concerns are comprehensive and represent a wide range of difficulty and scope. The regional and national synthesis of information from study-unit investigations will significantly contribute to answering fundamental water-quality questions facing the Nation. For example, a concern that will likely be addressed during the early years of the program is the relation of the presence of pesticides in ground and surface water to application rates, cropping practices, and climatic, geologic, and soil factors. Information on the factors affecting ground- and surface-water contamination by pesticides will be useful to water-resource policymakers and managers for:

(1) developing effective water-resource management approaches regarding pesticide contamination,

(2) determining the appropriate pesticide standards for particular geographic regions and hydrologic settings rather than using rigid nationwide standards that may overprotect the resource in some areas and underprotect it in others, and

(3) developing effective and efficient ways to monitor water-quality.

By including a large number of study units (60) and a large part of the United States, the NAWQA Program ensures that many critical water-quality concerns in diverse hydrologic and land-use settings can be evaluated. Water-quality concerns to be covered by the regional and national synthesis will be reviewed periodically and refined on the basis of findings from study-unit investigations and other programs, and advice from USGS coordinating and technical advisory committees.

The relation among national, regional, study-unit, and local scales of study are shown in figure 3. This figure also summarizes the type of information that will be reported for each scale of study. Because of the interdependence between the study-unit investigations and the regional and national synthesis of study-unit investigations results, elements of the program are being concurrently planned. Planning activities are being coordinated at both the regional and national levels with appropriate Federal, State, and local interests. Detailed planning of the regional and national synthesis activities will begin in FY 1990. These plans will affect ancillary data needs, the emphasis of the local scale investigations in selected study units, and to some extent, the staging of study-unit investigations.

Table 2.—*Examples of water-quality concerns of national and regional interest to be addressed by the National Water-Quality Assessment Program and examples of policy questions supported by this information*

Water-Quality Concerns
• Occurrence and concentration of pesticides in ground and surface water and their relation to human and aquatic health criteria,
• Relation of the presence of pesticide in ground and surface water to application rates, cropping practices and climatic, geologic, and soil factors,
• Relative magnitude of various point- and nonpoint-source contributions to different types of ground- and surface-water contamination,
• Effects of agricultural best management practices on ground- and surface-water quality,
• Regional occurrence and concentration of trace elements and industrial organic compounds in ground and surface water, and
• Effects of changes in municipal wastewater-treatment practices on water quality and ecosystem health.
Policy Questions
• Are national water-quality goals being met?
• How should resources be best allocated among competing water-quality interests?
• What are the key substances in water in need of regulation and for which research is needed regarding toxicity, human exposure, and drinking-water treatment?
• Can regulations for selected constituents be determined for particular geographic regions or hydrologic settings?
• What type and degree of water-quality protection are appropriate to particular hydrogeologic settings?

The regional and national synthesis will be conducted by several teams of 4 to 5 project members that are selected specifically because of their knowledge of particular water-quality concerns. Each team will address a regional or national water-quality topic for a period of about 4 years. The teams will be formed sequentially so that multiple topics will be under investigation during a single year; this will also ensure a steady flow of synthesis results. Depending on the concern, the individuals performing the synthesis will be from the USGS, other government agencies, and academia.

The regional and national assessments will rely in large measure, but not exclusively, on the results from the NAWQA study-unit investigations. As appropriate, results from investigations by Federal, State, and local agencies and from other USGS programs will be integrated with the NAWQA Program results to address the water-quality concerns.

Regional and National Reports

Work plans for regional and national aspects of the program will be prepared during the first several years of the program to identify water-quality concerns to be addressed annually for FY 1991-2002. A national topical report may be prepared every year, beginning near the completion of the first set of 20 study-unit investigations in FY 1995. The topical report generally will focus on one specific water-quality issue of national and (or) regional interest. Every 3 to 5 years, a separate national synthesis report will present summaries of the status, trends, and key findings regarding water quality in each study unit and regional and national summaries of these findings. The scope of these reports will become more comprehensive as the number of completed study-unit investigations increases and as information from studies conducted as part of other programs is integrated into the synthesis activities.

