HIGHLIGHTS OF THE 1983 FEDERAL-STATE COOPERATIVE WATER RESOURCES PROGRAM

by Bruce K. Gilbert and Thomas J. Buchanan

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ABSTRACT

The U.S. Geological Survey Federal-State Cooperative Water Resources Program in fiscal year 1983 continued to concentrate on investigations of highest priority to the Nation. Hydrologic data collection and interpretive studies were underway in every State, Puerto Rico, and several U.S. territories with focus on such current concerns as ground-water contamination, floods, impacts of toxic wastes, acid precipitation, and stream quality.

During the year, this 50-50 matching program was carried out in working partnership with more than 800 State, regional, and local agencies. Joint funding from all sources totaled approximately $92 million. Details of the program are mutually negotiated at the working level by representatives of the Survey and representatives of the cooperating agencies. The pooling of interests results in a balanced effort that directs combined resources to hydrologic investigations having the most significance to both parties.

A few of the highlights for FY 1983, and how the program is developed and coordinated with other agencies are described in this report.

INTRODUCTION

The mission of the U.S. Geological Survey's Water Resources Division (WRD) is to provide the hydrologic information and understanding needed to best use and manage the Nation's water resources for the benefit of the people of the United States. To accomplish this, the Division assesses the Nation's water resources in terms of the quality, quantity, and use of water, and develops the knowledge and hydrologic understanding necessary to predict the consequences of alternative plans and policies for developing and using water resources. To assure that hydrologic information is acquired and disseminated efficiently, the Division coordinates Federal water-data acquisition activities, and collects and distributes information about the availability of water data through the National Water Data Exchange (NAWDEX). WRD also develops and distributes information about natural hazards and other potentially catastrophic events such as floods, mudflows, droughts, and land subsidence. Much of this work is done through cooperation with and funding from Federal, State, and local agencies.

Activities of the Water Resources Division are funded in three principal ways:

- o Federal Program--funding by direct congressional appropriations.
- o Federal-State Cooperative Program--funding is shared 50-50 with State and local agencies; the Federal portion comes from direct congressional appropriations.
- o Other Federal Agencies--funding by the Federal agencies which request the work.

In addition, a small amount of reimbursable work is done for State and local agencies.

The Federal-State Cooperative Program continues to be the largest component of the Survey's water resources activity. This program was carried out in working partnership with more than 800 State, regional, and local agencies during fiscal year 1983 (see appendix). Joint funding in the Cooperative Program from all sources totaled about $92 million, and comprised almost half the overall WRD program (figure 1). Hydrologic data collection and interpretive investigations were underway in every State, Puerto Rico, and several U.S. territories. Figure 2 shows the location of the principal offices of the Geological Survey's Water Resources Division.

TYPES AND DISTRIBUTION OF ACTIVITIES

Support for the Cooperative Program has increased annually since 1970, when the combined total of Federal and State funds amounted to $35 million. By 1975, the program had grown to $56 million and in 1983 it totaled about $92 million. These funds comprised approximately 58 percent, 55 percent, and 47 percent, respectively, of the overall Water Resources Division program for each of those years.

The Cooperative Program can be considered as consisting of two principal components--hydrologic data collection and hydrologic investigations. The on-going data collection activities include the quantity and quality of surface and ground water, fluvial sediment transport, and the quantity and quality of precipitation. Hydrologic investigations include regional, State, county, and and site-specific studies, as well as applied research. The total number of hydrologic investigations and various types of data-collection activites underway in each State in the FY 1983 Cooperative Program are listed in table 1. A general idea of the major fields of study of Cooperative Program activities in FY 1983 is provided by table 2.

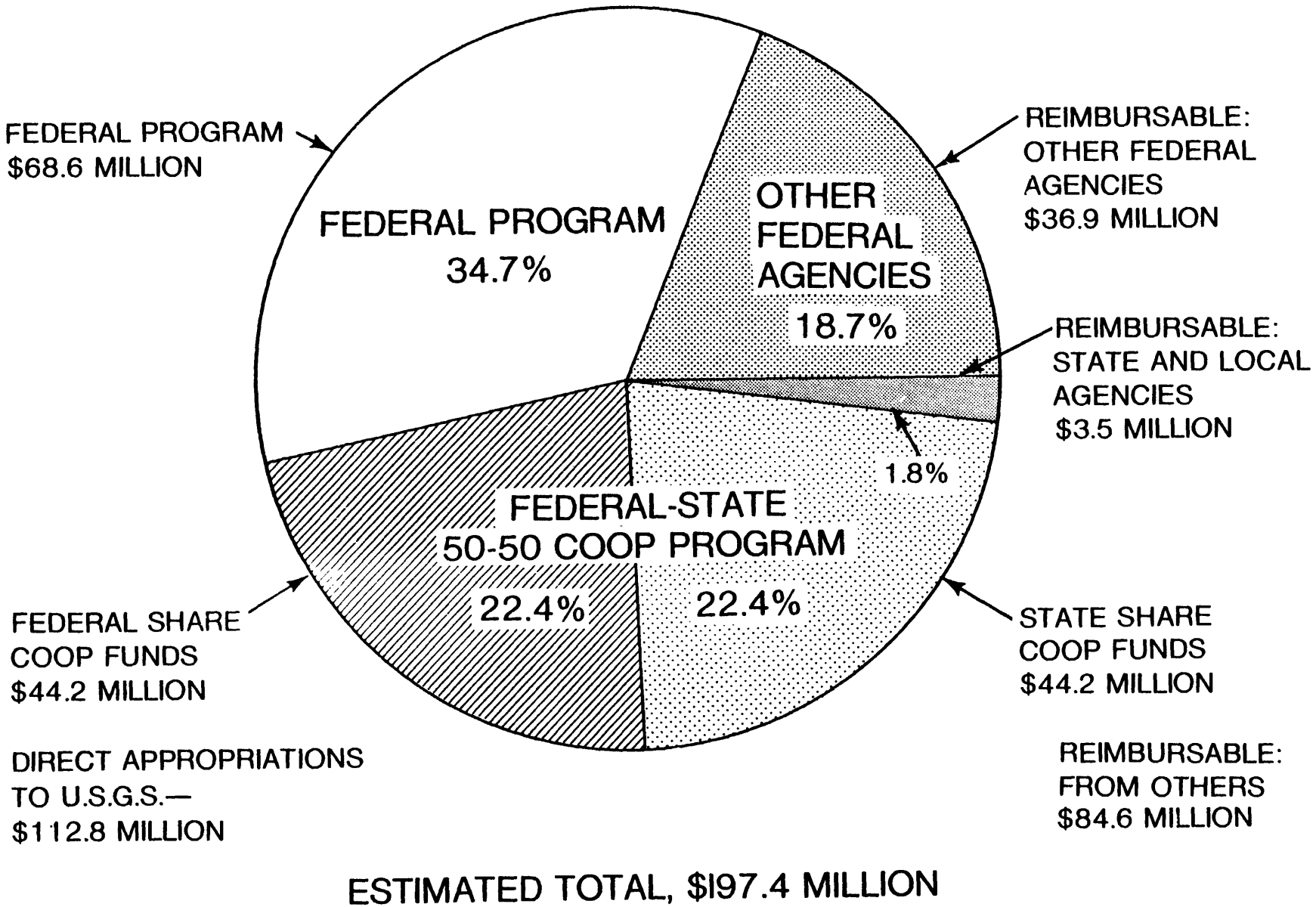

Figure 1.--The estimated fiscal year 1983 budget for the U.S. Geological Survey's Water Resources Division

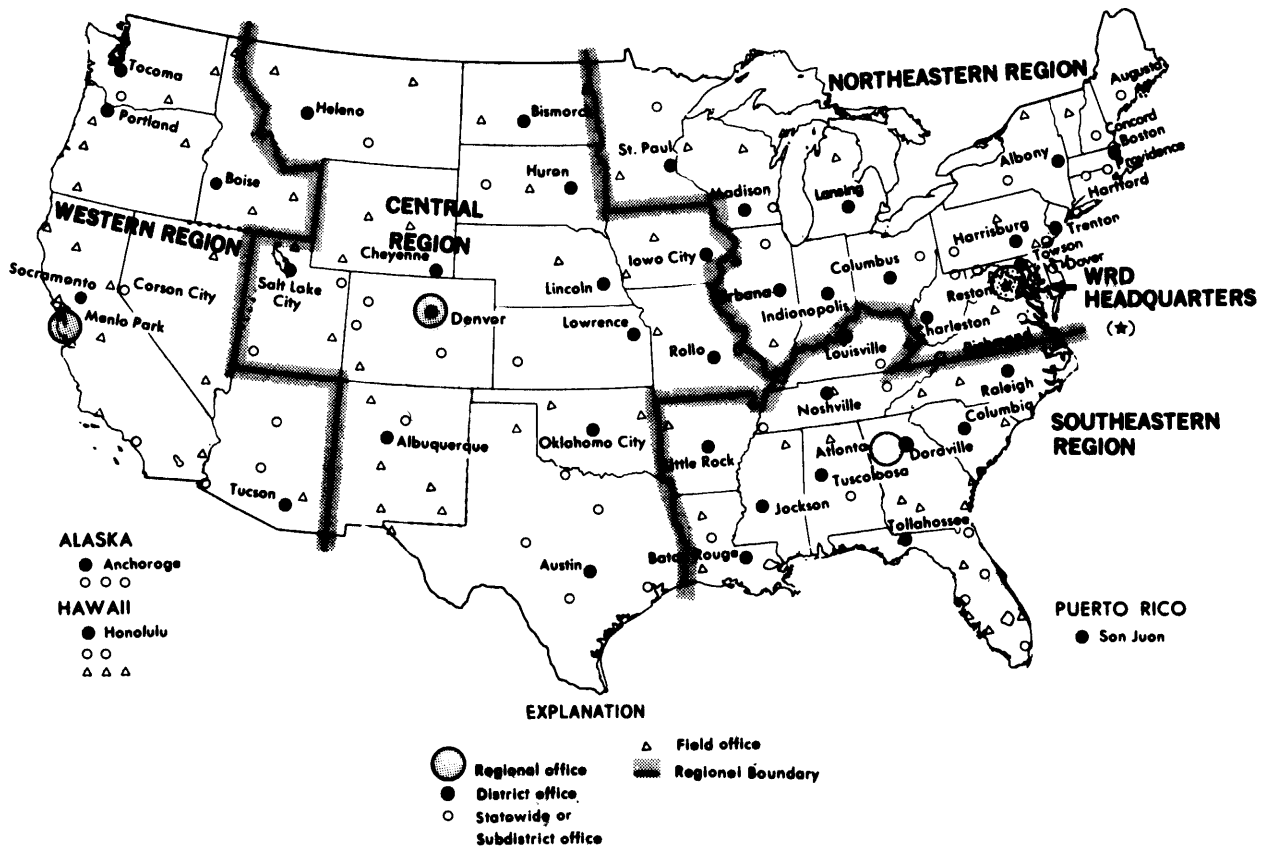

Figure 2.--Location of principal offices of the U.S. Geological Survey's Water Resources Division

Table 1.--Number of hydrologic investigations and data-collection projects in the fiscal year 1983 Federal-State Cooperative Program

State	Number of investigations	State	Number of investigations
Alaska	22	Montana	14
Alabama	10	North Carolina	12
Arkansas	8	North Dakota	17
Arizona	13	Nebraska	8
California	31	New Hampshire	5
Colorado	23	New Jersey	15
Connecticut	12	New Mexico	29
District of Columbia.	1	Nevada	19
		New York	38
Delaware	2	Ohio	21
Florida	52	Oklahoma	14
Georgia	11	Oregon	10
Hawaii 1/	28	Pennsylvania	30
Iowa	10	Puerto Rico 2/	17
Idaho	11	Rhode Island	6
Illinois	12	South Carolina	9
Indiana	9	South Dakota	16
Kansas	18	Tennessee	14
Kentucky	10	Texas	22
Louisiana	18	Utah	14
Massachusetts	18	Virginia	11
Maryland	14	Vermont	4
Maine	9	Washington	17
Michigan	9	Wisconsin	25
Minnesota	20	West Virginia	12
Missouri	10	Wyoming	9
Mississippi	12	Total	801

1/ Includes work in Guam and the Trust Territories.

2/ Includes work in the Virgin Islands.

Table 2.--Major fields of study identified for four or more fiscal year 1983 Cooperative Program investigations and data-collection projects.

Field of study	Number of investigations
Water quality, inorganic chemical	77
Ground-water supplies, occurrence and availability	76
Streamflow characteristics	72
Ground-water trends, change in storage	67
Sedimentation	59
Water-resources appraisals and drought studies	44
Withdrawal and water use	42
Model simulation studies	37
Urban hydrology	34
Movement of contaminants in ground water	33
Hydrologic principles and relationships	26
Hydrogeology	23
Flood reporting and analysis	20
Surface-water supplies and availability	16
Network design	15
Mine drainage and hydrology	15
Atmospheric studies, precipitation	14
Hydrology of specific aquifers	13
Highway and bridge design, site evaluation	11
Lake and reservoir studies	11
Aquifer characteristics and tests	11
Municipal and domestic wastes, organic chemical and nutrients	11
Saltwater encroachment	7
Small watershed studies	6
Industrial wastes, inorganic chemical	6
Artificial recharge, subsurface storage	5
Geochemistry	5
Subsidence	4

The data-collection component is extremely important because it provides the foundation of knowledge needed for developing and managing the Nation's water resources. The data also are essential in forming much of the basis for hydrologic investigations and research. Cooperative Program funding for data-collection activities and hydrologic investigations from 1973 to 1983 is shown in figure 3. Each component accounts for approximately half the funding every year. In FY 1983, it is estimated that the data-collection amounted to about 46 percent of total program funds.

A comparison of Cooperative Program expenditures on various types of hydrologic data collection for 1973, 1978, and 1983 is provided in table 3. The collection of surface-water quantity data accounts for more than 60 percent in each of the years. Collection of precipitation data is the smallest of the group--most of the Nation's data in this area are collected by the National Weather Service and Cooperative Program activities are typically geared to special studies. The collection of ground-water data has accounted for an increasingly significant part of the expenditures--12 percent in 1973, 16 percent in 1978, and almost 20 percent in 1983. During the period, total funding for data collection has essentially doubled, with about $21 million in 1973 to about $42 million in 1983.

The program component including hydrologic investigations and research provides water-resources information that is valuable for a wide variety of activites to Federal, State, and local agencies, to universities, to the consulting community, and to the general public. Table 4 provides a listing of the anticipated primary uses of the results of this part of the program as identified for investigations underway during the 1983 fiscal year. The anticipated uses include water supply, pollution control, international apportionment, waste disposal, and hydroelectric power. These diversified uses are indicative of the wide range of needs for, and interests in, hydrologic information produced by the program activities.

Figure 4 shows the nationwide distribution of hydrologic investigations, in percent of total, by Water Resources Region. Activities are carried out in each Region, with the maximum of 11 percent in the South Atlantic Gulf Region and the minimum of 1 percent in the Souris-Red-Rainy and Hawaii Regions. Table 1, as well as figure 4, indicate that a significant level of Cooperative Program activity is underway in most areas of the Nation.

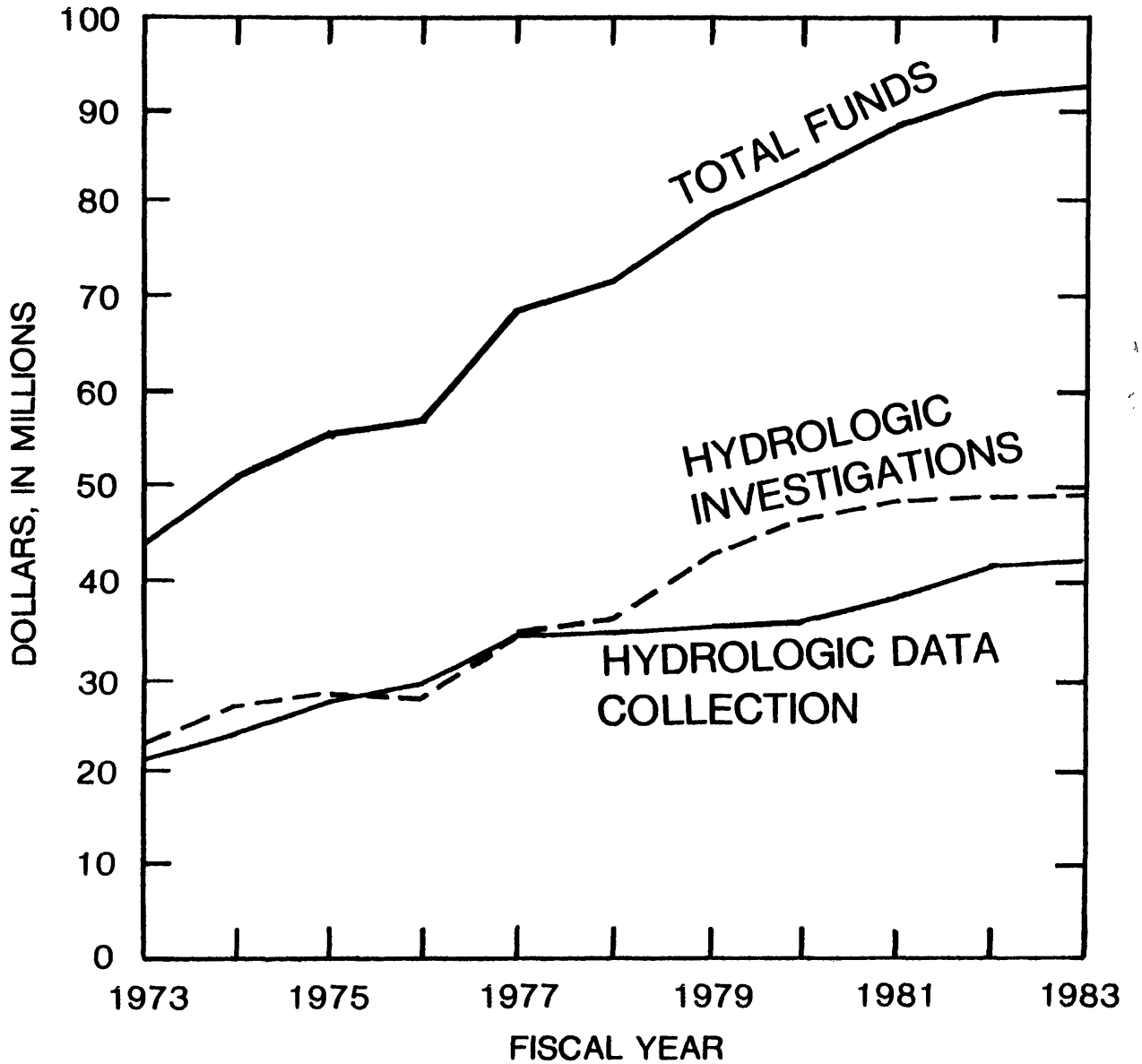

Figure 3.--Federal-State Cooperative Program funding for hydrologic data collection and investigations, FY 1973-1983

Table 3.--Comparison of cooperative funding of various types of hydrologic data collection in 1973, 1978, and 1983

[Values in parentheses are the percentage of the annual total]

Type of hydrologic data collection	Dollars in millions					
	1973		1978		1983*	
Surface water	$13.89	(64.9)	$21.32	(61.3)	$26.18	(61.6)
Ground water	$ 2.64	(12.3)	$ 5.44	(15.6)	$ 8.34	(19.6)
Water quality	$ 4.10	(19.1)	$ 6.81	(19.6)	$ 6.63	(15.6)
Sediment	$ .72	(3.4)	$ 1.08	(3.1)	$ 1.20	(2.8)
Precipitation	$ .07	(.3)	$ .15	(.4)	$ .15	(.4)
Total	$21.42	(100.0)	$34.80	(100.0)	$42.50	(100.0)

*Estimated.