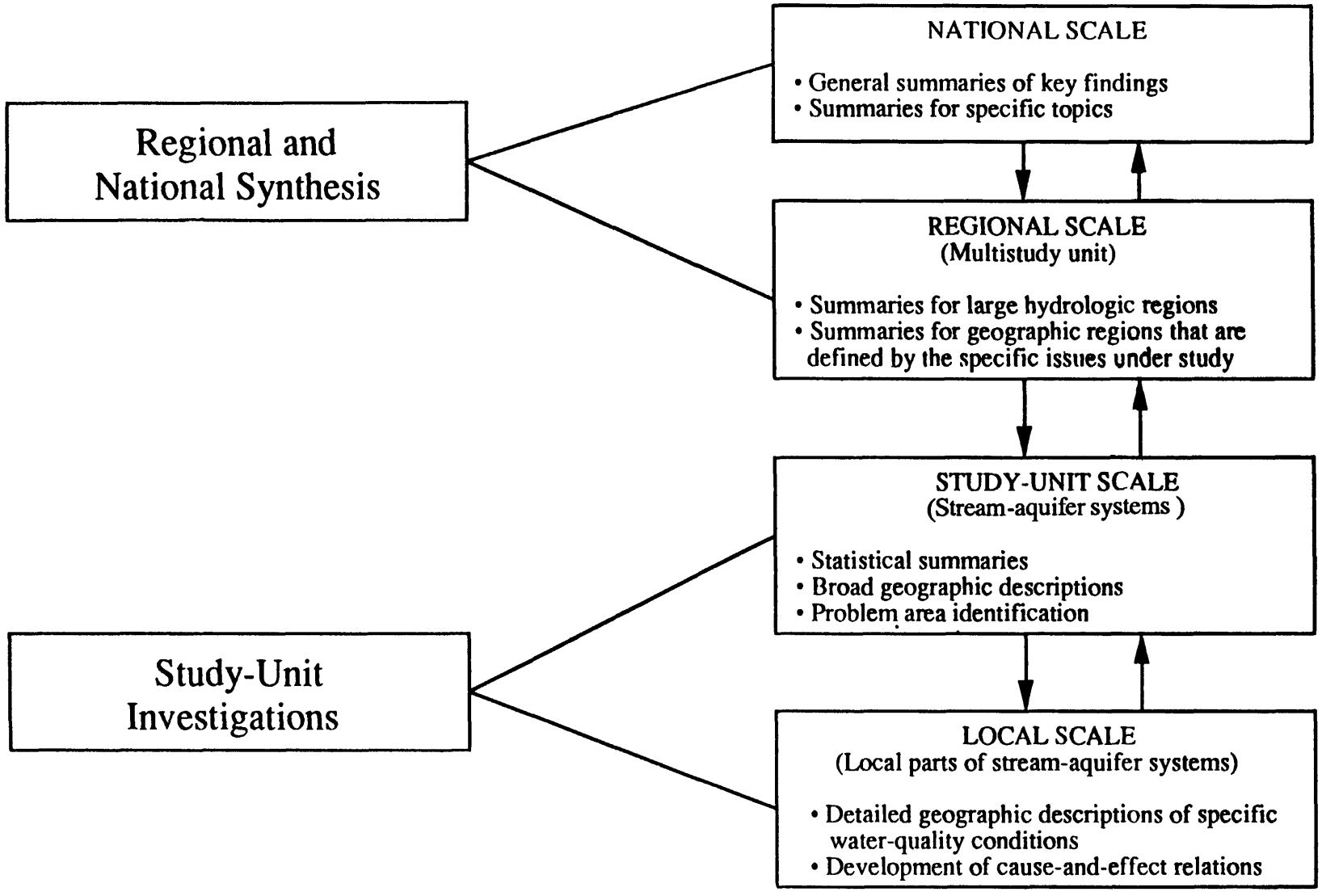

Figure 3. – Information provided at different scales by the National Water-Quality Assessment Program.

As the program progresses, the regional and national synthesis reports will address more complex water-quality concerns in greater detail.

COORDINATION

External coordination at all levels is an integral component of this program. Information exchange and coordination through study-unit liaison committees in the pilot program was highly successful and this coordinating mechanism will be used extensively to ensure local input to the 60 study units. Liaison committees will help ensure that the water-quality information produced by the program is relevant to regional and local interests. The liaison committees will be comprised of non-USGS members who represent a balance of technical and management interests. Represented organizations will include, as appropriate, Federal, State, interstate, and local agencies, Indian Nations, and universities. Specific activities of each liaison committee will include (1) exchanging information about water-quality issues of regional and local interest, (2) identifying sources of data and information, (3) discussing adjustments to program design, (4) assisting in the design of project products, and (5) reviewing and commenting on planning documents and project reports.

A Federal/non-Federal advisory subcommittee specifically designated for the NAWQA Program will be formed to ensure that both Federal and non-Federal interests and needs at the regional and national level are met. The USGS Office of Water Data Coordination provides staff assistance to Geological Survey advisory committees for water resources and will provide support to the NAWQA committees.

Finally, in addition to these activities and committees, communication and coordination of NAWQA and other USGS Programs with other Federal agencies will continue through several interagency committees and Memorandums of Agreement specifically developed to meet the need of the NAWQA Program. Appropriate interagency committees include, for example, the U.S. Environmental Protection Agency/U.S. Geological Survey Interagency Committee for Program Coordination, and interagency committees with the National Oceanic and Atmospheric Administration, Office of Surface Mining, U.S. Bureau of Reclamation, U.S. Forest Service, and U.S. Soil Conservation Service.

The USGS is exploring a number of approaches to ensure that national, regional, and local concerns are effectively taken into consideration in the program and that Federal, State, and local agencies have opportunities to participate in and influence the program; they will be kept apprised of data availability and findings that result from the program.

REFERENCES

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