Table 4.--Anticipated primary uses of results of Cooperative Program hydrologic investigations underway in fiscal year 1983

Primary use	Primary Use
General resource information	Research plot or experimental watershed activities.
Water supply (planning and development).	Waste disposal and dilution
Protection and conservation of resources.	Representative small watershed
Pollution control, abatement, and enforcement.	Interstate and international apportionment and control.
Technical application in field of hydrology.	Hydroelectric power
Bridge, culvert, and highway design.	Water rights, litigation, and enforcement.
Public safety (flood warning and flood-plain delineation).	Navigation and waterways
Salinity control and abatement	Recreation
Irrigation and reclamation	Solid-waste disposal
Land management	Energy--nuclear, coal, oil shale, and underground heat storage.
Flood control	Fish and wildlife resources management.

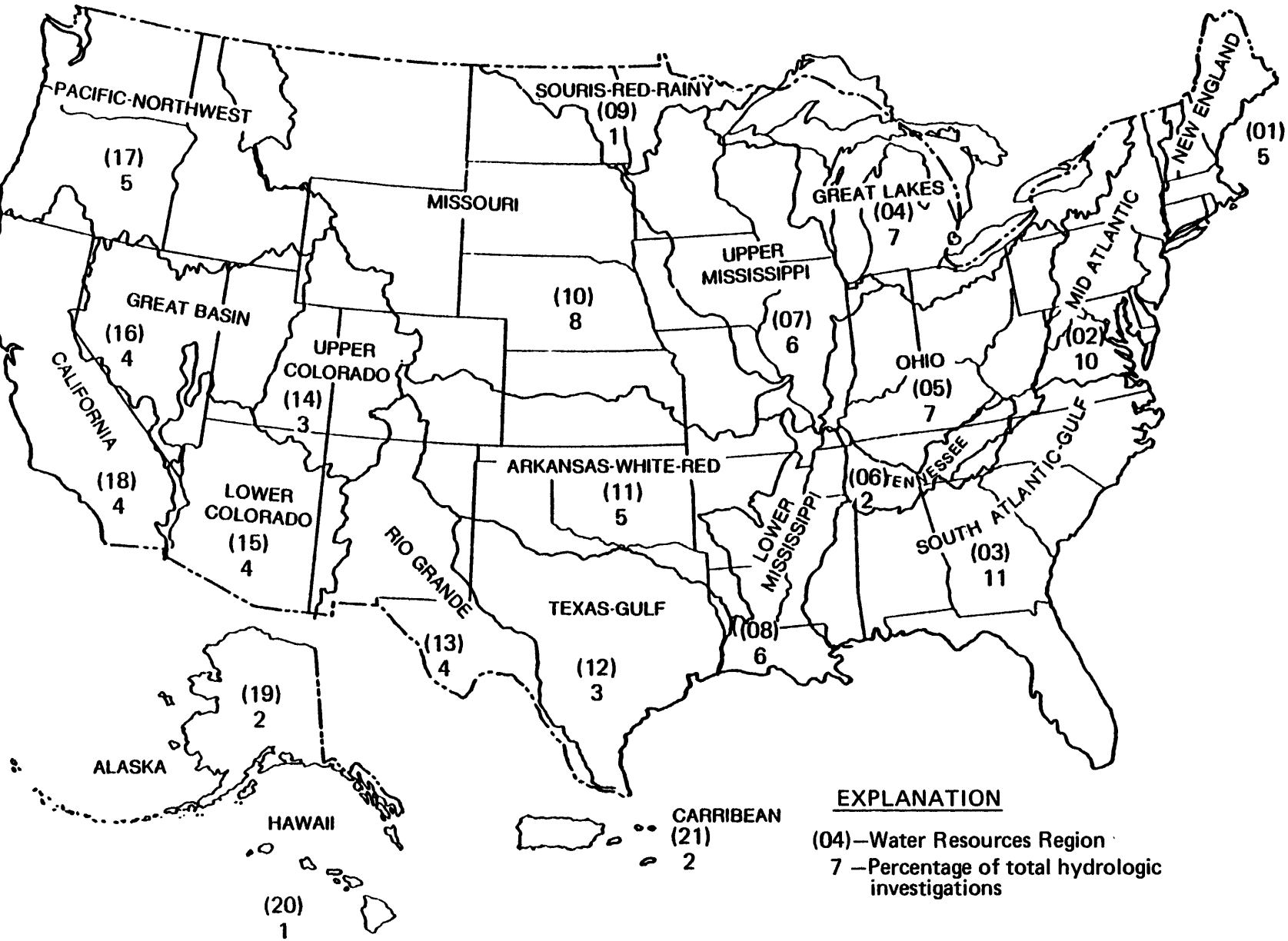

Figure 4.--Distribution of Federal-State Cooperative Program hydrologic investigations by Water Resources Regions, FY]983

PROGRAM DEVELOPMENT

Ensuring a supply of clean water is being described by many experts as the "next American crisis." The nationwide deterioration in the quality of water supplies for domestic, municipal, industrial, and agricultural uses is a growing problem, which affects human health as well as the economy. In spite of considerable progress in solving complex water problems, stresses impacting the quality of the surface and ground waters are multiplying. Thus, the need for water-quality information continues to increase in order to assess the severity and status of the problem and to evaluate the impacts and effectiveness of remedial measures that have been instituted.

Ground water supplies drinking water for at least half of the Nation's population. In some places, especially in densely populated and industrialized areas, disposal of toxic wastes has made much of the ground water unsafe for use. As a result, there is a great need for continued expansion of water-quality investigations to allow development of reliable ground-water supplies and economic disposal of toxic wastes. Ground-water contamination problems may be localized or may spread over a large area, depending on the contamination source and the nature of the ground-water flow system. For an isolated point source of contamination, such as an industrial disposal pond, the consequences may be severe in magnitude but only local in extent. In some places, however, many separate industries located over a large area are contributing to widespread and severe contamination.

The Nation's rivers have historically been used for water supplies, dilution of wastes, recreation, commerce, and for production of fish and other aquatic crops. These uses are not all compatible, and over time many problems have surfaced which managers have attempted to solve. Several years ago, the Geological Survey developed in its Federal Program a river-quality assessment thrust, aimed at producing hydrologic information in a number of demonstration areas that would be useful to all concerned. As a result of the knowledge gained in this thrust program, the Geological Survey is continuing to expand techniques and applications through the Federal-State Cooperative Program. These investigations are designed to provide management options with regard to treatment of wastewater, periods of storage release for dilution water, and assessment of compatible uses of the river. Moreover, the effects of ground-water inflow on streams are analyzed, so that decisions involving river management can be based on a comprehensive understanding of the hydrologic system.

Acid rain is another example of a problem addressed under both the Federal and the Federal-State Cooperative Programs. Acid rain is thought to have impaired the quality of many lakes in the northeastern United States and contributed to extensive fish kills. The problem may become more widespread depending on causative factors. The Federal Program element deals with more

general, nationwide, and international aspects of the problem, whereas the Federal-State Cooperative Program includes the following types of activities: (1) perform hydrologic investigations in specific areas susceptible to damage by acid rain, (2) document the degree to which water quality in specific locales is being affected by atmospheric depostion, (3) investigate the movement of contaminants from acid rain in surface and ground water, and (4) determine the role of acid rain as a contaminant to the ecosystem.

Of growing concern is the cumulative impact of pollution from diffuse sources, such as septic tanks, sanitary landfills, hazardous waste disposal, airblown debris, and agricultural return flow. The impact of urban runoff on water quality needs to be further defined so that the billions of dollars being spent for waste treatment can be optimally used. Runoff from urban areas is adversely impacting the quality of many streams, and also finds its way into aquifers and recharge areas, thereby degrading the quality of ground water as well. The Geological Survey structures investigations to define the quality and quantity of storm-water runoff from urban watersheds in a variety of hydrologic settings across the Nation. Such investigations typically are intended to define the extent of the problem, to provide a data base to be used in selecting alternative solutions, and to demonstrate the effectiveness of selected storm-water management practices.

Thus, priorities for data collection and hydrologic investigations are based on a detailed analysis of water problems and issues facing the country. At the local level, the problem identification process is carried out through discussions with State and local cooperators, Federal agency officials, and the general public. At Headquarters, additional perspective on problems is developed through advice from the Federal and non-Federal Advisory Committees (U.S. Geological Survey, 1979), the expressed desires of other Federal agencies for water information, and policy guidance from the Director, USGS, the Department of the Interior, the Office of Management and Budget, and the Congress.

The information needs of other Federal agencies are accommodated in the planning of WRD's water-resources investigations at the local, regional, and national levels. Field personnel, for example, are in frequent contact with their counterparts in agencies such as the Corps of Engineers, Bureau of Land Management, and the Environmental Protection Agency. In addition, conferences with State and Federal water agencies are held periodically to discuss desired hydrologic investigations and water information and to identify new water problem areas.

It is important to stress that the process of identifying water problems of the Nation is not regarded by the USGS as an exclusive Federal prerogative. Through communication channels established by the Cooperative Program, State and local agencies have a meaningful voice in informing and advising the Federal Government of water resources concerns and issues that warrant attention. Additional information in this regard is provided by Gilbert and Buchanan, 1981.

Principal emphasis of new work undertaken in FY 1983 was on current concerns such as ground-water contamination, water supply and demand, stream quality assessments, water use, and hydrologic hazards. Other topics of high priority were acid precipitation, energy hydrology, erosion and sedimentation, urban hydrology, and wetlands, lakes, and estuaries assessment.

Each year, cooperator proposals typically exceed Federal funds available for matching by several million dollars. An innovative process was begun as of the 1983 fiscal year to introduce an added dimension for allocation of Federal matching dollars on a national basis to specific investigations. In brief, $1 million from the Cooperative Program appropriation was identified to match proposed cooperator offerings for investigations selected on the basis of a merit ranking system. This system provided for an evaluation of each investigative proposal based on: the potential for transferring the knowledge to be gained to other locations; the originality and quality of the scientific approach; and the anticipated contribution of the investigative results to the advancement of science and technology.

The top 16 of the 33 proposed investigations were chosen for funding under the merit ranking procedure. Although it is highly probable that these investigations would have been funded under normal procedures, the system seems to have produced worthwhile results. The program development process has been strengthened because of the increased deliberation among the four WRD regional offices during the merit ranking. Incentive has been added for the planning and development of high quality proposals, and technology transfer has been enhanced through closer interaction of operational and research programs.

Progress on completion of the selected investigations and associated results will continue to be monitored for further evaluation of the process. Meanwhile, plans are to continue the merit system for next year at about the same level as in 1983.

RELATIONSHIPS WITH OTHER PROGRAMS

The USGS regards the Cooperative Program as a funding mechanism which is used to carry out part of a coordinated program of water resources investigations. In many places, the Cooperative Program provides the only source of support for water data collection and investigations required to assess, on a continuing basis, the Nation's water resources. The water-data programs of USGS are described by Gilbert and Buchanan, 1982. Table 5 shows the number of Geological Survey data-collection stations by sources of funding support in fiscal year 1983. Of the 7,400 continuous record stream-gaging stations, the Cooperative Program furnishes sole support for more than 3,700 stations and partial support for almost 1,300 more.

Clearly, the Cooperative Program cannot, and does not, exist apart from the Water Resources Division's other activities. It is necessary, therefore, to consider the Cooperative Program in the context of the total Survey program of water resources investigations, as well as its relationships to the programs and concerns of other Federal, State, and local agencies and the private sector.

Concurrent with negotiations on the content of the Federal-State Program, Survey representatives also hold discussions with representatives of Federal agencies to develop data programs and investigations for the Other Federal Agency Program. In addition, at the same time, project proposals are being developed for the Survey's Federal Program activities.

At the national level, the Survey's Office of Water Data Coordination (OWDC) has been specifically charged with the task of annually soliciting plans and needs for water-data acquisition from all Federal agencies concerned with water resources as part of its data coordination responsibilities under OMB Circular A-67.

Additional information about the needs of Federal agencies and technical advice about improvements of existing water-information programs are obtained from annual meetings of OWDC's Interagency Advisory Committee on Water Data which represents more than 30 Federal agencies. The USGS also uses special program coordination committees such as those with the National Oceanic and Atmospheric Administration, the Bureau of Land Management, the Environmental Protection Agency, and the Soil Conservation Service to assure the development of mutually supportive and complementary programs. OWDC distributes lists of Federal agency information needs and the recommendations of the Interagency Advisory Committee on Water Data to WRD Regional and District Offices for their use in planning the total WRD programs, including that portion funded by the Federal-State Cooperative Program.

Table 5.--Number of USGS data-collection stations by source of funding in fiscal year 1983

Type of station	Number of stations by source of funding							
	Federal Program (FED)	Federal-State Cooperative Program (CO-OP)	Other Federal Agencies (OFA)	Combined program support				Total stations
				FED, CO-OP	FED, OFA	CO-OP OFA	FED, CO-OP, OFA	
SURFACE WATER								
Discharge								
Continuous record	582	3748	1673	807	137	438	54	7439
Partial record	80	2870	408	559	5	27	0	3949
Stage only--streams								
Continuous record	4	125	194	78	13	11	0	425
Partial record	9	415	53	38	0	0	0	515
Stage only--lakes and reservoirs								
Continuous record	10	474	291	71	0	39	1	886
Partial record	11	283	57	48	0	0	1	400
Quality								
Continuous record	161	306	212	72	9	39	2	801
Scheduled, long-term operation	557	1670	470	225	18	24	6	2970
Short-term or project stations	122	404	294	98	15	8	1	942
GROUND WATER								
Water levels								
Continous record	103	1324	117	451	0	0	0	1995
Scheduled, long-term operation	867	17512	950	4970	0	0	0	24299
Short-term or project stations	1819	6461	607	1005	11	67	0	9970
Quality								
Scheduled, long-term operation	20	2274	219	584	0	2	0	3099
Short-term or project stations	607	2424	288	1560	0	0	0	4879
PRECIPITATION								
Quantity	60	436	132	181	2	0	0	811
Quality	94	24	5	3	0	0	0	126

The Federal-State Cooperative Program has pooled limited Federal, State, and local resources in order to acquire hydrologic information and knowledge of mutual interest and benefit that otherwise would have been beyond the financial means of the individual agencies. The benefits from pooling resources continue today to be a major driving force behind the program. Over the 80 year history of the program, the Nation has benefited from the Cooperative Program in the following ways:

- Reduces by 50 percent the cost to the Federal Government of gathering the data and conducting studies that otherwise might be carried out by the Federal Program.

- Reduces the need for other Federal agencies to collect critical water information.

- Provides perspective on emerging nationwide problems as identified at State and local levels.

- Provides funding of data collection in situations where Federal budget limitations have curtailed Federal agency support, thereby, avoiding premature termination or undesirable breaks in the continuity of time-dependent hydrologic records.

- Enlarges the network through which hydrologic information is shared among decisionmakers in the water-resources community and, thereby, enhances prospects that water-management decisions will be based on sound hydrologic principles and information.

- Assures uniformity and consistency in water-information activities by maintaining standards for collection and analysis procedures.

- Provides the means of coordination to avoid duplication in Federal, State, and local water-information programs.

- Encourages the development of hydrologic expertise to apply to the identification and resolution of State and local water problems.

In addition, the Cooperative Program directly complements and supplements many Federal agency activities. Some of the major users of information from the Cooperative Program include:

- National Weather Service (NWS)--to forecast floods. Of the more than 2,000 USGS gaging stations used by NWS, more than one-half are supported by the Cooperative Program.

- Corps of Engineers--to plan, design, construct, and operate water resources projects and to develop nonstructural measures for controlling floods. Of 2,300 gaging stations used by the Corps, many are funded by the Cooperative Program.

- Environmental Protection Agency (EPA)--to support Federal, State, and local water pollution abatement programs, and to assess the extent and severity of pollution. Many EPA regulations require the submission of hydrologic information as part of permit or grant applications.

- Department of Energy--to study and evaluate the effects of the development of energy sources on the quality and quantity of the water resources in more than 2,000 locations.

- Office of Surface Mining--to provide hydrologic information needed by the small-operator assistance program to review and approve mining permits, and to assess the impacts of mining and restoration activities.

- Bureau of Reclamation--to plan, design, construct, and operate water-resources development projects.

- Bureau of Land Management--to manage, conserve, and protect water resources on public lands.

- Fish and Wildlife Service--to establish instream flow requirements, to establish and maintain water supplies for fish hatcheries, and to assess ecological impacts of developments.

- Bureau of Indian Affairs (BIA)--to manage Indian lands and develop water supplies at BIA facilities.

- National Park Service--to manage and protect water resources on park lands, to help assure visitor safety, and to develop water supplies to meet the needs of visitors and employees.

In addition to planned use of Cooperative Program data and analyses, this information adds to the existing national store of hydrologic knowledge which can be drawn upon in times of need. For example, the Federal (and State) response to situations such as the Three Mile Island nuclear accident, the eruption of Mount St. Helens, and the 1980-81 drought depended heavily upon the data-collection activities already in place and the existing store of hydrologic knowledge acquired through the Cooperative Program.

REPRESENTATIVE ACTIVITIES

The Federal-State Cooperative Program in fiscal year 1983 continued to concentrate on water-resources investigations of highest priority to the Nation. A few of the representative activities are described below.

SLIDELL, LOUISIANA: Backwater and Flow Distribution of Pearl River Floods

Severe flooding on the lower Pearl River in the vicinity of Slidell, Louisiana, occurred in April of 1979, 1980, and 1983. Each flood approached or exceeded a 100-year frequency of recurrence. The chance for three such floods happening within a 4-year span is about 1 in 10,000.

Following the 1980 flood, the USGS in cooperation with the Louisiana Department of Transportation and Development, Office of Highways, began a study of backwater and flow distribution of the I-10 Interstate Highway crossing of the Pearl River near Slidell. A finite element model has been developed to simulate flow conditions through the existing bridge openings. The model may also be used to simulate conditions without I-10 in place, the effects of alternative bridge designs, or modifications to the existing bridge.

In the vicinity of Slidell, the Pearl River occupies a flood plain about 5 miles wide that is but slightly incised below the surrounding land. Just upstream from I-10 at Slidell, the river splits into three distributary channels with the main channel running along the west bank of the flood plain. During floods, however, water will cover the entire flood plain. Streamflow, rather than being concentrated along the main channel that parallels the west bank, shifts to the east side of the flood plain. With I-10 embankments and bridge openings, flow shifts from the west to the east bank further upstream than it would were the highway not present. Results of the investigation show too, that the I-10 crossing and the resultant shift in flow distribution also affect the height and area of backwater.

PAGAN ISLAND, NORTHERN MARIANAS: Effects of Volcanic Activity on Water Quality

The entire population of Pagan Island, in the Commonwealth of the Northern Mariana Islands, was evacuated to Saipan because of a volcanic eruption in May 1981. The volcano is a potentially explosive one; eruptions about 1920, necessitated evacuation of the population for several years. The people should not return home until their water supply is no longer contaminated. Under a joint-funding agreement, USGS is investigating the quality of water in the vicinity of the villages on Pagan Island.

A field reconnaissance was carried out in March 1983. Members of the party included seismologists and volcanologists from the Survey's Geologic Division, as well as engineers and chemists from Water Resources Division. Water samples were collected from numerous sources, and gas and vapor samples were collected at the volcano. A radio transmitter was installed to relay data on rainfall, seismic events, and harmonic tremors directly to the Honolulu District office via GOES satellite.

Results of this work will determine whether or not the water supply is potable and may give some indication of trends in volcanic activity.

ILLINOIS: Ground-Water Flow and Tritium Migration from Sheffield Low-Level Radioactive Waste Site

A sand and gravel unit underlying 67 percent of the Sheffield low-level radioactive-waste disposal site in Illinois extends to a strip-mine pond located 275 meters northeast of the nearest trench where waste is buried. As part of a study of the hydrogeology east of the site, a number of test wells were drilled. Tritium was detected in water samples from two of these wells located a few hundred meters east of the site.

In cooperation between USGS and the Illinois Department of Nuclear Safety, an additional 20 wells have been drilled in an effort to determine the areal extent of the tritium plume, the source of the tritium, and the nature of the release. One tritium migration pathway has been identified along a buried sand-and-gravel-filled channel. Tritium was found to be discharging through seeps to the strip-mine pond. Detailed information obtained from drilling test wells suggest that other pathways may also be present.

NEW MEXICO: Unexpected Results of Streamflow and Ground-Water Investigations

Investigations in cooperation with the Pecos River Commission, the New Mexico Environmental Improvement Division, and the city of Albuquerque are designed to provide information describing streamflow in the Pecos River and ground-water conditions in the Albuquerque-Belen basin. Recent results show that previous concepts about these hydrologic systems may need to be revised.

Studies of the Pecos River between Artesia and Carlsbad indicate that in the last several years base flow has not increased as much as expected as a result of clearing phreatophytes (salt-cedar). Base-flow was projected to increase about one acre-foot per acre, but analysis of streamflow records reveal only about one-fourth that amount.

In the Albuquerque-Belen basin, reconnaissance investigations of ground-water quality have detected unexpected concentrations of organic chemicals. One municipal well has been shut down as a result of the sampling program. In addition, water-level measurements have determined that ground-water movement is away from the Rio Grande, toward the eastern border of the basin. Thus, movement of contaminants may be in a direction opposite to that originally thought.

YAMPA RIVER BASIN, COLORADO: Cumulative Effects of Coal Mining on Dissolved Solids

A cooperative investigation is underway in a major coal-mining area of Colorado to provide the Mined Land Reclamation Division of the Colorado Department of Natural Resources with information for evaluating the cumulative impacts of coal mines on water quality. Results from a streamflow simulation model indicate the concentration of dissolved solids could increase by about 65 percent in Yampa River tributaries due to present and anticipated mining activities. In the Yampa River main stem, downstream from the mining area, dissolved solids might increase by about 5 percent. Analysis of the preliminary model results has enabled identification of additional sites where streamflow and water-quality data are needed to refine the model and to efficiently monitor the effects of coal-mining activities.

NORTHEASTERN WEST VIRIGINIA: Hydrologic Effects of Underground Mining and Mine Collapse

USGS in cooperation with the West Virginia Geological and Economic Survey has investigated the effects of underground mining and mine collapse on the areal hydrology at sites where the mined bed of coal is higher in altitude than major streams. The sites are located in northeastern West Virginia near Norton and Famington.

The investigations reveal that subsidence cracks observed at land surface generally parallel predominant joint sets in the rocks. The mining and subsidence cracks increase hydraulic conductivity and interconnection of water-bearing rock units, which in turn cause increased infiltration of precipitation and surface water, decreased evapotranspiration, and higher base flows in some small streams.

Water levels in observation wells in mined areas fluctuate as much as 100 feet annually. Both gaining and losing streams are found, and mine pumpage and drainage can cause diversion of water underground from one basin to

another. Aquifer tests indicated that near-surface rocks have higher transmissivity in mine-subsided basins than in unmined basins. Increased infiltration and circulation through shallow subsurface rocks increases dissolved mineral loads in streams, as do treated and untreated contributions from mine pumpage and drainage. Abandoned and flooded underground mines may be used as reservoirs because of their increased transmissivity and storage.

SOUTH-CENTRAL ARKANSAS: Saltwater Contamination in the Sparta Sand Aquifer

The Sparta Sand formation in south-central Arkansas is a sole-source aquifer for municipal and industrial use in Union County. Since 1965, pumpage has averaged 18 million gallons per day, causing a significant decline in water levels in the aquifer. As water levels have declined, sodium chloride concentrations have increased in water from some wells in the El Dorado, Arkansas, area. In cooperation with the Arkansas Geological Commission and the city of El Dorado, the USGS was asked to investigate the problem, beginning in March 1982.

Early geochemical evidence pointed to the underlying Nacatoch Sand as the probable source of the saltwater. However, measurements of hydraulic heads and geochemical analyses preclude the Nacatoch as a source. Analysis of chloride data and lithologic logs shows a distinct graben (a trough bounded by faults) south and east of El Dorado. Indications are that heavy pumping in the El Dorado area is pulling the saltwater through the graben into the Sparta Sand in the El Dorado area.

The city of El Dorado had planned to drill a new well adjacent to the graben, with additional wells to be drilled southeast of El Dorado. Discovery of the graben as the source of saltwater has already saved the city thousands of dollars that might have been spent on the new well, and will continue to save money as now the graben area will be avoided for future ground-water development. Industry and other municipalities also will save millions of dollars that might have been wasted on drilling wells near the graben.

SALT LAKE CITY, UTAH: Contaminants Detected in the Shallow Aquifer

A cooperative investigation with the Utah Department of Natural Resources and Salt Lake County, Division of Flood Control and Water Quality, has identified plumes of contamination that are believed to originate from abandoned landfills and other waste disposal sites. Relatively high concentrations of cadmium, iron, sulfate, and several organic compounds are contained in shallow ground water, which is moving toward and discharging to the Jordan River. The deep aquifers, which are used for municipal, industrial, and irrigation supplies, do not seem to be affected.

SAN DIEGO COUNTY, CALIFORNIA: Potential for Use of Reclaimed Water

Reclaimed water use is contemplated as an alternative to irrigation with imported water and as a supplement to natural recharge in three small areas in San Diego County, California. During a preliminary evaluation, the area was studied to determine suitability for reclaimed water use.

Reclaimed water use in the San Dieguito area would be primarily within the alluvial aquifer where storage is estimated to be 52,000 acre-feet. The alluvial aquifer has been intruded by seawater and water from surrounding marine sedimentary rock. In 1981-82, dissolved-solids concentrations ranged from 1,350 to more than 20,000 milligrams per liter. Only small areas in alluvium-filled side canyons yielded water having dissolved-solids concentrations less than 1,000 milligrams per liter. A seasonally high water table, lack of a consistent source of recharge, seawater intrusion, and intrusion of ground water from surrounding marine sedimentary rock may affect reclaimed water use plans.

In the San Elijo area, water levels are at or near land surface throughout much of the alluvial aquifer, restricting reclaimed water use to suitable soils in upland areas. The small storage capacity in the alluvial aquifer (8,500 acre-feet) may limit manipulation of the ground-water table within the alluvium.

Reclaimed water use in the San Pasqual area would be primarily within the alluvial aquifer although some soils in upland areas could accept reclaimed water. Ground-water storage within the alluvium is estimated to be 58,000 acre-feet. In 1981-82, dissolved-solids concentrations ranged from less than 400 milligrams per liter in the upper part of the basin to 1,900 milligrams per liter in the discharge area. Irrigation return from imported water is partly responsible for the high concentrations of dissolved solids found in some areas of the alluvial aquifer.

Presently, ground water is of limited value as a water-supply. Reclaimed water use is feasible and expected to improve ground-water quality, creating a new source of water for agricultural use.

OUTLOOK FOR NEXT YEAR

Major national concern continues to focus on ground-water contamination and surface-water quality as well as on traditional interests in water availability. Additional high-priority investigations in the Cooperative Program in these areas will embrace a wide variety of water-resources problems and needs, including analyses of the effects of water quality on supply and demand, acid precipitation, and the contamination of surface and ground waters by urban runoff.

Some of the Nation's major water issues of the 1980's as identified by the Geological Survey through its contacts with Federal, State, and local agencies as well as the private sector and the general public, are listed below.

Water availability and competition for water--Population growth, especially in the Sunbelt States, national goals to expand agricultural production and energy-resource development, and water rights of the State and Federal Governments, Indian tribes, and private individuals have increased competition for available water supplies. Principal uses competing for water are:

- o Crop irrigation
- o Energy production (other than hydroelectric)
- o Mineral-resources development
- o Municipal, domestic, and industrial uses
- o Instream-flow maintenance for hydroelectric power, fish, wildlife, and recreation

Water-quality degradation--Water availability cannot be separated from water quality because the usability of existing supplies depends on the quality. In some areas degradation of surface and ground waters is due to:

- o Nonpoint-source pollution, such as runoff or recharge from agricultural and urban areas.
- o Toxic wastes as a result of numerous chemcial compounds now in use.
- o Saltwater intrusion as a result of ground-water pumping.
- o Acid rain, which is thought to be responsible for the acidification of surface water.

Management of water and land resources--The hydrologic system does not conform to political boundaries and development of water resources in one State can affect the availability and use of water in other States. Hydrologic information in understandable form can help those who evaluate policy options to determine the effects of prior decisions and to guide future decisions.

Water information resulting from the Federal-State Cooperative Program will contribute to the scientific basis for management decisions at the local, State, and Federal levels and will fill critical gaps in ongoing and planned activities by the Geological Survey and other agencies. The collective results of the individual studies provide the foundation upon which regional and national assessments of water resources are based.

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Alabama:
- Alabama Department of --
  - Conservation and Natural Resources
  - Environmental Management
  - Highways
- Alabama Surface Mining Commission
- Geological Survey of Alabama
- Jefferson County Commission
- Tuscaloosa, City of

Alaska:
- Alaska Department of --
  - Environmental Conservation
  - Fish and Game
  - Natural Resources, Division of --
    - Geological and Geophysical Surveys
    - Lands and Water Management
  - Transportation and Public Facilities
- Alaska Power Authority
- Anchorage, Municipality of --
  - Department of Health and Environmental Protection
  - Department of Planning
  - Water and Wastewater Utility
- Fairbanks North Star Borough
- Juneau, City and Borough of
- Kenai Peninsula Borough
- King Cove, City of
- Matanuska Susitna Borough
- Sandpoint, City of

American Samoa: (See Hawaii)

Arizona:
- Arizona Department of --
  - Game and Fish
  - Health Sciences, Bureau of Water Quality Control
  - Water Resources
- Gila Valley Irrigation District
- Maricopa County --
  - Flood Control District
  - Municipal Water Conservation District No. 1
- Metropolitan Water District of Southern California
- Navajo County Parks Commission
- Pima County, Board of Supervisors
- Salt River Valley Water Users Association
- San Carlos Irrigation and Drainage District
- Show Low Irrigation Company
- Tucson, City of
- University of Arizona, Water Resources Research Center

Arkansas:
- Arkansas Department of Pollution Control and Ecology
- Arkansas Soil and Water Conservation Commission
- Arkansas Geological Commission
- Arkansas State Highway and Transportation Department

California:
- Alameda County --
  - Flood Control and Water Conservation District (Hayward)
  - Flood Control and Water Conservation District, Zone 7 (Livermore)
  - Water District
- Antelope Valley-East Kern Water Agency
- California Department of --
  - Boating and Waterways
  - Fish and Game (Sacramento)
  - Fish and Game, Region II (Rancho Cordova)
  - Health Services
  - Transportation, District 3 (Marysville)
  - Water Resources
    - Central District (Sacramento)
    - Northern District (Red Bluff)
    - San Joaquin District (Fresno)
- California Regional Water Quality Control Board --
  - Central Coast Region (San Luis Obispo)
  - Colorado River Basin Region (Palm Desert)
  - North Coast Region (Santa Rosa)
  - San Francisco Bay Region (Oakland)
  - Santa Ana Region (Riverside)
- California Water Resources Control Board
- Carpinteria County, Water District
- Casitas Municipal Water District
- Coachella Valley, County Water District
- Contra Costa County--
  - Department of Health Services
  - Flood Control and Water Conservation District
- Crestline-Lake Arrowhead Water Agency
- Desert Water Agency
- East Bay Municipal Utility District
- East San Bernardino County Water District
- El Dorado County
- Fresno County, Department of Resources and Development
- Fresno Metropolitan Flood Control District
- Georgetown Divide Public Utility District
- Goleta County Water Distict
- Humboldt Bay, Municipal Water District
- Imperial County, Department of Public Works
- Imperial Irrigation District
- Indian Planning Consortium-Central California
- Indian Wells Valley Water District

California--Continued
Inyo County Water Department
Kern County Water Agency
Kings River Conservation District
Lake County, Planning Department
Los Angeles County, Flood Control District
Los Angeles Department of Water and Power
Madera County, Flood Control and Water Conservation Agency
Madera Irrigation District
Marin County, Department of Public Works
Marin Municipal Water District
Merced, City of
Merced Irrigation District
Modesto, City of, Department of Public Works
Modoc County, Department of Public Works
Mojave Water Agency
Montecito County Water District
Monterey County Flood Control and Water Conservation District
Monterey Peninsula, Water Management District
Napa County Flood Control and Water Conservation District
Newport Beach, City of
Orange County --
Environmental Management Agency
Water District
Oroville-Wyandotte Irrigation District
Pacheo Pass Water District
Paradise Irrigation District
Placer County Water Agency (Auburn)
Placer County Water Agency (Foresthill)
Rancho California Water District
Riverside County Flood Control and Water Conservation District
Sacramento Regional County Sanitation District, Department of Public Works
San Benito County Water Conservation and Flood Control District
San Bernardino Valley Municipal Water District
San Diego, City of
San Diego County, Department of --
Planning and Land Use
Public Works
San Diego County Water Authority
San Francisco, City and County of, Hetch Hetchy Water and Power
San Francisco Water Department
San Joaquin County Flood Control and Water Conservation District
San Luis Obispo County, Engineering Department
San Mateo County --
Department of Planning
Department of Public Works
Santa Barbara, City of, Department of Public Works
Santa Barbara County --
Flood Control and Water Conservation District
Water Agency
Santa Clara Valley, Water District
Santa Cruz County --
Flood Control and Water Conservation District
Planning Department
Santa Cruz, City of, County Community Resources Center, Zone 4
Santa Maria Valley Water Conservation District

California--Continued
Santa Rosa Band of Mission Indians
Siskiyou County Flood Control and Water Conservation District
Sonoma County--
Planning Department
Water Agency
Soquel Creek County Water District
Tahoe Regional Planning
Terra Bella Irrigation District
Thousand Oaks, City of
Tulare County, Flood Control District
Turlock Irrigation District
United Water Conservation District
University of California--
Berkeley, Agricultural Experiment Station, School of Forestry and Conservation
Davis, Division of Environmental Studies
Ventura County, Public Works Agency
Western Municipal Water District
Westlands Water District
Woodbridge Irrigation District
Yolo County, Flood Control and Water Conservation District

Colorado:
Adams County, Board of Commissioners
Arapahoe, County of
Arkansas River Compact Administration
Arvada, City of
Aspen, City of
Aurora, City of
Boulder, County of, Department of Public Works
Central Yuma Ground Water Management District
Chapel Hills Water and Sanitation District
Cherokee Water District
Colorado Department of Highways
Colorado Division of Water Resources, Office of the State Engineer
Colorado River Water Conservation District
Colorado Springs, City of --
Department of Public Utilities
Office of the City Manager
Colorado Water Conservation Board
Copper Mountain Water and Sanitation District
Delta County, Board of County Commissioners
Denver, City and County, Board of Water Commissioners
Denver Regional Council of Governments
Eagle County, Board of Commissioners
El Paso County Water Users Association
Englewood, City of, Bi-City Wastewater Treatment Plant
Frenchman Ground Water Management District
Fruita, City of
Garfield County
Glenwood Springs, City of
Grand County Board of Commissioners
Larimer-Weld Regional Council of Governments
Marks Butte Ground Water Management District
Mesa, County of
Metropolitan Denver Sewage Disposal District No. 1

Colorado--Continued
Northern Colorado Water Conservation District
Pitkin County, Board of Commissioners
Pleasant View Water and Sanitation District
Pueblo, City of, Board of Water Works
Pueblo Civil Defense Agency
Purgatoire River Water Conservancy District
Rio Blanco County, Board of County Commissioners
Rio Grande Water Conservation District
Sand Hills Ground Water Management District
Southeastern Colorado Water Conservancy District
Southwestern Colorado Water Conservation District
Trinchers Conservancy District
Uncompahgre Valley Water Users' Association
Upper Arkansas River Water Conservancy District
Upper Yampa Water Conservancy District
Urban Drainage and Flood Control District
Ute Mountain Ute Tribe
Water Users No. 1 (Rangely)
Yellow Jacket Water Conservancy District

Connecticut:
Connecticut Department of Environmental Protection
Enfield, Town of
Fairfield, Town of, Conservation Commission
Manchester, Town of, Department of Public Works
Meriden, Town of, Department of Public Works
New Britain, City of --
Board of Water Commissioners
Improvement Commission
New Haven Water Company
Northeast Connecticut Regional Planning Agency
Norwalk, Town of
Simsbury, Town of
Torrington, City of

Delaware:
Department of Natural Resources and Environmental Control
Geological Survey
New Castle County, Public Works Department

District of Columbia:
Department of Environmental Services

Florida:
Big Cypress Basin Board
Boca Raton, City of
Bradenton, City of
Brevard County, Board of County Commissioners
Broward County --
Environmental Quality Control Board
Water Resources Management Division
Cape Corsl, City of
Clearwater, City of

Florida--Continued
Collier, County of
Cocoa, City of
Coordinating Council on the Restoration of Kissimmee River Valley and Taylor Creek-Nubbins Slough Basin
Englewood Water District, Board of Supervisors
Escambia County, Board of County Commissioners
Flagler County, Board of County Commissioners
Florida Department of --
Environmental Regulation --
Bureau of Water Resources Management
Division of Recreation and Parks
Transportation
Florida Institute of Phosphate Research
Florida Keys Aqueduct Authority
Fort Lauderdale, City of
Fort Walton Beach, City of
Gainesville, City of
Hallandale, City of
Hernando, County of
Highland Beach, Town of
Hillsborough County
Hollywood, City of
Jacksonville, Consolidated City of --
Department of Health and Environmental Services
Department of Public Works
Jacksonville Electric Authority
Juno Besch, Town of
Jupiter Inlet District
Lake County --
Board of County Commissioners
Pollution Control Department
Lee County, Board of County Commissioners
Leon County--
Courthouse
Department of Public Works
Manatee County, Board of County Commissioners
Marion County, Board of County Commissioners
Miami-Dade Water and Sewer Authority
Northwest Florida Water Management District
Old Plantation Water Control District
Orange County, Board of County Commissioners
Palm Beach County, Board of County Commissioners
Pasco, County of
Pensacola, City of
Perry, City of
Pinellas County, County Courthouse
Pinellas Park Water Management District
Polk County, Board of County Commissioners
Pompano Beach, City of, Water and Sewer Department
Quincy, City of
Reedy Creek Improvement District
Sarasota, City of
Sarasota, County of

Florida--Continued
South Florida Water Management District
Southwest Florida Regional Planning Council
Southwest Florida Water Management District
St. Johns, County of
St. Johns River Water Management District
St. Petersburg, City of
Stuart, City of
Sumter County, Recreation and Water Conservation and Control Authority
Suwannee River Authority (Live Oak)
Suwannee River Authority (Trenton)
Suwannee River Water Management District
Tallahassee, City of, Underground Utilities
Tampa, City of
University of South Florida
Walton, County of
West Coast Regional Water Supply Authority
Winter Park, City of

Georgia:
Albany, City of, Water, Gas, and Light Commission
Bibb County, Board of Commissioners
Brunswick, City of
Chatham County, Board of Commissioners
Clayton County, Water Authority
Consolidated Government of Columbus
Covington, City of
Georgia Department of --
Natural Resources --
Environmental Protection Division
Geological Survey
Transportation
Macon-Bibb County, Water and Sewage Authority
Valdosta, City of

Guam: (See Hawaii)

Hawaii:
American Samoa, Government of
Guam, Government of
Hawaii Department of --
Health
Land and Natural Resources --
Division of Water and Land Development
Transportation
Honolulu, City and County --
Board of Water Supply
Department of Public Works
Kosrae, State of
Micronesia, Federated States of
Northern Mariana Islands, Government of the
Palau, Republic of
Ponape, State of
Truk, State of
Trust Territory of the Pacific Islands
Yap, State of

Idaho:
Big Lost River Irrigation District
Idaho Department of --
Health and Welfare, Bureau of Water Quality
Water Resources
Idaho Water Resources Board
Oakley Canal Company
Salmon River Canal Company
Teton County, Board of Commissioners
The Shoshone Bannock Tribes, Fort Hall Indian Reservation
Water District No. 01--Idaho Falls
Water District No. 31--DuBois
Water District No. 33--Howe
Water District No. 37--Shoshone
Water District No. 37-N--Carey
Water District No. 65-K-Lake Fork

Illinois:
Bloomington and Normal Sanitary District
Cook County, Forest Preserve District
Decatur, City of
Illinois Department of--
Energy and Natural Resources, State Water Survey Division
Nuclear Safety
Transportation, Division of Water Resources
Illinois Environmental Protection Agency
Springfield, City of

Indiana:
Carmel, Town of
Elkhart, City of, Water Works
Indiana State Board of Health
Indiana Department of--
Highways
Natural Resources --
Division of Water
Division of Reclamation
Indianapolis, City of, Department of Public Works

Iowa:
Cedar Rapids, City of
Charles City, City of
Clear Lake, City of
Des Moines, City of
Des Moines Water Works
Fort Dodge, City of
Iowa Department of --
Transportation --
Highway Division
Iowa Geological Survey
Iowa State University
Marshalltown, City of
Sewage Disposal Plant
Sioux City, City of
University of Iowa, University Physical Plant
Waterloo, City of
West-Central Iowa Rural Water Association

Kansas:
- Arkansas River Compact Administration
- Harvey, County of
- Hays, City of
- Kansas Department of --
  - Health and Environment
  - Transportation
- Kansas Geological Survey
- Kansas State Board of Agriculture, Division of Water Resources
- Kansas Water Office
- Kansas-Oklahoma-Arkansas River Commission
- Southwest Kansas GWMD No. 3
- Western Kansas GWMD No. 1
- Wichita, City of, Flood Control Maintenance

Kentucky:
- Elizabethtown, City of
- Kentucky Department of --
  - Natural Resources & Environmental Protection Cabinet
  - Transportation Cabinet, Division of Design
- Kentucky Geological Survey
- Univeraity of Kentucky

Louisiana:
- Baton Rouge City-Parish Government
- Capital-Area Groundwater Conservation Commission
- Louisiana Department of--
  - Natural Resources--
    - Geological Survey
    - Office of Environmental Affairs, Water Pollution Control Division
  - Transportation and Development --
    - Office of Highways
    - Office of Public Works
- Sabine River Compact Administration

Maine:
- Androscoggin Valley Regional Planning Commission
- Cobbossee Watershed District
- Maine Department of --
  - Conservation, Geological Survey
  - Environmental Protection
- Wilton, Town of

Maryland:
- Anne Arundel County, Planning and Zoning Office
- Baltimore County --
  - Department of Permits and Licenses
  - Department of Public Works
  - Office of Planning and Zoning
- Calvert County
- Caroline County
- Carroll County, Board of County Commissioners
- Howard County, Department of Public Works

Maryland--Continued
- Maryland Department of --
  - Health and Mental Hygiene, Office of Environmental Programs
  - Transportation, State Highway Administration
- Maryland Energy Administration
- Maryland Geological Survey
- Maryland Water Resources Administration
- Montgomery County--
  - Department of Environmental Protection, Office of Environmental and Energy Planning
  - Division of Pollution Control
- Poolesville, Town of
- St. Marys County, County Commissioners
- Upper Potomac River Commission
- Washington Suburban Sanitary Commission

Massachusetts:
- Barnstable County, County Commissioners
- Cape Cod Planning and Economic Development Commission
- Falmouth, Town of
- Massachusetts Department of Public Works --
  - Division of Highways
  - Division of Research and Materials
- Massachusetts State Water Resources Commission --
  - Division of Water Pollution Control
  - Division of Water Resources
- Metropolitan District Commission, Water Division

Michigan:
- Ann Arbor, City of
- Battle Creek, City of
- Branch County
- Clare, City of
- Coldwater, City of, Board of Public Utilities
- Dickinson County, Board of Commissioners
- Elsie, Village of
- Flint, City of, Water Supply and Pollution Control, Department of Public Works and Utilities
- Genesee County Drain Commission, Division of Water and Waste Services
- Huron-Clinton Metropolitan Authority
- Imlay, City of
- Kalamazoo, City of, Department of Public Utilities
- Lansing, City of, Board of Water and Light, Water and Stream Division
- Macomb County
- Mason, City of
- Michigan Department of --
  - Agriculture, Soil and Water Conservation Division
  - Natural Resources --
    - Geological Survey Division
    - Office of Budget and Federal Aid
  - Transportation
- Oakland County, Drain Commission
- Otsego County, Road Commission
- Portage, City of
- St. Johns, City of
- Van Buren County, Board of Commissioners
- Ypsilanti, City of

Minnesota:
- Bassett Creek Flood Control Commission
- Carnelian-Marine Watershed District
- Coon Creek Watershed District
- Eagan, City of
- Elm Creek Conservation Commission
- Iron Range Resources Rehabilitation Board
- Metropolitan Council of the Twin Cities Area
- Metropolitan Waste Control Commission
- Middle River-Snake River Watershed District
- Minnesota Department of --
  - Energy, Planning & Development
  - Health
  - Natural Resources
  - Transportation
- Minnesota Geological Survey
- Minnesota Pollution Control Agency
- Minnesota Waste Management Board
- Morrison County, Soil and Water Conservation District
- Red Lake Watershed District
- St. Louis Park, City of
- University of Minnesota
- Wesmin Resource, Conservation and Development Association

Mississippi:
- Harrison County --
  - Board of Supervisors
  - Development Commission
- Jackson, City of
- Jackson County --
  - Board of Supervisors
  - Port Authority
- Mississippi Department of --
  - Highways
  - Natural Resources --
    - Bureau of Geology
    - Bureau of Land and Water Resources
    - Bureau of Pollution Control
- Mississippi Research and Development Center
- Natchez, City of
- Pat Harrison Waterway District
- Pearl River Valley Water Supply District

Missouri:
- Little River Drainage District
- Missouri Department of --
  - Conservation
  - Natural Resources --
    - Division of Environmental Quality, Lab Services Program
    - Division of Geology and Land Survey
    - Land Reclamation Commission
- Missouri Highway and Transportation Commission
- Springfield, City of --
  - City Utilities, Engineering Department
  - Sanitary Services Department
- St. Louis County, Department of Highways and Transportation

Montana:
- Chippewa Cree Tribal Council
- Montana Bureau of Mines and Geology
- Montana Department of --
  - Fish, Wildlife, and Parks
  - Health and Environmental Sciences
  - Highways
  - Natural Resources and Conservation
  - State Lands
- Montana State University
- State of Montana
- Salish and Kootenai Tribes of Flathead Reservation
- Wyoming State Engineer

Nebraska:
- Central Platte Natural Resources District
- Kansas-Nebraska Big Blue River Compact Administration
- Lincoln, City of
- Little Blue Natural Resources District
- Lower Platte Natural Resources District
- Lower Republican Natural Resources District
- Nebraska Department of --
  - Environmental Control
  - Water Resources
- Nebraska Natural Resources Commission
- Tri-Basin Natural Resources District
- Twin Platte Natural Resources District
- University of Nebraska, Conservation and Survey Division
- Upper Loup Natural Resources District

Nevada:
- California Regional Water Quality Control Board, Lahontan Region
- Carson City, Department of Public Works
- Churchill County
- Douglas County, Department of Planning
- Fallon, City of
- Nevada Bureau of Mines and Geology
- Nevada Department of --
  - Conservation and Natural Resources --
    - Division of Environmental Protection
    - Division of Water Resources
  - Transportation
- Reno, City of
- Washoe County, Department of Planning

New Hampshire:
- Nashua Regional Planning Commission
- New Hampshire Water Resources Board

New Jersey:
- Bergen, County of
- Camden County, Board of Chosen Freeholders
- Cranford, Township of
- Logan, Township of

New Jersey--Continued
- Morris County, Municipal Utilities Authority
- New Jersey Department of Environmental Protection, Division of Water Resources
- North Jersey District Water Supply Commission
- Passaic Valley Water Commission
- Somerset County, Board of Chosen Freeholders
- West Windsor Township, Environmental Commission

New Mexico:
- Alamogardo, City of
- Albuquerque, City of
- Albuquerque Metropolitan Arroyo Flood Control Authority
- Costilla Creek Compact Commission
- Las Cruces, City of
- New Mexico Bureau of Mines and Mineral Resources
- New Mexico Environmental Improvement Division
- New Mexico Department of Highways
- Office of State Engineer
- Pecos River Commission
- Pueblo of Zuni
- Santa Fe Metropolitan Water Board

New York:
- Albany, City of, Department of Water and Water Supply
- Auburn, City of
- Brookhaven, Town of
- Chautauqua, County of, Department of Planning and Development
- Cornell University--
  - Department of Natural Resources
  - Department of Utilities
- Cortland, County of, Planning Department
- Erie County, Division of Environmental Control, Department of Environment and Planning
- Hudson-Black River Regulating District
- Kirkwood, Town of
- Kiryas Joel, Village of
- Long Island Regional Planning Board
- Monroe, County of --
  - Engineering Department
  - Water Authority
- Nassau, County of, Department of Public Works
- New York City --
  - Department of Environmental Protection, Air Resources-Water Resources-Energy
  - Department of Sanitation, Office of Resource Recovery
- New York State Department of --
  - Education
  - Health, Division of Environmental Health
  - Environmental Conservation --
    - Bureau of Monitoring and Assessment, Resource Monitoring Section
    - Bureau of Water Research
    - Division of Air
    - Division of Water
    - Hydrologic Services Section, PCB Project Unit
    - Water Research Bureau
  - Transportation, Bridge and Construction Bureau

New York--Continued
- New York State Power Authority
- Nyack, Village of, Board of Water Commissioners
- Onondaga, County of --
  - Department of Drainage
  - Environmental Management Council
  - Water Authority
- Oswego, County of, Planning Board
- Rochester, City of, Department of Public Works
- Rockland, County of, Drainage Agency
- Seneca Nation of Indians
- Shelter Island, Town of
- Suffolk, County of --
  - Department of Health Sciences
  - Water Authority
- Susquehanna River Basin Commission
- Temporary State Commission on Tug Hill
- Ulster, County of, County Legislators
- University of the State of New York, Regents Research Inc.
- University of Virginia, Department of Environmental Sciences
- Westchester, County of --
  - Department of Health
  - Department of Public Works

North Carolina:
- Cary, City of
- Charlotte, City of
- Durham, City of, Department of Water Resources
- Greensboro, City of
- North Carolina State Department of--
  - Human Resources
  - Natural Resources and Community Development
  - Transportation, Division of Highways
- North Carolina Agricultural Research Service
- Raleigh, City of
- Rocky Mount, City of

North Dakota:
- Burleigh County, Water Resources District
- North Dakota Geological Survey
- North Dakota State University
- Oliver County, Board of Commissioners
- Public Service Commission
- State Department of Health
- State Water Commission
- University of North Dakota

Northern Mariana Islands: (See Hawaii)

Ohio:
- Canton, City of, Water Department
- Columbus, City of --
  - Department of Public Service
  - Division of Water
- Miami Conservancy District

Ohio--Continued
- Northeast Ohio Areawide Coordinating Agency
- Ohio Department of --
  - Natural Resources --
    - Division of Geological Survey
    - Division of Oil
    - Division of Reclamation
    - Division of Water
  - Transportation
- Ohio Environmental Protection Agency
- Seneca Soil and Water District

Oklahoma:
- Ada, City of
- Altus, City of
- Central Oklahoma Master Conservancy District
- Claremore, City of
- Fort Cobb Reservoir Master Conservancy District
- Foss Reservoir Master Conservancy District
- Lawton, City of
- Lugert-Altus Irrigation District
- Mountain Park Master Conservancy District
- Oklahoma City, City of
- Oklahoma Conservation Commission
- Oklahoma Department of Transportation
- Oklahoma Geological Survey, University of Oklahoma
- Oklahoma Water Resources Board
- Sapulpa, City of
- Tulsa, City of

Oregon:
- Benton County Emergency Services
- Burnt River Irrigaton District
- Confederated Tribes of --
  - Umatilla Indian Reservation
  - Warm Springs Indian Reservation
- Coos Bay-North Bend Water Board
- Douglas, County of, Department of Public Works
- Eugene, City of, Water and Electric Board
- Lane Council of Governments
- Lane, County of, Office of the Chief Administrator
- McMinnville, City of, Water and Light Department
- Oregon Department of --
  - Environmental Quality
  - Fish and Wildlife
  - Water Resources
- Oregon State Highway Division
- Oregon State University
- Portland, City of, Department of Finance and Administration
- Rajneeshpuram, City of
- Salem, City of
- Wasco County People's Utility District

Pennsylvania:
- Altoona City Authority
- Bethlehem, City of
- Chester, County of, Water Resources Authority
- Delaware River Basin Commission
- Harrisburg, City of, Department of Public Works
- Letort Regional Authority
- Millcreek, Township of
- New York State Department of Environmental Conservation
- Oley Township
- Philadelphia, City of, Water Department
- Pennsylvania Department of --
  - Environmental Resources --
    - Mining and Reclamation Bureau
    - Office of Resources Management
    - Soil Wastes and Management Bureau
    - State Parks Bureau
    - Topographic and Geologic Survey Bureau
    - Water Quality Management Bureau
- Susquehanna River Basin Commission
- Washington County --
  - Conservation District
  - Planning Commission
  - Supervisors

Puerto Rico:
- Puerto Rico Aqueduct and Sewer Authority
- Puerto Rico Department of --
  - Agriculture
  - Health
  - Natural Resources
  - Transportation and Public Works
- Puerto Rico Electric Power Authority
- Puerto Rico Environmental Quality Board
- Puerto Rico Industrial Development Company
- Puerto Rico Land Authority
- Puerto Rico Planning Board
- Puerto Rico Sugar Corporation
- (See also Virgin Islands)

Rhode Island:
- Narragansett Bay Water Quality Commission
- Rhode Island State Department of Environmental Management --
  - Division of Water Resources
- State Water Resources Board

South Carolina:
- Charleston, Commission of Public Works
- Grand Strand Water and Sewer Authority
- Hilton Head Island, Public Service District No. 1
- Myrtle Beach, City of

South Carolina--Continued
North Myrtle Beach, City of
South Carolina State --
Department of Highways and Public Transportation
Geological Survey
Health and Environmental Control
Public Service Authority
Water Resources Commission
Spartanburg Water Works, Commissioners of Public Works

South Dakota:
Black Hills Conservancy Subdistrict
East Dakota Conservancy Subdistrict
Lower James Conservancy Subdistrict
South Dakota Department of --
Water and Natural Resources --
Geological Survey Division
Water Rights Division
Watertown, City of

Tennessee:
Franklin, City of
Lawrenceburg, City of
Lincoln County, Board of Public Utilities
Memphis, City of --
Light, Gas, and Water Division
Public Works Division
Water Division
Metropolitan Government of Nashville and Davidson County,
Department of Public Works
Shelby, County of
Tennessee Department of --
Conservation, Geology Division
Health and Environment
Transportation, Bureau of Highways

Texas:
Abilene, City of
Alice, City of
Arlington, City of
Athens Municipal Water Authority
Austin, City of
Bexar-Medina-Atascosa Counties, Water Improvement District No. 1
Bistone Municipal Water Supply District
Brady, City of
Brazos River Authority
Cleburne, City of
Clyde, City of
Coastal Bend Council of Governments
Coastal Industrial Water Authority
Colorado River Municipal Water District
Corpus Christi, City of
Dallas, City of, Public Utilities
Dallas, County of, Public Works Department
Dallas-Ft. Worth Airport

Texas--Continued
Edwards Underground Water District
El Paso, City of, Public Service Board
Franklin, County of, Water District
Gainesville, City of
Galveston, County of
Garland, City of
Graham, City of
Greenbelt Municipal and Industrial Water Authority
Guadalupe-Blanco River Authority
Harris, County of, Flood Control District
Harris-Galveston Coastal Subsidence District
Houston, City of
Lavaca-Navidad River Authority
Lower Colorado River Authority
Lower Neches Valley Authority
Lubbock, City of
Mackenzie Municipal Water Authority
Nacogdoches, City of
North Central Texas Municipal Water Authority
Northeast Texas Municipal Water District
Orange, County of
Pecos River Commission
Red Bluff Water Power Control District
Reeves, County of, Water Improvement District No. 1
Sabine River Authority of Texas
Sabine River Compact Administration
San Angelo, City of
San Antonio, City of --
Engineering Department
Public Service Board
San Antonio River Authority
San Jacinto River Authority
Tarrant, County of, Water Control and Improvement District No. 1
Texas Department of Water Resources
Titus, County of, Fresh Water Supply District No. 1
Tom Green, County of, Water Control and Improvement District No. 1
Trinity River Authority
Upper Guadalupe River Authority
Upper Neches River Municipal Water Authority
Upper Trinity Basin Water Quality Compact
Velasco Drainage District
West Central Texas Municipal Water District
Wichita, County of, Water Improvement District No. 2
Wichita Falls, City of
Wood, County of

Trust Territory of the Pacific Islands: (See Hawaii)

Utah:
- Bear River Commission
- Salt Lake, County of --
  - Board of County Commissioners
  - Division of Flood Control and Water Quality
- Utah Department of --
  - Natural Resources --
    - Geological and Mineral Survey
    - Water Resources Division
    - Water Rights Division
    - Wildlife Resources Division

Vermont:
- Vermont Department of --
  - Water Resources and Environmental Engineering

Virginia:
- Alexandria, City of, Department of Transportation and Environmental Services
- James City, County of, Department of Public Works
- Newport News, City of, Department of Public Utilities
- Roanoke, City of, Utilities and Operations
- Southeastern Public Service Authority of Virginia
- University of Virginia, Department of Environmental Sciences
- Virginia Department of Highways and Transportation
- Virginia State Water Control Board

Virgin Islands:
- Department of Public Works
- Planning Office
- Virgin Islands, College of

Washington:
- Bellevue, City of, Public Works Department
- Chelan, County of, Public Utility District No. 1
- Cowlitz, County of, Board of County Commissioners
- Everett, City of
- Fircrest, Town of
- Hoh Indian Tribe
- Island, County of, Board of County Commissioners
- King, County of, Department of Public Works
- Lewis, County of, Board of Commissioners
- Makah Tribal Council
- Municipality of Metropolitan Seattle
- Pend Oreille, County of, Public Utility District No. 1
- Puyallup Indian Nation
- Quinault Indian Business Committee
- San Juan County Board of County Commissioners
- Seattle, City of --
  - Department of Lighting
  - Water Department

Washington--Continued
- Skagit, County of
- Snohomish County
- Stillaguamish Indian Tribe
- Tacoma, City of --
  - Public Utilities Department
  - Public Works Department
- Tulalip Tribal Board of Directors
- University of Washington
- Yakima Tribal Council
- Washington Public Power Supply System
- Washington Department of --
  - Ecology
  - Fisheries
  - Transportation

West Virginia:
- Morgantown, City of, Water Commission
- West Virginia Department of --
  - Highways
  - Natural Resources --
    - Division of Reclamation
    - Division of Water Resources
- West Virginia Geological and Economic Survey

Wisconsin:
- Brown County Planning Commission
- Dane, County of --
  - Department of Public Works
  - Regional Planning Commission
- Forest County Potawatomi Community
- Green Bay Metropolitan Sewerage District
- Green Lake Sanitary District
- Lac du Flambeau Indian Reservation
- Madison Metropolitan Sewage District
- Madison Water Utility
- Menominee Indian Tribe of Wisconsin
- Middleton, City of
- Southeastern Wisconsin Regional Planning Commission
- University of Wisconsin -- Extension, Geological and Natural History Survey
- University of Wisconsin -- Milwaukee
- Wisconsin Department of --
  - Natural Resources
  - Transportation --
    - Bridge Section
    - Division of Highways

Wyoming:
- Buffalo, City of
- Water Development Commission
- Wyoming Department of --
  - Agriculture
  - Economic Planning and Development
  - Environmental Quality
  - Highways
- Wyoming State Engineer